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## Reception of Educational Broadcasts.

WHAT is there about the reception in schools of broadcasts intended for educational purposes which seems to require, in the view at least of the B.B.C. and many educational authorities, a type of receiver different from that used and considered satisfactory for the reception of other portions of the broadcast programme in individual homes? We were amazed to discover only recently that the B.B.C. is still acting as a sort of "fairy godmother" to educational bodies in the matter of advising them on the design of special apparatus for broadcast reception, and we can, perhaps, be forgiven if we ask where is the necessity for such special treatment of these cases.

There was, perhaps, some years ago a little excuse for the B.B.C. to give suggestions as a general guide to educational authorities on this subject, but surely that time has now passed, for there are dozens of first-class receivers on the market which could be picked out as eminently suitable for this purpose, and certainly as likely to be free from trouble as the special receivers which the B.B.C. continue to recommend. Moreover, we have recently come across receivers designed to these specifications which, in our opinion, are so antiquated by comparison with modern design that they might almost have been extracted from whatever is the equivalent of the ark in wireless history. Surely it is time the B.B.C. realised that if they may be specialists in the design of broadcast transmitting stations and in the preparation of programmes and other matters which

are their proper sphere, they are no longer in the running as far as the design of modern receiving equipment is concerned. Nor should they be, unless they are expending money on a job which we would regard as no longer any concern of theirs. If, from amongst all the British manufacturers of wireless receivers there is not to-day an adequate choice from which the educational authorities can make their selection and with it have the assurance of satisfactory service, then there must be something radically wrong with our own impressions of the industry and its products.

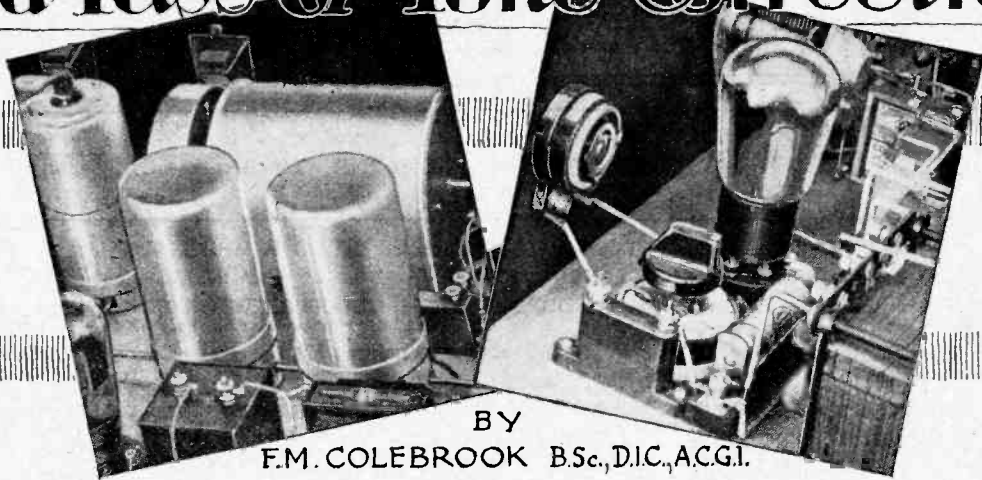
Broadcasts to schools occupy a large part of programme time, and there is no lack of effort on the part of the B.B.C. to render the instruction given as effective as possible. On the other hand, the number of schools taking these broadcasts are, we believe, comparatively few. Educational authorities place rather a low value on the merit of broadcast instruction if one may judge by the meagre expenditure usually made for the acquiring of suitable receiving equipment. Technical assistance by the B.B.C. has mainly been in the direction of economical set construction in an endeavour to encourage listening. There are a few schools possessing generous and well designed apparatus, but in other cases the receiving gear is altogether inadequate.

Radio reception and speech amplification are no longer matters of experiment, and it is in the schools we should at least see demonstrated the possibilities of perfection in radio reception.

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# Band Pass or Tone Correction?



BY

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

## Valve Correction of Side-band Cutting.

THERE are at least two ways of preventing the attenuation of the higher modulation frequencies that occur when a speech- or music-modulated wave is received in a selective tuned circuit. One of these is the use of tuning and amplifying systems incorporating what are known as band-pass filters, i.e., networks giving approximately rectangular resonance curves of sufficient width to include all the necessary side-band frequencies. The perfect realisation of such resonance curves would involve the use of filter networks with a large number of "cells" or coupled circuit elements, an arrangement scarcely practicable for a receiving set intended to be tunable to a number of different frequencies. Fortunately, a practicable compromise between perfect uniformity of band response and simplicity of design and control is offered by the use of an elementary form of filter consisting of two coupled circuits only, linked by inductance, capacity, or, in the latest development,<sup>1</sup> by a combination of the two using negative inductance.

Various circuit arrangements of this type have been described at length in a number of useful and informative articles published in *The Wireless World* during the past twelve months or so. The band-pass system is probably the most general solution of the side-band problem; and, given reasonable skill in the design and manipulation of the circuits, very satisfactory results can be obtained. There is, however, an alternative line of development, namely, tone correction, of which the possibilities have not as yet been fully explored.

*AN interesting alternative to band-pass tuning as a means of obviating high-note loss with highly selective tuning circuits is put forward. A valve stage is so designed that its rising response characteristic when combined with the falling curve of the tuned circuit gives substantially a level overall response. Practical data is given in the article for the design of a regenerative detector set capable of excellent quality of reproduction even when considerable reaction is applied.*

The object of the present article is to show that tone correction can be applied in a very simple manner to quite simple circuits, and has at least sufficient in its favour to make it eligible for consideration in future developments of broadcast reception. It describes an audio-frequency amplifying stage, which gives theoretically perfect compensation for the side-band cutting of a very highly retroactive tuned detector circuit, and thus enables the high sensitivity and selectivity of such a circuit to be employed without any sacrifice of quality. In the form described it is most suitably applicable to the simple detector amplifier type of circuit. Its possible application to circuits embodying high-frequency amplification will be considered at some future time.

First, it will be necessary to consider the nature and degree of the side-band cutting associated with a single selective circuit. There should be no need at this date to explain why the side-band cutting occurs, but for the present purposes it is necessary to have some definite idea of the magnitude of the effect and of the way it depends on the modulation frequency and on the selectivity of the tuned circuit. Those who are interested in the theory of the subject will find some account of it in an article on side-bands by the present writer, published in *Experimental Wireless* for January, 1931. The actual magnitude of the effect can be stated fairly simply.

We will assume a tuned circuit very loosely coupled to an aerial and to the first valve of a receiving set—possibly a detector valve with retroaction. Let  $S$  be the selectivity of the tuned circuit, i.e.,  $2\pi fL/R$ , where  $f$  is the carrier wave frequency and  $L$  and  $R$  are the inductance and the total effective resistance of the tuned

<sup>1</sup> See *The Wireless World*, Feb. 18th, 1931, "New Band-Pass Filter," by W. I. G. Page.

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circuit, including, of course, the effect of the load of the aerial and of the input valve to which the tuned circuit is connected. In general, S may have any value from, say, 50 in a circuit of fairly high resistance to perhaps 500. If the coil resistance is artificially reduced by means of retroaction, it may have an even higher value—perhaps as much as 1,000. Let  $n$  be the modulation frequency; then the amplitude of the side-band corresponding to the modulation frequency  $n$  is reduced by the effect of the selectivity of the tuned circuit in the ratio of 1 to  $\sqrt{1 + kn^2}$ , where  $k$  is written for the number  $4S^2/f^2$ . Let us see what this will amount to in practice.

Take as a fairly extreme case  $S=500$ . This means either an exceptionally low-resistance coil or some degree of retroaction. Further, let  $f=1,000,000$ —i.e., a wavelength of 300 metres. Then the number  $4S^2/f^2$  is  $1/1,000,000$ , or, as it is more compactly written,  $10^{-6}$ , so that the side-band cutting is represented by the ratio of 1 to  $\sqrt{1 + 10^{-6}n^2}$ . This means a reduction of about 30 per cent. at a thousand cycles, and as much as 90 per cent. at 10,000 cycles. Fig. 1 shows how the modulation frequencies will be reduced in amplitude as compared with their original amplitudes in the received modulated wave. It would obviously be no use following such an input circuit with a straight line frequency amplifier and a good quality loud speaker. Yet the high selectivity of the circuit is itself a very desirable feature. How, then, can this selectivity be retained, but freed from this loss of the higher modulation frequencies?

The answer most in favour at present is band-pass tuning. There is, however, another simple answer. Follow the input circuit by an amplifying stage having a frequency characteristic which just cancels out the effect of the side-band cutting. Since the side-band cutting is represented by the factor  $1/\sqrt{1 + kn^2}$ , the amplification characteristic must be of the form  $M\sqrt{1 + kn^2}$ . The overall response will be represented by the product of these factors, i.e.,  $M\sqrt{1 + kn^2}/\sqrt{1 + kn^2}=M$ , which is constant with respect to modulation frequency.

**Alternative to Band-pass Tuning.**

Fortunately, such a characteristic is very easy to obtain in practice by means of the circuit shown in Fig. 2. It is shown in the appendix to this article that the amplification characteristic of such a stage is represented by  $M\sqrt{1 + k_1n^2}$ , where  $M$  is written for the number  $\mu R/(R + R_0)$ , and where  $k_1$  is written for the number  $2\pi^2L^2/R^2$  ( $\mu$  and  $R_0$  being the voltage factor

and slope resistance of the valve). It is only necessary to arrange matters so that the  $k_1$  of this factor is equal to the  $k$  of the factor representing the side-band cutting, and the combination of the tuned circuit and the amplifying stage will give a uniform modulation frequency response curve without the necessity of band-pass tuning and with the high selectivity of a retroactive circuit.

Now let us consider the matter in relation to actual figures. It is shown in the appendix referred to above that  $4\pi^2n^2L^2$  must be small compared with  $R_0$ . This means that we cannot make the stage efficient, from the point of view of amplification, but that does not seriously matter. Signal strength is a minor problem nowadays, thanks to the improvement in valves and components generally. However, there is no need to treat this stage as a passenger. We can see that it pays its way at least. As long as  $R$  is greater than  $R_0$  divided by  $(\mu - 1)$ , the amplification will be greater than 1 even at the lowest frequencies. The smaller  $R$  is made the more perfect will the tone correction be, so let us take  $R=R_0/(\mu - 1)$  as a starting point, and for purposes of illustration take the H type of valve with  $R_0=50,000$  and  $\mu=36$ , giving  $R=50,000/35=1,430$ , or, rounding this off, 1,500 ohms.

**Tone Correcting Stage.**

Now to get the right value for  $k_1$  to correct for the very selective circuit we have assumed, we have to make  $4\pi^2L^2/R^2$  equal to  $10^{-6}$ , or  $2\pi L/R$  equal to  $1/1,000$ . This gives  $L=240$  millihenrys. Such an inductance can easily be obtained in compact form even with an air core. The anode circuit required is thus an inductance of 240 millihenrys with a resistance of 1,500 ohms—part of which can, of course, be the actual resistance of the inductive coil, the remainder being added in series. The amplification characteristic given by such an anode circuit load with the valve suggested is illustrated in Fig. 3, while Fig. 4 shows the cut-off characteristic, the amplification characteristic, and the product of the two which represents the overall audio-frequency characteristic of the tuned circuit and low-frequency amplifying stage. (This, of course, assumes grid-circuit rectification of uniform frequency characteristic, a matter which will be referred to later.)

It will be seen that the overall response is not quite a straight line, there being a loss of about 5 per cent. at 10,000 cycles. This would, of course, be quite

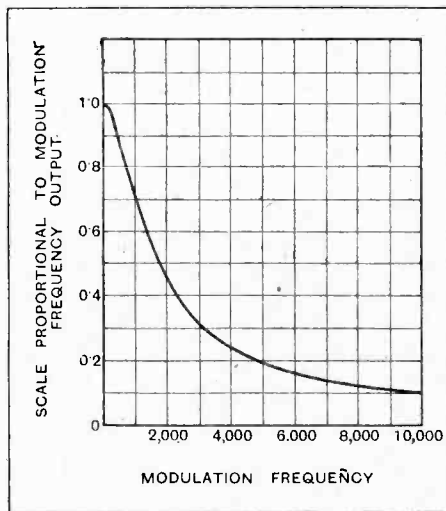


Fig. 1.—Curve showing how the side-band or speech frequencies are reduced by a selective coil having a magnification of  $(\frac{2\pi fL}{R}) = 500$ .

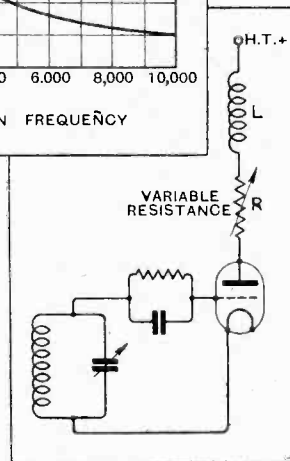


Fig. 2.—If a selective input tuning circuit cuts side-bands considerably, it is possible to design an amplifying valve stage which just cancels out this effect. Such a circuit is shown in this illustration.

**Band Pass or Tone Correction?**—

negligible in practice. Actually, there would be no need to aim at quite so high a standard as this. If we are prepared to allow, say, a 16 per cent. drop at 10,000 cycles, a somewhat more efficient amplifying stage can be used, giving twice as much amplification. This would be obtained by making  $R=3,000$  and  $L=480$  millihenrys. The corresponding overall response curve is shown in Fig. 5.

For a given value of the inductance in the anode circuit of the amplifying valve, the amount of frequency correction introduced depends on the resistance associated with it. With a variable resistance of, say, 5,000 ohms, the overall response can be made uniform or biased in favour of either low or high frequencies if this is desired in order to correct for some other defective element in the whole set—the loud speaker, for instance. The curves of Fig. 6 show as examples the response curves obtained with the original inductance of 240 millihenrys, and resistances of 0, 1,000, 1,500, 2,000, and 5,000 ohms. It will be seen that with  $R=0$  the response begins to cut off fairly sharply all frequencies below 2,000, whereas with  $R=5,000$  all frequencies up to 2,000 are over-amplified.

In all cases the curves flatten out at the higher frequencies, and with the correct value of the resistance, i.e., 1,500 ohms, it is practically level over the whole range.

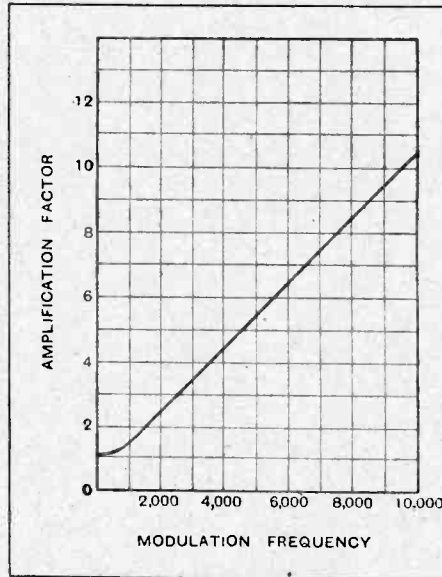


Fig. 3.—The amplification-frequency characteristic of the correcting stage shown in Fig. 2.

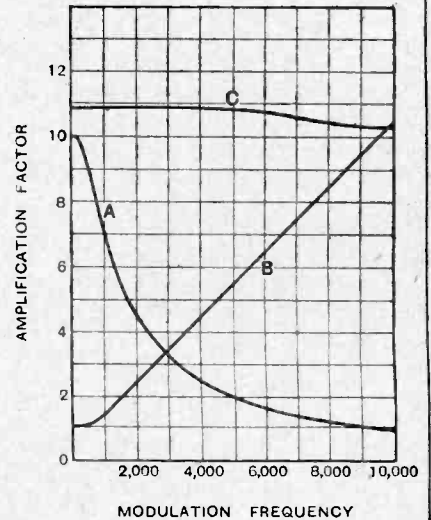


Fig. 4.—The cut-off and amplification characteristics. The side-band cut-off is shown as A; while B is the characteristic of the correcting stage; and C the overall response (the product of A and B). Note the level response of curve C.

The principle of the method should now be clear. It will not be possible in the limited space available to do more than touch on the main features of its practical realisation.

In the first place, there is the question of rectification.

The conditions of the correcting stage cannot easily be satisfied consistently with anode bend rectification, so the use of grid-circuit rectification is a necessity. As is well known, this is liable to introduce its own non-uniformity of frequency response unless means are taken to prevent it. The variation liable to be produced is actually of the same character as that associated with side-band cutting, but the extent of it can be kept small by using a low value of grid-leak and a small by-pass capacity. Further, the present writer has described<sup>2</sup> another means of obtaining uniformity of

<sup>2</sup> "Avoiding Detector Distortion." *The Wireless World*, May 20th, 1931.

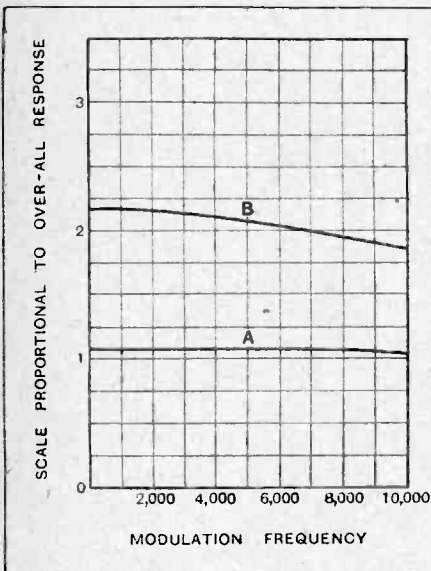


Fig. 5.—Overall response curves. In the case of curve A the resistance in the correcting stage was 1,500 ohms and the inductance 240 millihenrys. In curve B the resistance was 3,000 ohms and the inductance 480 millihenrys.

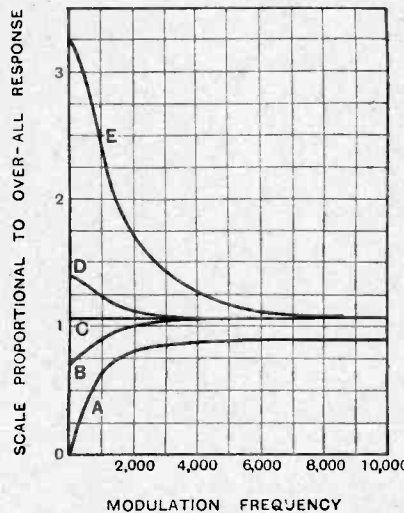


Fig. 6.—Showing the effect of the resistance on the overall response characteristic. A represents zero resistance; B, 1,000 ohms; C, 1,500 ohms; D, 2,000 ohms; and E, 5,000 ohms.

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frequency response in this type of rectifier, namely, the use of a tuned "acceptor" by-pass circuit with very small series capacity in place of the usual by-pass condenser. By such means the departure from perfect uniformity in the frequency response of the rectifier can at least be reduced to an extent which can be compensated by a slight degree of over-correction in the amplifying stage by the method which has already been described.

The next question is whether the method is applicable to sets which have a radio-frequency amplifying stage. Here there are two tuned circuits, each having its own side-band cutting effect. The simple system as described will not give theoretically perfect tone correction in such cases, for the total side-band cutting is represented by the product of the factors corresponding to each selective element, and to cancel this uniformly would require two correcting stages giving a correction product of the same form. This, though possible, is hardly practicable. There is, however, an alternative which may prove practicable, namely, the concentration of all the selectivity in one of the selective elements, the other being made sufficiently flat in tuning to give negligible side-band cutting. The possibilities of this system are being further explored.

It must be admitted, however, that the arrangement as described is best adapted for a simpler type of circuit—a detector with the tone correcting element in the anode circuit coupled by capacity and resistance to an ordinary audio-frequency amplifying stage and an output valve.

The arrangement shown in Fig. 7 may be taken as representative of this type of circuit. On test it is found to behave as far as the ear can judge quite in

accordance with the theory. Under conditions of maximum retroaction and with the resistance R all in (about 5,000 ohms) the reproduction has the woolly tone associated with excessive selectivity and side-band cut-off. If the resistance be reduced to zero the tone changes to a thin tinny effect due to the cutting off of all frequencies below about 1,500 or 2,000. The changes in tone are quite gradual, but quite audible and definite as R is increased, and for a given degree of retroaction the

appropriate degree of compensation is easily judged by a moderately sensitive ear.

**Summary.**

It may be possible at some future time to consider in fuller detail the various elements of the circuit and alternative circuit arrangements. For the present the main object of this article is to make clear the fundamental principle involved and to bring to the attention of experimenters a line of development which obviously has great possibilities, since it combines the uniformity of response of the band-pass systems with the simplicity and the high selectivity of the single retroactive tuned circuit.

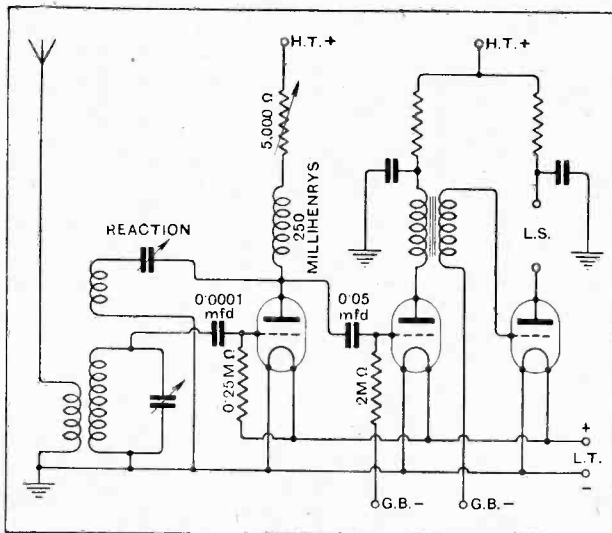


Fig. 7.—A complete circuit embodying the correcting stage. The effect of side-band cut-off is cancelled at a certain point in the range of the 5,000-ohm variable resistance.

**APPENDIX.**

The amplification given by the circuit illustrated in Fig. 2 is

$$\frac{\sqrt{R^2 + 4\pi^2 n^2 L^2 \mu}}{\sqrt{(R + R_0)^2 + 4\pi^2 n^2 L^2}} = \frac{\mu R}{R + R_0} \frac{\sqrt{1 + 4\pi^2 n^2 L^2 / R^2}}{\sqrt{1 + 4\pi^2 n^2 L^2 / (R + R_0)^2}}$$

The value of L can be chosen so that  $4\pi^2 n^2 L^2 / (R + R_0)^2$  is small compared with 1, in which case the amplification is given by

$$\frac{\mu R}{R + R_0} \sqrt{1 + 4\pi^2 n^2 L^2 / R^2}$$

which is of the form  $M\sqrt{1 + k_1 n^2}$

**BOOKS RECEIVED.**

*Foundations of Radio*, by R. L. Duncan.—A text-book for students, covering the elementary theory of electricity and allied subjects that comprise the essentials of wireless but not the theory or practice of radio itself. Pp. 246+ix., with 145 diagrams and illustrations. Published by John Wiley and Sons, Inc., New York, and Chapman and Hall, Ltd., London, price 12s. 6d. net.

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*Jornadas de Onda Corta*. A summary of the papers read and discussed at the meeting of short-wave radio engineers during the International Exhibition at Barcelona in November, 1929, including papers by Dr. B. Cabrera and Prof. R. Mesny. Pp. 242, with numerous illustrations and diagrams. Published by "Iberica," Barcelona, Spain.

B 9

*Television To-day and To-morrow* (second edition), by Sydney A. Moseley and H. J. Barton Chapple, with a foreword by John L. Baird. A general account of the history and progress of television, chiefly relating to the Baird system. Pp. 163+xxvii., with numerous illustrations and diagrams. Published by Sir Isaac Pitman and Sons, Ltd., London, price 7s. 6d. net.

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*Quartz Resonators and Oscillators*, by P. Vigoureux, M.Sc., of the N.P.L. A summary of the practical applications of the piezo-electric properties of quartz. Pp. 217, with 125 diagrams and illustrations and extensive bibliography. Issued by the Department of Scientific and Industrial Research, and published by H.M. Stationery Office. Price 7s. 6d. net.

# Unbiased . . . .

"Time from the Mains"  
Again.

By FREE GRID.

I WAS interested the other week to see an account in *The Wireless World* of the various remote tuning control systems using electric motors now being employed in connection with certain American sets. Regular readers will, no doubt, remember that several months ago I made reference to the lack of such systems, or the components for constructing them, on the British market. I also briefly referred to my own home-made system, which made use of four-volt motors. The result of my note was six letters of abuse.

One letter which I received was from a firm that I had overlooked, and who actually had an advertisement in the same issue as my remarks appeared. They said that they "were slightly astonished to read your comments . . . more especially as our remote control system is advertised . . . in the same issue as that in which your article appeared." They rather flattered me by referring to *The Wireless World* as "your paper," and since the letter actually reached me in Paris—having been forwarded by *The Wireless World*—at a moment when I was feeling rather ill after drinking a cup of what the French people, in the exercise of their quaint humour, are pleased to call tea, I immediately sat down and wrote a rather tart reply, informing them that unfortunately *The Wireless World* was not my paper, since Iliffe's were unwilling to part with it for all the money in the world, which, in my case, I did not possess. I said, further, that, having been brought up in a religious atmosphere, I was forbidden by my conscience to avail myself of Madam Estelle's services and gaze in her crystal at the contents of the particular issue in which my remarks were to appear so that I might have foreknowledge of them. However, as they used to say in Victorian novels, my better nature prevailed—or perhaps it was the influence of some old French brandy

which the garçon persuaded me to take in order to get rid of the evil effects of the tea—and I eventually tore my letter up and referred the whole matter to the Editor.

What I really wanted to say in this note, however, is that since the appearance of synchronous-motor clocks in this country—as described in an informative article published recently in *The Wireless World*—I am more than ever keen to get a programme clock which will enable me to pre-select my programme—using sundry sources of misinformation as a guide—not only for



At the moment when I was feeling rather ill after drinking a cup of French tea.

twelve hours, but for a whole week in advance, and I look to the Everett Edgecumb or the British Sangamo Companies to produce the necessary article in time for the Olympia Exhibition.

## Do Valves Die Young?

An acquaintance of mine, who for the past ten years has been suffering from a chronic disease referred to in standard American medical works as *mordax cimicis lectularii radionis*, was telling me the other day that it was his experience that modern valves do not last nearly as long as did the very earliest dull-emitters. He told me that prior to about 1926 or 1927 it was no un-

common thing for a dull-emitter to retain a goodly part of its total emission after two years' hard work, while nowadays a valve which held out for more than a year was an exception.

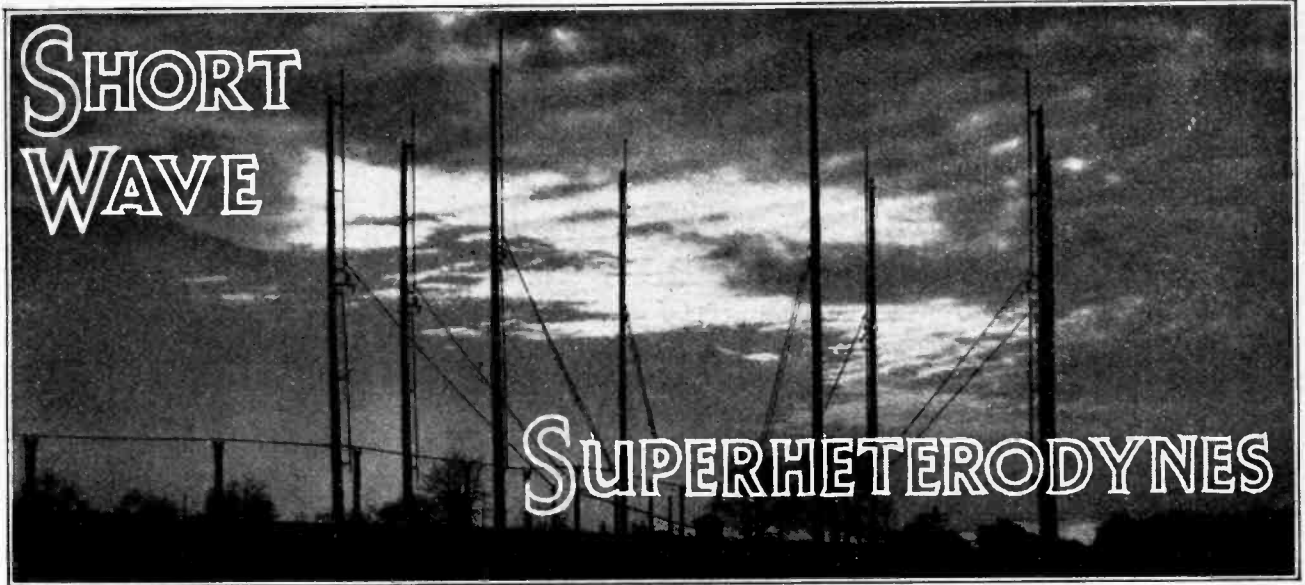
I am afraid that, personally, I have never made very careful observations, but I put my friend's opinion before one of the leading valve manufacturers, who has the honour of my acquaintanceship, and he said that my friend's experience was in accordance with facts, "because," he explained, "we simply do not want them to last so long. In the early days they lasted far too long, and the public let us down by not renewing them until their emission had fallen almost to zero. It must be remembered," he added rather coarsely, "that our wives and children have stomachs as well as those of the general public." As I left him I reflected that there certainly was something in that.

## Dial Divisions.

Tuning dials marked in geometrical divisions, or from 0 to 100, are rapidly giving place to that type of dial marked directly in wavelengths or kilocycles, but I notice that the earlier type are being retained in several "1932" models, and many of those adopting the wavelength scale are maintaining the "divisions" dial in addition, in the manner of certain American manufacturers.

I was an interested listener the other day to an animated debate among certain manufacturers as to whether it was the 0 to 100 or 0 to 180 scale which ought to be retained. Those who supported the latter very rightly pointed out that everyone has to imbibe a certain amount of elementary geometry at school, and is thus familiar with this scale. This is, of course, undeniable, but, all the same, I think that it cannot be doubted that, if any, it is the 0 to 100 division dial which should survive.

Of course, we must not overlook the claims of the superheterodyne which is now rushing into the limelight again. This type calls for subdivisions in the dial intervals; and it is much easier to read half or quarter divisions than thirds and fifths.



Short-wave transmitting aeriuls at KDKA (8XK).

## Practical Hints on the Reception of Long-range Broadcasting.

(Concluded from page 205 of previous issue.)

By F. H. HAYNES.

A FEW brief practical details on the making up of a short-wave converter unit will remove that difficulty of testing to find the most suitable values. Coil windings, for instance, cannot be predicted, and, as already pointed out, require to be formulated with care and exactitude when the critical control of reaction is involved. Reference to lists of short-wave transmissions shows that there is little point in exceeding the wavelength of some 60 metres, whilst at the lower end of the scale provision must at least be made to reach the transmissions from 2XAD on the wavelength of 19.56 metres.

The accompanying calibration chart shows a wave range of 17 to 65 metres on the two-range coil used in conjunction with a tuning condenser of 0.0003 mfd. This calibration applies to the coil when wired into the set, and assumes a small value of aerial capacity as may be passed on with an aerial condenser of 50 micro-microfarads and a reaction condenser of 0.0001 mfd. In calibrating the receiver, slight adjustment of the reaction condenser is taken into account in order to maintain the circuit in an oscillating condition. The tuning chart can be taken as a pretty close guide for any set using this particular coil, the dial setting relating to the lower of the two positions on which a station is received.

Next in components is the tuning condenser, and care in its selection will greatly facilitate the ease with which stations are tuned in. A geared drive is essential, and, while higher ratios than 10 to 1 are not advised in ordinary broadcast receivers, a much greater reduction ratio is desirable in a short-wave superheterodyne. Quite powerful stations may be missed if the drive is too rapid, and when tuning in telephony a very critical setting is required to produce the best quality. The special re-

duction pinions on the condenser used give a ratio of nearly 30 to 1.

H.F. losses in dielectrics are many times greater on the short waves than on the broadcast band, calling for the use of "low loss" components, although it might be mentioned that in practice many liberties may be taken, say, in valve holders, terminal connections, and wiring, which have no apparent detrimental effect on the range of reception. Precise dimensions are not required in respect of the short-wave H.F. choke, and should consist roughly of 1½ in. of winding of No. 36 enamelled or S.S.C. wire on a ½ in. diameter piece of ebonite. While the ends of this coil are actually terminated on tags, as shown in the drawings, a spot of Chatterton's compound is equally effective. Reduction gearing on the reaction condenser may be helpful, but the set can be operated quite well without it, and a compact 0.0001 mfd. air dielectric condenser is satisfactory. It is assembled on the front panel at some distance from the tuning coil, and the length of the single lead running to it can have no adverse effect, as it can possess only that property of the reaction condenser itself—capacity to earth. A small value stopping condenser, in this case 0.005 mfd., is interposed in the lead to the reaction condenser, which removes the danger of short-circuiting the H.T. supply should an earth contact occur on the moving vanes of the reaction condenser.

The screen potential of the first valve, which functions as an anode bend detector, is somewhat critical, and potentiometer control is provided. It is best to arrange that this potentiometer shall not bridge off the entire supply voltage. As the potential fed to the detector may have already been dropped by a feed resistance, as shown in Fig. 10 of the previous issue, it is convenient

**Short Wave Superheterodynes.—**

to tap in the screen grid potentiometer at the end of this voltage dropping resistance and in this way spread out the control while avoiding the possibility of applying excessive volts to the screen. When only a single valve attachment is used, a fixed resistance should be connected in series with the potentiometer. In the converter unit, again, the second H.F. choke in the anode feed is of the usual type employed in a broadcast set, while the anode voltage is the maximum value stated for the valve.

Passing on to the intermediate amplifier, an ordinary tuned grid and tuned anode or tuned transformers on the two sides of the screen grid valve are the only requirements. Such a circuit represents the normal conditions in the single H.F. stage of a broadcast receiver. It will be less selective, however, than the pair of bandpass intermediates shown in the accompanying practical wiring diagrams. The construction of the intermediate amplifier is straightforward and calls for little moment. Decoupling resistances in the anode feeds associated with the primaries of these band-pass units are advisable when the H.T. supply comes from a mains unit, but can be omitted when using H.T. batteries. As decoupling is already provided in the screen lead of the first valve, it can be omitted in the second. It might

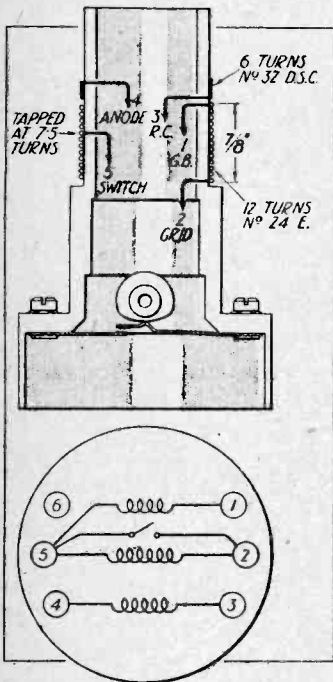
be mentioned here that a choke feed may be connected in the anode circuit of the second screen grid valve and a 0.0001 mfd. condenser connected to its anode may pass on to the aerial terminal of a simple detector L.F. set tuned to 2,000 metres.

Avoid the use of an "L" valve in the detector stage and use, for preference, an "H.L." valve giving greater magnification. The customary by-pass condenser\* connects the anode of the detector to earth and transformer coupling feeds the grid of the detector valve. A pentode is shown in the mains-operated set, while in the battery set a triode is used, as the 2-volt pentodes are but little better than the triodes. For the present purpose, choose the output battery valve by its magnification factor, which should exceed 10, and, likewise, in choosing a mains pentode, adopt one which will give a large power output in relation to a low value of grid

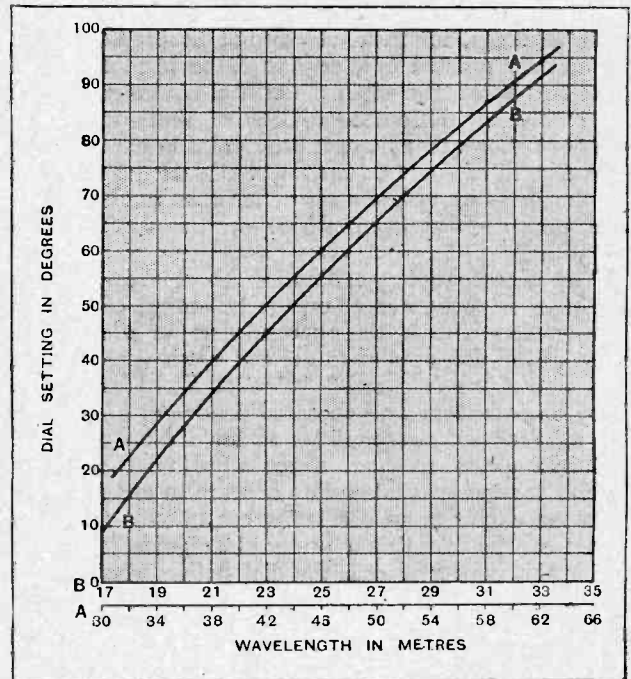
bias. Owing to the variety of valves available, values cannot be given in respect of feed resistances used for voltage dropping and decoupling. These values are easily determined by noting how many volts are to be dropped and multiplying this value by 1,000 and dividing by the current to be passed in milliamperes. It is useful to check over the current in the anode circuit of each valve before going after signals. The first screen grid valve is to be a little overbiased, and it is a simple matter to test whether one or two cells shall be used for biasing in conjunction with an adjustment of the screen volts potentiometer. Evidence of correct working of the intermediate amplifier is the ability to oscillate, and this is brought about by careful adjustment of the trimmers and coupling. Correct spacing for the coils will be approximately 1/2 in. apart for the first pair, and 1/4 in. apart for the second pair. Take the first pair just sufficiently far apart to give the required selectivity and adjust the second pair for maximum signal with threshold regeneration. If difficulty is met with, check the screen and anode voltages of the second valve, making sure that they are at the maximum.

**Stations Received.**

Little need be said with regard to operating hints. Use the aerial coupling condenser when taken to a minimum value where signal strength just starts to suffer. If reaction cannot be obtained in spite of adjustment of the screen voltage potentiometer, then drop the bias



Winding details of two-range short wave coil with reaction, covering a range of 17 to 65 metres.



Tuning chart showing approximate dial settings for given wavelengths.

voltage by one cell. Reaction control should be found to be smooth and require little adjustment, and in no position should the set break into an audio frequency howl. If this condition is not obtained, do not meddle

\* Omitted from Fig. 10 on page 204 of previous issue.





**Short Wave Superheterodynes.**—

with the reaction winding, but turn attention to the working potentials of the first detector valve.

Considered to be the best and possibly the most interesting of the stations heard are 2XAD and 2XAF at Schenectady, N.Y. These stations relay the New York programme of WGY, the transmission from 2XAD being available from 9 p.m. to midnight B.S.T. (8 p.m. to 11 p.m. G.M.T.), and the 2XAF (31.48 metres) from 11.30 p.m. to 5 a.m. These times are modified on Sunday. Reception cannot be obtained, as a rule, at this time of the year from these stations until after 10.30 p.m., and, when one station fades out, the other may be found to be receivable at full loud-speaker strength. The dial settings for these two stations are approximately 26 on the lower range and 21 on the higher range, both being near the minimum end of the condenser where sensitivity is at maximum. For colonial listeners G5SW, the Chelmsford transmitter operating on a wavelength of 25.3 metres, comes in at about 60 on the lower range. Again, from America the Bound Brook station at New Jersey, 3XAL, operating on a wavelength of 49.18 metres, relays the programme of WJZ from 1 a.m. to 2 a.m. B.S.T. (Mondays excepted). The station 8XK at E. Pittsburg, Pa., apparently the successor to old KDKA, crops up on several different wavelengths, and these are believed to be 19.7, 25.24, and 48 metres. None of these transmissions is

really well heard at the present time, but the best is probably the 25.24-metre transmission which operates daily from 8 p.m. to 3 a.m., but cannot be heard until approaching midnight.

Among other English-speaking stations, one must now include the Trade Union radio station at Moscow working on a wavelength just below 50 metres. Recently the times of transmission of this station, which comes in extraordinarily well on a loud speaker, and, usually, with entire absence of fading, have been announced as Tuesday and Thursday at 10 p.m., B.S.T. The Transatlantic telephony from both sides is, of course, encountered on the dial and is easily recognised by its marked distortion, tending to prevent interception. There are a number of European short-wave transmitters for relaying normal broadcast programmes. It is the intention shortly to publish a complete list of the short-wave broadcasting stations.

Owing to the varying requirements of constructors of short-wave superheterodynes embodying different types of apparatus and valves which they may have to hand, the aim here has been to avoid precise constructional details. It might be mentioned that when putting together an assembly of odd apparatus earthing strips should be run under all screen components and that an earthed metal front panel is essential. Wiring may be carried out by the simplest means, using No. 22 tinned wire in sleeving.

**International Short-wave Club.**

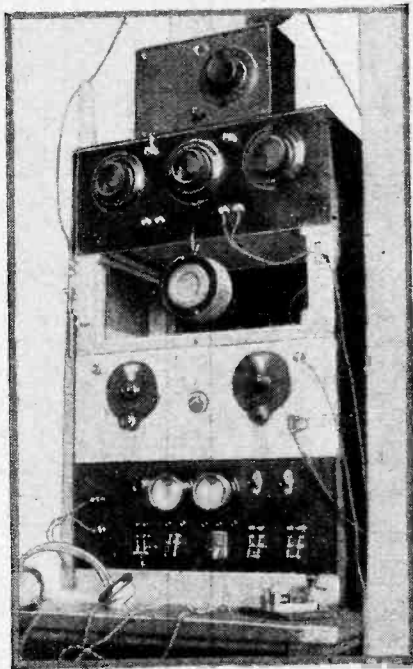
We have received a copy of the July bulletin of the International Short-Wave Club, which has its headquarters in Klondyke, Ohio, U.S.A. The object of the club is primarily for the exchange of information among short-wave amateurs, and Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16—who kindly sent us the bulletin—will be pleased to give enquirers all particulars if they will enclose a stamped and addressed envelope for replies. The annual subscription is \$1 per annum, and the present membership extends to 59 countries.

**Slow Morse for Beginners.**

We frequently get enquiries from our readers asking if there is any regular transmission of Morse at various speeds which would enable them to practise reading the code. Some time ago regular transmission at speeds varying from eight to twenty words per minute were sent out three times a week from Aldershot for the benefit of military cadets, but we believe these have been discontinued. We shall be very glad to hear from readers who know of any such transmissions which are now being sent out.

**A New Zealand Amateur.**

ZL4BK Mr. J. W. Booker, 41, Argyll Street, Mornington, Dunedin, New Zealand, is anxious to arrange regular schedules with British amateur stations. He says that these are well received during January and February and that he has already worked with several of our amateurs. He also states that any "G"

**TRANSMITTERS' NOTES.**

**A COMPACT STATION.**—G 60F, owned and operated by Mr. A. M. Robertson, at 97, Derbyshire Lane, Stretford, Manchester. The set comprises a crystal-controlled TP-TG transmitter and an o-v-1 receiver and is used for low-power work only, the input being from dry cells. The compact arrangement was necessitated by the fact that it is in "Digs" where space is a consideration.

visiting New Zealand will be sure of a hearty welcome at his address.

**Reconstructing a Gloucester Station.**

Mr. H. W. Haydon, G2ZL, informs us that he is at present remodelling his station at 158, Bristol Road, Gloucester, and expects to be working again on 168 metres about the end of September, when the station will be entirely crystal-controlled.

**New Call-Signs and Changes of Address.**

- G2WK W. A. Hayes, Moyallon, 96, Crescent Rd. Reading. (Change of address.)  
 G2WG W. C. Goult, Holly Mount, Rayleigh, Essex  
 G2WS W. A. Scarr, 4, Ridge Mount, Cliff Rd., Hyde Park, Leeds. (Change of address.)  
 G5GD D. G. Sainsbury, Bishampton, near Pershore, Worcestershire.  
 G5JV (ex 2ASZ) H. W. Medcraft, 5, Sussex Road, Holloway, N.7, (transmits on 7 mc. waveband and will welcome reports.)  
 G5LN W. Lilburn, 40, Theresa St., West Stanley, Co. Durham.  
 G5RS E. W. Rawlings, 20, Hedgeway, Onslow Village, Guildford. (Change of address.)  
 G5VS (ex 2ACK) V. A. Sims, 29, Rockford Ave., Westcliff-on-Sea, Essex.  
 G5WR C. Wrigley, 68, Church Rd., Urmston, Manchester.  
 G6GG (ex 2AFM) G. Golling, 5, Elm Cottages, Elm Rd., Shoeburyness, Essex.  
 G6SG (ex 2AZR) H. J. Seagood, 20, Sunnydene Ave., Highams Park, E.4.  
 2AKB H. L. Williams, 9, Austral Street, Kennington, S.E.11.  
 2AOZ P. R. Solder, 35, Torrington Gardens, New Southgate, N.11. (Change of address.)  
 2API J. A. Guy, 42, Grosvenor Buildings, Manisty Street, Poplar, E.14.  
 2BJD F. M. Caine, 75, Warren Drive, Wallasey, Cheshire.

Nigeria.  
 ZD2A (ex FN2C) Capt. G. C. Wilmot, Nigeria Regiment, Zaria.

**QRA's Wanted.**  
 G2AZ, G2TG, G5LL.

**RADIO PROBLEM AT SCIENCE MUSEUM.**

Lack of space is presenting a serious obstacle to the development of the Wireless Section of the Science Museum. According to the report of the Advisory Council for 1930 this is the reason why the transmitting side "is not adequately represented." The wireless section now embraces most of the important advances up to present time, but, in the words of the report, "many more are to be expected and the collection has almost reached the stage where further development can only be shown by withdrawing important representative exhibits."

While we recognise the value of the Science Museum as a whole, numerous visits have convinced us that there are many objects in other sections of the collection which might well yield space to the radio exhibits. Industrial machinery, power production, land, air and water transport, optics, chemistry, and other evidences of man's conquest of nature are all given generous "elbow room." It seems a paradox that radio, which many of us consider to be the most advanced application of scientific research, should be "cribbed, cabin'd and confined."

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**PROPAGANDA ON 100 KW.**

We learn that tests will be started very soon by the new super-power station at Luxembourg, the first to be established in Europe for the avowed purpose of broadcasting advertisements and general propaganda. The wavelength will be 217.4 metres and the power 100 kW.

It would not be surprising if a large proportion of the programmes were financed by American interests.

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**GERMANY'S RADIO LIBRARY.**

The first public library devoted to wireless and allied subjects has been opened in the new Berlin Radio House. Already the visitor can make his choice from several thousands of books in many different languages. More than 200 journals are available for reference.

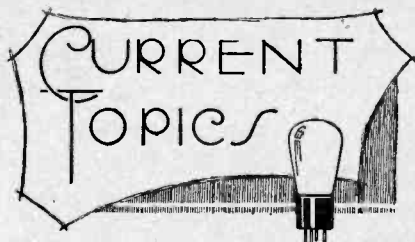
Where is Britain's radio library?

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**HIGH-POWER REGIONAL SCHEME FOR FRANCE.**

General Ferrié's now famous map of France, with which the veteran radio worker is preparing a scheme of French broadcasting for submission to the Postmaster-General, is nearly ready. Our Paris correspondent states that the new plan provides for (a) two 100-kW. stations (Eiffel Tower and Paris P.T.T.), the former to use a long and the second a medium wavelength; (b) six regional stations of 60-80 kW. (to be situated respectively at Rennes, Lille, Bordeaux, Toulouse, Lyons and Limoges), with a supplementary station of 20 kW. (Grenoble); and (c) a number of 5-kW. relay stations.

So many schemes evolved for French broadcasting have already proved abortive that there seems no particular reason why this one should meet with greater success, except the fact that it is sponsored by so illustrious a personage as General Ferrié.



**Events of the Week  
in Brief Review.**

**NEARING THE FOUR MILLIONTH.**

British receiving licences increased in number by 30,000 during July, the total at the end of that month being 3,810,099.

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**NO WIRES FOR BIRMINGHAM.**

Birmingham Corporation has rejected applications by a dozen firms to install a wireless relay system. The reason given is that a conglomeration of wires would interfere with the amenities of the suburbs.

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**CHOOSING AN INTERVAL SIGNAL.**

The B.B.C. might copy the example of the directors of the Leipzig broadcasting station, who are seeking an attractive interval signal. Instead of experimenting with death ticks, cat calls, or musical boxes, they are inviting listeners to make their own choice.

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**BELGIAN SHORT WAVES.**

We understand that two wavelengths will be used by the new station at Brussels intended for communication with the Belgian Congo and South America. During the day the transmitter will work on 15.62 metres with a power of 9 kW.; at night the power will be 12 kW. and the wavelength 29.04 metres.

**7-METRE TESTS BY B.B.C.**

The news that the B.B.C. is to undertake experiments with a 7-metre transmitter must not be accepted as an indication of any imminent change in the present broadcasting system. A B.B.C. official informed *The Wireless World* that a 1 kW. test transmitter now under construction by the Marconi Company will probably not be ready for three or four months. The tests will be similar to those conducted recently in Germany, the object being to restrict relays of distant transmissions to a well-defined radius of five or six miles.

A technical description of the German 7-metre tests, with illustrations, appeared in our issue of May 20 last.

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**MIDGET-WAVE BROADCASTING.**

The Hôtel Carlton at Amsterdam has installed an ultra-short-wave transmitter. Tests are carried out every Saturday from noon to 1 p.m. (G.M.T.). We understand that the wavelength is 7 metres.

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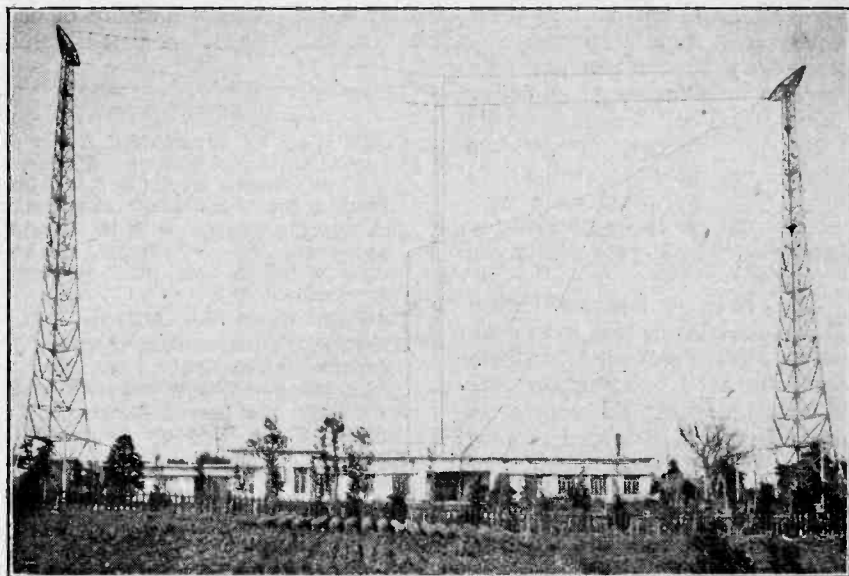
**LENDING A WAVELENGTH.**

For purely experimental purposes, Spain has agreed to the temporary loan of Seville's 368.1-metre wavelength to Helsinki, the Finnish broadcasting station. This friendly gesture has a precedent, for it may be remembered that for many months last year Hilversum was permitted to use the wavelength of 1,071 metres, belonging to Oslo.

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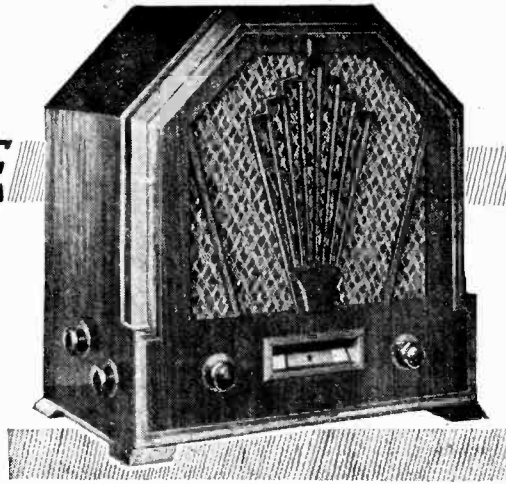
**THE TELEVISION GOLD RUSH.**

Patents relating to television are being issued by the United States Patent Office at the rate of two a week. In America, however, the term "television" has a rather wide application, for it is stated that of the total 350 "television" patents now in existence, 176 cover photographic recording and transmission systems.



**TWIN-WAVE BROADCASTING IN JAPAN.** A new view of the Tokio station, which transmits with a power of 10 kW. Behind the station building can be seen a slender mast which supports a small aerial used for alternative transmissions. A photograph of the studio appears on page 241.

# COMPACT THREE-VALVE RECEIVER



# FOR A.C. MAINS OPERATION

**M**ASSIVE proportions, besides giving dignity to a wireless set, generally suggest good performance, but it is a mistake to assume that in radio what is bigger is always better. In their new Compact all-electric three-valve A.C. receiver The General Electric Company go far towards proving that quality results are not measured by bulk. This attractive receiver, while measuring only 18in. x 16in. x 10in., contains that comprehensive equipment which goes to make up an ambitious A.C. receiver, as well as a built-in Gecophone inductor dynamic speaker chassis.

The method of construction on a metal chassis lends itself well to production in large quantities, and in view of the general performance, both as regards distant station reception and volume and quality of reproduction, a wide market is deserved.

The three-valve circuit with one H.F. stage follows well-tried practice. The aerial is connected through a variable series capacity to a single-tuned circuit with separately wound primary. This control, used judiciously in combination with reaction as a means of adjusting volume and selectivity, is to be found in a number of receivers to-day, and probably will afford the best compromise as a pre-selector until a cheap and simply controlled band-pass filter is produced.

The H.F. valve—an Osram M.S.4—obtains its bias from a resistance in the cathode lead, there being no need to anticipate any hum trouble from this source, as the makers now give an assurance that a difference of potential of some 100 volts is permissible between cathode and heater.

Screening grid volts are fed from the main H.T. positive lead through a series resistance, and a special non-inductive condenser of low H.F. resistance ties this electrode down to earth and so prevents the valve from tending to act as a triode. There are a number of these

## GECOPHONE

Self-contained Receiver with Good  
All-round Performance.

special condensers housed in small cylindrical metal containers to be found in the receiver where by-pass capacities of low loss are necessary.

The intervalve coupling consists of a plain untapped tuned-grid circuit, to which reaction is applied *via* a differential condenser. Negative bias for a gramophone pick-up (terminals for the latter are provided at the

back of the chassis) is arranged in the detector cathode lead, and the anode circuit of this valve is well decoupled by a 20,000-ohm resistance and a 1-mfd. condenser. The output valve—one of the new Osram directly heated pentodes (the P.T.4)—is linked to the detector by a 3 to 1 transformer having a high-permeability core.

There is no voltage-dropping resistance in the auxiliary grid circuit of the P.T.4 which receives the full smoothed H.T. voltage, but a by-pass to earth of 4 mfd. is afforded by the condenser across the output of the eliminator. Choke filter output to the inductor speaker gives a measure of decoupling and ensures that the D.C. component is confined to the choke circuit. An interesting

compensating circuit consisting of a resistance and condenser in parallel is shunted across the output and prevents H.F. oscillations from passing to the speaker leads; furthermore, it acts as an impedance limiter to the high peak voltages which are often developed in pentode stages when the load is not held within certain limits.

A generous smoothing equipment is supplied, and a feature of interest in the mains unit is the inclusion of two special tappings at plus 10 and plus 20 volts on the primary of the transformer, so that all voltages in increments of 10 between 100 and 150 and

200 and 250 can be accommodated. One pole of the mains is taken through a removable link marked M.A., and through a condenser of 0.001 mfd. to the aerial terminal of the set. Where the field strength of a local station is large, sufficient pick-up may be often obtained

### SPECIFICATION.

**CIRCUIT:** Single screen-grid H.F. stage with parallel tuned grid coupling. Regenerative leaky grid detector coupled by 3 to 1 transformer to directly heated high-voltage pentode.

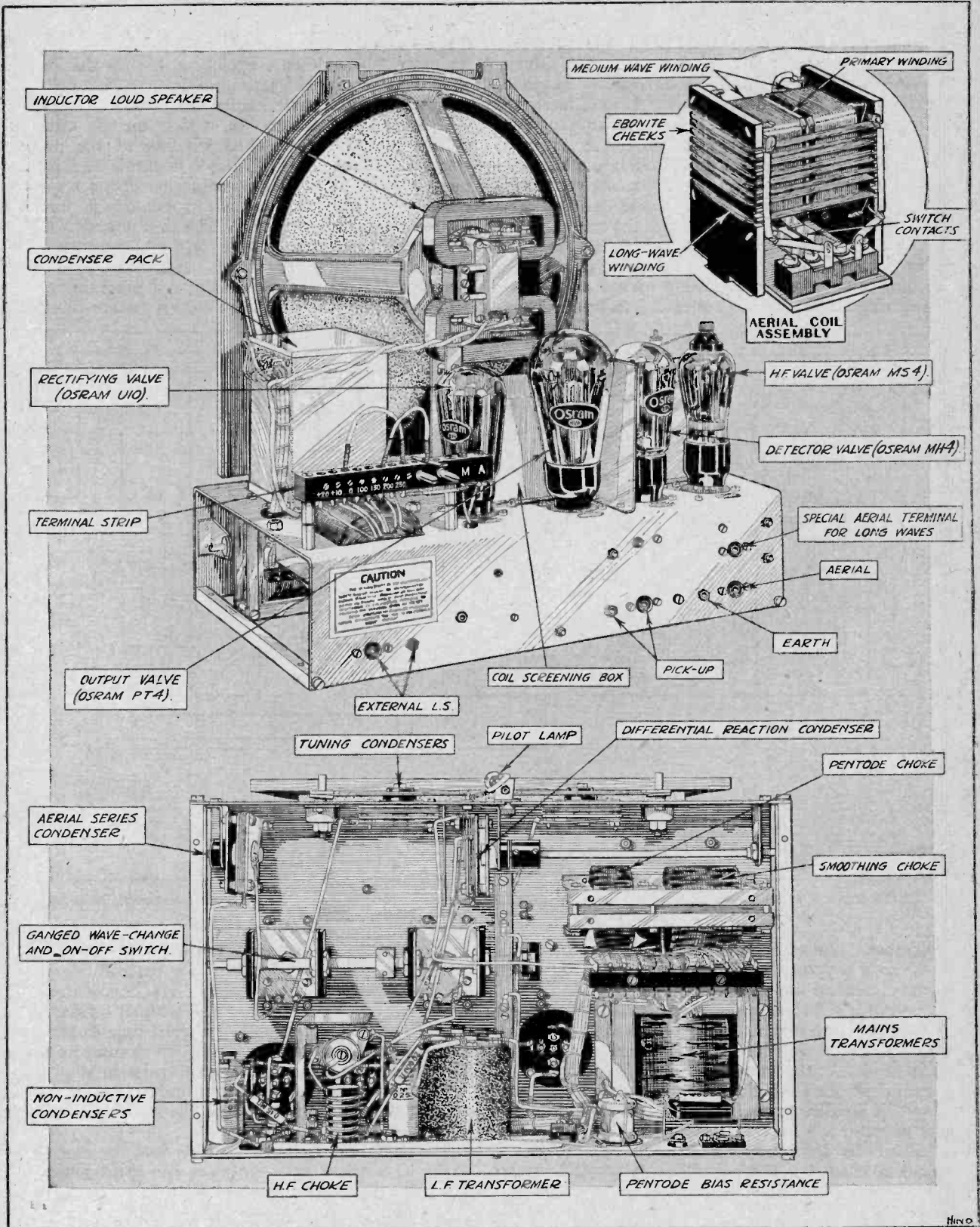
**CONTROLS:** Two tuning dials. Combined wave-change and on-off switch. Series aerial capacity (volume and selectivity) control. Reaction control.

**VALVES:** Osram MS4, MH4 and PT4.

**GENERAL:** Illuminated tuning scales. Self-contained inductor loud speaker. Provision for gramophone pick-up and mains aerial.

**MAKERS:** The General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

**PRICE:** 18 guineas, including valves and loud speaker.

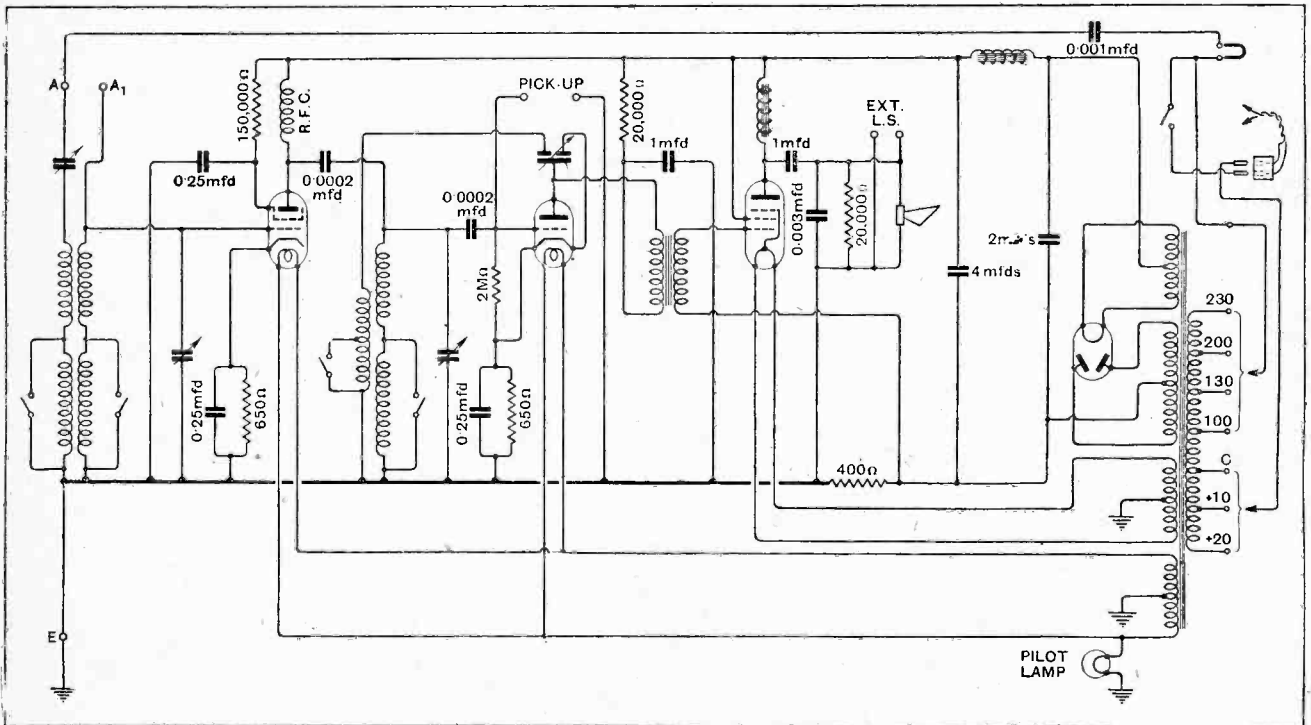


Showing the constructional details of the Gecophone Compact three-valve receiver for A.C. mains.

**Geophone Three-valve Receiver for A.C. Mains Operation.**— by this means without the use of an external aerial. Tuning of the two circuits is effected by separately controlled condensers with solid dielectric. The advantage of this construction is, of course, economy of space, but a small price has to be paid in the form of increased high-frequency resistance. Owing to the efficient construction of the coils, however, which are totally screened, the dynamic resistance of the tuned circuits attains the satisfactory figure of about 90,000 ohms. Adverse criticism, therefore, can hardly be levelled at the condenser design. Behind the speaker can be seen the screen, which covers the somewhat unconventional coils. For the medium waves an enamelled wire winding is arranged on a  $1\frac{1}{4}$  in. square former consisting of two rectangular pieces of ebonite slotted and assembled to form a right-

specially shaped escutcheon ample light is thrown on to the two scales. The pilot light is also seen through a small red window, and serves as a reminder that the mains switch is closed. Prolonged life for this lamp is assured by heating the 3.5-volt filament with 2 volts A.C.

With regard to performance, one is at once struck by the excellent bass response, which can be attributed chiefly to the well-matched winding of the inductor speaker. There is "brilliance" in music and naturalness in speech, but over-attenuation of the upper frequencies often experienced with a pentode is prevented by the compensator circuit. The undistorted A.C. output is about one watt—ample for even large rooms. Although only one H.F. stage is used, about 16 medium-wave stations can be received at full programme value after dark without pressing reaction to the limit. On



Circuit diagram of the Geophone Compact A.C. receiver. By means of extra windings on the mains transformer provision is made for all-mains voltages between 100 and 250.

angled cross. Slotted end-cheeks slipped on to the ends of these coils support the long-wave inductances, which are wound around the whole assembly.

Wave-range switches operated by a ball and plunger arrangement are to be found under the metal baseboard, and the same spindle which controls them also actuates the mains switch, the movement of which is by means of a cam depressing a spring, and by a process of "lost motion" a sudden break is made. Reference to the circuit diagram will show that there is at the high-potential end of the secondary of the aerial transformer a terminal labelled  $A_1$ , which provides in special circumstances an increase of volume of the long waves.

To assist in keeping the two tuning dials approximately in step over the wave range, a dial lamp is arranged in the middle of the chassis front, and by means of a

the long waves consistently good reception can be relied upon from some six stations. By carefully combining the series aerial capacity and the reaction controls adequate selectivity can be obtained without serious reduction of volume. It may take a short time to get accustomed to the two tuning controls, which must be rotated in opposite directions to keep the scales in step. After very little practice, however, one finds that more accurate tuning is possible than when the two dials must be turned in the same direction.

In conclusion, it is safe to state that the new G.E.C. Compact receiver will appeal to the great majority of listeners who require neatness of appearance and a high standard of performance for the minimum of expense.

*Next Week's Set Review: MARCONIPHONE MOVING-COIL TRANSPORTABLE THREE.*

**The B.B.C. at Olympia.**

"Distribution," I hear, will be the keynote of the B.B.C.'s exhibit at Olympia.

The intention is to give the listener an idea of the tentacle-like scheme of cables which makes it possible (or impossible) to hear Jack Payne and others in every part of the country.

**A Zepp's-eye View.**

A large semi-relief map of Great Britain—18ft. by 15ft.—is being prepared on which we shall see the chain of stations (with power and wavelength marked), the network of cables, and, by a colouring system, the density of population in each service area.

**Where to See the Amplifier.**

One of the big attractions will be the B.B.C.'s giant amplifier, which will be supplying broadcast programmes and gramophone selections to as many loud speakers as the exhibitors are prepared to install on their stands. The number will be in the neighbourhood of 300.

Following last year's practice, the amplifier will be easily visible in a large glass-walled chamber on the first floor of the Empire Hall.

**Boosting the International Union.**

The B.B.C. stand will also give a well-deserved "boost" to the Union Internationale de Radiodiffusion. Nothing spectacular is being arranged, as I understand that the facts and figures to be displayed will themselves be sensational enough.

The Union represents no fewer than 90 million listeners scattered up and down Europe.

**Busy Nights at Brussels.**

One of the B.B.C. transmitter wave-meters will be on view, together with a description of the work carried on at the Brussels wave-checking post, which is probably the busiest radio receiving station in Europe, if not in the world. The engineers frequently check the wavelengths of two hundred stations in one evening.

**"By Special Request."**

Mr. Charles Siepmann, who is "O.C." of the Adult Education talks scheme, gave an eloquent exposition of the B.B.C.'s aims in this direction at a luncheon party on Wednesday last.

He stressed the point, which critics may be inclined to overlook, that the forthcoming series of talks under the title "The Changing World" is a reply to the direct request of listeners in all parts of the country.

**The Changing World.**

No fewer than a thousand organised listening groups communicated with the B.B.C. last winter, and for each group there must be many hundreds of individual listeners.

Listeners have asked for a co-ordinated series of talks to meet the present "intellectual emergency," as Mr. Siepmann called it, in which ordinary men and women, confronted with a be-

BROADCAST  
BREVITIES

By Our Special Correspondent.

wildering array of new facts and new discoveries, are seeking a fuller understanding of the changed conditions and possibilities of human existence.

The B.B.C. is ambitious.

**Marchese Marconi's Talk.**

Many readers who were disappointed when Marchese Marconi's broadcast talk on the pioneer days in radio was postponed will be glad that the suggestion first made in these columns is to be carried out. The famous inventor's talk will coincide with the Olympia Radio Exhibition. It will be given at 10 p.m. on Saturday, September 19th—the day following the opening of the Show—and will last half an hour.

**At the Faraday Commemoration Meeting.**

And, as if to compensate us for our earlier disappointment, Marchese Marconi will again be heard before the microphone on the following Monday, September 21st, when, with Sir William Bragg, he will address an audience at the Faraday Commemoration Meeting at the Queen's Hall. Unfortunately, these speeches will be given in the afternoon, when not all of us can listen, even with portables.

**The Economy Cuts.**

Talk at Savoy Hill is still centring round the possibility that the suggested "cut" of £475,000 will not take effect. Some reduction of income is inevitable,

but I gather that the B.B.C. are budgeting for a maximum drop of £250,000 next year.

If this figure is not exceeded, it is believed that programmes will not suffer.

But the whole situation is so unsettled that one hesitates to prophesy . . . a grave portent in radio journalism!

**The Schneider Trophy.**

Squadron Leader Helmore is one of our best running commentators, and I am glad that he has been chosen to describe the thrills of the Schneider Trophy contest on September 12th. He will take up his stand on Ryde Pier, within four hundred yards of the course taken by the seaplanes. Quite near enough, one would think, if the worthy commentator is to avoid that distressing complaint known to the police fraternity as "swivel neck."

**Opera from Covent Garden.**

The English season at Covent Garden opens on September 14th, when National listeners will hear a relay of Act 3 of "The Bartered Bride."

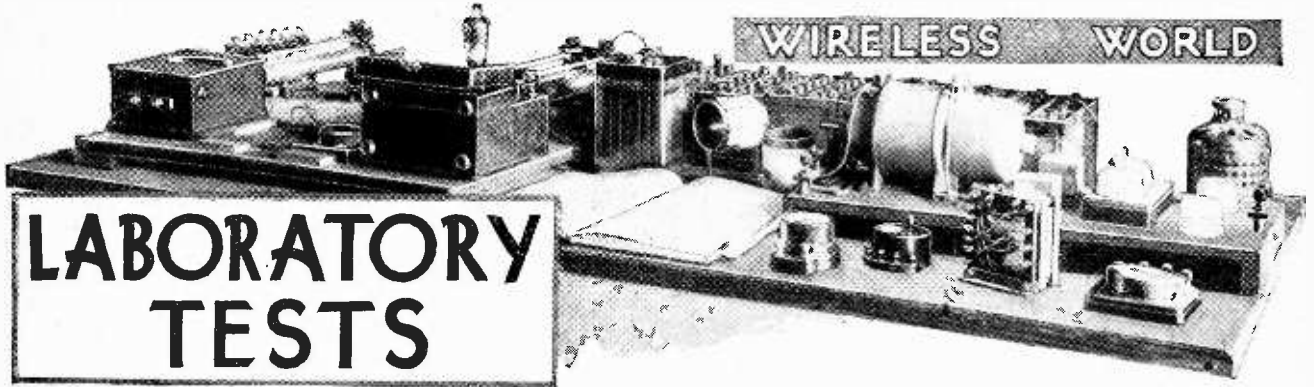
Other relays from the home of opera during next month are extracts from "The Mastersingers," on September 19th, for Regional listeners; September 24th, "The Wreckers," also on the Regional wavelengths; and September 26th, "The Barber of Seville," which is for National listeners.

**Slipped Ease for the Announcers.**

Have you noticed the growing heartiness and warmth of the announcers' voices? I have, and I put it down to the psychological effect produced by the introduction of a new staff superannuation scheme. The announcers no longer look forward apprehensively to a *doleful* occasion when, their service with the Corporation completed, the final "Good night everybody, good-night" would be followed by a doss on the Embankment



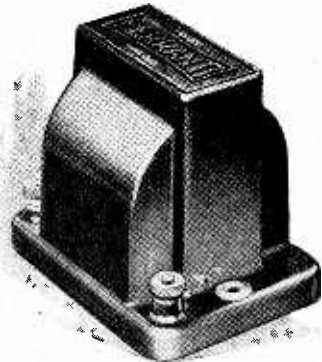
IN A JAPANESE STUDIO. This interesting photograph was taken recently at the Tokio broadcasting station. It will be noticed that the orchestra plays from memory, thus eliminating the rustling noise of turning pages. The microphone can be seen on the left of the conductor. Tokio has abandoned its short-wave transmissions, and can now be heard only on 345 metres.



A Review of Manufacturers' Recent Products.

**FERRANTI B8 CHOKE.**

The B8 L.F. choke is similar in size and appearance to the Ferranti A.F.8 transformer, its nominal inductance is 17 henrys, and the maximum D.C. per-



New Ferranti E8 L.F. choke to carry 45 mA. of D.C.

missible is 45 mA. Measurements were made of the inductance with various values of D.C. flowing and with 1 mA. of A.C. passing through the winding. The following values were found:—

D.C. in mA.	Inductance in Henrys.	D.C. in mA.	Inductance in Henrys.
0	19.3	30	18.05
5	19.5	35	17.5
10	19.5	40	16.9
15	19.3	45	16.2
20	18.95	50	15.4
25	18.55		

The choke is suitable for use in output circuits or as a smoothing choke in battery eliminators, since an inductance of some 17 henrys is generally ample for these purposes. The measured D.C. resistance is 740 ohms, and the price is 7s. only.

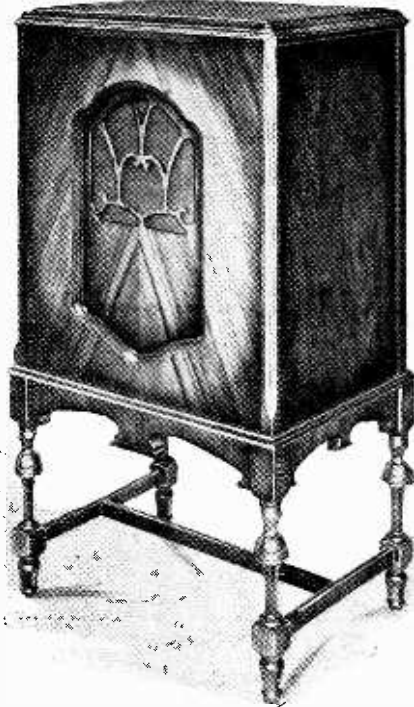
The makers are Ferranti, Ltd., Hollinwood, Lancashire

**CAMCO "WESTMINSTER" RADIO-GRAM CABINET.**

This cabinet is designed to house a complete radio-gramophone, including the batteries or mains equipment. The overall height is 3 ft. 6 ins., the width 2 ft.

and the depth 1 ft. 4½ ins. The turntable compartment measures 20½ ins. wide by 14 ins. deep, and there is a 3½ in. clearance below the lid which allows ample head room for the pick-up arm.

Provision is not made for a visible control panel, and all controls will presumably be located on the motor-board. The main compartment, in which will be fitted the receiving set, loud speaker and H.T. supply, is 20 ins. high, 21 ins.



Camco "Westminster" walnut finished radio-gramophone cabinet.

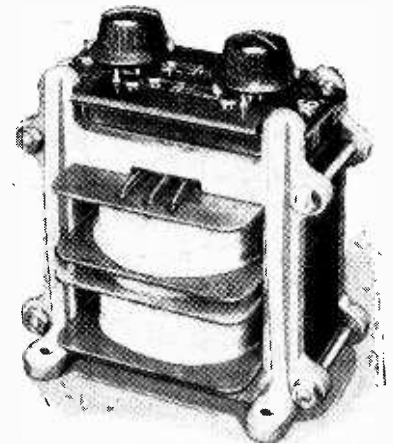
wide and 15 ins deep, and the loud speaker grille is located immediately below the motor-board. A removable back is fitted and is acoustically open. Other precautions to preclude any tendency of cabinet resonance take the form of re-enforced sides and bottom. The cabinet is sturdily made and well

finished, the outside being veneered in handsomely figured walnut. The price is £8 10s., and the makers are Carrington Manufacturing Co., Ltd., 24, Hatton Garden, London, E.C.1.

**"INSTAMAT" (MAJOR) OUTPUT TRANSFORMER.**

Made by Ready Radio (R.R., Ltd.), 159, Borough High Street, London, S.E.1, the function of this output transformer is to enable the valve and loud speaker impedances to be quickly matched. Its official description is an abbreviation of the expression "instant matching." Both primary and secondary windings are tapped, and, by means of two four-position switches, ratios of 10:1, 12½:1, 14:1, 16:1, 20:1, and 25:1 can be selected at will. The primary winding is tapped in two places only, and the various ratios mentioned above are obtained by selecting the suitable combination of primary and secondary turns. For the 25:1 and 14:1 ratios the maximum primary inductance is available, while when the other ratios are employed the alternative primary tapping is utilised, giving an inductance approximately half of the maximum value.

Measurements reveal that, with no D.C. flowing, the inductance of the whole of



Ready Radio "Instamat" (Major) output transformer for use with moving-coil loud speakers.



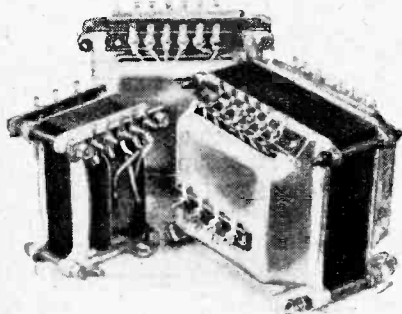
the primary winding is 9.5 henrys, while the tapped portion shows a value of 5.13 henrys. Further measurements were made to determine the primary inductance with various amounts of D.C. flowing with the switches set for 25:1 ratio, the A.C. through the primary being maintained at 1 mA. throughout.

D.C. in mA.	Inductance in Henrys.	D.C. in mA.	Inductance in Henrys.
0	9.5	30	5.3
5	9.2	35	4.9
10	8.6	40	4.5
15	7.5	45	4.2
20	6.5	50	4.05
25	5.9		

The D.C. resistance of the whole primary winding is 32.5 ohms, and that of the tapped portion 25.5 ohms. This model is intended for use with moving-coil loud speakers fitted with low-resistance speech coils, as the D.C. resistance of the secondary winding is of the order of 2 ohms only. The price is 37s. 6d.

**VORTEXION MAINS TRANSFORMERS.**

A special feature of these mains transformers is the care taken in the construction to guard against defective insulation



Vortexion mains, and tapped output transformers.

in the high-voltage windings. Enamelled covered wire is employed, but, by a special process of winding, cotton is interweaved with the wire, thus considerably augmenting the insulation between each turn.

One of the models submitted for test has been designed especially for the Super Selective Six receiver described recently in this journal. Under full-load conditions the 5-volt rectifier filament winding gave 5.08 volts, the two 4-volt L.T. windings giving 4.05 volts at 4 amps, and 3.9 volts at 1 amp respectively. The H.T. output is of the correct order to meet the needs of this set.

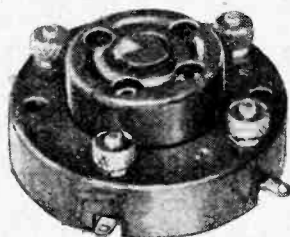
An iron core of generous size is embodied, and special die-cast aluminium end plates completely shield the windings, in addition to serving as clamps for the core laminations. The price of this model is 47s. 6d.

A small transformer for use with the Westinghouse Style 6 metal rectifier is available at 17s. 6d. This carries one 4-volt L.T. winding, and the primary is tapped for use on 110- and 220-volt mains. A tapped output transformer is another product of this firm; both primary and

secondary windings are tapped, thus providing for the use of output valves of widely different impedances, in addition to enabling loud speakers to be operated under the most favourable conditions. The primary is rated to carry 20 mA. of D.C., and the price is 42s. The makers are Vortexion, Ltd., 72, Merton Road, Wimbledon, London, S.W.19.

**NEW ANTI-MICROPHONIC VALVE HOLDER.**

This is one of the many new components recently introduced by Graham Farish, Ltd., Mason's Hill, Bromley, Kent. It consists of two parts; a centre-piece carrying the valve sockets and an outer shell, both being made of bakelite.



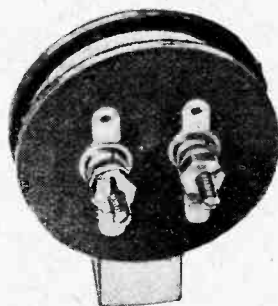
Graham Farish new anti-microphonic 4-pin valve holder.

The sockets, springs and soldering tags are fashioned in one piece, and the small terminals serve to attach the springs to the outer shell. The valve holder is of the four-pin type, and the price is 10d.

**SPECIAL COMPONENTS BY H. & B. RADIO.**

H. & B. Radio Co., 54-58, Beak Street, London, W.1, are now in production with two special components embodied in recent *Wireless World* receivers. The small slab coil, designated L4 in the theoretical diagram of the "Super Selective Six" receiver, is wound with the specified number of turns on an ebonite bobbin, and complete with mounting bracket, costs 3s.

Readers will, no doubt, recall the special coil screens used in the "D.C. Mains Three" receiver. These measure



H. & B. slab coil for the "Super Selective Six" receiver.

4 3/8 ins. in diameter and are 5 ins. high. They are spun from aluminium and are being marketed by this firm at 3s. 6d. each, including the special base.

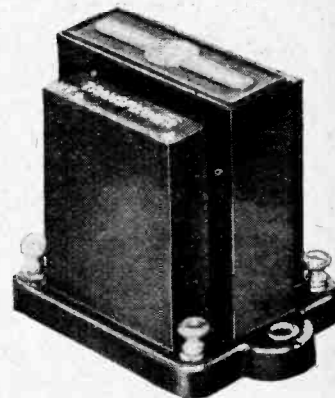
**R.I. "DUX" L.F. TRANSFORMER.**

This L.F. transformer has been developed to meet the demand for a high-quality component at a very competitive price. It is enclosed in a maroon-coloured bakelite moulding somewhat similar in size and shape to the well-known R.I. Hypercore transformer, and it will carry up to 5 mA. of D.C.

The core is built up from laminations cut from specially selected transformer iron, which, while possessing low losses and a reasonably high permeability, is not a nickel-iron alloy. With a view to keeping the distributed capacity of the primary as low as possible, a three-section winding is employed, by which means it has been found possible to reduce the self-capacity to some 15 micro-mfds. only.

D.C. in mA.	Inductance in Henrys.
0	52.0
1	39.0
2	29.6
3	24.0
4	20.8
5	18.8

Measurements of the primary inductance at 50 cycles and with various selected amounts of D.C. flowing gave the above values:—



R.I. "Dux" L.F. transformer with 1:3 1/2 ratio and rated to carry 5 mA. of D.C.

For the purpose of this test, the A.C. was maintained at 1 mA. throughout.

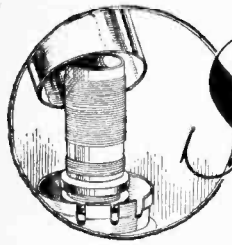
The step-up ratio is 1:3 1/2, and the measured D.C. resistance of the primary 1,200 ohms.

The "Dux" transformer is priced at the very attractive figure of 6s. 9d., and the makers are Radio Instruments, Ltd., Purley Way, Croydon.

**Catalogues Received.**

Henry Joseph, 11, Red Lion Square, High Holborn, London, W.C.1.—Descriptive folder dealing with the latest range of Grawor loud speakers, chassis units and gramophone pick-ups.

Radio Service (London), Ltd., 105a, Torriano Avenue, Camden Town, London, N.W.5.—Broadsheet giving full particulars of the high- and low-tension accumulator service operated by this company.



# Simplified H.F. Calculations

The Case of the Screen-grid Valve.

By W. A. BARCLAY, M.A.

(Continued from page 216 of previous issue.)

THE amplification to be obtained from screen-grid valves has steadily improved since their inception, and the latest mains-operated types set up a standard of H.F. magnification which was quite undreamed of three or four years ago. Nevertheless, they are not entirely without disadvantages, chief among which may be noted their comparative lack of selectivity. To ameliorate this defect, as is well known, coupling transformers of non-optimum ratio are usually employed, with the result that some stage gain is inevitably sacrificed. The huge magnification factors of

these valves are such, however, that the resulting loss is very largely discounted, and the user may well congratulate himself—and those research workers who have made it possible—on the enormous magnification which is obtainable with even this imperfect coupling.

The methods of employing screen-grid valves—neutralised and otherwise—have already been fully dealt with in this journal, and the following notes and diagrams are intended to do no more than supplement what has previously been said, with a view to enabling the reader to arrive expeditiously at precise numerical values for his own problems.

To obtain the best results with screen-grid valves, it is, of course, necessary to take all possible precautions against unwanted coupling between output and input circuits. We shall assume, therefore, that our valves are properly “decoupled” and effectively screened, and, further, that the secondary of the H.F. transformer shall have the highest possible dynamic resistance at resonance compatible with stability.

### Threshold Instability of Unneutralised S.G. Valve.

If we assume a one-to-one transformer (or tuned anode) together with perfect screening, we shall find that the greatest dynamic resistance possible for our tuned circuit will depend upon the wavelength which it is desired to receive. If the receiver is tuned to a wavelength below that for which the optimum dynamic resistance has been computed, instability will occur. In practice, we select arbitrarily a certain minimum wavelength above which we desire the receiver to be stable, and proceed to calculate the value of dynamic resistance,  $R$ , which, in conjunction with the residual capacity of the valve, will ensure stability over the tuning range. Our problem is thus to find the value of this dynamic resistance when the other factors are known. The formula which is usually employed has appeared on several occasions in

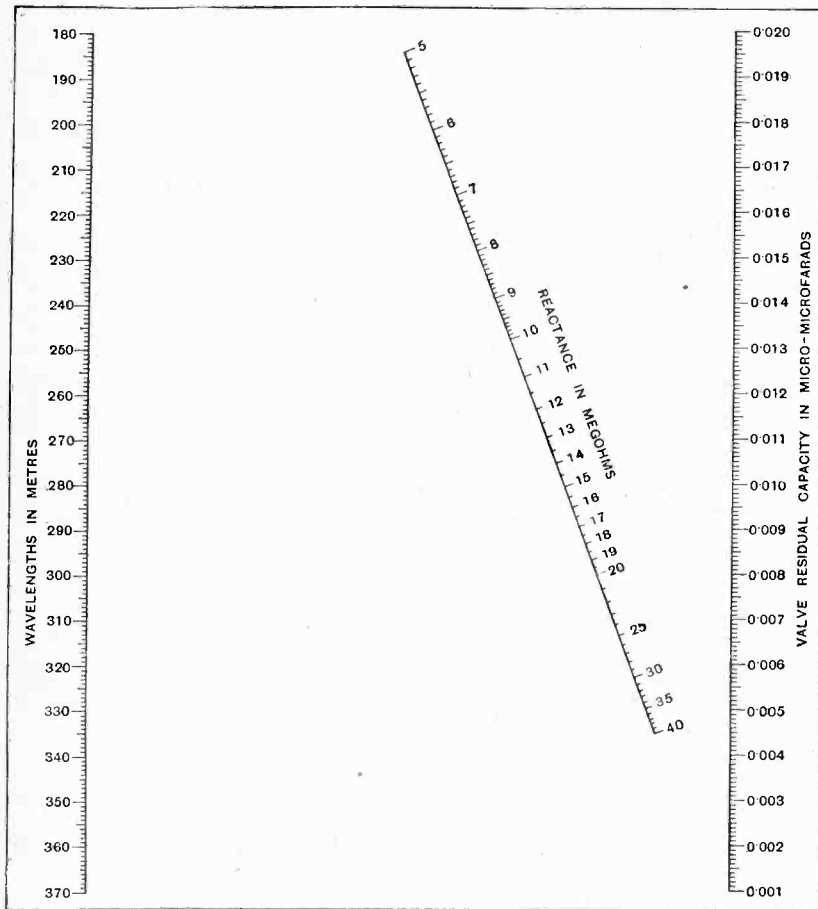


Fig. 3.—Simple alignment chart showing the reactance in megohms of various values of anode-grid capacity at different wavelengths.

**Simplified H.F. Calculations.—**

*The Wireless World.* It may be written:

$$\frac{C_o \omega G}{\frac{1}{R} \left( \frac{1}{R} + \frac{1}{R_o} \right)} = 2,000$$

where  $G$  is the mutual conductance of the valve in milliamps. per volt,  $C_o$  is the residual capacity, and  $R_o$ , as usual, the A.C. resistance of the valve taken under working conditions. It will be seen that this equation provides a means of finding  $R$  when all the other values are known, and it is now proposed to show how this may actually be done in the practical case without the troublesome necessity of solving it numerically.

**Two Alignment Charts.**

Let us first consider the residual capacity of the anode to grid in the screen-grid valve. Usually this is a very small quantity indeed—being of the order of a fraction of a micro-microfarad—and, of course, its reactance at the “threshold instability” wavelengths is correspondingly high—usually several megohms. As we shall find it necessary to know the value of this reactance, a simple three-variable alignment diagram is reproduced in Fig. 3 by means of which the reactance value in megohms may be connected directly with the wavelengths for such capacities up to a maximum of  $0.02 \mu\mu F$ .

We now turn to the chart reproduced in Fig. 4. This also is an instance of simple “three-variable” alignment, in which, however, each supporting line carries two scales lettered  $\alpha$  and  $\beta$ , the values on  $\beta$  being simply in extension of those on  $\alpha$ . By this means a much wider range of the variables can be brought within

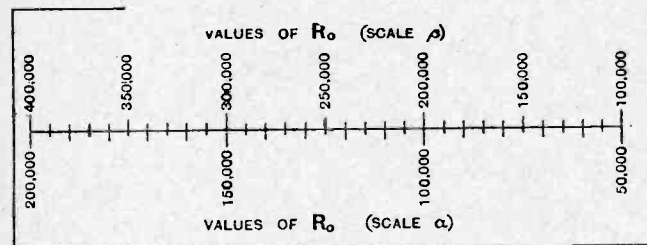


Fig. 4.—Alignment chart for dynamic resistance of tuned secondary when using screen-grid valves. Either scales  $\alpha$  or  $\beta$  for any one alignment must be employed.

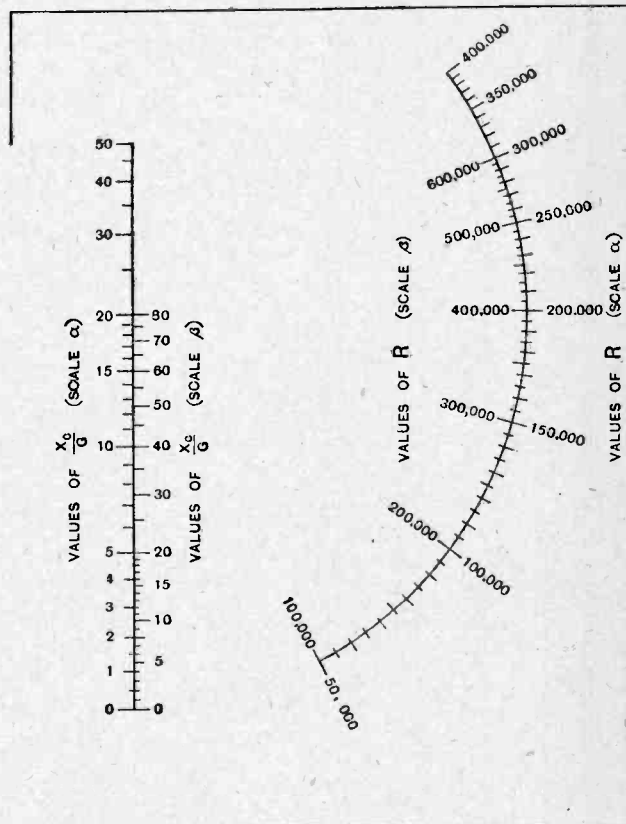
the compass of the diagram than would be the case if each support carried but one scale. It is, of course, essential to use either the three scales lettered  $\alpha$  or those lettered  $\beta$  for any one alignment.

The horizontal scale at the foot of the diagram carries values of anode A.C. resistance  $R_o$  from 50,000 ohms up to 400,000 ohms. The right-hand curved support carries values of dynamic resistance,  $R$ , from 50,000 ohms to 600,000 ohms. Finally, the centre vertical scale carries values of  $\frac{X_c}{G}$ , the ratio obtained when the residual capacity reactance (in megohms) found by Fig. 3 is divided by the mutual conductance of the valve (in mA. per volt). It will be recalled that  $G$  is equal to  $\frac{\mu}{R_o} \times 1,000$ , and that its value may be ascertained

very conveniently when  $\mu$  and  $R_o$  are given by the use of Chart 2 of the previous instalment.

**An Example.**

As an example of the rapidity with which the diagrams of Figs. 3 and 4 may be used to find the maximum dynamic resistance for stability, let it be required to find this resistance in the case of a valve for which  $\mu = 135$ ,  $R_o = 270,000$  ohms, and  $C_o = 0.008$  micro-microfarads, the wavelength at which threshold stability is desired being taken as 225 metres. From the chart of Fig. 3 it is readily found that  $X_c$ , the residual capacity



reactance at 225 metres, is 15 megohms. (In passing, it might be pointed out that the accuracy of this result is considerably in excess of practical requirements, as it is obvious that the figure given for residual capacity can be only very approximate—being, in fact, subject to many causes of variation according to the conditions under which the valve is operated). The mutual conductance of the valve is  $\frac{135}{270,000} \times 1,000$  mA. per volt, i.e.,  $G = 0.5$ , so that the ratio  $\frac{X_c}{G}$  is equal to 30. Turning now to Fig. 4, we note that the point corresponding to  $R_o = 270,000$  ohms appears on the  $\beta$ -scale. We then find the point  $\frac{X_c}{G} = 30$ , also upon the  $\beta$ -vertical, and, by alignment with the curved  $\beta$ -scale, the required

**Simplified H.F. Calculations.**

value of dynamic resistance R is found to be 380,000 ohms. The whole process, it will be seen, is extremely easy to carry through, and renders patent to the view a wealth of statistical material which, to say the least, is not otherwise very easily obtainable.

Having thus found R, the total amplification of the stage may be read from a chart to be described in a subsequent issue, where it is also proposed to deal with transformers of non-optimum ratio in conjunction with screen-grid valves.

(To be concluded.)

**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.

**SINGLE-DIAL SUPERHETS.**

Sir,—I am sure the radio public will raise its hat to the Marconiphone Company (*vide* Mr. Dyer, in *The Wireless World* of August 12th) for its initiative in breaking the sound slumber of our manufacturers in the matter of single-control superhets.

Among these hat-raisers will be a good sprinkling of service engineers who hope that this famous company will adhere to those methods of mechanical construction which do not drive the said engineers bald.

May I add, too, that I have not noticed any doffing of head-gear in respect of the diagrams and technical data on commercial receivers which you have published, and I would like you to accept my thanks for valuable contributions to my "service" file—this week makes the fifty-first.

C. ALEXANDER HOWARD, A.M.I.R.E., A.I.W.T.

London, N.4.

**EMPIRE BROADCASTING.**

Sir,—The enclosed reprint from the *Barbados Advocate* is sent to you on behalf of radio listeners throughout the British Colonies, but more particularly in this instance Barbados, with a fervent hope that you may in some way be able to help us in obtaining some improvement in transmitting conditions, whereby Britishers in the Colonies may hear programmes from England with as good clarity, volume and regularity as we get programmes from the U.S.A. or France by the short waves.

St. Michael, Barbados.

J. W. BROWN.

The following is an extract:—

For the past few years colonists have tuned for G5SW mostly without success, but certainly with little effort from G5SW to help them or to care whether they heard them or not, and now for the past several weeks, almost at the same dial position when FYA (the French Colonial transmitter at Pontoise) is working, the French broadcasts pour in with a swamping effect.

**THE AMATEUR.**

Sir,—Having read, with no little interest, the various opinions regarding the position of the amateur, I hope you will be kind enough to consider the point of view of an English professional overseas.

Unfortunately, I have not been able to follow, to any extent, the activities of the English amateur, being very busily engaged in professional wireless work in North, Central and South America. I am not, moreover, well acquainted with the latitude granted to the amateur at home, but am nevertheless of the opinion that he is deserving of far more credit and consideration than he has received. Having quite a profound respect for the amateur operator, I am very much in sympathy with those of my countrymen who are, apparently, operating under extreme difficulties.

It seems to me that the English amateur might well take a leaf out of the book of his American cousin. This might bring a storm of protest; but one must regard the facts, and they are remarkably clear. The American amateur can "pound his brass" twenty-four hours out of twenty-four if he is so inclined, admittedly with certain restrictions with regard to power and frequency. Those restrictions, however, are sensible and are agreeable to the amateur, who very strictly abides by them because he is satisfied with them and is allowed to pursue

his hobby unmolested. He has formed an American Radio Relay League, which is not only recognised by the Government, but receives every assistance and co-operation from it. The American Government realises that the amateur is a valuable asset to the country, and in times of national emergencies the amateurs have proved their value.

Surely professional and amateur followers must realise that the times assigned for amateur transmissions are so much "eye-wash." It is, of course, very necessary to keep the ether clear for official and commercial transmissions and to cater for the broadcast listener, but it is not necessary to limit the amateur in his operations to such a great extent.

I am positively certain that if British amateurs were really interested in achieving a similar position to that outlined above, and were they formed into an efficient organisation, with a head of affairs that was really conversant with what is required, it would not be very far distant when a "British Radio League" would be established, just as efficient and well-operated as the American League.

My very serious advice to the British amateur who is really keen in his transmission activities is to wake up before he becomes a back-number.

H. F. JONES.

Panama City.

**RESONANCE IN ORGAN REPRODUCTION.**

Sir,—I read "F. U. W.'s" letter in your issue of August 12th regarding resonance of organ reproduction. I was engaged a few years ago in the development of a similar idea in a London cinema. This cinema is very big, and resonance very difficult to deal with. After several experiments we finally put the microphone on the console itself, the two organ chambers being some 25ft. away. A powerful four-valve amplifier was brought into operation, with two Marconi horn speakers such as are used for relaying speeches, etc., placed approximately 180ft. away, but facing the organ itself. The result was quite satisfactory, the organ being given the necessary pompous effect. I am now undertaking the same task in another theatre which has been specially adapted for sound equipment, and the resonance to be obtained here will be very much more difficult to deal with. This method I have described has also been adopted in several churches with great success by Messrs. Comptons, the famous organ builders, and I have no doubt they would furnish particulars.

W. LEON MINEL.

Kingston Hill.

**TIME FROM THE MAINS.**

Sir,—We were interested to read Mr. F. L. Franklin's letter in the current issue of *The Wireless World* on the subject of "Time from the Mains." We quite agree with Mr. Franklin when he says that breakdowns and interruptions may have serious consequences even although breakdowns as a rule do not last more than a few minutes. The Hammond Clock Company have been able to overcome all difficulties in this direction with their new bichronous clocks. These clocks will continue to operate for a period between 30 and 45 minutes in the event of current failure through the medium of its auxiliary spring-wound motor. When the current fails the electric mechanism automatically switches over to the spring-wound motor and vice versa when the current is again resumed.

THE ROTHERMEL CORPORATION, LTD.

(E. F. Heaver, Sales Manager).

READERS

PROBLEMS

Technical enquiries addressed to our Information Department are used as the basis of the replies which we publish



in these pages, a selection being made from amongst those questions which are of general interest.

**More Magnification from a Short-wave Set.**

Without going to the length of adding an extra stage, I should like to increase the magnification of my short-wave set (conventional det.-L.F. circuit) so that more stations can be heard on the loud speaker. It is proposed to replace the triode output valve by a pentode; are there any other alterations that can be recommended?

There is little reason why you should not use a high-ratio L.F. transformer (say 1:7) between the detector and pentode. Ordinarily, these special transformers are recommended as couplings to be followed by a triode, but if you are able to overcome the natural tendency towards L.F. instability the arrangement we describe should be quite satisfactory.

Quality may suffer to a certain extent unless the detector valve is of reasonably low A.C. resistance.

**An Imaginary Difficulty.**

I would like to adopt "ganged" tuning control of all three circuits, but am rather afraid that I may find it difficult to make initial adjustments with sufficient accuracy. I have built several sets, but have never attempted single-dial tuning.

There is a tendency to over-emphasise the difficulties likely to be encountered in setting up a ganged tuning system. Provided that reasonably well-matched coils are used, with a suitable multiple condenser, this operation is relatively easy, given a fair amount of patience and a little common sense.

We would go so far as to say that no operation connected with the construction of wireless receivers is more interesting than the process of ganging; further, this method of tuning is a virtual necessity if an up-to-date band-pass filter is to be employed.

**"Squegger" Oscillator.**

For use in testing experimental receivers, I have made up a "squegger" oscillator, in which the high-frequency output is modulated at audio-frequency by the discharging of the grid condenser, for which a leak of high value is provided.

This piece of apparatus is useful, but I should like to have some means of varying the frequency of the L.F. output.

The audio-frequency output of an oscillator of this kind depends on the rate of discharge of the grid condenser. This can be changed by means of a variable grid leak, or by using a variable grid condenser.

**Replies to Readers' Questions of General Interest.**

**Automatic Over-biasing.**

I understand that a fair measure of automatic volume control can be obtained by the simple expedient of biasing an anode bend detector by inserting a resistance of suitable value in its cathode lead.

This would be simple enough in the case of an A.C. mains-fed receiver, but I cannot see how the principle can be applied to a battery set in which an anode bend detector follows an H.F. valve coupled by the tuned grid method.

Is there any fairly simple solution of my problem?

As you say, a more or less effective form of automatic volume control may be devised in this way, but it is not free from objections; in particular, the quality of reproduction is likely to suffer, particularly when deeply modulated signals are being dealt with.

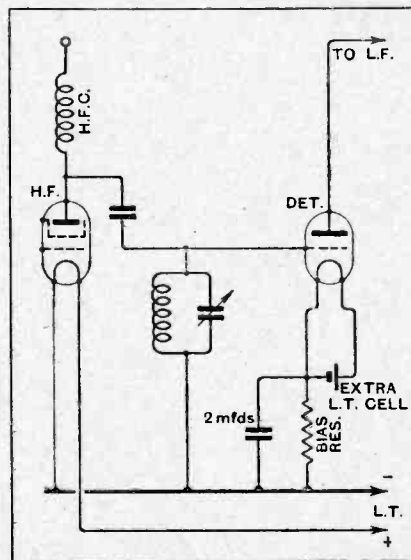


Fig. 1. — Automatic volume control: method of biasing an anode bend detector by inserting a resistance in its cathode lead.

**Leave Well Alone.**

Being dissatisfied with the quality of reproduction of my receiver, which is distinctly "boomy" and muffled, I recently tried the experiment of replacing the coupling resistance between detector and first L.F. valves by a choke—actually the primary winding of a cheap intervalve transformer. This has made a great improvement and reproduction is now much brighter and generally more pleasing.

Do you think it would be worth while to obtain a proper choke, and, if so, what inductance value would you recommend?

Everything points to the fact that there was originally serious high-note loss in your receiver. Possibly this was due to an excessively high anode resistance, or it may be taking place in the tuned circuits. By fitting a coupling choke of low inductance, proportional amplification of the low frequencies has been reduced, and apparently a beneficial degree of tone correction has been introduced. Possibly by replacing your improvised choke by a better component of high inductance, this advantage would be lost, and we think you would be well advised to make no change.

**A.C. Filament Heating.**

I notice that it is quite usual to feed the filaments of an ordinary directly-heated output valve from A.C. mains through a step-down transformer. Would it not be possible to carry this a step farther, and, instead of obtaining special indirectly-heated valves, to supply all the valve filaments with unsmoothed A.C.?

Practically speaking, this is impossible. A certain amount of "ripple" is inevitably introduced into the grid and anode circuits when raw A.C. is used for heating an ordinary valve; in the case of the output, these ripple voltages do not undergo any great magnification, and so a hum is not produced. But the output of preceding valves supplied in this way is amplified to a considerable extent, and so the arrangement becomes impracticable.

**An Unsatisfactory Conversion.**

It is proposed to add a band-pass filter to my 2-v-1 receiver, using the present aerial input variable condenser for tuning the secondary of the filter, and an external condenser for the primary.

Which type of filter coupling would you recommend in these circumstances?

It is clear that you intend to tune the two component circuits of the band-pass filter by means of separate variable condensers. We would strongly dissuade

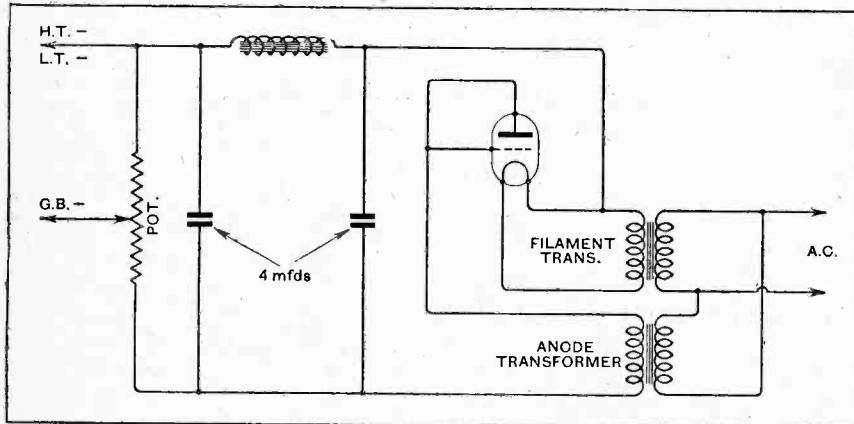


Fig. 2.—An extemporised grid bias battery eliminator operating on an A.C. mains supply

you from attempting to do this, and unless you decide to use a two-gang condenser for tuning the filter, it would be better to employ a less ambitious two-circuit aerial tuner, with variable coupling which may be arranged to give optimum transference of energy between the circuits, rather than a true band-pass effect.

As to the actual method of coupling between the circuits of the tuner, this is largely a matter of convenience, and no particular system has outstanding advantages over the others.

**Another Use for L.F. Transformers.**

As the output from my eliminator is only just adequate for feeding the output valve of my set at maximum rated voltage, there is no surplus to spare for automatic grid bias, and consequently I have been using a battery for this purpose.

If it can be done without incurring any great expense, I should like to make a bias-battery eliminator (A.C. mains) for the output valve only. For rectification it is proposed to use a discarded three-electrode valve with grid and anode connected together; would it be possible to use an old L.F. transformer as a step-down transformer between the mains and the rectifying valve?

I intend to use as a smoothing choke another old transformer, and as a potential divider a 50,000 ohm wire-wound potentiometer. Will you please give me a diagram of connections?

When the secondary of a normal type

of L.F. transformer is connected across a 240-volt A.C. supply a voltage of roughly 70 or 80 is developed across the other winding, and it is possible to use this component in the way you suggest, particularly as a very small current will be flowing. You should realise, however, that the transformer is being used for a purpose for which it was never intended, and it is wise to make sure that its insulation is adequate.

In Fig. 2 we give a circuit diagram showing how the various components may be connected. It is assumed, of course,

that you will be using a small step-down transformer to heat the rectifier valve filament.

**Filters and Reaction.**

It would appear from articles published in "The Wireless World" that the operation of filter circuits is to a certain point upset by the application of reaction. In consequence I am uncertain whether it would be wise to adopt this principle of tuning in my new H.F.-det.-L.F. set, as in this neighbourhood a fair amount of reaction is always required for long-distance reception, except, perhaps, with sets having two H.F. stages. Is there any fairly simple way of overcoming the reaction difficulty?

When a receiver has H.F. amplification it is customary to apply reaction between the detector anode circuit and the inter-valve coupling. Consequently, the input filter (which precedes the H.F. valve) is not affected in any way by reaction, and so your fears are quite ungrounded.

**Graphite Track Resistances.**

I know that variable resistances of the graphite track type are not intended to carry a heavy current, but do you think that one of these components would be adequate for use in a screening grid feed circuit where the current flowing will not exceed some 3 milliamperes?

As a general rule it may be taken that these resistances are not suitable in cases where an appreciable current is flowing:

even so low a value as 3 milliamperes is more than can be dealt with by the average specimen.

○○○○

**A Common Fault.**

(Referring to previous correspondence.) In your reply to my last letter you stated that the fault in my set was probably due to a minute and intermittent break in the primary winding of the L.F. transformer. I expect you are right, but, on making a test between "anode" and "H.T.+" terminals of that component with a dry cell and phones, a good click is obtained, which would seem to indicate that there is continuity. Is it possible that the fault may be due to an internal short-circuit rather than to a break in the winding?

From the information you give us, it cannot be definitely assumed that the transformer is defective, but we think it will be found to be so. The test you have made is by no means conclusive; the fault is most likely to show itself when a current approximating to that normally passed is used for testing purposes. Accordingly, we recommend you to join the phones in series with two or three accumulator cells across the winding and to listen carefully for some minutes. A minute break will then be shown by slight crackling noises.

Of course, if there is complete silence in the phones after the initial click on making contact, you will know that the winding is in order; a complete internal short-circuit is virtually impossible.

**FOREIGN BROADCAST GUIDE.****MORAVSKA-OSTRAVA**

(Czechoslovakia).

Geographical position: 49° 51' N., 18° 18' E.  
Approximate air line from London: 810 miles.

Wavelength: 263.4 m. Frequency: 1,139kc.  
Power: 11 kW.

Standard Time: Central European (coincides with B.S.T.).

**Standard Daily Transmissions.**

07.00 B.S.T., relay of concert from Carlsbad (Sun.); throughout day relays transmissions from Prague, Brno and Bratislava; 22.00, radio-film, variety and dance music (Sat. only).

Male and female announcers.

Call: when own transmissions: *Hallo! Moravská-Ostrava.* (For relays of Prague and other Czech studios see individual calls).

No special interval signal.

Announcements are sometimes made in Slovene, French, German and Magyar. Closes down with the words: *Hallo! Radio-journal Moravská-Ostrava konci dněm vysílání a přeje všem posluchačům doma i za hranicemi dobrou noc* (Hallo! Bratislava concludes its day's programme and wishes all listeners in the land and beyond the frontiers good-night).

# The Wireless World

AND  
RADIO REVIEW  
(19<sup>th</sup> Year of Publication)

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

## Olympia Show Competition.

How Every Reader Should Participate.

EACH year as the annual Show comes round we announce *The Wireless World* Olympia Show Competition, and from year to year interest in it continues to grow. It has now become an established feature of the Wireless Show, looked forward to both by our readers and other visitors to the Show, and also by the manufacturers on account of its usefulness as a guide to public opinion regarding the exhibits.

The increasing variety of sets and other apparatus exhibited makes the outstanding exhibits harder to discover each year, especially when the general standard is higher as a result of keen competition between rival manufacturers.

The purpose of the Competition, it will be remembered, is to decide what, in the opinion of our readers, are the best products of British manufacture at the Exhibition, and this year we have again organised the Competition on the basis that every reader of *The Wireless World* shall be entitled to one vote for what he considers to be the outstanding single exhibit of the Show in any classification, and a vote, also, for the best item of each of a number of classes into which we have grouped the exhibits.

Our classification of the apparatus has been modified slightly from previous years, in order that we may keep pace with the changing conditions in industry. In particular, we have felt it necessary to divide receivers into two classes rather than include all types under one heading. The classification of apparatus is, therefore, as follows:

(1) Receivers employing four or more valves, including radio-gramophones. (2) Receivers employing

three valves or less, including radio-gramophones. (3) Component parts for home construction, including tuning coils, condensers, resistances, etc. (4) Valves. (5) Loud speakers. (6) Accessories, such as pick-ups, gramophone motors, mains units, meters, etc.

How to Record Your Vote.

Details of the Competition will be found on the entry form, which will be published in the next three issues amongst the advertisement pages, these three issues constituting the special Show Numbers of *The Wireless World*.

Cash and other prizes are offered in connection with the Competition to the entrants whose votes agree with the opinion of the majority in the selection of the outstanding single exhibit, and also in the largest number of classes. The prizes will consist of:

1st. £50 in cash. 2nd. A voucher for the purchase of apparatus to the value of £20 from the firms represented at the Show. 3rd. A similar voucher for £15. 4th. A similar voucher for £10. 5th. A similar voucher for £5.

Only British apparatus represented at the Olympia Show is eligible in the Competition. Competitors are particularly asked to bear in mind when completing their ballot forms that their choice should be guided largely by a consideration of the value of the apparatus at the price asked for it, rather than basing their decisions on quality alone.

Entry forms should not be sent in until after the appearance of *The Wireless World* Special Review Number, of September 30th, but they must reach the Competition Editor not later than Wednesday, October 7th.

### In This Issue

THE VARIABLE-MU VALVE.  
THE BERLIN RADIO SHOW.  
KIT CONSTRUCTORS' NOTES.  
NEW MARCONIPHONE  
TRANSPORTABLE THREE.  
SIMPLIFIED H.F. CALCULATIONS  
and  
OTHER REGULAR FEATURES.

# The Variable-Mu Valve



A New Screen-grid Valve with  
Linear Properties.

By R. O. CARTER, M.Sc., A.C.G.I., D.I.C.

(The Research Laboratories of the General Electric Company, Wembley, England.)

WE welcome the advent of the first British Variable-mu Screen-grid Valve—the Osram V.M.S.A. This newcomer differs little from its prototype in its properties as an H.F. amplifier at small grid potentials, but its characteristic is so shaped that when very large negative grid bias is applied, the amplification of powerful signals is quite linear. An ideal means is thus provided for pre-H.F. volume control by variation of bias which is distortionless and free from cross-modulation. Especial interest attaches to the valve in view of the persistent reference which has been made in this journal to the undesirable secondary effects which occur in certain circumstances with the ordinary screen-grid valve.

THE problem of providing a satisfactory pre-detector volume control in the modern receiver is one which has received considerable attention among designers in the last twelve months. In the days when most "straight" receivers relied, for sensitivity, on the plentiful use of reaction, this usually served also as a volume control. But with the advent of the screen-grid valve, and the large high-frequency amplification which it has made possible, frequently without the use of reaction at all, some more satisfactory method, giving greater range of control and freedom from distortion, has become necessary.

high-frequency amplifying valve by voltage control.

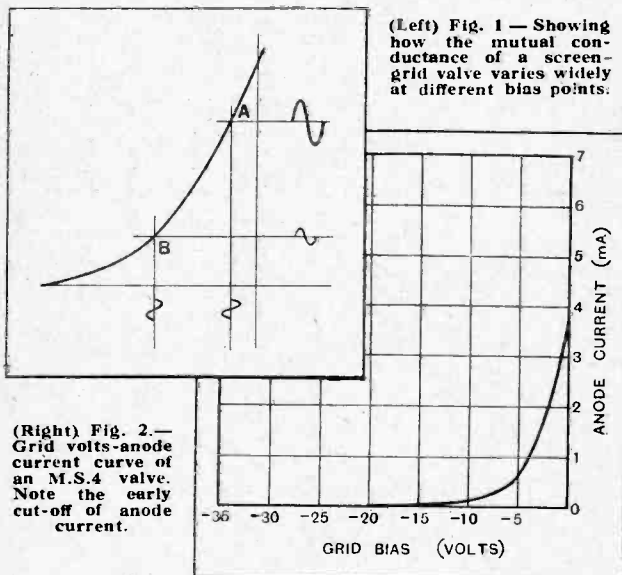
(3) Those which use a combination of the above two methods—the two controls generally being ganged together. This scheme has been used in a number of *Wireless World* receivers.

The first type has the disadvantage that, since the amplifier is always working at full gain, any valve noises, or other amplifier noises, introduced in the first stage always receive full amplification.

Consequently, the background noise (apart, of course, from atmospheric interference picked up by the aerial) is as bad on a strong station as a weak one. While most people will tolerate a slight background on a distant station, everyone expects the best possible quality from the local station with freedom from interference and background.

Method (2) does not suffer from the same defect, since the amplification is reduced for signal and noise alike, and strong stations are received with a quiet background, while full amplification is available when required for weak ones. The amplification of a screen-grid valve may be varied in several ways, the simplest being variation of the control-grid bias.

Fig. 1 shows a typical grid volts-anode current curve for a screen-grid valve, with constant anode and screen volts. If the valve is biased to point "A" the H.F. current in the anode circuit for a given H.F. input voltage to the grid will be greater than if it is biased to the point "B." If the input is small, the radio-frequency component of the anode current will be proportional to the slope of the grid volts-anode current curve at the operating point, i.e., to the mutual conductance of the valve at that point. As there is in practice a load in the anode circuit, the dynamic characteristic of the valve will not be the same as the static; but in most commercial receivers where ultra-efficient coils are not used, and the coupling of the intervalve



Pre-detector volume controls may be divided into three types:

- (1) Those which vary the input from the aerial to the first valve.
- (2) Those which control the actual gain of the



**The Variable-Mu Valve.—**

transformers is fairly loose in order to obtain selectivity, the effect of the load is small, and the dynamic characteristic is to a very close approximation the same as the static curve with no load in the anode circuit.

Neglecting the load, then, we may say that for a fixed small input the radio-frequency current in the anode circuit, and therefore the voltage amplification, is proportional to the mutual conductance of the valve. Fig. 2 shows the grid volts-anode current curve of an Osram M.S.4 valve, and Fig. 3 the mutual conductance against grid bias. It will be seen that the mutual conductance changes from 1.1 mA./volt at -0.5 volt to 0.05 mA./volt at -10 volts grid bias, or a change of amplification of 22 to 1 per valve.

The practical case, however, is not that of a single valve with a constant input, but of a complete amplifier with a constant output, since it is recognised that to avoid detector distortion the radio-frequency input to the detector should not be allowed to vary over very wide limits.

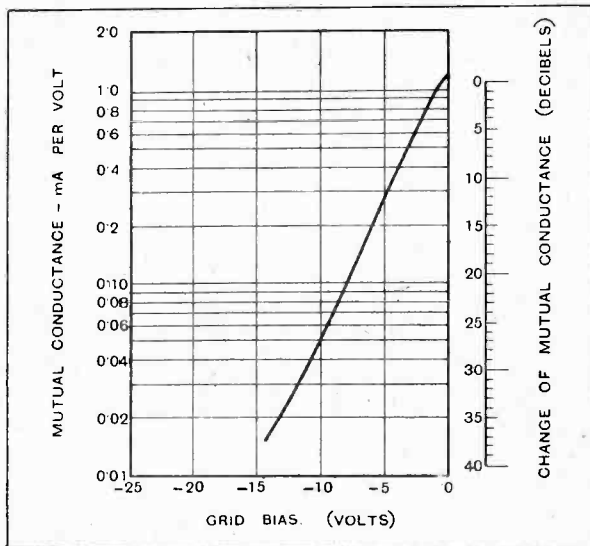
It will be seen that the input to the high-frequency valves will increase rapidly as the grid bias is increased and the gain reduced.

**Causes of Distortion.**

When the input becomes very large, for example, when the set is situated near to a powerful transmitting station, so that the operating point moves over a portion of the characteristic which is appreciably curved, the amplification of the valve is no longer proportional to the mutual conductance at the bias point, and, which is more important, distortion is introduced. Therefore, the ideal grid volts-anode current curve is one in which the curvature rapidly diminishes as the grid bias is increased. Referring to Fig. 1, it will be seen that this is the exact opposite of what occurs in the ordinary screen-grid valve where the initial part of the curve is fairly straight, but at large grid bias the curvature is rapid. The amount of curvature which can be tolerated is much greater than in a low-frequency amplifier, since the initial effect is merely to introduce harmonics in the radio-frequency waveform, which are not amplified on account of the selectivity of the intervalve couplings. When the curvature is very bad, the effect is to increase the depth of modulation and also to distort the shape of the modulated wave (or "envelope") so that after detection harmonics of the audio output are produced which were not present at the transmitter. This has already been described in a note in the July 22nd issue

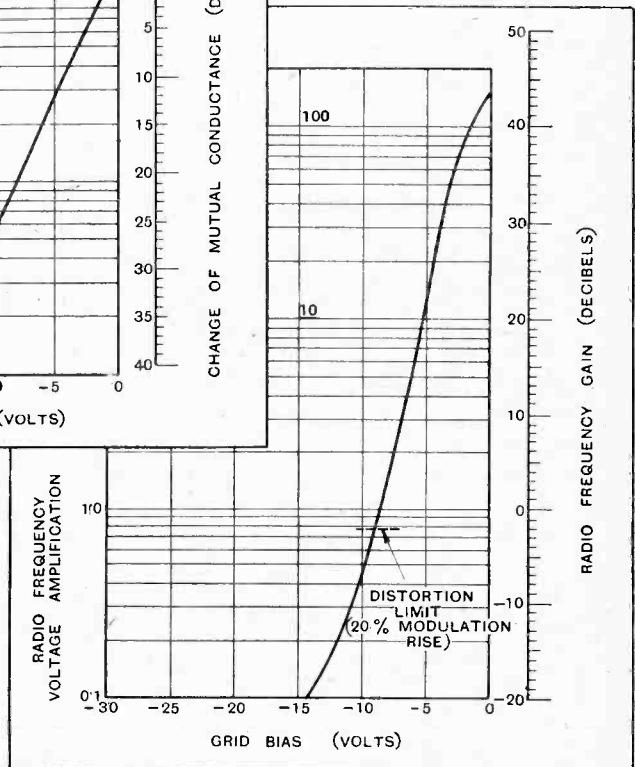
of *The Wireless World*. The first effect is known as "modulation rise," and is not serious if small. But if it is large it may cause distortion at the detector.

For example, the average depth of modulation at the transmitter may be about 20 per cent., with only occasional peaks rising to 80 or 90 per cent. If the high-frequency amplifier causes a doubling in the depth of modulation, the average depth will rise to 40 per cent., which will not *in itself* produce any serious detector distortion; but when the transmitter modulation rises to 50 per cent., the input to the detector will be modulated 100 per cent., at which all ordinary detectors will distort badly. Hence, quite apart from envelope distortion, modulation rise should



(Left) Fig. 3.—Mutual conductance plotted against grid bias for an M.S.4 valve.

(Right) Fig. 4.—Curves showing the variation of radio-frequency gain with grid bias of a typical commercial receiver using two screen-grid H.F. stages with M.S.4 valves.



be kept small. Since both are due to the same cause—rapid curvature of the characteristic—a large modulation rise will invariably be accompanied by envelope distortion.

"Modulation rise," therefore, serves as a useful criterion of distortion in high-frequency amplifiers, and is, moreover, by far the easiest quantity to measure. For the purpose of this investigation, a rise of modulation from an initial value of 20 per cent. to 24 per cent. at the detector input ("20 per cent. modulation rise") has been taken as the "distortion limit." This is not put forward as a rigid rule representing a limiting degree of distortion,

**The Variable-Mu Valve.—**

but merely as a useful basis of comparison between different valves.

Figs. 4 and 5 show the results of measurements on a typical commercial receiver having two high-frequency stages, using M.S.4 valves, the only change made being that necessary to vary the grid bias.

Fig. 4 also shows the amplification (i.e., the ratio of the H.F. input to the detector to the H.F. voltage on the grid of the first valve) at different grid bias values, keeping the detector input constant at 1.4 volts R.M.S. The scale on the right shows the gain in decibels. Fig. 5 shows the percentage modulation at the detector input when a modulation of 20 per cent., at 400~, was applied to the H.F. input. The "distortion limit" of 20 per cent. rise is reached at -9 volts bias, when the voltage amplification is 0.8.

A fractional voltage amplification, or a negative gain in decibels, means, of course, that the amplification has been so reduced that the two H.F. valves are attenuating and no longer amplifying the input. As the detector input was always 1.4 volts, the

H.F. voltage on the grid of the first valve was  $\frac{1.4}{0.8} = 1.75$  volts at -9 volts bias.

In many localities no station will give a greater input to the first valve than this, and hence to use M.S.4 valves in this way in the set would be quite satisfactory.

The M.S.4 is considerably better in this respect than some other screen-grid valves which, although having a high initial mutual conductance, have characteristics

of such rapid curvature that not more than a fraction of a volt of H.F. input can be applied at any bias without distortion.

In practice, a valve capable of handling a somewhat larger input than the M.S.4 without distortion is desirable.

At about twelve miles from Brookmans Park it is quite usual to obtain about three volts on the grid of the first valve, even with the comparatively loose coupling to the aerial employed in modern receivers. If this is reduced, either by making the aerial coupling still looser or by decreasing its size, sensitivity on weak stations will, of course, be lost.

To obtain a valve capable of handling a larger input, the curvature of the grid volts-anode current curve at large bias (low mutual conductance) must be reduced, i.e., a more "tailing" characteristic is necessary. This can be obtained in various ways, of which the simplest is to increase the spacing of some of the wires in the control grid. A very

much larger bias will be necessary to prevent electrons flowing to the screen and anode through the "holes" thus formed than to cut off the bulk of the normal anode and screen current, which has to flow between grid wires of normal spacing. The result is a characteristic which is similar to that of an ordinary screen-grid valve at normal bias, but continues to "tail off" slowly at large bias, after the anode current of the ordinary valve has practically ceased. It will be appreciated that the amount of variation in characteristic obtainable by varying the size and number of the "holes" is very large.

(To be concluded.)

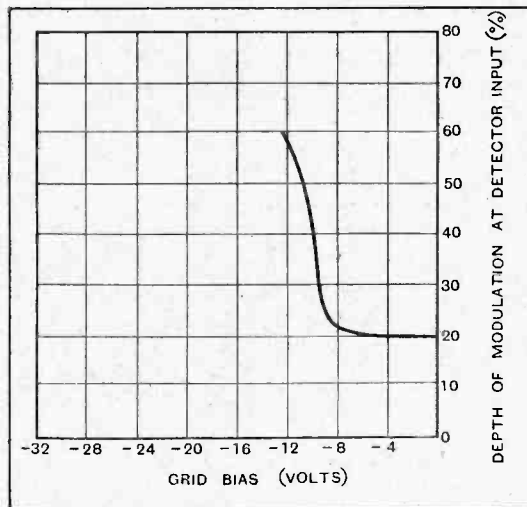


Fig. 5.—Curve showing increase in depth of modulation using M.S.4 valves.

## OLYMPIA RADIO SHOW

### THREE SPECIAL ISSUES

**SEPT. 16** A FORECAST OF THE SHOW

Giving first details of new apparatus and components, as well as complete constructional particulars of a new set for battery operation, "The Wireless World" Three.

**SEPT. 23** STAND TO STAND REPORT

The only complete technical report compiled after the opening of the Show. Will contain detailed specifications of the new sets and accessories.

**SEPT. 30** SHOW REVIEW

An issue which records the progress of the year as revealed by the new season's products.

# BERLIN RADIO SHOW



## General Impressions at the Exhibition.

By Our Staff Representative Visiting Berlin.

THE eighth annual Berlin Radio Show, which closed its doors on the last day of August, was the second show in which gramophone reproducing instruments were exhibited under the same roof with wireless equipment. Talking films, home recording apparatus, and television also added to the variety and interest of the exhibits.

Whatever impressions may have

in the record attendances of the public, but also in the very substantial orders for apparatus which the manufacturers are able to report having taken during the period of the show.

It is natural to try to find an explanation for this rather unexpected state of affairs, and the reason given to us by a German friend is that in Germany to-day many people are without the necessary funds to enable them to enjoy annual holidays and regular amusements which they have formerly been used to, and a wireless set has proved to be the most economical alternative form of re-

creation available to them. In fact, it is said that wireless sets and slippers are amongst the most saleable commodities in Germany to-day.

The general first impression obtained on a visit to the show is very favourable. No doubt this is in part due to the site which has been so well planned for exhibition purposes, the buildings surrounding the imposing wireless tower which is now almost as famous a landmark in Berlin as the Eiffel Tower in Paris.

The Germans are characteristically thorough in their efforts, and it is



The Dralowid home recording outfit. Records are sent to the manufacturers for baking to render them hard and durable.

been gained in regard to the financial crisis through which German industries generally are now passing, the visit paid to the Radio Show cannot but provide an agreeable contrast because of the success which it has achieved—a success which has been expressed not only

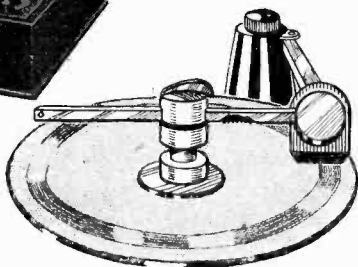
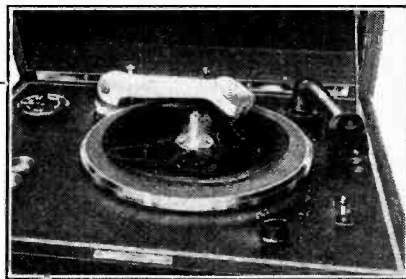


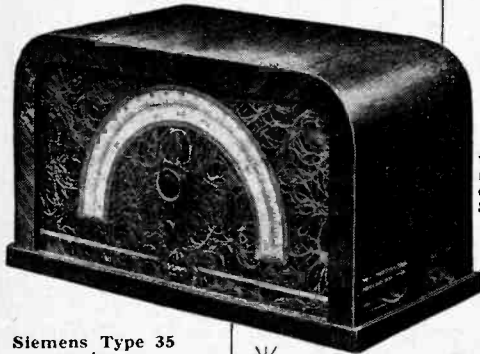
Diagram of the A.E.G. mechanism. A weighted tracking rod is attached to the pick-up.



The Siemens home recording equipment, reproduction from which is outstandingly good.

particularly noticeable that with wireless they are not merely content to see that the

**Berlin Radio Show.**— public buys sets, but they are also interested in seeing that when they have bought them they are satisfied with broadcast reception. For this reason very determined efforts are being made in Berlin and other large

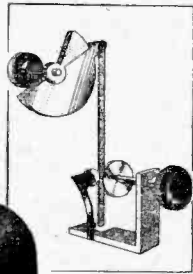


Siemens Type 35 receiver.

cities to overcome the nuisance of man-made interference, and quite a large section in the exhibition is this year again devoted to exhibits of anti-interference apparatus, and there are cinematograph and other demonstrations to educate the public as to what types of electrical apparatus cause interference and how it can be eliminated at the source. This very thorough effort to explain to the public how to overcome interference is an example which might well be followed here. Much could be done, we believe, at our own exhibition if a section of it were devoted to this subject.

It would be a mistake to pass to recording exhibits without first paying a tribute to the efficient way in which practically every stand is staffed. It would seem that at any stand, whatever the nature of the enquiry which the visitor wishes to make, there is an expert present ready and willing to enlighten him. Another feature which it might be well for our own exhibition authorities to copy is that from year to year approximately the same locations are occupied by the standholders, so that, having become acquainted with the positions of various exhibitors'

stands in any previous year, it is possible to go direct to that location and find the same firm there again. This little point saves an immense amount of trouble in locating exhibitors.



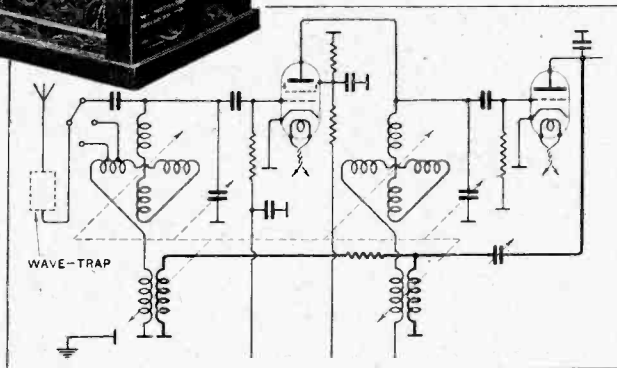
Arrangement for vernier adjustment of ganged condensers in Siemens Type 35 receiver.

The Heinrich Hertz Institute in Berlin was responsible for organising an exhibit of popular interest mostly devoted to the

larity of ultra-short-wave apparatus, made the Heinrich Hertz section quite a centre of attraction for the public.

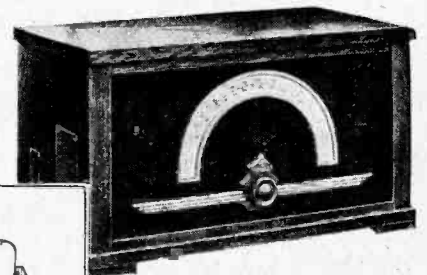
One has come to look upon the Berlin Show as setting a standard of low prices for wireless receivers. This year, however, we formed the impression that this tendency was not nearly so marked as formerly. This is not, we think, because German sets are any dearer, but because our own sets of equivalent type are (or will be when our own Show opens) so much more closely in agreement this year as regards price. There were, naturally, some receivers at the Berlin Show which were really remarkably low in price, but these were mostly of a type so obviously cheaply constructed that we are inclined to think that they would not be popular here where quality of workmanship is still a factor generally taken into account by the purchaser.

Whereas in previous years moulded cabinets for receivers have been almost universally used by German manufacturers, it is very noticeable that this year the tendency is towards good-looking wooden cabinets for most of the better types of receivers. Every effort, however, seems to be made to cheapen cabinet construction, and the use of woodwork where the grain of the wood had been photographed on to a cheap wood foundation before polishing was observed. The effect is pleasing, although it will not



Circuit of the Siemens Type 35 receiver, showing the elaborate ganging arrangements.

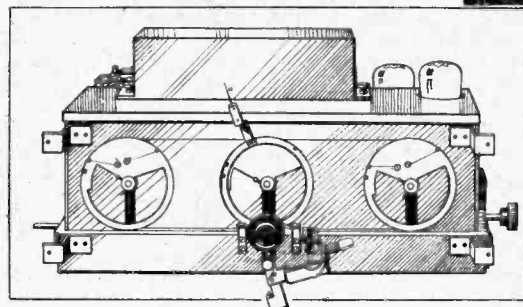
various types of electrical musical instruments which have been introduced during recent years, such as the Theremin oscillator, a type of piano developed by Dr. Trautwein, and others; but, since these instruments have mostly been described in *The Wireless World* at the time that they were first made public, it is unnecessary to go into details concerning them here. The demonstrations of these instruments, and also a number of general exhibits, particu-



A four-valve receiver by Siemens, Type 45, for A.C. or D.C. mains.

bear such close inspection as the real article.

Considerable interest is shown in home recording and apparatus of various types and at different prices was shown. The



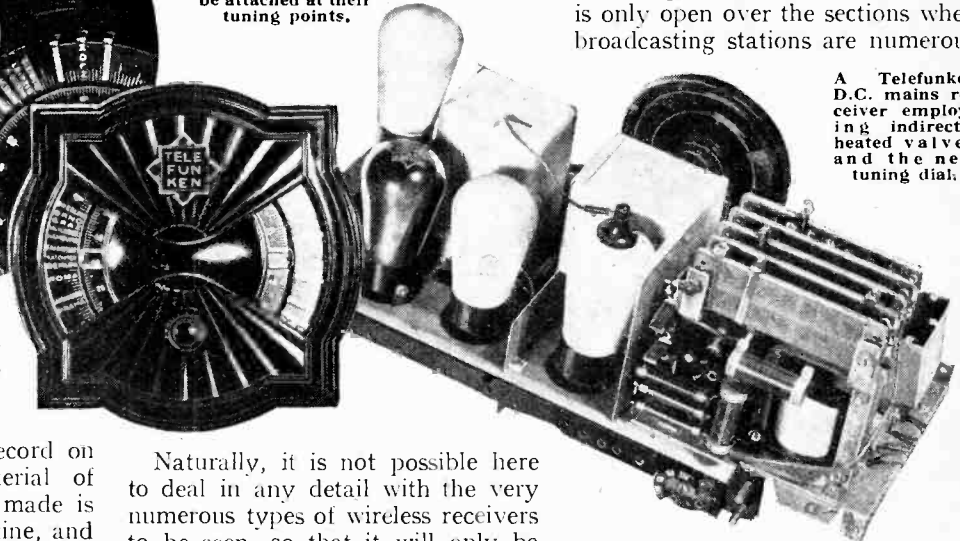
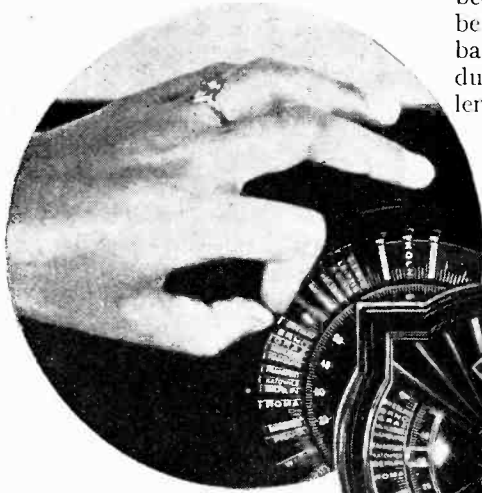
A sketch to show the arrangement of the chassis of the Siemens 45 receiver.

**Berlin Radio Show.—**

most ambitious and a rather expensive equipment was shown by Sie-

recording disc of metal covered on both sides with a soft, wax-like material, and, after a record has been made on this, the disc has to be sent to the manufacturers, who bake it, and so render the record durable and of a hardness equivalent to that of commercial records.

Telefunken "Auto-Skala," to which station names can be attached at their tuning points.



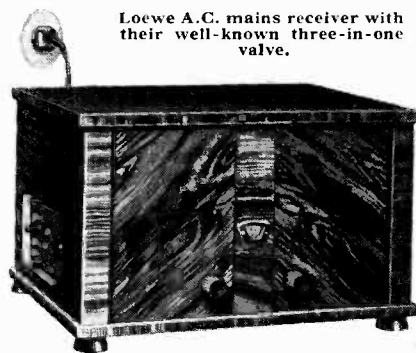
A Telefunken D.C. mains receiver employing indirectly heated valves and the new tuning dial.

mens, the quality of reproduction being probably the best we have yet heard, and the opportunity was given us of making a personal record on this apparatus. The material of which the blank record is made is of the nature of a hard gelatine, and the cutting needle removes an unbroken thread as it cuts the sound channel. By using special needles for reproduction, it is claimed that a record will last for almost as many reproductions as a commercial record. An illustration of the apparatus is given.

Naturally, it is not possible here to deal in any detail with the very numerous types of wireless receivers to be seen, so that it will only be possible to mention and illustrate one or two receivers as typical of the general trend or of special technical merit.

Amongst the most interesting receivers were those exhibited on the

Loewe A.C. mains receiver with their well-known three-in-one valve.



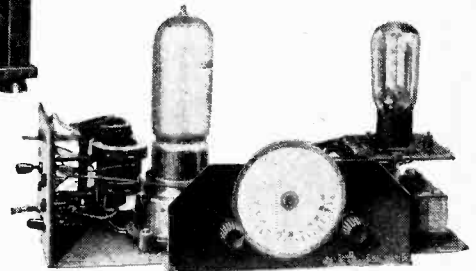
the wavelengths from about 500 to 1,200 metres being passed through rapidly as the pointer is moved along the scale. This effect, again, is obtained by means of a special cam.

The Siemens 45 Type receiver is another interesting production, also designed for A.C. mains operation. The appearance of the receiver is shown as well as a sketch giving an idea of the general plan of the chassis and the mechanical ganging arrangement. This receiver is quite a new product, and consists of two stages of screen-grid, high-frequency

A home recorder of simple design to fit to an existing gramophone is produced by A.E.G. at a price of about £5, and a suitable microphone is supplied at £2 10s.; although for specially good results the A.E.G.-Reisz microphone, costing about £12 10s., is recommended.

A third example which should be mentioned is the Dralowid, which employs the rather novel idea of a

Siemens stand, for these showed, not only considerable ingenuity in design, but were also rather outstanding amongst their competitors in the matter of general workmanship. The Siemens Type 35 receiver employs an interesting circuit which we reproduce; the outside of the receiver is shown in the reproduced



The chassis of the Loewe receiver.

amplification, detector, and output stage. It is interesting to note that more attention seems to be paid to-



A four-valve A.C. receiver of very neat appearance by Blaupunkt.

**Berlin Radio Show.—**

day in Germany to selectivity than hitherto, and the number of tuned circuits in a receiver is stressed in advertisements rather than the number of valves.

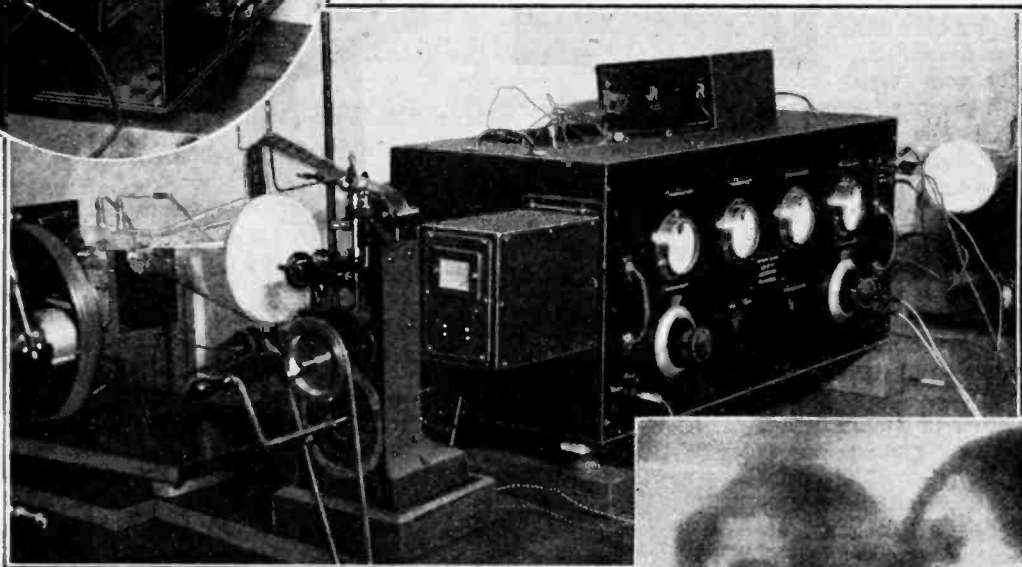
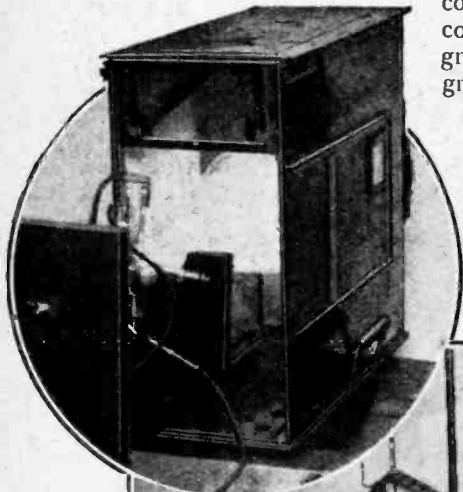
Some excellent receivers were to be found on the Telefunken stand, and a special display is made of new valves; but, as these are similar in

in A.C. and in D.C. models, and the chassis have been made as nearly as possible identical except for the mains equipment. This has naturally resulted in a considerable reduction in manufacturing costs. The speciality of the Telefunken sets is in the number of tuned circuits employed, yet with the use of what is practically single-knob turning. A series aerial condenser, a parallel condenser across the aerial circuit coil, and two condensers tuning the grid circuits of the two screened-grid H.F. stages, are all coupled mechanically to a single knob for tuning. In addition to these tuned circuits, the aerial circuit, which is tuned, is mechanically coupled to the first grid circuit in such a way that the coupling can be reduced almost to zero when

own arrangements for cabinet work.

As is the case in our own country, there is a tendency amongst manufacturers to neglect the battery receiver market, and, therefore, it was not surprising to find a large amount of public interest in the Blaupunkt T.S.5 receiver with batteries and aerial incorporated. The circuit employs five valves, and yet the price appears to compare very well with most of the four-valve sets of other makes.

One or two firms were showing superheterodynes, and amongst them should be mentioned Stassfurter Rundfunk, whose receivers are marketed under the name "Imperial." These receivers employed six valves and valve rectifiers, band-pass intermediate stage, and a particularly interesting tuning scale device on which was inscribed the names of



The Von Ardenne Cathode-Ray tube television apparatus set up for the transmission of moving film pictures. (Inset above) Lantern used for projecting images. (Inset below) Photograph of a received image.



types to the new British valves, it is not necessary to deal with them in particular. The most attractive item on the Telefunken stand, from the point of view of the general public, was a new tuning dial with provision for clipping on to the dial at the appropriate tuning position a little metal plate bearing the name of the station to which the receiver tunes at that point. This gadget seemed very popular. All the new Telefunken sets have been designed both

local station interference becomes troublesome.

The receivers shown on the stand of "Blaupunkt" attracted considerable attention, and prices here were low, considering the rather high standard of finish and general workmanship. It was interesting here to note that most of the receivers could be purchased either cased or in chassis form, where the purchaser might wish to make his

some 80 stations, the circular scale being of large diameter passing behind a small window, the scale being illuminated.

Schaleco were showing an interesting band-pass superheterodyne for home construction. We reproduce an

**Berlin Radio Show.—**

illustration of the completed receiver.

A report on the Berlin Show would not be complete without some reference to the section specially devoted to the subject of television. The exhibits were under the auspices of the German Post Office, although without, we understand, any responsibility for the individual systems which were being demonstrated. The Post Office endeavoured to give the public some basis for interpreting the value of the demonstrations by staging a series of exhibits showing the degree of definition attainable with a varying number of elements employed in the compilation of the picture. Thus the Post Office moving-picture demonstrations showed the amount of definition to be expected when the picture elements were 12,000, and again, at various higher values, until finally a picture composed of 30,000 elements was shown.

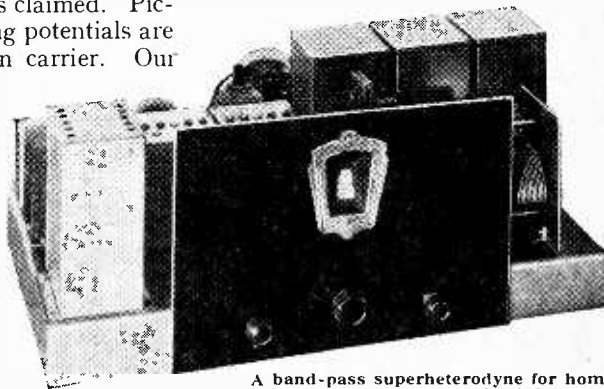
Undoubtedly the exhibit in the television section which attracted the largest crowd was that for which Manfred von Ardenne was responsible. His system employs cathode-ray tubes as the basis of the equipment, and the degree of definition as well as the remarkable brilliancy of the pictures certainly tend to give the impression that a system developed on these lines has greater promise of final success than other systems which we have seen demonstrated.

The cathode-ray tube is used at

both transmitter and receiver, in conjunction with a valve-neon oscillator for scanning. Persistence of glow is a feature of the tube, so that flicker is avoided with picture repetition running as slow as 5 to 8 a second. With a potential of 4,000 volts between the cathode and screen of the tube a stop brightness of from 2 to 3 candle-power is claimed. Picture and synchronising potentials are applied to a common carrier. Our illustration shows the transmitter arranged for use with cinematograph film. Scanning is effected by a traversing bright spot on the screen of the cathode-ray tube. Behind the tube is a photoelectric cell followed by the necessary amplifier. The lantern used for projecting the image formed on the fluorescent screen of the receiver is shown above, whilst below is seen a photograph of the received image from a film transmission.

The exhibition was by far the largest yet held in Berlin, and 325 firms were stand-holders. By way of general comment, however, it might be said that the exhibition does not appear to have produced so large a proportion of new things as in former years, and even some re-

ceivers could be recognised as former types brought up to date with as little change as possible, and perhaps housed in new cabinets. This observation seems to suggest that the German industry has hesitated to commit itself to heavy new expenditure in the way of tools and equipment for the production of new sets on account



A band-pass superheterodyne for home construction, exhibited by Schaleco.

of the difficult times through which the country has been passing. From our conversations with engineers and designers we feel confident that there is actually no shortage of new ideas, and that when once confidence returns and money for development is again available, rapid progress will be resumed. Competent engineers appeared ready to admit that the show did not represent the standard of development of radio in Germany but rather the degree to which it had been possible to progress with a definitely restricted capital expenditure.

**H.M.V. AUTOMATIC**

WE have recently had an opportunity of testing the H.M.V.

Model 117 record-changing playing desk, the mechanism of which is similar to that fitted to the new H.M.V. superheterodyne radio-gramophone. The records are supported in jaws immediately above the turntable, and are released automatically one at a time, the movements being synchronised with those of the tone arm. One side only of each record is played, and the total capacity is eight records. The mechanism is adjustable for 10in. or 12in. records, but only one size can be played in any given sequence. A starting switch is provided, which also enables any record to be rejected in favour of the next, while it is possible to repeat the final record in the magazine any number of times. All the movements are beautifully



H.M.V. Model 117 playing desk.  
1. Detachable spindle extension.  
2. Pick-up. 3. Indicator dial.  
4. Starting switch. 5. Volume control.

**GRAMOPHONE.**

timed, and the interval between records is approximately 12 seconds. Adjustments are provided for the starting position and height of the needle, and the record release mechanism. These are carefully set before leaving the works, but are easily accessible for servicing by lifting the motor board, and in the normal way should not require further attention.

A type 15 pick-up and tone arm is fitted, and provision is made for tone control by the addition of fixed resistances in the volume control. The pick-up is short-circuited during the changing operation to avoid extraneous noises. Warped records should be avoided, as these sometimes cause the needle to overshoot the first few grooves. Incidentally, the trip mechanism is operated by throw-off grooves of the eccentric or minimum-diameter type.

The price of the desk model illustrated is 18 guineas.

# CURRENT TOPICS

Events of the Week in Brief Review.

## THE "SPEAKERINES" WILL REMAIN.

Italy's lady announcers are to remain at their posts. This is the happy decision of the Italian broadcasting authorities in response to the flood of protests from all parts of Europe which followed the news that the "speakerines" were to retire in favour of male announcers.

So the dulcet tones are still to be heard, though we are sorry to learn that the authorities intend to employ the "speakerines" for shorter periods. In future, certain bulletins and other announcements will be read by men.

Referring to the lady announcers, a Turin correspondent writes: "Thus these fairylike voices, so full of perfume and mystery, will continue to be diffused through the ether of Europe... to comfort, aid and support mankind in the daily strife."

We can say no more.

## FIRST RADIO MOUNTAIN.

A feature of a solemn demonstration at the opening of the Trieste broadcasting station a few days ago was the procession which journeyed to the foot of Mount Triestimiceo, the hill on which the transmitter is built. In the name of Italy, its King and its Duce, the eminence was solemnly baptised: "Mount Radio."

It is rumoured that Savoy Hill will soon be known as Mount Reith.

## AMATEURS TO MEET IN PARIS.

Man-made static is worrying the amateur transmitters. The topic forms one of the principal items on the agenda of the International Congress of Amateur Transmitters, which will meet at the Paris Colonial Exhibition from September 23rd to 28th. Other matters to be discussed at this gathering of European amateurs are wavelength allocation, call-signs, sharing of wavebands for telegraphy and telephony, and the issue of licences.

The importance of the radio amateur is being recognised by the French railway authorities, who are courteously allowing 50 per cent. reductions in fares to delegates attending the Congress.

## VOICES ON THE LINE.

If Jack Payne's dance music was interrupted without warning by a violent political speech listeners would want to know the reason why. An occurrence of this sort is reported from Germany. The other evening listeners enjoying the Langenberg dance music had their pleasure cut short by a Communist propaganda talk superimposed on a jazz melody. The authorities took prompt action, and, after a long search, discovered that Communist agents had grafted a microphone cable on to the Cologne-Langenberg line.

## THE NEW P.M.G.

British broadcasting and wireless generally come once more under an official wing with the appointment to the Postmaster-Generalship of Major the Right Hon. W. Ormsby-Gore.

Major Ormsby-Gore, who is a Conservative, was Under-Secretary of State for the Colonies from 1922 to 1924 and from November, 1924, to 1929.

## LISTEN TO COPENHAGEN.

Two interesting innovations are reported from Copenhagen. After much discussion the station directors have decided to employ a lady announcer, whose voice we shall soon hear, both from the Copenhagen and the Kalundborg transmitters.

An interval signal has also been chosen. It is described by a correspondent as resembling a tiny carillon. The tune is taken from an old folk-song of the twelfth century.

## PRISON FOR OSCILLATORS.

If the latest story from Yugo-Slavia is true, the Government of that interesting country must have lost its temper with oscillators and other producers of static. According to a correspondent, "every Yugo-Slavian amateur who voluntarily or involuntarily oscillates his receiver will be punished by a fine of £400 and run the risk of a year in prison."

At this rate an illicit transmitter of messages would receive penal servitude for life.

## REVISING THE PRAGUE PLAN: A RADIO LOCARNO?

The Postal Administration of Czecho-Slovakia has addressed to all States subscribing to the Prague wavelength plan a proposal for a revision of the existing scheme to cope with the problem of mutual interference. We learn that the project is to augment the 9-kilocycle separation between stations to 13 kilocycles.

It is hoped that an opportunity to discuss the new proposals will occur immediately after the forthcoming meeting of the International Broadcasting Union at Rome. The suggested venue for the discussions is Locarno.

## THE MOYDRUM MYSTERY.

All we knew about Moydrum until a few days ago was that it had a castle and was about a buggy ride from Athlone. And then, suddenly, the secret came out. Moydrum has been visited by officials of the Irish Free State Broadcasting Department, a glimpse of whom was enough to convince the Sunday Press that a site had been secured for Ireland's high power-broadcasting station and that "work would be commenced immediately."

We gather from enquiry that Moydrum is one of several districts still under survey for broadcasting purposes. An official of the Marconi Company informed *The Wireless World* that the 120 kW. transmitter is already partly completed at the Chelmsford works, but that no official advice has been received in this country as to the ultimate destination of the apparatus.

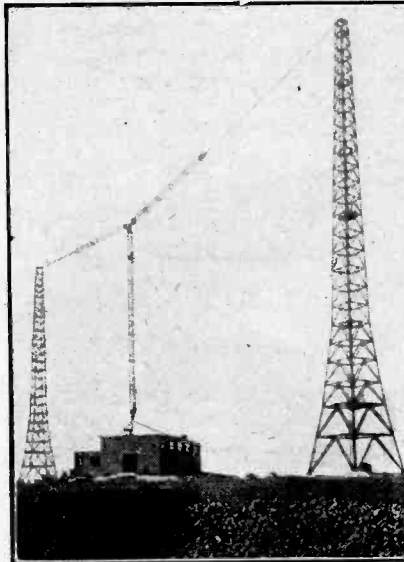
The actual locality matters very little to listeners in Britain; what disturbs us is the thought of a transmitter on our doorstep with a power exceeding that of any B.B.C. station—past, present or (probably) future.

## PROCEEDINGS OF THE I.W.T.

Thanks mainly to the increase in membership, the Institute of Wireless Technology is able to announce the early publication of a new journal to be known as the "Proceedings of the Institute of Wireless Technology." The editors will be Francis T. Fawcett, M.A., Ph.D., D.Sc., and Harrie J. King, F.C.C.S., F.R.Econ.S. The address of the Institute Secretary is 71, Kingsway, London, W.C.2.

## ON THE SPOT.

When a big fire occurred recently in a warehouse and office block nearly opposite the studio of 2YA broadcasting station, Wellington, New Zealand, the station director took a microphone to the window and thrilled listeners throughout the Dominion with a graphic description of the conflagration, writes our New Zealand correspondent. The noise of the fire engines and the crackle of the flames could be clearly heard.



HEARD THIS ONE? Moravska-Ostrava (Czecho-Slovakia) is a station which would be heard more easily in this country if its wavelength (263.4 metres) were not so near to that of London National. Full details were given in last week's "Foreign Broadcast Guide."



**LOVE AT FIRST SCAN.**

To Natalie Towers, Columbia's "Miss Television," belongs the distinction of winning what is perhaps television's first proffer of a "date." Our Washington correspondent states that an electrical engineer in a nearby city, who had been tuning in the visual signals of W2XAB, New York, wrote to Miss Towers that seeing and hearing her "has won my heart." Then the romantic youth asked her to show evidence that she was interested by singing "Lover Come Back

to Me" on one of her programmes. If she did, he said, he would wire when he would come to New York and meet her. She didn't.

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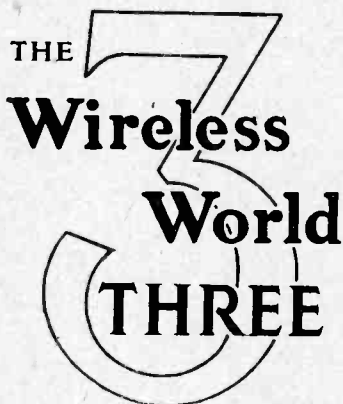
**PRISON FOR "PIRATE."**

During the second quarter of this year 320 unlicensed listeners were prosecuted in Germany, and one of their number, who resisted the efforts of the police, went to prison for three weeks without the option of a fine.

**FEWER BROADCASTERS IN AMERICA.**

There are now exactly 612 radio broadcasting stations in the United States, a substantial decrease from the 733 peak point attained just before the Federal Radio Commission took over the regulatory reins in February, 1927, writes our Washington correspondent. Though it is following a general policy of licensing no more new stations, except in the few remote areas not now receiving good radio service, the Commission has authorised eleven new stations this year.

**Complete Constructional Details in Next Week's Issue.**



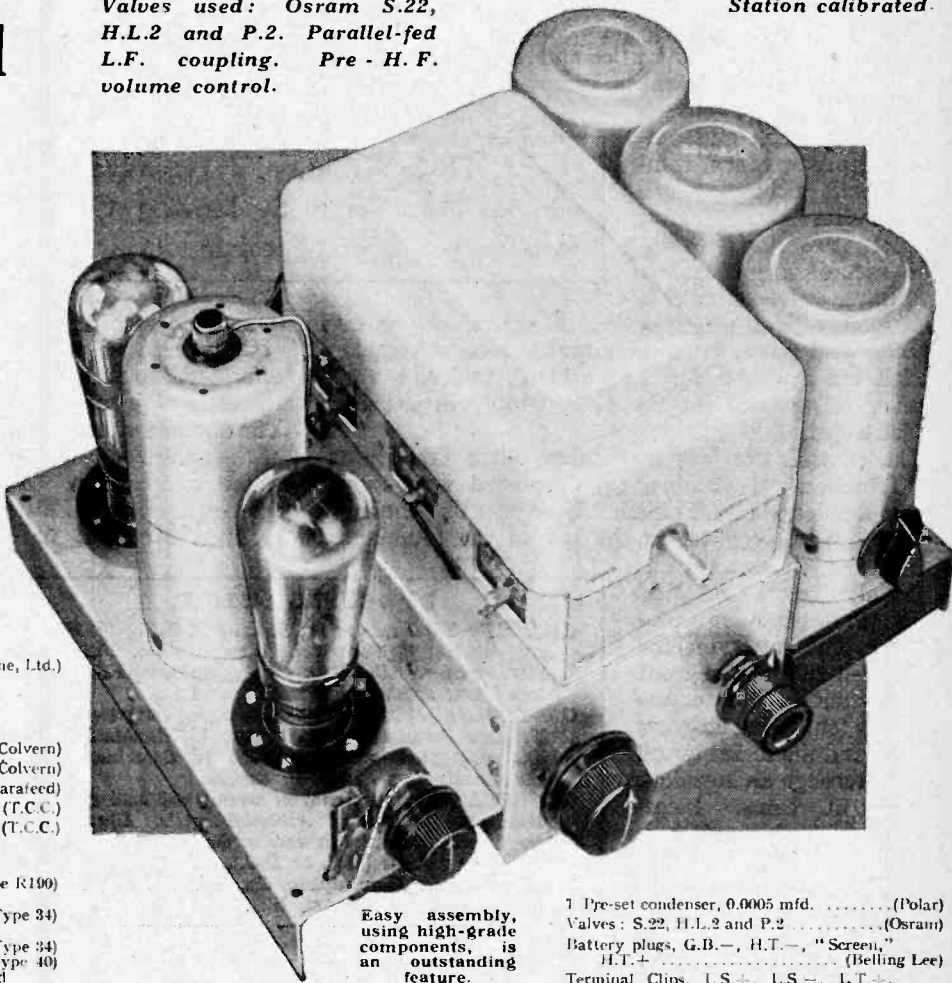
**SPECIFICATION.**—Metal chassis-built receiver of good appearance and simplified construction, avoiding soldering and drilling. Lowest possible cost and high-grade components. Band-pass input filter of new design combining capacity with negative inductance, giving high and constant selectivity across the tuning range. Ganged single-dial tuning. Ganged waveband switching. Complete screening. Station calibrated.

Valves used: Osram S.22, H.L.2 and P.2. Parallel-fed L.F. coupling. Pre - H. F. volume control.

Selective Band-pass Receiver with Single-dial Tuning.

**LIST OF PARTS REQUIRED.**

- 1 Three-gang condenser with fixing screws (British Radiophone, Ltd.)
- Screened band-pass coils and H.F. interval coupling, ready assembled on metal chassis complete with screws and nuts for attaching all components (Colvern)
- 1 Valve screen (Colvern)
- 1 L.F. interval transformer (R. I. Parafeed)
- 1 Condenser, 2 mfd., 400 volts D.C. test. (T.C.C.)
- 2 Condensers, 1 mfd., 400 volts D.C. test. (T.C.C.)
- 1 Double reaction condenser, 0.0002 mfd. slow motion drive and fitted with insulating bush (Ormond, Type K190)
- 3 Condensers, 0.0002 mfd. (T.C.C., Upright Type 34)
- 1 Condenser, 0.0001 mfd. (T.C.C., Upright Type 34)
- 1 Condenser, 0.05 mfd. (T.C.C., Type 40)
- 1 Grid leak, 1 megohm with wire end terminations (Pye)
- 1 H.F. choke (McMichael, Junior type)
- 1 G.B. battery, 15 volts (Pertrix)
- 1 Resistance, 50,000 ohms (Watmel)
- 1 Variable resistance, 50,000 ohms (Colvern)

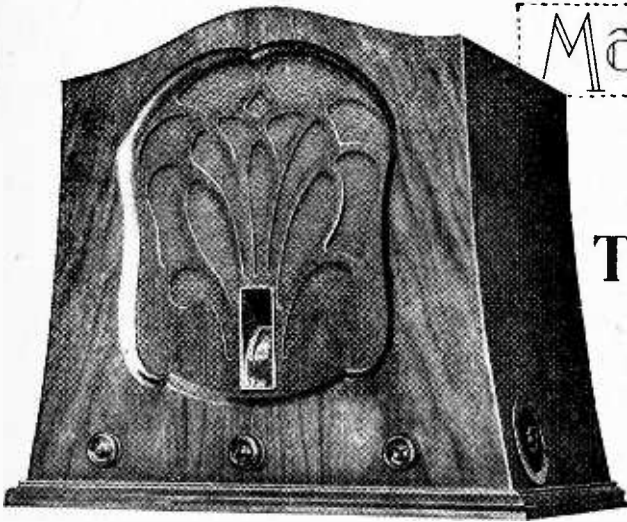


Easy assembly, using high-grade components, is an outstanding feature.

- 1 On-aud-off switch (B.A.T., Type 161, Claude Lyons, Ltd.)
- 1 Geared dial (Burnlept Ethovermier, with station indicating scale — Henry E. Taylor, 51-53, Church St., Greenwich, S.E.10)

- 1 Pre-set condenser, 0.0005 mfd. (Polar)
- Valves: S.22, H.L.2 and P.2 (Osram)
- Battery plugs, G.B.—, H.T.—, "Screen," H.T.+ (Belling Lee)
- Terminal Clips, U.S.—, U.S.—, L.T.—, L.T.— (Belling Lee)
- 3 Lengths of green sleeving, 2mm. gauge.
- Small quantity No. 24 tinned copper wire.
- Cabinet (Clarion Radio Furniture, 28/38, Mansford St., Hackney, E.2)

# Marconiphone



## MOVING= COIL TRANSPORTABLE=THREE

MODEL. 42

as radio reproduction, and no external pick-up volume control is required.

The trimming control, which actually takes the form of a series aerial condenser, is a most useful aid to the extraction of maximum efficiency from the H.F. stage. It compensates not only for aerials of different sizes, but also for any slight discrepancies which may develop in the ganging of the tuned filter circuits. Its adjustment is not critical, neither does it vary appreciably when once set on either waveband. Consequently it need not interfere with the simplicity of tuning in the

normal way, but is always available to deal with exceptional circumstances requiring the maximum efficiency of the H.F. stage.

Tested within five miles of Brookmans Park on a 50ft. outdoor aerial, the set gave

immediate proof of the claims made for it in the matter of range and selectivity. In the space of half an hour after dark, fourteen stations other than the B.B.C. transmissions were received with perfect clarity and volume. The absence of background noise is a noteworthy feature of the performance, and the volume control is absolutely silent in operation. A test in daylight gave Brussels (509 metres) and Hilversum (298 metres) at full programme strength, in itself a sufficient proof of the

sensitivity on medium waves. The long-wave range is equally good, and eight stations were logged without any difficulty.

The selectivity provided by the band-pass filter is of a high order, and gave sufficient clearance between the two Brookmans Park transmitters at a distance of five miles to receive three foreign stations with but a faint trace of background interference. The Hilversum

programme (298 metres) was quite clear of London Regional and only slightly masked by London National. On long waves, Königswusterhausen was received between Daventry and Radio Paris without any difficulty. Incidentally, there is no trace of break-

THE new season's models of the Marconiphone Company are invariably a matter of keen interest both to the buying public and the student of design. Judging from the price and specification of the new Model 42, neither will be disappointed, for in this receiver we have a chassis of original design and outstanding performance, combined with a moving coil loud speaker in an attractive cabinet, at the very reasonable price of 20 guineas.

A three-valve circuit is employed with a screen-grid H.F. stage, power grid detector and power pentode output valve. Alternative models are available for A.C. or D.C. mains, a valve rectifier being used for the H.T. supply in the A.C. model tested.

The controls are four in number, viz.: (1) Tuning, (2) Trimmer, (3) Volume, (4) Combined wave-range, gramophone and on-off switch. Unexpectedly, the main tuning control is offset to the left of the illuminated tuning dial, the control immediately below the dial being the trimming condenser. The knob on the right-hand side of the front panel actuates the wave-range switch, the radio-gram switch, and the mains on-off switch, through an ingenious system of cams. Incorporated with this switch is an illuminated horizontal dial indicator, viewed through a small window below the tuning scale, and showing the particular circuit arrangement in use at any given time. Finally, there is the volume control knob, which is recessed into the side of the cabinet on the right. Incidentally, this control operates, by means of the same spindle, separate potentiometers for gramophone as well

A High-efficiency Three-valve  
Mains Receiver with Moving Coil  
Loud Speaker

### SPECIFICATION.

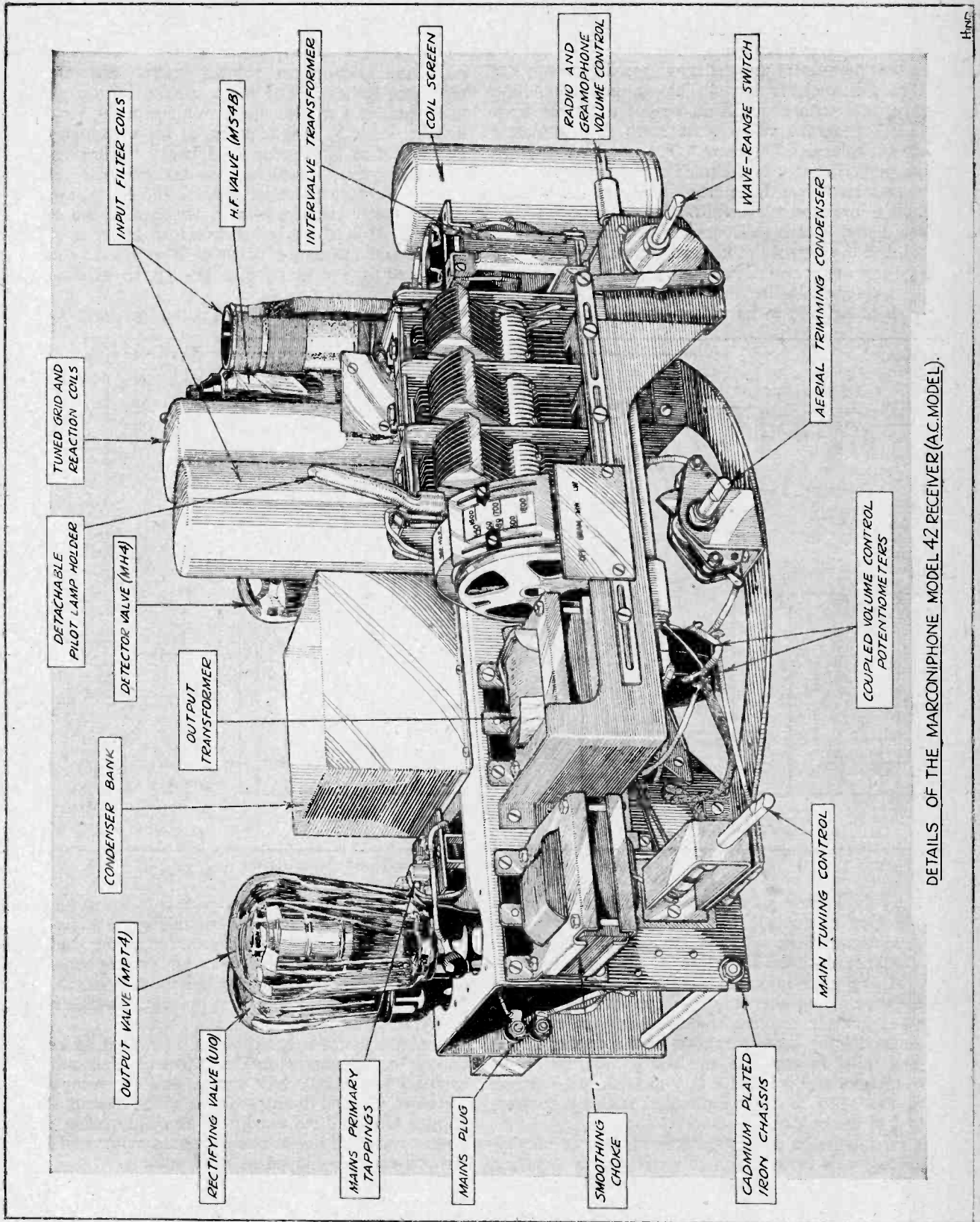
**CIRCUIT:** Three valves: (1) Screen-grid H.F.; (2) Power grid detector; (3) Power pentode output valve. Full-wave valve rectifier. Provision for gramophone pick-up, external loud speaker, and mains aerial.

**CONTROLS:** (1) Main tuning (triple gang condenser); (2) Trimmer (series aerial condenser); (3) Combined radio and gramophone volume control; (4) Combined wave-range radio-gram and on-off switch.

**GENERAL:** Permanent-magnet moving coil loud speaker. Band-pass input filter. All-metal chassis. Illuminated tuning scale calibrated in wavelengths.

**PRICE:** 20 guineas (A.C. or D.C.).

**MAKERS:** The Marconiphone Co., Ltd., 210-212, Tottenham Court Road, London, W.1.



DETAILS OF THE MARCONIPHONE MODEL 42 RECEIVER (AC MODEL).

**Marconiphone Moving-Coil Transportable-Three, Model 42.**— ing through of the local medium-wave stations at the bottom of the long-wave range.

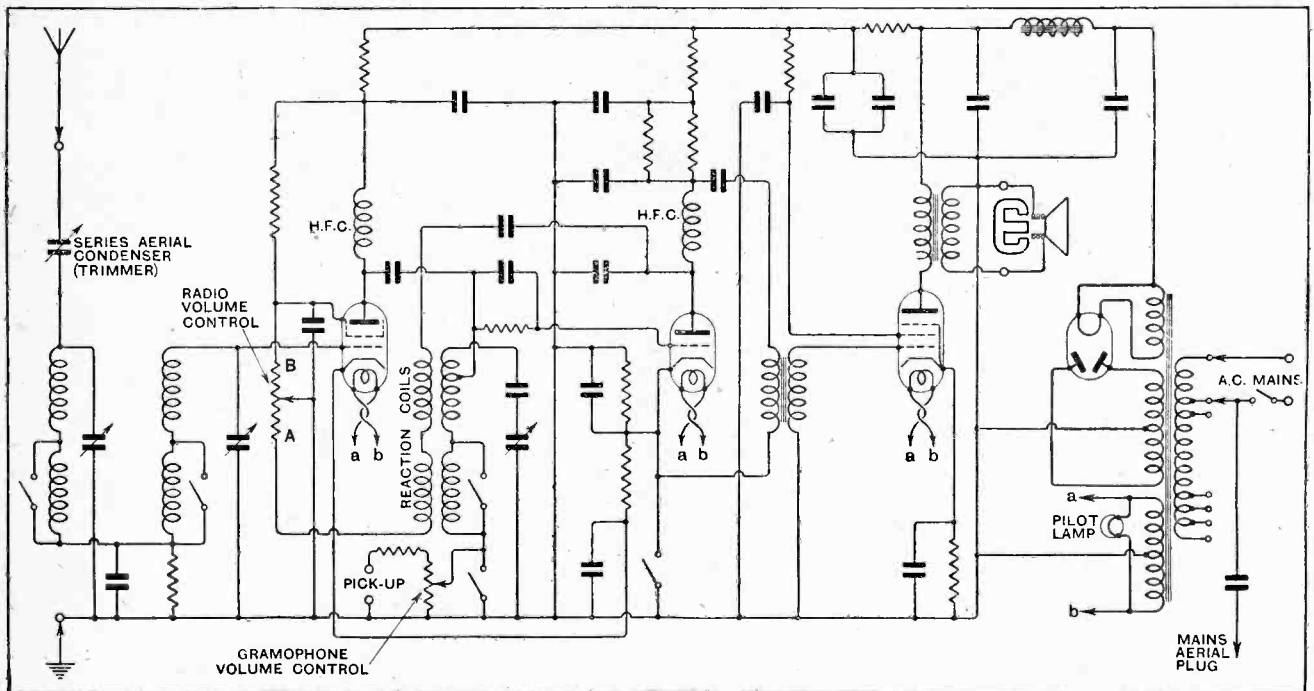
The new permanent-magnet moving-coil loud speaker fitted to this receiver has an ample power-handling capacity, and with the  $1\frac{1}{2}$ -watt output available from the M.P.T.4 output valve gives more than sufficient volume for a large living-room. The quality is notable for exceptional clarity in the middle and upper register. We have seldom heard the true quality of the various wood wind instruments so well reproduced. This rather suggests a range of high-frequency response above the normal, but the absence of background noise shows that the high-frequency cut-off has been adjusted to give just the right compromise between quality and "mush."

Speech is inclined to be rather low-pitched, and the

the centre wire and the braiding to keep the spacing wide and the capacity to earth as low as possible.

Mention has already been made of the fact that the radio and gramophone volume controls are ganged on the same spindle. The radio volume control potentiometer performs two functions simultaneously, viz., variation of the H.F. magnification of the screen-grid valve and variation of reaction feed back. Referring to the circuit diagram, it will be seen that when the slider is at B, the screen potential is zero, and the whole of the potentiometer resistance is in series with the reaction circuit. At A there is no resistance in series with reaction, and the screen potential is at maximum. The resistance is logarithmically graded to give a linear variation of volume.

The pick-up volume control potentiometer has a fixed



Circuit diagram of the A.C. Model 42 Marconiphone transportable.

reproduction of music gives evidence of a bass resonance in the region of 100-200 cycles—probably nearer 200 cycles, as mains hum is not objectionable. The walls of the cabinet are thin, but it is unlikely that this is the cause of the bass resonance, since all the sides are curved, thus giving adequate rigidity. We understand that a reduction in the bass response has been achieved in later models by a redistribution of the doping of the cone material. In any case, the bass is prominent only at full volume, and it is quite easy to achieve a balance of tone according to one's individual taste by varying the level of the output.

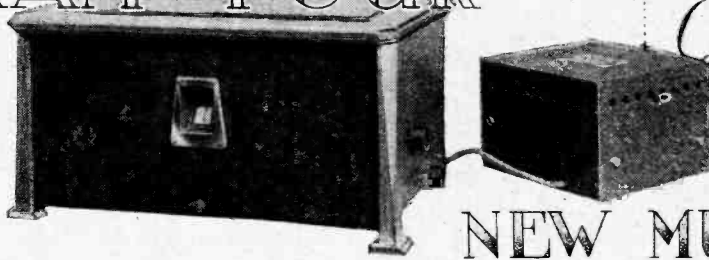
The circuit design is straightforward, and is notable for thoroughness in attention to detail rather than for outstanding novelty. The decoupling of all H.T. circuits is very complete, and all high-potential leads associated with the H.F. stage are screened with large-diameter braiding. Systoflex tubing is inserted between

resistance connected in series with it to bring the maximum output within the power-handling capacity of the final valve. A switch is incorporated in the controls to increase the detector grid bias for gramophone reproduction. At the same time this switch increases the bias on the H.F. valve, and so prevents possible residual background noises from the H.F. stage.

A mains aerial is incorporated in the set as an alternative to the normal outdoor aerial. The cabinet is compact and not unduly heavy, and the receiver can, therefore, be used in any room in which there is a power point. Under these conditions the alternative B.B.C. programmes and one or two of the more powerful foreign stations can be enjoyed at good volume.

To sum up, the performance amply justifies the makers' confidence in this model, which is likely to prove itself one of the most popular items in the new season's range of Marconiphone receivers.

# OSRAM FOUR



*Kit  
Constructors  
Notes*

## NEW MUSIC MAGNET

New and Improved Receiver: also Provision for A.C. Mains Operation of Last Season's Model.

FOR the past three years it has been our pleasant task each autumn to describe and review an Osram "Music Magnet" kit of parts for home assembly. This season we have in some respects rather less to talk about with regard to the new battery model, because it is unaltered so far as its fundamental circuit is concerned; but an important step has been made in bringing out an A.C. mains version of this deservedly popular receiver. Of almost equal importance is the introduction of a "conversion kit," whereby last year's battery-fed set may be converted for mains operation.

Basically, both battery- and mains-fed models embody a 2H.F.-det.-L.F. circuit, with transformer-coupled H.F. stages, grid detection, and a triode output valve, also coupled by a transformer. Reaction is controlled by a differential condenser, and a variable condenser in series with the aerial acts as an input volume control. The tuning of all three circuits is fully "ganged," and the indicating scale is directly calibrated in wavelengths.

So far, this description applies equally to last year's model. Electrical alterations made this season include the provision of gramophone pick-up terminals, and the fitting of a new type of volume-control condenser, with

a low minimum capacity and a plate-shape devised to give a more nearly linear change of volume.

Several constructional modifications have been made, and the new cabinet, in well-finished real walnut, is definitely more pleasing, and also easier to assemble, than its predecessor. There is also a better escutcheon plate, with a transparent window having an engraved hair-line indicator.

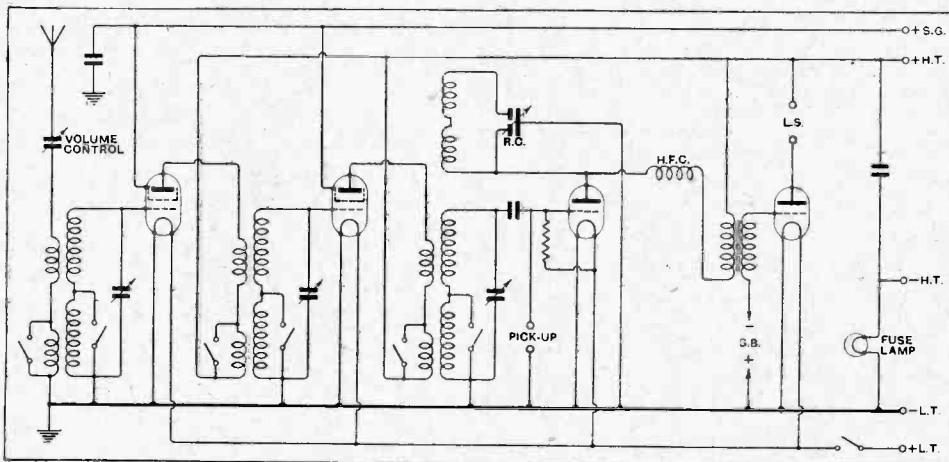
Turning to the A.C. receiver, the circuit arrangement, though basically identical, is modified at several points to allow the use of indirectly heated valves. Bias resistances are inserted in each cathode lead, and there is a choke-filter feed for the loud speaker.

At this point it should be made clear that the A.C. "kit" differs from its "battery" counterpart only in so far as it includes additional apparatus, such as bias resistances, with their by-pass condensers and suitable mountings, and a completed power supply unit. This extra apparatus is, as already mentioned, available as a "conversion kit" for the benefit of those who have built the 1930 "Music Magnet."

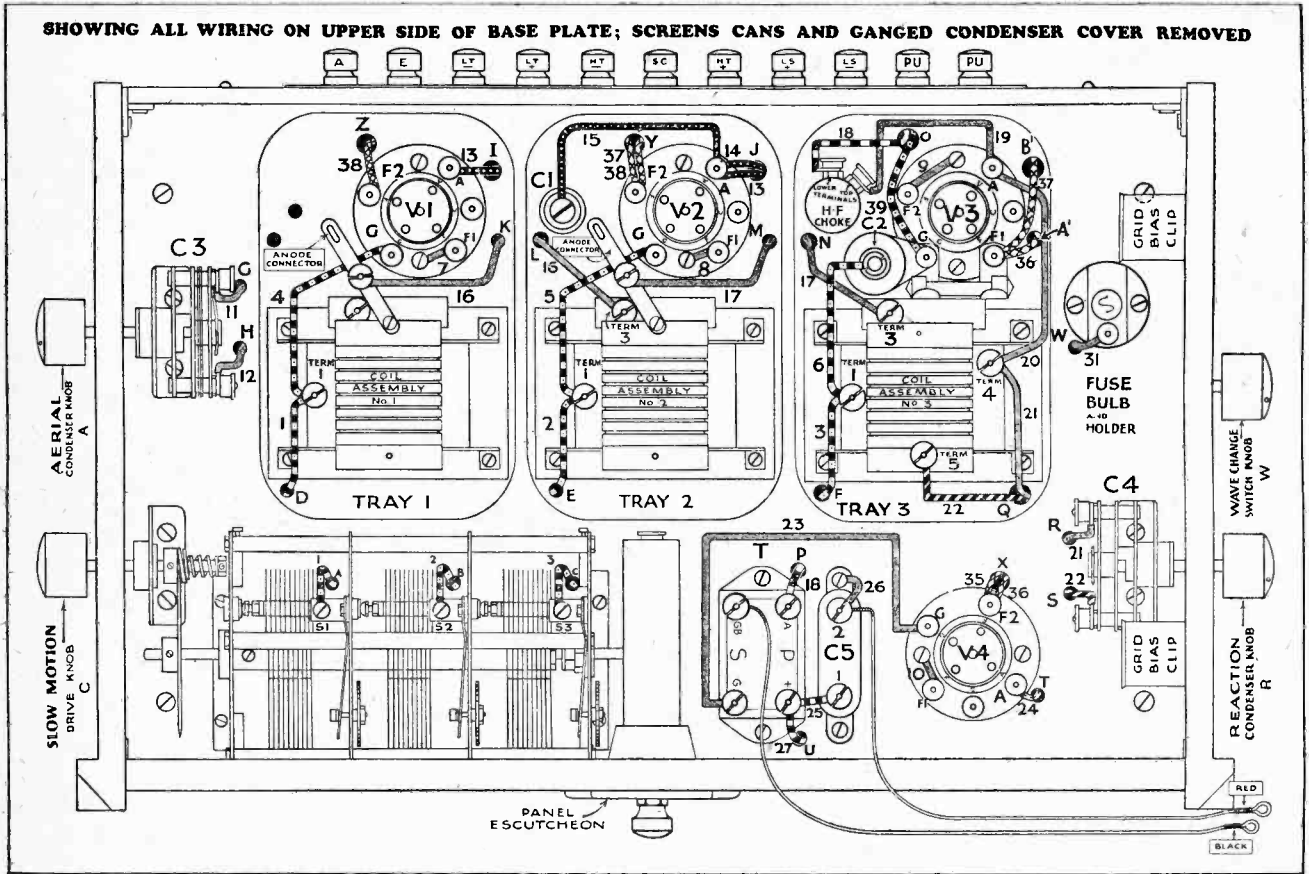
Reverting to the complete new receivers, it is noticed that all the attractive constructional features that have already been commented upon favourably in this journal

are retained. Provided that the instructions are followed implicitly—and it is unwise to take what may appear to be short cuts—it is certain that anyone who can use his fingers at all should be able to assemble the set in a couple of evenings. Everything is made as easy as it could possibly be, and it seems that any mistake could only be due to rank carelessness.

Although it was originally intended that this article, as well as being a description of the new sets, should also contain helpful hints for those who



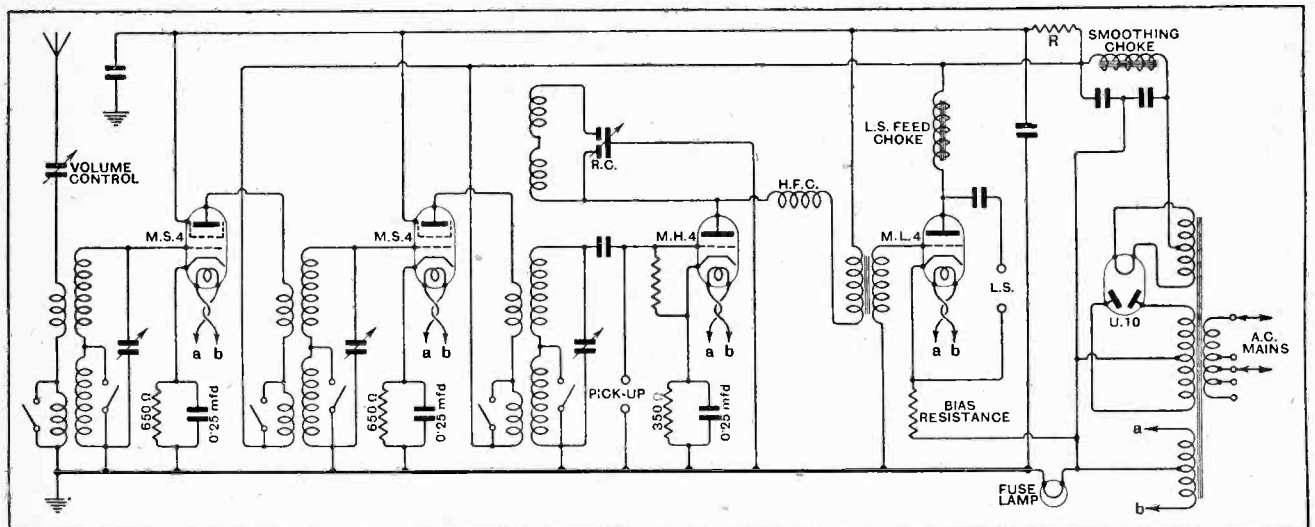
Circuit diagram of the battery model. Valves used are Osram S.215, H.210, and L.P.2. Anode current consumption varies between 14 and 18 milliamperes.



A reproduction, one-third full size, of the practical wiring plan, showing the upper side of the base-plate. Connecting leads are distinctively marked, so they can easily be traced to the under-side.

may decide to build them, it seems almost impossible to supplement the makers' instructional sheet, which is singularly free of the deficiencies so often encountered. The operation of adjusting the condenser trimmers, for

example, is clearly explained; as a rule, the simple method advocated will be entirely satisfactory, but should a milliammeter be available, it is as well to check visually the settings determined aurally, as a more



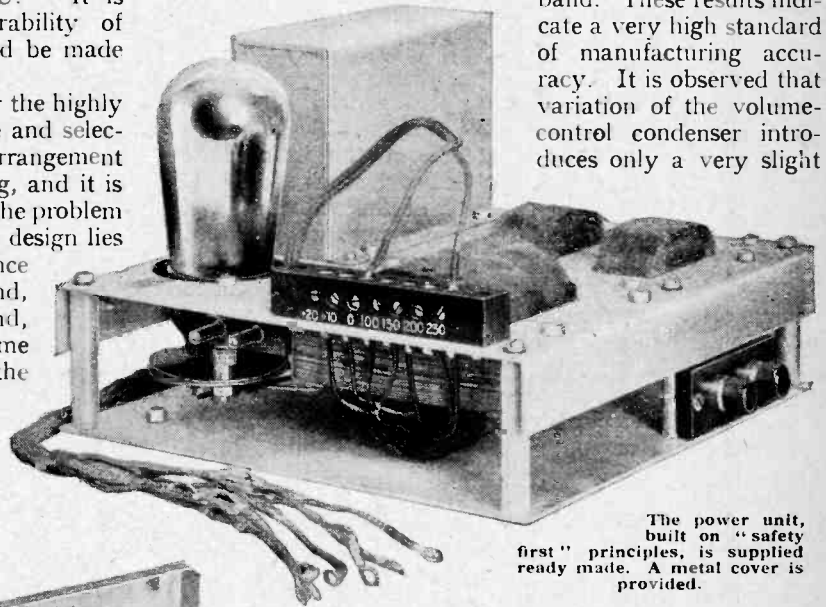
Complete circuit diagram of the new "Osram Four" A.C. kit receiver. A conversion set for modifying the 1931 Music Magnet to this circuit is now available. Both screening grids and the detector anode are fed through resistance R. Valve types are indicated.

**Osram Four—Kit Constructors Notes.—**

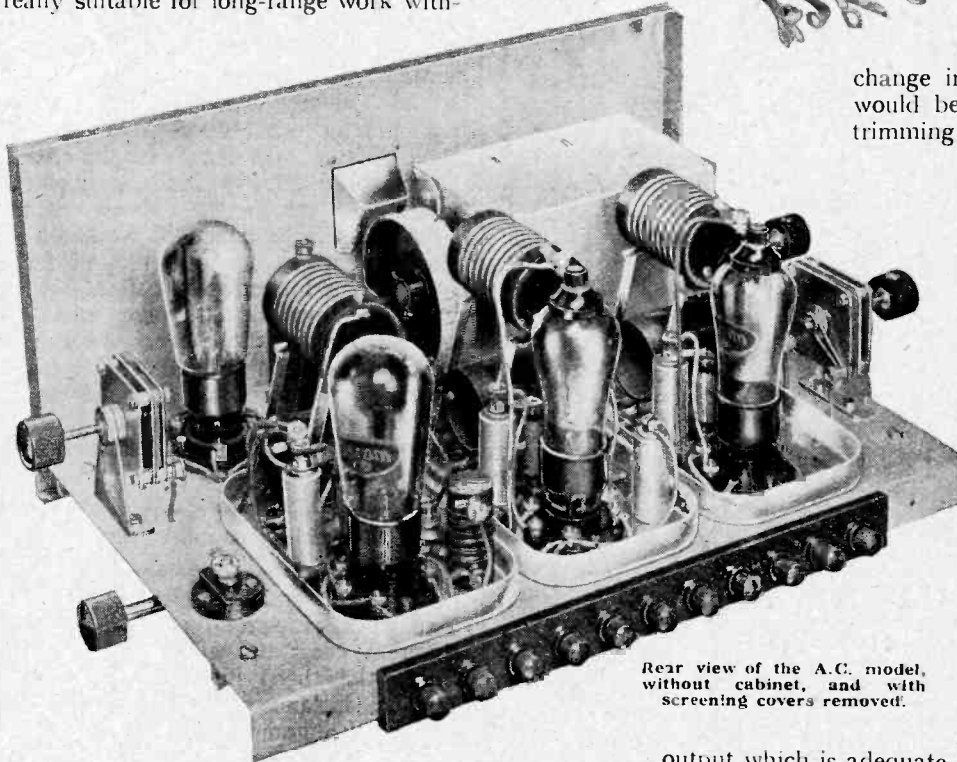
accurate adjustment can generally be made in this way. The meter can conveniently be interposed between the "+" terminal on the L.F. transformer "T" and the high-tension feed lead which passes through the baseboard hole marked "U." It is impossible to over-emphasise the desirability of accurate trimming, and no attempt should be made to hurry over this operation.

It is at first rather difficult to account for the highly satisfactory performance, as regards range and selectivity, of the "Osram Four." Its circuit arrangement is, frankly, too conventional to be exciting, and it is only after a little thought has been given to the problem that one realises that the cleverness of the design lies mainly in the way that a judicious balance has been struck between, on the one hand, high magnification with poor selectivity, and, on the other, poor sensitivity with extreme selectivity. All this depends mainly on the extent of aerial-grid and H.F. inter-valve couplings, and the conclusion is reached that no more perfect compromise could have been made. The set is infinitely more sensitive and selective than any of the popular 1-v-1 combinations, and is really suitable for long-range work with-

has been made at the middle of the medium-band frequency scale, it is possible to detect only the slightest tendency towards divergence at the extreme upper and lower limits. More surprising still, there is even less sign of mistuning on switching over to the long-wave band. These results indicate a very high standard of manufacturing accuracy. It is observed that variation of the volume-control condenser introduces only a very slight



The power unit, built on "safety first" principles, is supplied ready made. A metal cover is provided.



Rear view of the A.C. model, without cabinet, and with screening covers removed.

out depending too much on critical control of reaction. It has no unpleasant tricks, and every control functions "according to plan."

The ganged tuning system is highly successful, and seems to be even better than that of the earlier four-valve model. When an accurate trimming adjustment

change in input circuit tuning, but it would be as well to make the initial trimming adjustment with this condenser "all in." The reaction condenser setting has an almost negligible effect on the detector grid circuit tuning, but here again it would perhaps be as well to "trim" with almost full regeneration.

It is rather beside the point to comment on the quality of reproduction of any well-designed set unless it includes a built-in loud speaker, or is definitely intended to be operated only with a certain specified instrument. Consequently, it will be enough to say that the "Osram Four," either for battery or mains supply, is well up to present-day standards in this respect, and, moreover, has an output which is adequate for ordinary needs.

Finally, the question of price. The complete battery kit, with cabinet and valves, costs £10 15s., while the price of the A.C. model, similarly complete and with power unit, is sold for £17 15s. The conversion kit, including the power unit and valves, is obtainable for £9 10s. The makers are The General Electric Company, Ltd., Magnet House, Kingsway, London, W.C. 2.

# Simplified H.F. Calculations.

## Estimating Stage Gain.

By W. A. BARCLAY, M.A.

(Concluded from page 246 of previous issue.)

IN the previous sections of this article, alignment charts were described by means of which the maximum dynamic resistance of the transformer secondary could be readily deduced when the A.C. resistance and residual capacity of the valve as well as the "threshold instability" wavelength were known. It will be recalled that the discussion had reference to a "one-to-one" transformer (equivalent to tuned anode), it being roughly assumed that the ratio 1:1 gives optimum amplification for screen-grid valves in the absence of all reference to the question of selectivity. It will now be asked, What is the actual value of stage magnification realised when the transformer secondary has the optimum dynamic resistance R as

above determined? The answer is that, following the usual rule when the load in the anode circuit is a pure resistance, the amplification of the stage at the "threshold" wavelength is given by

$$A = \mu \frac{R}{R + R_0}$$

In the case of the valve previously discussed, where  $\mu = 135$ ,  $R_0 = 270,000$  ohms,  $C_0 = 0.008 \mu\mu\text{F.}$  and the "threshold instability" wavelength 225 metres, the value of R was found to be 380,000 ohms. At the threshold wavelength, therefore,

$$A = 135 \times \frac{380,000}{380,000 + 270,000} = 79 \text{ approximately.}$$

It will very often happen that, to save trouble in calculation, one desires to arrive at this value of A, the "threshold instability amplification" obtainable with optimum R without the necessity of finding R itself. Especially is this the case when it is desired to compare the effect upon A of choosing some different wavelength for the critical "threshold." If we decide to raise the minimum wavelength above which stability is to be essential, we shall, of course, sacrifice our reception of those wavelengths immediately below, but we shall be compensated by somewhat increased amplification over the tuning range above the threshold. Conversely, by fixing the threshold as far down as possible, one necessarily forgoes to some extent the magnification otherwise available.

### Alignment Chart for Threshold Instability Amplification.

The matter, then, is somewhat one for compromise, and to assist in the practical work of comparing the merits of different cases the alignment chart of Fig. 5 has been designed. This is a further instance of simple "three-variable" alignment, the three supports carrying values of the three quantities  $\frac{R_0}{X_c}$ ,  $\mu$  and A. The fraction  $\frac{R_0}{X_c}$ , values of which appear on the left-hand scale, is obtained by the quotient of  $R_0$  divided by the reactance of the valve residual capacity at the threshold wavelength. It will be remembered that this value of

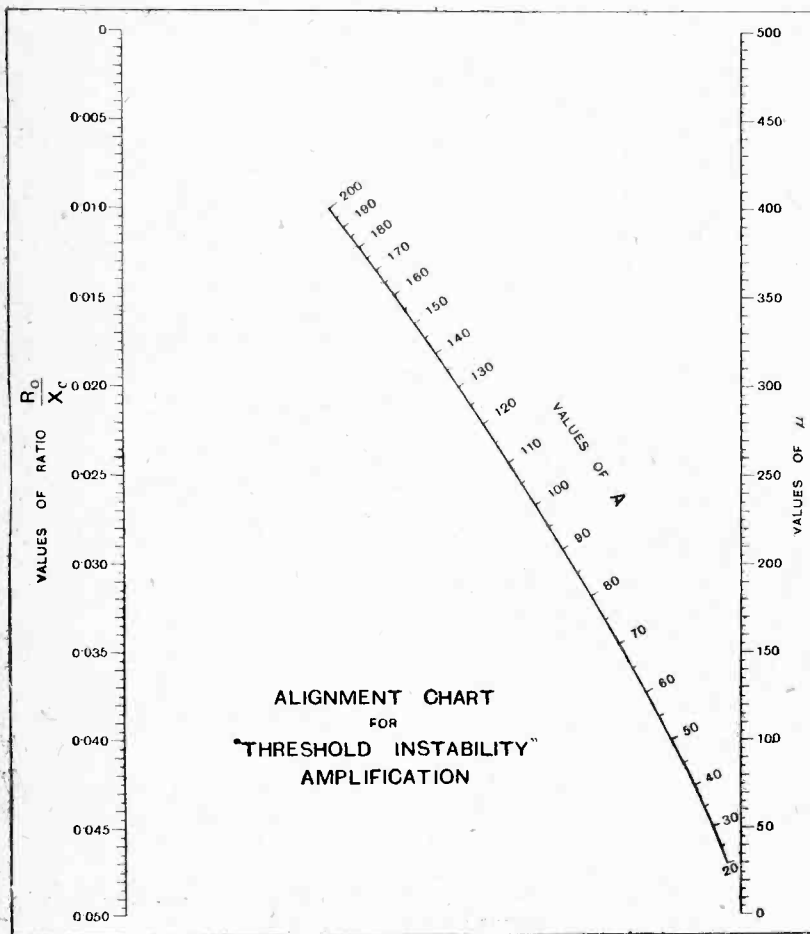


Fig. 5.—From this chart the greatest possible H.F. amplification which can be obtained from a screen-grid valve before self-oscillation occurs can be measured. It is assumed that the external screening is carried out with such care that no feed-back results from this source.



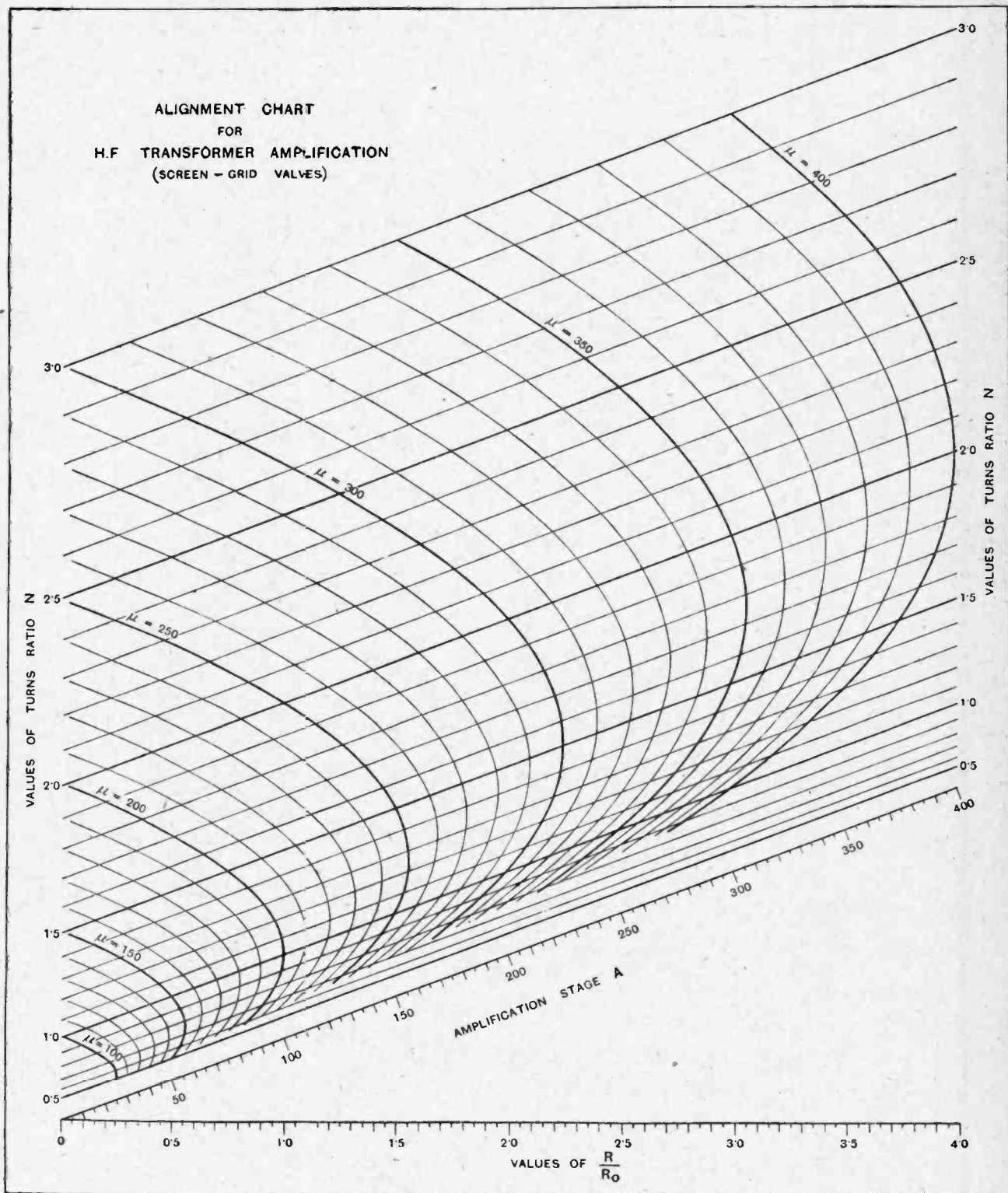


Fig. 6.—When a non-optimum ratio transformer is used with a screen-grid valve to obtain adequate selectivity, the stage amplification can be rapidly calculated from this chart.

**Simplified H.F. Calculations.—**

$X_c$  may be conveniently ascertained from the chart of Fig. 3. Since  $X_c$  is of the order of megohms while  $R_0$  is usually some hundreds of thousands of ohms, the value of  $\frac{R_0}{X_c}$  will ordinarily be a small fraction, and values of it are shown on the left-hand scale of Fig. 5 from zero to 0.05. The right-hand scale carries values of  $\mu$ , while the curved support in the centre is graduated with values of  $A$ . The variation of the "threshold instability amplification" with the threshold wavelength is thus easily traced in conjunction with Chart 3.

We may typify the use of Fig. 5 by treating the same example as was cited above. At 225 metres, the selected threshold of instability, the reactance of the residual capacity of 0.008  $\mu\mu\text{F.}$  was found to be

15 megohms. The value of  $\frac{R_0}{X_c}$  is thus  $\frac{270,000}{15,000,000}$  or 0.018. Joining this point to  $\mu=135$  on Fig. 5, the required value of  $A$  is read off as 79, thus confirming the value found by the longer process described above.

It is interesting to observe the effect on  $A$  if a different wavelength be chosen as our threshold of stability. For example, if the above wavelength of 225 metres already chosen were reduced in order to ensure stability down to 200 metres, we should have, from Chart 3,  $X_c=13.3$  megohms, so that  $\frac{R_0}{X_c}$  would be 0.02. Hence, from Fig. 5,  $A$  is now 76.5. That is, the amplification obtainable would be slightly reduced.

It is important to observe that these values of  $A$  obtained as above represent the amplification obtainable with the optimum resistance  $R$  at the threshold wavelength. When the transformer is tuned to any higher wavelength, the amplification will, of course, be less than this, depending on the variation of the dynamic resistance with the altered tuning. The "threshold instability amplification" is thus in the nature of an optimum value, being in fact the greatest possible amplification obtainable before instability sets in. In the absence of any neutralising device, the figures thus obtained for stage gain are sufficiently impressive; if neutralising be adopted, they are capable of yet greater improvement.

**Transformers of Non-optimum Ratio.**

As already remarked, however, such great magnification is not without attendant disadvantages. One of the greatest drawbacks to the H.F. transformer circuit employed as above is its inordinately flat tuning. To enable a somewhat greater degree of selectivity to be obtained it is usual to reduce the number of turns on the primary winding, thus increasing in effect the turns ratio of the instrument. The theory of this device has been discussed fully in these pages; here it is merely intended to show how the resulting diminution in stage gain due to the adoption of such a "non-optimum" transformer may be conveniently estimated.

For this purpose the chart of Fig. 6 has been prepared. This chart is entirely similar in principle and construction to the chart previously given in Fig. 1, which dealt with the analogous problem in the case of

triodes. The index-line through the values of  $\frac{R}{R_0}$  and the stage gain  $A$  passes through a network of  $\mu$ -curves and  $N$ -lines, whose intersection gives the third point on the alignment.

As an example, consider a valve whose  $R_0=200,000$  ohms and  $\mu=340$ , to be used with a transformer for which  $R=470,000$  ohms and turns ratio  $N=2.6$ . Then  $\frac{R}{R_0}=2.35$ . Joining this figure to the intersection of the curve for  $\mu=340$  with the line  $N=2.6$ , we find the required value of stage amplification to be 228.

Various details in connection with the use of this chart (optimum turns ratio, etc.) have been described when dealing with the former chart (Fig. 1) and need not now be repeated.

**Conclusion.**

It may be well to point out, in conclusion, that the formulæ on which the above charts have been based must all be considered in the light of the limitations which experiment must always impose upon theory. For example, no account is here taken of possible feedback from an anode-bend detector. It is, of course, well known that if such a detector is followed by a low-frequency transformer with capacity across the primary, a load of several ohms may be thrown back on the H.F. transformer. This fictitious load operates in addition to the ordinary H.F. resistance of the transformer, and must be taken into account in computing the dynamic resistance  $R$ , which will thus suffer considerable reduction, with consequent loss of amplification. This point has been fully brought out in previous articles, to which readers are referred.<sup>1</sup>

For the rest, it may be well to emphasise again the very "variable" nature of some of the variables! For instance, the value of  $R_0$  adopted for the A.C. plate resistance of a screen-grid valve may vary between wide limits with but small changes in the operating conditions of the valve. This, however, is no disadvantage attending the use of the charts presented above, since one of their great merits is to display at a glance the alterations in numerical values which would attend any such changes in  $R_0$ . Not least interesting among the many possible applications of these charts would be an investigation into the effect upon amplification of changes in the mean working potentials on the grids and anodes of screen-grid valves, with the consequent variations in  $R_0$ . Other such uses may well be left to the reader.

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**THE WIRELESS ENGINEER AND EXPERIMENTAL WIRELESS.**

In the September issue of this journal, which now appears under the new name of *The Wireless Engineer*, the following special articles are included:—

- How Many Ionised Layers? By Prof. G. W. O. Howe, D.Sc.
- A Single-valve Multi-frequency Generator, By A. T. Starr, B.A., B.Sc.
- Modulation and Side Bands. Relation between Amplitude and Frequency Modulation. By N. F. S. Hecht, M.I.E.E.
- Coil Resistance Shunts. A Simple Graphical Construction. By W. A. Barclay, M.A.
- Transients and Telephony. By T. S. E. Thomas, B.Sc.
- Abstracts of the World's Current Radio Literature.

<sup>1</sup> See *inter alia* W. B. Medlam—"Increasing Detector Efficiency," *The Wireless World*, 22nd May, 1929.

# Broadcast Brevities

By Our Special Correspondent.

## The 7-metre Tests.

It says much for the level-headedness of British listeners that the recent announcement of the B.B.C.'s intention to experiment with the ultra-short wavelengths has not resulted in a deluge of letters at Savoy Hill. Five years ago the same news would have roused indignant cries from "Pro Bono Publico" and others protesting that their receivers were to be rendered obsolete.

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## B.B.C. Clutching at a Straw.

At the moment the nation has so many other matters on its mind that the 7-metre tests have failed to awaken very much interest. They are important, however, for two reasons. First, of course, come their technical possibilities, which are certainly not yet clearly envisaged, particularly in regard to television. And, secondly, they point to the significant fact that the B.B.C., like the German authorities, are beginning to clutch at any straw in an effort to meet the interference difficulty.

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## The First Tests.

My friends in the Marconi Company are sworn to secrecy concerning the technical details of this 1-kilowatt mobile transmitter which they are constructing at Chelmsford, and Savoy Hill is hardly less reticent. I can say, however, that the tests will begin early next year, probably in London, in which case the first radiation may be made from the roof of "Broadcasting House." Field distribution tests with the transmitter and a few special receivers will probably follow in the Daventry area, after which certain provincial towns will be visited.

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## No Threat to Regional Scheme.

A B.B.C. official with whom I discussed the project emphasised the point that these tests will in no way threaten the Regional Scheme. There is no notion (at present) of a central transmitter sending out programmes to a scattered army of midget wave relay points.

"It will be three or four years at least," he said, "before the ultra-shorts come into regular use in Britain."

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## Searching for an Hour.

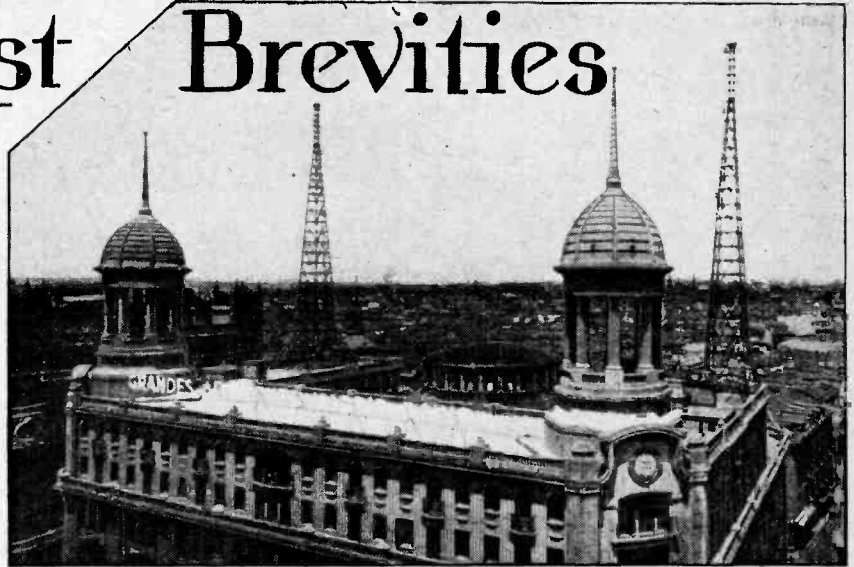
These midget waves are not easy to handle. I hear that a world-famous amateur transmitter now employed by the B.B.C. took over an hour to "find" a 7-metre transmission. If I had to rely on these waves for my programmes I doubt whether I should be in time even for the tail-end of the Epilogue.

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## Winter Whistles Begin.

Already the darker evenings are beginning to show up the increase in heterodyning between European transmitters. In a month's time the confusion will be worse than last year. I am all the more

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Radio-Madrid, which occupies one of the highest buildings in the city.

pleased, therefore, to hear of a definite desire within the ranks of the Union Internationale de Radiodiffusion to bring about a meeting of Government representatives to revise the Prague Plan.

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## Action by Governments?

Only such an assemblage could effect any big change in the structure of the famous Plan, which owed its inception to Government effort.

This move comes not a moment too early. Recently there have been disturbing signs of a *laissez-faire* attitude among certain of the broadcasting countries of Europe.

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## Quality at a Discount.

An insidious idea has gained ground that European listeners are not greatly concerned over quality reception, that selectivity is their principal demand, and that everyone is prepared for a noble sacrifice of the high notes to secure "knife edge" tuning.

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## Throttle Down the Power.

Let us hope that this absurd notion will be scotched before the "battle for power" is carried another stage.

The first aim in revising the Prague Plan should be to include restrictions regarding power output.

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## Great Days in Bristol.

Bristol's fifth Annual Radio Week, which will be held from September 19th to 27th inclusive, has been specially arranged this year to coincide with the first Bristol and West of England Radio Exhibition, to be held in the Colston Hall from September 21st to 30th. In the centre of the Exhibition a large broadcasting studio is being erected with glass panels so that the broadcasters may be seen.

On September 19th Mr. H. G. Tanner, Sheriff of Bristol, will give an introductory talk for West Regional listeners.

## Broadcasting in Public.

On September 21st the first relay from the studio in the Exhibition at the Colston Hall will be given, when the Victor Olof Sextet will play. The Sextet will also be relayed on September 22nd, 25th, and 26th.

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## What They Think of Us.

A microphone debate of special interest, called "As Others See Us," will be heard by National listeners on September 18th, when a discussion about England, between a Dutchman, Dr. G. J. Renier, and a German, Dr. Karl Silex, is to be broadcast.

Dr. Renier is the author of that much-discussed book, "The English: Are They Human?" Dr. Silex has written a book about Englishmen which is still in the press. It is called "John Bull at Home."

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## Scottish Broadcasting House.

The first of the public concerts to be held in the big studio of Scottish Broadcasting House in Edinburgh during the winter season will take place on September 25th. The B.B.C. intends to open this season with a light concert of the variety type, and this will be presented by those old friends of the Scottish microphone, the Radioptimists. The stage at Scottish Broadcasting House is peculiarly suited for variety programmes.

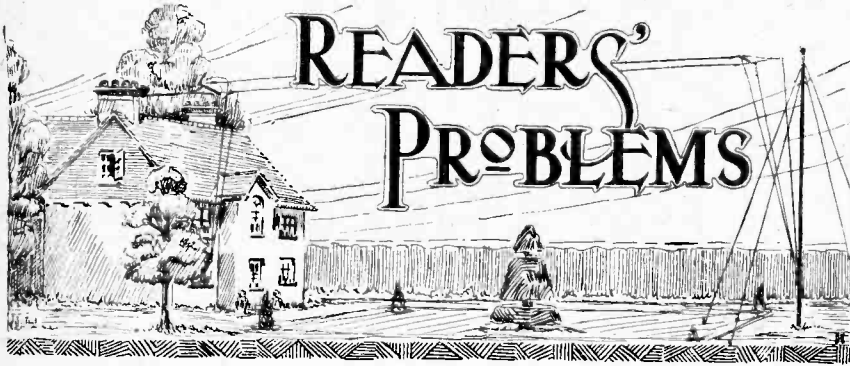
Though not very deep, it is wide, and can take a large number of singers ranged in a single line.

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## Thank You, Miss Sprott!

Did we but know it, many of us owe a debt of gratitude to Miss Elise Sprott, of the B.B.C. Talks Department. For it is Miss Sprott who has saved countless homes from the horrors of indigestion. Her task for several years has been to test the genuineness of the cookery recipes submitted to Savoy Hill for broadcasting.

In her own private kitchen Miss Sprott has made up the recipes and consumed the fruits thereof. And still she lives!



Replies to Readers' Questions of General Interest.

Technical enquiries addressed to our Information Department are used as the basis of the replies which we publish in these pages, a selection being made from amongst those questions which are of general interest.

The "Super-Selective Six" on Short Waves.

Will you please give me some hints as to how the "Super-Selective Six" (A.C. model) may be modified for the reception of short wavelengths, from about eighteen metres upwards?

It would be impossible to treat this matter adequately in the course of a letter, but we may say that it is hoped to publish a description of a short-wave adaptor, specifically intended for operation with this type of superheterodyne receiver, in the near future.

Indirectly Heated D.C. Valves in Push-pull.

So far as I can see, the new D.C. valves should be suitable for use in a receiver with a push-pull output stage. Is it to be anticipated that any difficulty will be encountered in arranging for automatic grid bias, and will it be necessary to fit a small auxiliary bias battery for balancing purposes, as is usual when filaments are connected in series?

As the heaters of these valves are quite independent of the cathodes, bias difficulties do not exist, as the cathodes of a pair of output valves may be at the same potential.

A Margin of Safety.

It is noticed that by-pass condensers specified for constructional sets described in your journal are generally of somewhat greater capacity than those used in corresponding positions in commercial receivers. Can it be assumed that in most cases it is possible to use smaller capacities without risk of introducing instability or "hum"?

Designers of sets intended for amateur construction must always face the fact that various modifications may be introduced in assembly, and consequently they consider it wise to play for safety in these matters. You are right in thinking that in many cases it is possible to make some reduction, but if you have any doubt with regard to any specific instance, we should be glad to give you a definite ruling.

Neon Tuning Indicator.

I was interested to read in your issue of August 19th that some of the new American sets include a neon lamp, arranged to give an indication that the circuits are tuned to exact resonance. Have you any information as to the exact method of connection adopted? I should like to fit a device of this sort to my own 2-c-1 mains-operated receiver, which includes power grid detection.

Our American correspondent has not provided us with any details other than those published, but it would seem fairly easy to fit an indicator of this kind, at any rate if the receiver embodies an anode-bend detector—which is still quite popular in America—and provided that a suitable form of neon lamp is obtainable.

In your case it would appear to be almost necessary to fit an extra valve to operate the indicator lamp; this valve, connected in parallel with the detector grid circuit, might be arranged in the

anode current rises to a sufficient extent under the influence of a signal that is just sufficient fully to load the detector.

Pentode and Loud Speaker.

In an attempt to increase magnification I have just fitted a pentode output valve in place of a triode. Contrary to expectations, volume is no greater than before, and I should be glad to know whether you consider it likely that the pentode valve is defective. I suppose that quality could be improved by fitting a compensated output circuit with a tapped choke, but at the present time I am mainly concerned with poor magnification.

Although special pentode-loud speaker couplings are generally advocated on the score of quality alone, it must not be forgotten that if the loud speaker windings are entirely unsuitable for direct connection in the anode circuit of a valve of this type, volume will be reduced to an appreciable extent.

It is, of course, possible that your pentode valve is faulty, but, before condemning it, you should certainly try the use of some form of coupling which will enable you to match its impedance by that of the loud speaker with a fair degree of accuracy.

What Advantage?

I am thinking of buying a new—and better—L.F. transformer to replace my existing component. Will you tell me exactly what advantage is likely to be gained by making this change, particularly with regard to quality of reproduction?

An L.F. transformer of indifferent design almost always tends to over-emphasise the middle frequencies—in the region of 1,000 cycles—and the result of replacing it by a modern instrument of the best design is to improve low-note response, and, to a lesser extent, the amplification of the higher audible frequencies.

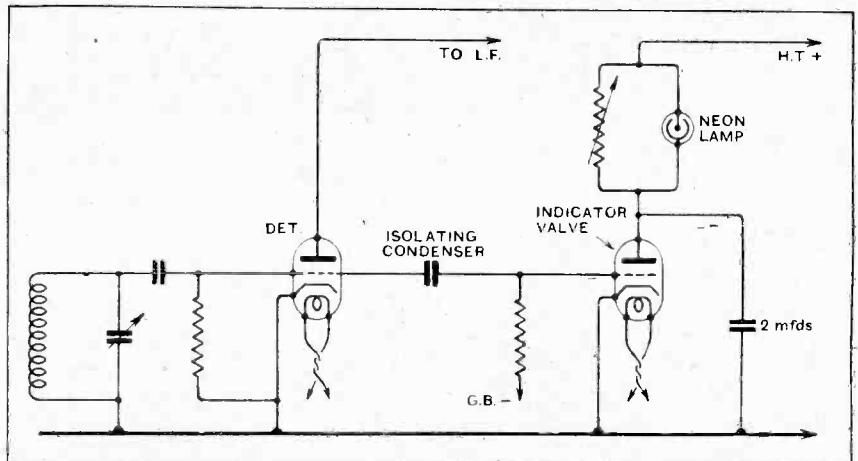


Fig. 1.—A low-voltage neon lamp as a visual tuning indicator; it is operated by an extra parallel-connected valve, which is biased to act as an anode bend rectifier.

manner suggested in Fig. 1. The resistance shunting the lamp should be adjusted to such a value that the critical "striking" voltage is developed across it when

As a result of making this change, a considerable increase in overall L.F. magnification is sometimes noticeable, but it is not possible to count on this in every case.

# The Wireless World

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(19<sup>th</sup> Year of Publication)

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

## Points from our Forecast.

Prices of many of the new sets are temptingly low. (P. 286.)

Sets of parts for the home construction of receivers are to be shown in greater number than ever before. (P. 289.)

A three-valve chassis, with ganged tuning, balanced by a concentric external control, a pentode output valve, and a reed-driven cone speaker. (P. 286.)

A receiver with a new station indicator dial, which combines a large-diameter tuning dial, directly calibrated in station settings, a wave-range switch, and a radio-gramophone switch, all operated by rotation of one knob. (P. 286.)

A new high-speed geared gramophone motor which sells at 58s. 6d., complete with fully automatic starting and stopping switch. (P. 293.)

Two H.F. stages, grid detector, and push-pull output, a sixth valve being a power rectifier. Tuning controls are ganged, there is a band-pass input filter, and this is one of the first sets, if not actually the first, to make use of the new variable-mu H.F. valves. (P. 286.)

A band-pass filter input, ganged tuning, a combination volume control, and a simplified switching system. (P. 286.)

The prophets who foretold a "superheterodyne year" seem to have been justified, as this type of circuit is employed in a number of receivers. (P. 287.)

Modern production methods are exemplified in a receiver built up on an all-steel chassis. (P. 287.)

Although we have become accustomed to regard the AC/SG screened valve as giving the high-water mark of H.F. amplification per stage, we shall see an even more sensitive S.G. valve. (P. 296.)

The choice of receivers, at any rate of the more ambitious type, for those who are forced to use batteries, is likely to be much more restricted than in previous years. (P. 286.)

Superheterodynes, including a "Midget" set, with a stage of pre-detection, H.F. amplification, band-pass tuning in both signal frequency and intermediate circuits, and a corrected L.F. amplifier. (P. 287.)

A receiver where all the modern features that have met with universal approval are included, and a great deal of care and skill has obviously been devoted to its design. (P. 286.)

A receiver with provision for the reception of ultra-short wavelengths, as well as of the medium and long broadcasting wavebands. (P. 287.)

A superheterodyne model which appears to be of extremely advanced design. With a total of eight valves, there are nine tuned circuits, including band-pass filters in both the signal-frequency and intermediate-frequency stages. (P. 288.)

Screened coils of an entirely new style. (P. 290.)

Progress has been well maintained in the design of components generally during the past year. (P. 290.)

It is in the development of ganged condensers that the greatest strides have been made. (P. 290.)

A valve belonging to the new class of high-efficiency output valve with a slope of 6 and an output of 5 watts (A.C.) for an input of about 25 volts. (P. 297.)

A tuned-grid type of coil, an oscillator assembly for superheterodyne receivers, and a band-pass coupling unit, comprising two separately screened coils. (P. 290.)

Valve makers are to be congratulated on putting the D.C. user almost in a position of equality with the A.C. consumer as regards upkeep costs. (P. 296.)

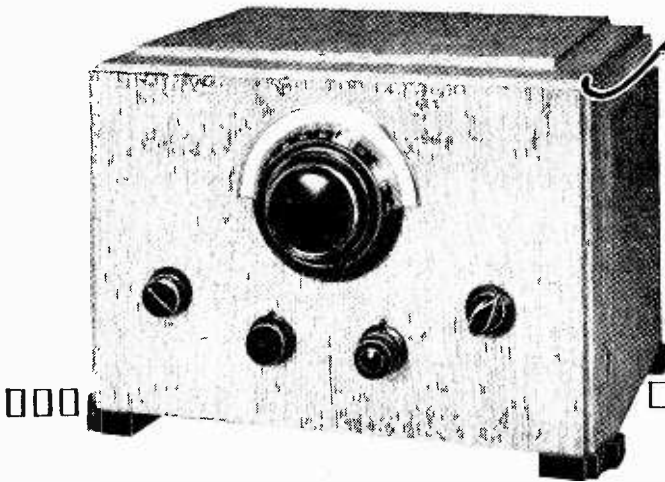
The outstanding feature of the numerous L.F. transformers and L.F. chokes that will be seen this year is the general reduction in size and weight. (P. 290.)

Following the introduction of new power valves demanding a higher operating voltage than hitherto, rectifying units have had to follow suit. (P. 292.)

A special exhibit of commercial-type battery chargers has been arranged, and these will be demonstrated throughout the period of the Show. (P. 292.)

A novelty which is certain to attract a good deal of attention. In appearance and size it is similar to the conventional type of pick-up and tone arm, but the principle of operation is entirely different. (P. 294.)

Among valve developments is the variable-mu high-frequency valve. (P. 296.)



# A Selective

THE  
Wireless  
World  
THREE

By  
F. H. HAYNES.

**B**AND pass is essential to a three-valve set. The need for adequate selectivity with screen-grid amplifiers has led to the development of band-pass tuning, having as its object sharp and constant selectivity across the tuning range with equal sensitiveness at all dial settings. Loose coupling of the aerial circuit, as an alternative to band pass, may sharpen the tuning to provide the required station separation, but an extra control will be required, ganged single-dial tuning will fail, while high-note loss will probably result. With band-pass filters the desired sharpness of tuning is achieved, whilst the range of frequencies embraced is sufficiently broad to give quality reception. Methods of coupling band-pass filters have been discussed at length, and while a purely capacity coupling may be satisfactory where several H.F. stages are employed, owing to the characteristics of the tuned circuits, a mixed filter using both inductance and capacity coupling is required to produce constant overall selectivity before a flatly tuned single H.F. stage. An entirely new form of mixed filter is here used in practice for the first time. It has been well tried and carefully developed by measurement, and its principles are explained elsewhere in this issue.\* Apart from the fact that the combination of capacity and negative inductance have been proportioned to give constant selectivity, taking into account the changing resistance and inductance-capacity ratio of the tuned circuits over the range, the circuit possesses the merit of being symmetrical, so that the two ganged tuning controls will not run out of step and thus cripple the properties of the filter.

*HIGH selectivity combined with single dial tuning is obtained by the use of a new form of band-pass filter, while the use of reaction does not throw the H.F. intervalve coupling out of step with the two tuned circuits of the band pass. This set will meet the requirements of those wishing to use the pick of specialised components. In addition, recent developments which have formed the subject of contributions to the pages of this journal have been taken into consideration.*

#### SPECIFICATION.

*Chassis built receiver of easy construction assembled on an aluminium frame.  
Band pass input filter of new design combining capacity with negative inductance giving high and constant selectivity across the tuning range.  
Single dial tuning. Reaction and pre-H.F. volume controls.  
Ganged waveband switching. Parallel fed L.F. coupling.  
Complete screening. Station calibrated.  
Valves — Osram S.22, H.L.2, and P.2.  
H.T. potential required 150 volts. Current consumption 21 m.A. with 9 volts bias, 19 m.A. with 16 volts, 16.5 m.A. with 12 volts and 10 m.A. with 15 volts.*

While dealing with the problems of single-dial control it must not be forgotten that adjustment of a reaction condenser associated with a coil coupled to a tuned circuit will normally call for a change in the setting of the tuning condenser. If single-dial control is to be maintained, careful attention must be given to this difficulty, or, otherwise, operation of the reaction condenser will throw the detector input out of tune. A modified form of reaction coupling has been adopted making use of a differential condenser in such a way that, as the capacity coupling to the anode and thence to earth is reduced, an equal increase is made through an alternative condenser to earth. It is sufficient to provide another path to earth through a small fixed condenser equal to the anode by-pass capacity. Owing to the presence of the small fixed series condensers, the capacity on the two sides of the differential condenser does not total up to a precisely constant value when capacity is taken off one side and added to the other, but the difference is too small to produce any noticeable effect. It was found that when treating the reaction coil and its reaction condenser as a tuned circuit, adjustment of the latter scarcely altered the wavelength.

Any change made in the value of the capacity path to earth from the top of the reaction coil is equivalent to making a change in the capacity of the tuning condenser of the H.F. stage, and thus it will be appreciated that the customary arrangements of capacity or differential capacity reaction may throw the intermediate

\* Constant Peak Band-Pass Filters, by W. I. G. Page.

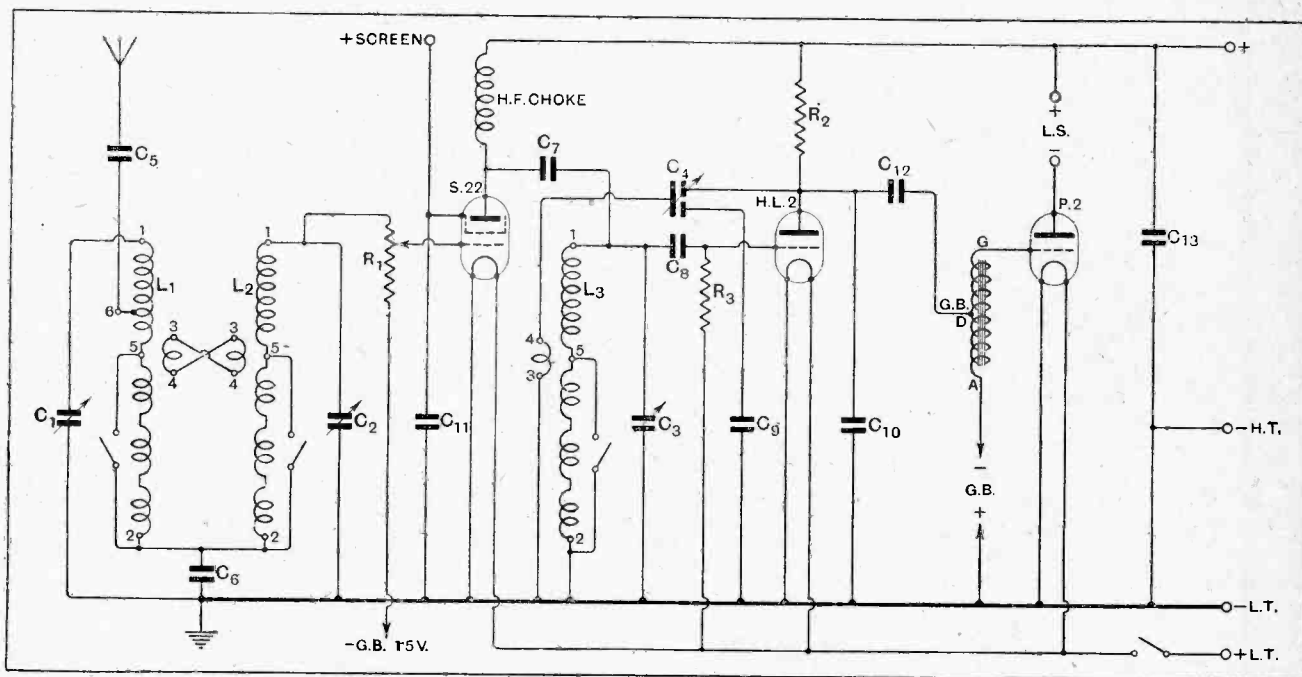
# Band Pass Receiver

coupling widely out of tune when its variable condenser is gang controlled.

The other details in the circuit are more or less orthodox except that attention has been given to the avoidance of any apparatus which might be superfluous. It is a simple matter to provide generous decoupling in conjunction with filter-fed circuits throughout as a means of avoiding back couplings and self-oscillation. Depending on various conditions in the circuits, decoupling may be safely dispensed with, thus simplifying the wiring and reducing the cost. It will be seen from the circuit that no decoupling is employed, and, while it would be a simple matter to add the necessary extra components, their inclusion is quite unnecessary, in spite of the fact that filter feeding does not entirely remove intervalve coupling. As a measure of safety against the possibility of L.F. oscillation occurring, the circuit arrangement was tested out with a resistance in the H.T.

without distortion. Negative bias of the H.F. valve is not essential, but a value up to  $1\frac{1}{2}$  volts may be applied to the grid without loss of range, and this effects a small but worth-while saving in anode current, passing only 1 mA. in the anode circuit and 0.8 mA. in the screen lead. The detector will handle sufficient signal to load fully the output valve without distortion, while the H.F. valve will give the necessary input to the detector when fed with a signal voltage on its grid considerably below the maximum it will handle.

Turning to the practical side, every attention has been given to produce a form of construction that may be repeated without electrical or mechanical difficulties being encountered. A metal chassis has been produced carrying the tuning condenser on an elevated platform in the centre so that the tuning control falls in the correct central position on the front of the cabinet. Beneath this is a compartment of ample size to carry

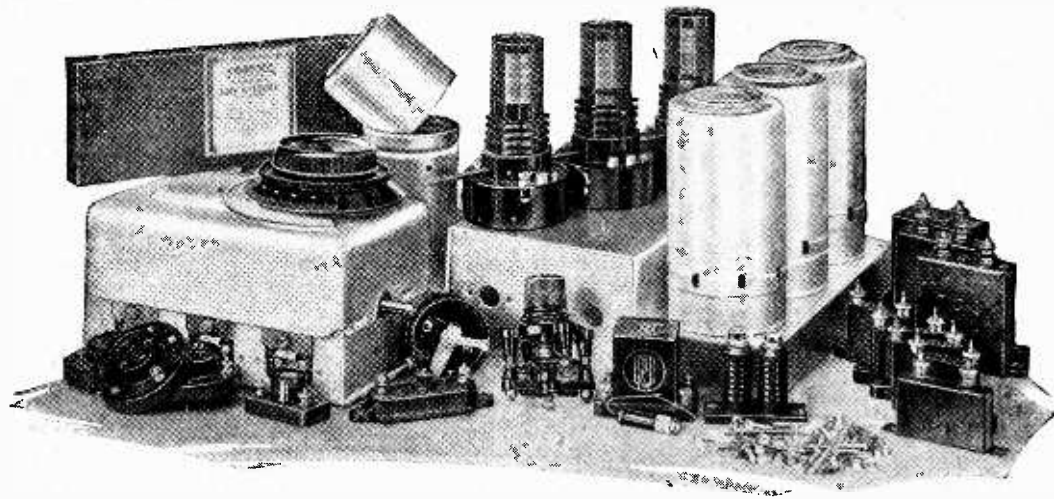


A minimum of apparatus has been employed. The band pass and reaction couplings are arranged to permit of single dial control. C<sub>1</sub>, C<sub>2</sub>, C<sub>3</sub>, 0.0005 mfd.; C<sub>4</sub>, 2 × 0.0002 mfd.; C<sub>5</sub>, 0.0005 mfd. pre-set; C<sub>6</sub>, 0.05 mfd.; C<sub>7</sub>, 0.0001 mfd.; C<sub>8</sub>, C<sub>9</sub>, C<sub>10</sub>, 0.0002 mfd.; C<sub>11</sub>, C<sub>12</sub>, 1 mfd.; C<sub>13</sub>, 2 mfd.; R<sub>1</sub>, R<sub>2</sub>, 50,000 ohms.; R<sub>3</sub>, 1 megohm.

lead producing an equivalent condition to a battery of high internal resistance, but it was found that the limited number of components used was sufficient to avoid motor boating.

Volume control precedes the H.F. valve so that the input from a local station can be brought down to a value where overloading of the valves right through the set is avoided and quality with selectivity maintained. The valves used are of the latest type, giving considerable amplification and generous power output

the bulk of the components. On the two sides, but slightly dropped, are the valve holders and the tuning coils, producing an overall height approximately equal to that of the cover of the condenser. On a small panel in the front are the reaction and volume controls, and, while these carry H.F. currents, the potentials are in such relation that there is no tendency to produce self-oscillation. The tuning condenser, tuning coils, and grid circuits, all carrying H.F. currents, are wired up above the base plate. Before adopting the compact type of



LIST OF PARTS REQUIRED.

- 1 Three-gang condenser with fixing screws ..... (British Radiophone, Ltd.)
- Screened band-pass coils and H.F. intervalve coupling, ready assembled on metal chassis complete with screws and nuts for attaching all components ..... (Colvern)
- 1 Valve screen ..... (Colvern)
- 1 L.F. intervalve transformer ... (R. I. Parafeed)
- 1 Condenser, 2 mfd., 400 volts D.C. test. . (T.C.C.)
- 2 Condensers, 1 mfd., 400 volts D.C. test. (T.C.C.)
- 1 Double reaction condenser, 0.0002 mfd. slow motion drive and fitted with insulating bush ..... (Ormond, Type R190)

- 3 Condensers, 0.0002 mfd. (T.C.C., Upright Type 34)
- 1 Condenser, 0.0001 mfd. (T.C.C., Upright Type 34)
- 1 Condenser, 0.05 mfd. .... (T.C.C., Type 40)
- 1 Grid leak, 1 megohm with wire end terminations ..... (Pye)
- 1 H.F. choke ..... (McMichael, Junior type)
- 1 G.B. battery, 15 volts ..... (Pertrix)
- 1 Resistance, 50,000 ohms ..... (Watnet)
- 1 Variable resistance, 50,000 ohms ..... (Colvern)
- 1 On-and-off switch (B.A.T., Type 161, Claude Lyons, Ltd.)
- 1 Geared dial (Buradep Ethovernier, with scale holder — Henry E. Taylor, 51-53, Church St., Greenwich, S.E.10)

- 3 Valve holders, 5-pin type ..... (W.B.)
- 1 Pre-set condenser, 0.0005 mfd. .... (Polar)
- Valves : S.22, H.L.2 and P.2 ..... (Osram)
- Battery plugs, G.B.—, H.T.—, "Screen," H.T.+ ..... (Belling Lee)
- Terminal Clips, L.S.—, L.S.—, L.T.—, L.T.— ..... (Belling Lee)
- 3 Lengths of green sleeving, 2 mm. gauge.
- Small quantity No. 24 tinned copper wire.
- Cabinet (Clarion Radio Furniture, 28/38, Mansford St., Hackney, E.2)

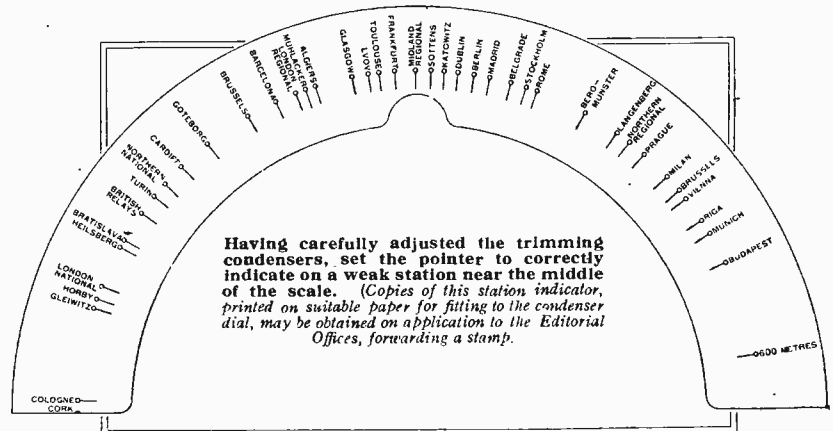
(Cost, less valves and cabinet, £6.)

screened coil where the diameter of the screen has been brought down to approximately equal the width of a section of the condenser, measurements of dynamic resistance were made showing the superiority of these small coils wound with enamelled wire.

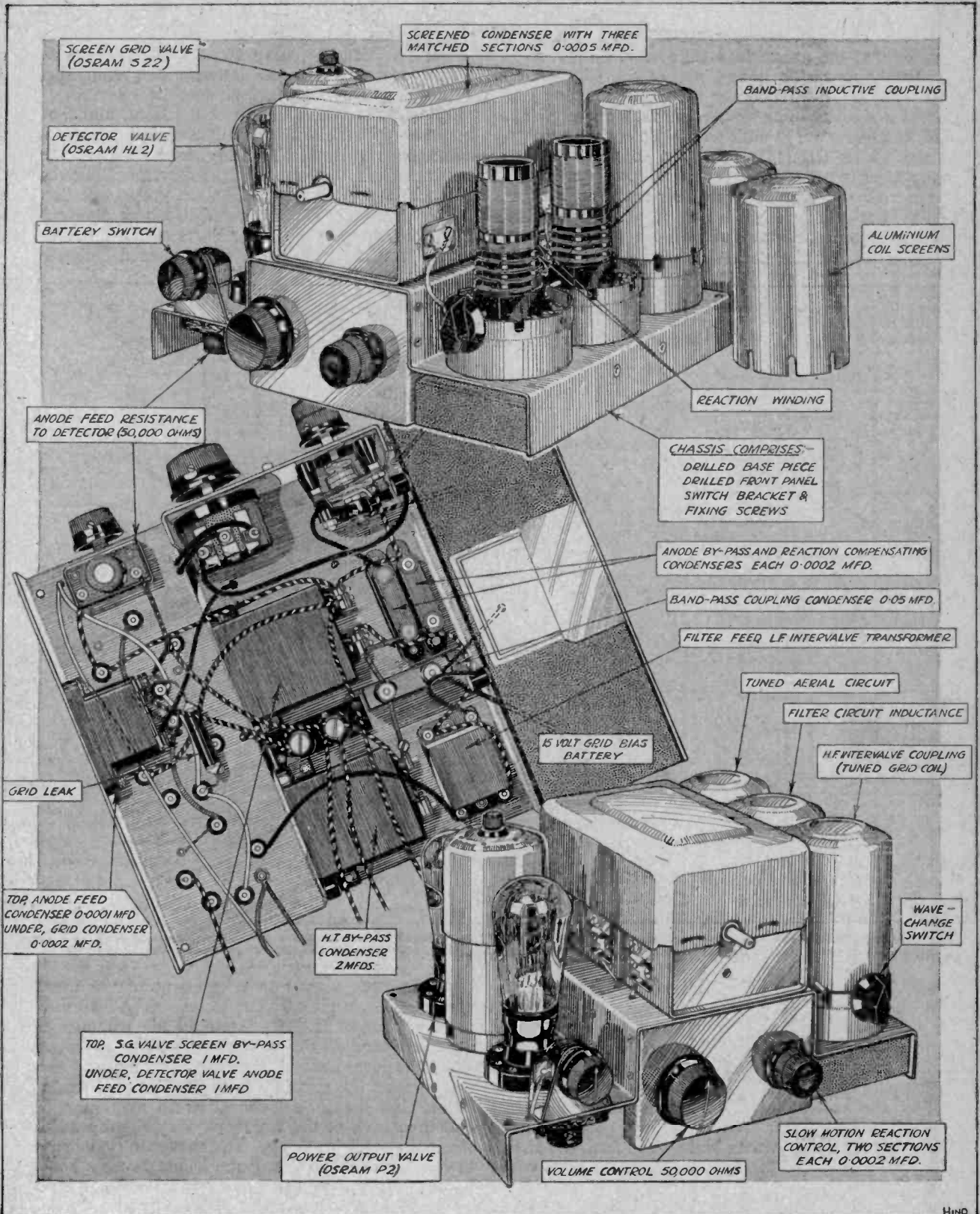
When constructing the set one is not involved in making measurements for setting out the positions of the components, neither is there any need for drilling. The whole job can be assembled and wired in an evening. A start is made by reversing the terminals, with the exception of one grid connection, on the valve holders, transferring the hexagon-headed nuts to the underside, taking the screw home as tightly as possible, and using the thin circular nut for subsequently holding down the wiring. Assemble the valve holders and next the two 1-mfd. condensers, the two 0.0002-mfd. condensers side by side, the two 0.05-mfd. condenser, and the choke, a single bolt engaging the two components at the centre, and then the intervalve transformer. It is advisable to secure some 18in. of wire at its centre to the terminal nearest the front of the least accessible 1-mfd. condenser and a single length of about gin. to the other terminal before assembling. If it is thought that any of the nuts are difficult to engage, they may be held up into position by attaching them with paraffin wax on the end of a pencil, subse-

quently holding them with long-nose pliers. After the tuning condenser has been securely pulled up into position, remembering to leave a length of earth wire held down under its single centre screw, the reaction condenser and volume control may be slipped into position. Take every care with this latter component and avoid knocking its fine winding on the edge of the screwdriver or against the metal, for a break that might occur cannot readily be seen.

Wire up the valve platform first, using No. 24 tinned copper wire and the smallest size silk sleeving that will allow the wire to pass through. Take the sleeving close up into the terminals in order to avoid the danger of







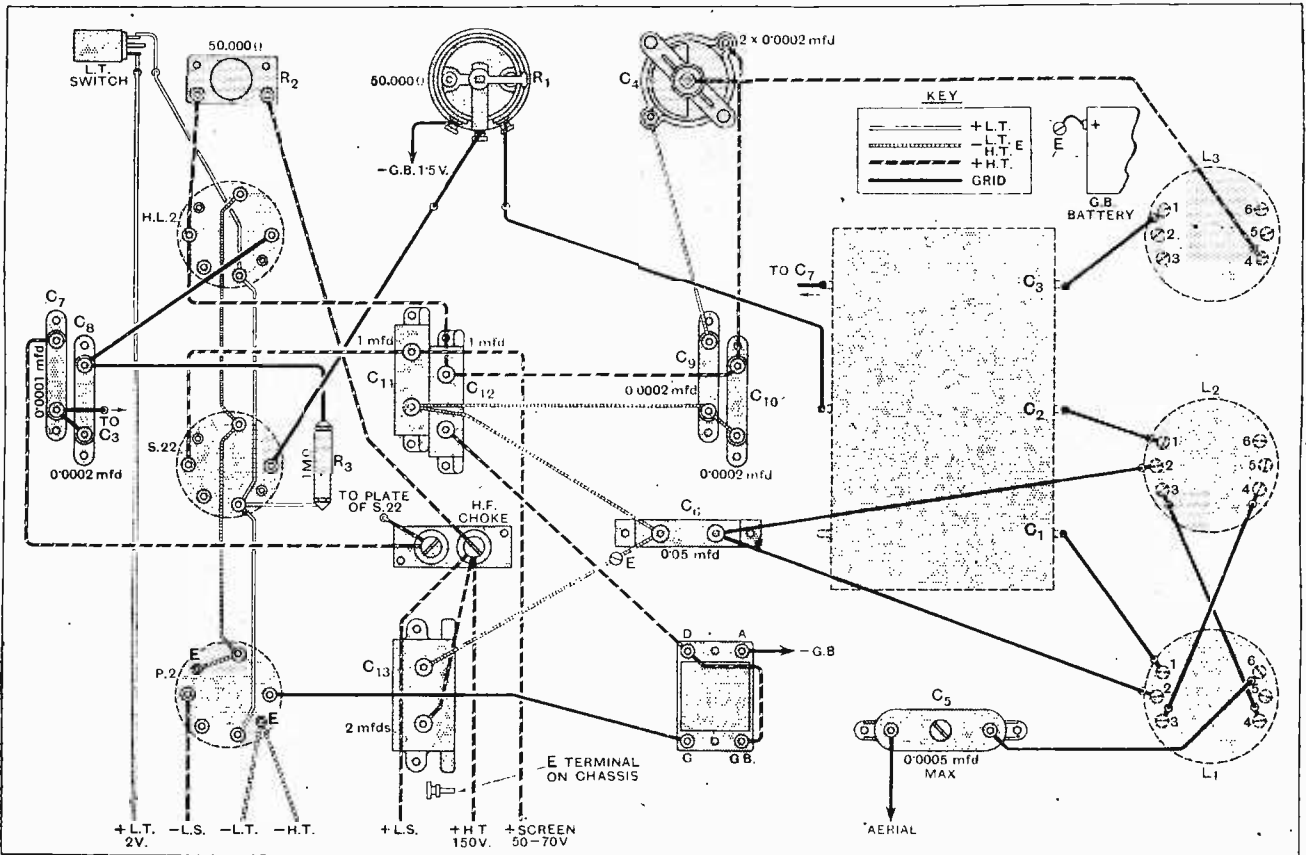
The arrangement of the underside wiring and other assembly details is shown in these top and underside views of the chassis.

"The Wireless World" Three.—

contact with the aluminium. The 0.0002-mfd. grid condenser can next be dropped in place near to the valve terminals and the anode feed condenser, 0.0001 mfd., immediately alongside it and nearer the edge of the metal. Pay great attention to the wiring of these condensers; it is really quite simple, but requires care. The 2-mfd. condenser put in position completes the assembly, and one of its terminals earths on to the condenser holding-down screw, which is immediately underneath it. The coils are supplied with their under connections wired so that only three leads pass from the under side of the coil platform, and two of these are joined together. The remainder of the underside wiring can be easily

from No. 1 terminal of each coil by a short loop to the adjoining tag of a variable condenser, as well as one from terminal No. 6 of the back coil to the aerial pre-set condenser. Good-quality flexible leads about 2ft. in length are attached for batteries and loud speaker. Wiring is so easy that no fault need be expected.

The detector valve is nearest the front, and the L.T. may be applied and left switched on before making the connections to the H.T. battery, for so long as the low-resistance L.T. battery is across the valves they cannot be accidentally burnt out. For the purpose of test with the set out of the cabinet, the dial can be attached and used only on its coarse adjustment. Signals from several stations will, of course, be heard before atten-



Practical wiring diagram showing the actual running of the leads. Small circles indicate the points where the wires pass through the base plate. If the set is to be used with an aerial less than 25ft. in length the pre-set condenser should be omitted.

followed, using both the practical wiring diagram and the underside view as guides. In this connection it will be observed that the reaction condenser is assembled with its most accessible terminal nearest the coil platform.

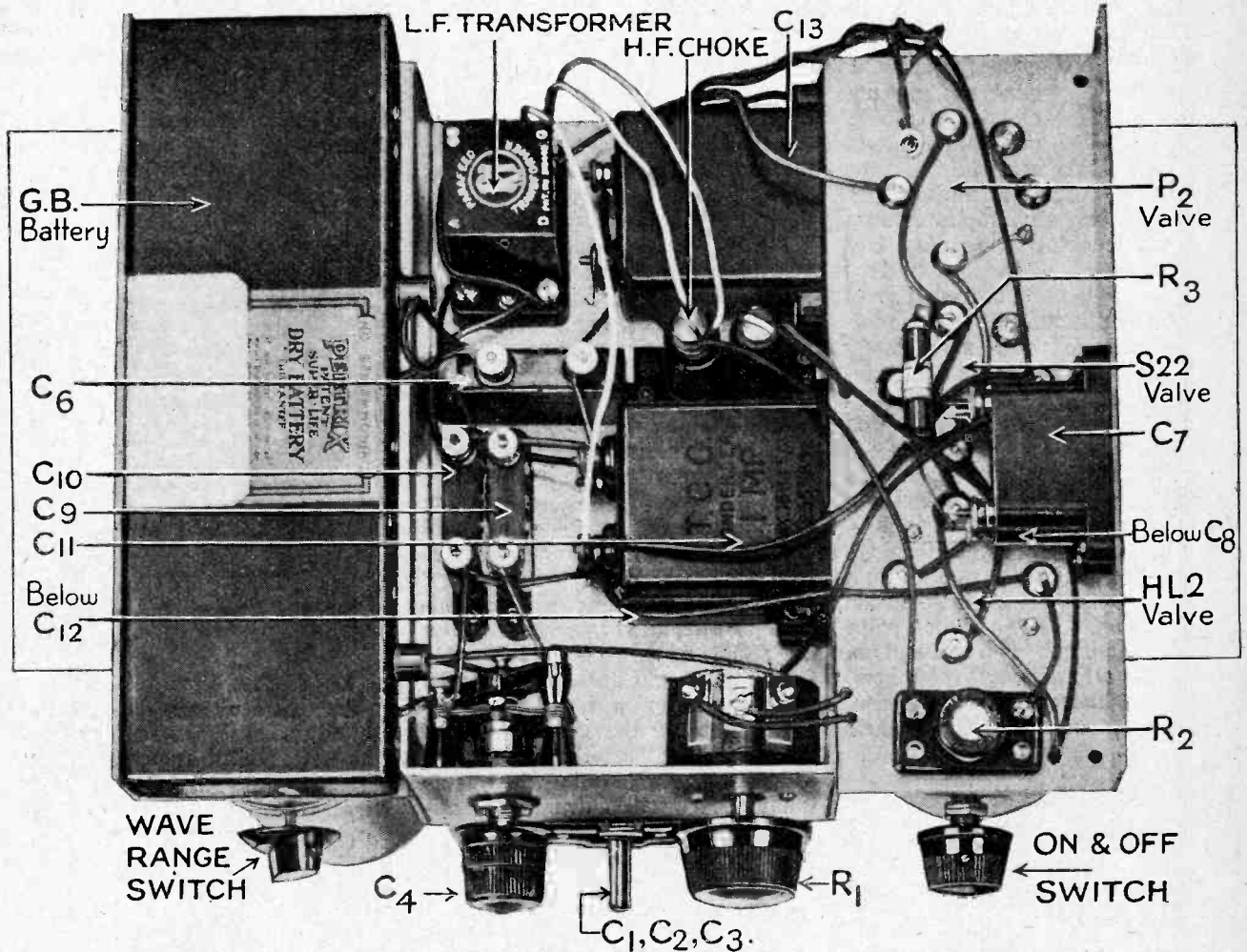
Wires pass through the valve platform from one terminal of the potentiometer to the middle condenser, another from the centre terminal of the potentiometer to the grid of the H.F. valve, and a third from the H.F. choke to the anode of the S.G. valve. If flexible wire is used for this latter connection, protect it with a piece of sleeving. The only other leads above the baseboard are those which run to the switch and the connections

tion has been turned to adjustment of the trimming condensers. Apply 50 volts to the screen lead and 150 volts to "max. H.T." Screw all the trimmers home and then slack off three half turns. After darkness and when the local station has closed down, select a weak station near the minimum end of the tuning scale and adjust first the pre-set condenser to maximum signal and then each of the trimmers, very slightly adjusting the tuning while so doing. The change in signal strength to the ear while adjusting the trimmers may not seem much, but if an output meter of the metal oxide type were to be used instead of the loud speaker, the adjustment would be found quite critical. Much depends on

"The Wireless World" Three.—  
getting the trimmers just right, which takes a little time, but it is not really difficult.

Reaction may be applied while adjusting, slowly slacked off as the trimming becomes perfect. Check over the operation of the reaction control and see that the set does not break into oscillation over any part of either tuning range when the knob is turned back to zero. If it does, reduce the screen potential just far enough to remove the trouble, though the voltage should

used have been carefully matched at all settings in manufacture, and the coils are tested by measurement, the station scale should be closely correct. If the pointer cannot be made to cover the entire scale and correctly indicate, then the trimmers have probably been screwed up too tightly. All of the stations shown have been carefully logged and many more as well. The quality on these foreign stations on a moving-coil loud speaker is in every way satisfactory, and the best gauge of performance is made after 10 p.m. on a Sunday evening.



Underside view showing the identity of the components for use as a guide when assembling.

not fall below 50. On the other hand, if oscillation cannot be produced at every point of the tuning range, increase the screen voltage as may be required, at the same time making sure that the maximum H. T. potential is 150 volts. If trouble is experienced, test both the fixed and variable resistance for continuity. Only place the set in its cabinet after it has been completely tested out. It is attached by four screws passing up from under the base, and on the right-hand side these pass behind the grid battery.

To set the station indicator, tune, say, to Radio Toulouse, after dark, and fix the pointer to correctly indicate. As all the sections of the variable condenser

For the quality reception it is essential to turn back the volume control when listening to a local station, and, owing to the output valve used, this set is admirably suited to the use of a moving-coil loud speaker.

An alternative cabinet design to that shown in the heading of this article has been developed and is arranged to include the loud speaker. It is fitted with an interior light wooden frame to which a loud speaker either of the balanced armature or moving-coil type with output transformer may be secured so that set and loud speaker are assembled as a unit. This form of construction is to be adopted in the design of an all-mains model shortly to be described.

# UNBIASED \* \* \*

By FREE GRID.



I have always been curious concerning the manner in which a big exhibition like the Radio Show is actually got together, and I resolved many moons ago to make an effort to get behind the scenes this year. Accordingly, I wended my way Olympiawards soon after the moving-in process had actually begun, and, having found the front door bolted and barred, I crept round surreptitiously to the tradesmen's entrance, and immediately ran into what the insurance companies usually term a riot and civil commotion, or at least so it appeared to me.

Getting into the way of half a dozen vans at once and being roundly—and no doubt deservedly—abused, I eventually reached a position of comparative safety from where I could get a look inside the building. The whole place was chock-a-block with carpenters, painters, electricians, plumbers' mates, and heaven knows who else, all shouting at the top of their



A naval officer of high rank.

voices, and seemingly doing nothing but getting in each other's way. Here and there I noticed bloated-looking individuals strutting about

importantly, with cigars stuck into the corners of their mouths, waving sheafs of papers and behaving generally in the manner of film directors, or at least in the manner I have always been led to believe that film directors usually behave. The aforesaid bloated ones were doing a good deal of shouting on their own, without, of course, removing the cigars, but, as nobody seemed to be paying the slightest heed to them, it did not seem to matter much.

Later in the day when I returned, after having temporarily retired for refreshment, the carpenters and plumbers' mates, etc., seemed to have been partially dislodged by a howling mob of porters armed with packing cases of all shapes and sizes in which were contained the precious wireless exhibits. By skilfully dodging from pillar to post, I managed to get inside the building, but was immediately brought up with a round turn by a naval officer of high rank, who demanded my pass. Hastily thrusting my card into his hand, I attempted to move on, but he would have none of it, and I feared that I was about to suffer the indignity of being handed over to the minions of the law once more on a charge of "loitering with intent to commit a felony," when, fortunately, a well-known set manufacturer of my acquaintance, who was staggering along under the weight of one of his own portable receivers, barged into us, and at once secured my grudging release by promising to be responsible for my good behaviour.

By the good offices of my friend I was able to get into the building again next day, and managed to get from him a copy of the floor plan showing the positions of the various stands, from which I observed that *The Wireless World* had secured a commanding position in front of one of the bars; those readers, therefore, who usually surge round members of the technical staff who are in attendance will have a great opportunity of getting more comprehensive

answers to their queries by reviving the flagging energies of the aforementioned staff from time to time.

I have already been able to have a preliminary glance at some of the exhibits, which has had the effect of whetting my appetite for the delights to come when the Exhibition is actually opened, and I have jotted down in my notebook several items which I want to discuss with the technical representatives on the various stands.

Talking of technical representatives reminds me of the unfortunate experiences which I detailed in these columns last year, and I sincerely echo the demand which has recently been made in the Editorial columns



... in the manner of film directors.

of *W.W.* that there should be a pukka technical man on each stand and fewer of the superior persons with no technical knowledge, and of the *figurantes* from the *Folies Bergères* who have infested the stands like vermin in previous years.

The Exhibition opens on Friday, and although vast strides have been made since I entered the building early yesterday morning, I cannot for the life of me see how it will be possible for order to emerge from all this chaos by then. The whole place is humming with activity, however, and the "film directors" are shouting louder than ever. Three times I have been abruptly dislodged from an upturned packing case upon which I am attempting to scribble these few notes.

Now a large staff of individuals armed with notebooks, cameras, and harassed looks have appeared to add to the general din and dust. . . .

# The Golden Age of Electricity

Two Notable  
Centenaries.

THE rapidity of wireless development is so much taken for granted in these days that it comes as something of a shock to be reminded that the science of electricity is little more than a century old. Yet exactly one hundred years have passed since Michael Faraday established the principle of electro-magnetic induction, and thus paved the way for the truly astonishing developments which were to follow. This event may be said to have marked an epoch, and its centenary is about to be fittingly celebrated by scientists from all parts of the world.

The years immediately preceding 1831 may well be called the "Golden Age" of electricity. The new powers called into being by Galvani and Volta were being studied throughout Europe, but little knowledge of a quantitative kind had been obtained until the experiments of Oersted. As early as 1807 this Danish savant had suspected the existence of some connection between electricity and magnetism, and had even published a work in which he described his purpose as to "ascertain whether electricity in its latent state had any effect on the magnet." (In passing, it may be remarked that by the "latent state" of electricity Oersted meant what we should now call "current.") It is an eloquent commentary on the difficulties attending electrical research in those times that thirteen years were to pass before he found what he sought. In 1819 he observed that a current from a voltaic battery, if made to pass near a delicately suspended magnetic needle, would deflect it, while further experiment showed that it tended always to place itself in a direction crossing the path of the current. Thus, the first needle galvanometer saw the light.

This result was published in 1820, and was studied carefully by the French scientist, Ampère. Two months

after Oersted's discovery was announced, we find Ampère lecturing to the Academy of Sciences in Paris, and using for the first time the term "electro-dynamic." In the course of his experiments Ampère established that the sense of the deviation of the needle depended on the direction of the current flow. Moreover, he was able to demonstrate the attractive effect of a current-carrying wire on iron filings, thus exhibiting the close relation between magnetism and electricity. From this it was but a step to employ an electric current to magnetise a needle, and further reasoning led him to wind an insulated copper wire round an unmagnetised steel bar—thus producing the first electro-magnet.

These results attracted the attention of Faraday. A born experimenter, he was never content with a new discovery until he had repeated the experiment to his own satisfaction. In words that deserve to become classic, he has said: "I was never able to make a fact my own without seeing it; I could trust a fact, and always cross-examined an assertion." In 1821 he repeated Ampère's experiments with additions of his own, and concluded that it would be possible to cause a magnet and a current-carrying wire to revolve around each other. This, after much experiment, he succeeded in doing.

But ten years were still to elapse before he made his grand discovery, ten fruitful years in which much new knowledge was gained, and during which, in particular, Ohm published his famous "Law" relating to currents and voltages. All this time Faraday was seeking for the link between electricity and magnetism which should establish finally the fact of their inter-connection. And all this time he was experimenting. Why,

then, was his success so long delayed?

The *dénouement* to the quest must surely rank high in the annals of scientific detection, while it is fully as thrilling as any fiction. *Faraday was searching for the wrong thing, and the truth, when it finally came to him, came in a form different to that which he had sought.*



(Left) Michael Faraday, born in London, 22nd Sept., 1791, died 25th Aug., 1867.



(Right) James Clerk Maxwell, born in Edinburgh, 13th Nov., 1831, died 5th Nov., 1879.

**The Golden Age of Electricity.—**

Let us see then just what it was he was looking for.

We have seen that, by Ampère's discoveries, magnetism could be produced by means of a voltaic current. If the two things are interconnected, reasoned Faraday, why should not the reverse process be true, and a continuous current be induced in a wire placed in close proximity to a magnet? Yet, although he employed the most powerful electro-magnets then available, no current was found to flow in the induced circuit, and Faraday was baffled.

But only until the year 1831. It was then that he happened to observe that, although no continuous current would flow, the needle of his galvanometer registered a slight movement every time the energising circuit of the electro-magnet was made or broken. This hint was sufficient. Within a short space of time he had established that the same momentary deflection might be produced by altering the relative positions of the

precise scientific language. In this connection the following tribute to Faraday's attainments may well be quoted: "It is hard to know which to praise most, the insight that foresaw a possible discovery, the experimental skill with which the conception was realised and the fact made sure, or the exquisite simplicity and clearness of the language in which the result was expressed." In his avoidance of mathematical methods, Faraday presented a remarkable contrast to his friend, James Clerk Maxwell, who, though many years his junior, had in a peculiar degree the esteem and affection of the older man. That this was so may be seen from the two extracts from their correspondence which are here reproduced, and which speak for themselves.

The year 1831 is surely an *annus mirabilis* in the history of electricity, for in that year also Clerk Maxwell was born. Of this distinguished mathematical physicist it may be said more truly than of any other that he was the first pioneer of wireless. For it was he who clothed

**To Prof. Faraday from Prof. Maxwell.**

129, Union Street,  
Aberdeen, 9th November, 1857.

*Now, as far as I know, you are the first person in whom the idea of bodies acting at a distance by throwing the surrounding medium into a state of constraint has arisen, as a principle to be actually believed in. We have had streams of hooks and eyes flying around magnets, and even pictures of them so beset; but nothing is clearer than your descriptions of all sources of force keeping up a state of energy in all that surrounds them, which state by its increase or diminution measures the work done by any change in the system. You seem to see the lines of force curving round obstacles and driving plump at conductors, and swerving towards certain directions in crystals, and carrying with them everywhere the same amount of attractive power, spread wider or denser as the lines widen or contract.*

**To Prof. Maxwell from Prof. Faraday.**

Albemarle Street,  
London, 13th November, 1857.

*There is one thing I would be glad to ask you. When a mathematician engaged in investigating physical actions and results has arrived at his conclusions, may they not be expressed in common language as fully, clearly, and definitely as in mathematical formulæ? If so, would it not be a great boon to such as I to express them so?—translating them out of their hieroglyphics, that we also might work upon them by experiment. I think it must be so, because I have always found that you could convey to me a perfectly clear idea of your conclusions, which, though they may give me no full understanding of the steps of your process, give me the results neither above nor below the truth, and so clear in character that I can think and work for them. If this be possible, would it not be a good thing if mathematicians, working on these subjects, were to give us the results in this popular, useful, working state, as well as in that which is their own and proper to them?*

wire and magnet, and that it was much enhanced by the presence of soft iron. Finally, he introduced a bar magnet into a solenoid of insulated copper wire, the two ends of which were connected to a galvanometer. On the approach and withdrawal of the magnet, the needle registered momentary deflection. In that hour the dynamo was born, alternating currents were made possible, and the discovery was complete.

Faraday was gifted with an unusual degree of imagination and scientific insight, and had, moreover, the power of very clear exposition. He was no mathematician, and, though profoundly aware of his limitations in this respect, he was never consciously at a loss to clothe his ideas in

Faraday's ideas in mathematical form, and thus presented a symbolic picture of the inter-relations of magnetism and electricity which has proved the firm foundation for all subsequent advance. Maxwell's theoretical research on wave-motion in the ether was confirmed by the practical discovery of wireless waves twenty years afterwards, though Maxwell himself did not live to see the remarkable consequences of his analytical work.

Maxwell's achievements are, happily, the subject of far more worthy laureation than any that can be attempted here, and it is very fitting that his name should be linked with that of Faraday in the celebrations which are going forward at the present time.

# OLYMPIA SHOW COMPETITION

## Wireless World

# BALLOT

THE voting Competition conducted by *The Wireless World* has now come to be regarded as a regular feature of the Olympia Radio Show, and from year to year interest in the Competition grows.

Readers will find included in this and the two following issues of *The Wireless World* an entry form amongst the advertisement pages. This entry form entitles them to participate in the Competition and register their votes in the various classes of apparatus.

This annual ballot provides a very useful guide to wireless manufacturers as to what products appeal most to the intelligent section of the wireless public. The Competition is also of great interest to our readers, quite apart from the attraction of the prizes offered. Year by year the importance of the Competition has grown, for the number of entries has increased enormously and, although last year entry forms were only available through the pages of *The Wireless World*, yet the number of entries far exceeded those of the previous year when entry forms were freely distributed at Olympia.

The reason that we restrict the entry form to the pages of *The Wireless World* is that we are most anxious that the vote should be based on technical discrimination, and we therefore wish to confine it to those who take *The Wireless World*. Were a competition of this nature to be conducted by a non-technical journal, then it is probable that the ballot would be misleading, and the results would not represent a sound technical opinion on the exhibits at Olympia, but we believe that where readers are technically informed, as in the case of *The Wireless World*, they are in a position to judge apparatus for themselves on its merit and so arrive at a result which is definitely useful.

We have this year further simplified the entry form so that there should be no difficulty in filling it up.

First the reader has to make his choice in the various classes into which we have divided the exhibits, and he also has to make up his mind what individual item is the outstanding exhibit at the Show. As in previous years, only one form should be used by each entrant, and the forms should not be sent to us until the Wednesday following the appearance of the issue of *The Wireless World* of September 30th, which constitutes the last of the three special Show numbers. The reason for delaying the forwarding of the entry forms in this way is so that those readers who may not be able to visit the Exhibition personally can have the full benefit of the published reports of the Show which appear in the present issue and the two numbers which follow: these three issues constituting *The Wireless World* Show Num-

bers. The price asked for it should be an important consideration in making a choice.

The ballot is organised on the basis that every reader of *The Wireless World* has one vote for what he considers to be the outstanding single exhibit of the Show, and in order to reduce the possibility of ties, each competitor is required to vote, in addition, for one piece of apparatus in each of the classes into which we have divided the exhibits.

Our classification of the exhibits this year is as follows:—

- (1) Receivers employing four or more valves, including radio gramophones.
- (2) Receivers employing three valves or less, including radio gramophones.
- (3) Component parts for home construction, including coils, condensers, resistances, etc.
- (4) Valves.
- (5) Loud Speakers.
- (6) Accessories, such as pickups, gramophone motors, mains units, meters, etc.

#### The Prizes.

Details of the prizes which are offered will be found on the entry forms. A cash prize of £50 is to be awarded by *The Wireless World* to the competitor whose vote agrees with the opinion of the majority in the selection of the outstanding single exhibit and also in the largest number of additional classes. There will be second, third, fourth and fifth prizes to the total value of a further £50 in the form of vouchers for the purchase of apparatus.

We are most anxious that every reader should take a personal interest in assisting to make the competition a success. It is only by insuring that the number of votes are truly representative that the greatest value and interest can be realised from the competition.

VOTE  
FOR  
THE BEST

bers. These numbers will be found very helpful to readers in assisting them in their choice, since they deal in some detail with nearly all the representative exhibits on every stand.

#### An All-British Competition.

As in previous years, the competition is confined to apparatus of manufacturers who are represented at Olympia. We are anxious that, when coming to their decisions, competitors should take into account the general quality of the product first, but that they should pay special attention to price. The value of the apparatus at



# EXHIBITORS at OLYMPIA

- A**DIE & Co., Ltd., (169)  
2, Aldermanbury Av., E.C.2.
- Arding & Hobbs, Ltd., (171)  
315, Lavender Hill, S.W.11.
- Atalanta, (191)  
1-3, Brixton Road, S.W.9.
- Audiovisor, Ltd., (226)  
28, Little Russell St., W.C.1.
- Auto Electric Devices, Ltd., (159)  
Diamond Works, Brighton, Sussex.
- Automatic Coil Winder & (207 & 208)  
Electrical Equipment Co., Ltd.,  
Winder House, Douglas St., S.W.1.
- B**. & S. Electrical Co., Ltd., (181)  
9, Brunswick Place, City Rd., N.1.
- Baird Television, Ltd., (157)  
133, Long Acre, W.C.2.
- Bakers Selhurst Radio, (216)  
89, Selhurst Rd., S. Norwood, S.E.
- Beaver Electrical Supply Co., (165)  
5, Gt. Chapel St., W.1.
- Belling & Lee, Ltd., (13)  
Queensway Works, Ponders End.
- Benjamin Electric, Ltd., (99)  
Tariff Road, N.17.
- Betta Electric Motors, Ltd., (218)  
119-125, Finsbury Pavement, E.C.2.
- Bird, Sydney S., & Sons, Ltd., (172)  
Sarnesfield Road, Enfield.
- Birkbys, Ltd., (206)  
Liversedge, Yorks.
- British Blue Spot Co., Ltd., (65)  
94-96, Rosoman St., E.C.1.
- British Broadcasting Corp., (211)  
Savoy Hill, Strand, W.C.2.
- British Ebonite Co., Ltd., (153)  
Nightingale Road, Hanwell, W.7.
- British General Mfg. Co., Ltd., (30)  
Brockley Works, Brockley, S.E.4.
- British Hard Rubber Co., Ltd., (182)  
Wharf Road Works, Ponders End,  
Middlesex.
- British Radiophone, Ltd., (155)  
Aldwych House, Aldwych, W.C.2.
- British Rola Co., Ltd., (250)  
1a, Willesden Lane, N.W.6.
- Brooks, Ltd., Kenneth, (225)  
72-86, Oxford St., W.1.
- Brown Bros., Ltd., (105)  
26, Great Eastern St., E.C.2.
- Brown, S. G., Ltd., (2)  
Western Av., N. Acton, W.3.
- Brownie Wireless Co. of G.B., Ltd., (37)  
Nelson Street Works, Mornington  
Crescent, N.W.1.
- Bulgin, A. F., & Co., Ltd., (102)  
Abbey Rd., Barking, Essex.
- Bullphone, Ltd., (12)  
38, Holywell Lane, E.C.2.
- Burton, C. F. & H., (31)  
Bernard St., Walsall.
- C**ADISCH, R., & Sons, (184)  
5-6, Red Lion Sq., W.C.1.
- Calders, Ltd., (183)  
29-31, Regent St., S.W.1.
- Carrington Mfg. Co., Ltd., (51)  
24, Hatton Garden, E.C.1.
- Catesbys, Ltd., (245)  
Tottenham Court Rd., W.1.
- Celestion, Ltd., (40)  
London Rd., Kingston-on-Thames.
- Chloride Electrical Storage Co., Ltd., (8)  
Clifton Junction, nr. Manchester.
- Churchmans, Ltd., (200)  
79, Maidenburgh St., Colchester.
- Clarke, H., & Co. (M/C.), Ltd., (33)  
Easton St., Old Trafford, Man-  
chester.
- Climax Radio Electric, Ltd., (42)  
Haverstock Works, Parkhill Rd.,  
Hampstead, N.W.3.
- Colasson, Ltd., (209)  
Mark Lane Station Buildings,  
Gt. Tower St., E.C.3.
- Cole, E. K., Ltd., (26)  
Ekco Works, Southend-on-Sea.
- Columbia Graphophone Co., Ltd., (7)  
92, Clerkenwell Rd., E.C.1.
- Colvern, Ltd., (38)  
Mawneys Rd., Romford, Essex.
- Concordia Electric Wire Co., Ltd., (248)  
Trent Mills, New Sawley, nr.  
Nottingham.
- Cossor, A. C., Ltd., (16)  
Cossor House, Highbury Grove, N.5.
- Craufurd Wireless, (242)  
24-26, Holborn, E.C.1.
- Crypto Electrical Co., Ltd., (235)  
Acton Lane, Willesden, N.W.10.
- D**ANIPAD Rubber Co., Ltd., (70)  
5-7, Market St., E.C.2.
- Darwins, Ltd., (101)  
Fitzwilliam Works, Sheffield.
- Dayzite, Ltd., (251)  
17, Lisle St., W.C.2.
- De La Rue & Co., Ltd., Thos., (164)  
90, Shernall St., Walthamstow, E.17.
- Dew, A. J., & Co., Ltd., (104)  
33-34, Rathbone Place, W.1.
- Dibben, Wm., & Sons, Ltd., (1)  
St. Mary's Rd., Southampton.
- Donotone (Regd.) Loud Speakers, (161)  
40, Furnival St., E.C.2.
- Downing & Sons, Ltd., John S., (54)  
Commercial St., Birmingham.
- Dubilier Condenser Co. (1925), Ltd., (92)  
Ducon Works, Victoria Rd.,  
N. Acton, W.3.
- Dulcetto-Polyphon, Ltd., (230)  
2-3, Newman St., W.1.
- Dyson, J., & Co. (Works), Ltd., (78)  
5, Godwin St., Bradford.
- E**AST London Rubber Co., Ltd., (176)  
29, Gt. Eastern St., E.C.2.
- Eastick, J. J., & Sons, (252)  
118, Bunhill Row, E.C.1.
- Edison Bell, Ltd., (41)  
Edison Bell Works, Glengall Rd.,  
S.E.15.
- Edison Swan Electric Co., Ltd., (21)  
123-5, Queen Victoria St., E.C.4.
- Electric Gramophones, Ltd., (89)  
The Quadrant, Winchmore Hill, N.21.
- Electrical Devices, Ltd., (185)  
12, Great James St., W.C.1.
- Electrical & Radio Products, Ltd., (3)  
Empire Works, Salfords, Redhill,  
Surrey.
- Electro-Dynamic Construction Co., (228)  
Ltd.,  
Devonshire Grove, Old Kent Rd., S.E.
- Ensign, Ltd., (85)  
88-89, High Holborn, W.C.1.
- Epoch Radio Mfg. Co., Ltd., (106)  
3, Farringdon Ave., E.C.4.
- Ericsson Telephones, Ltd., (219)  
71, Kingsway, W.C.2.
- Ever Ready Co. (G.B.), Ltd., (76)  
Ever Ready Works, Hercules Place,  
Holloway, N.7.
- F**ALK, Stadelmann & Co., Ltd., (87)  
83-93, Farringdon Rd., E.C.1.
- Faudels, Ltd., (192)  
36-40, Newgate St., E.C.4.
- Fay Home Recorders, Ltd., (220)  
121, Victoria St., S.W.1.
- Ferranti, Ltd., (45)  
Hollinwood, Lancs.
- Flinders (Wholesale), Ltd., (204)  
East Stockwell St., Colchester.
- Formo Co., (61)  
23, Golden Sq., W.1.
- Francke, F., (224)  
28, Blomfield Rd., Maida Vale, W.
- Fuller Accumulator Co. (1926), Ltd., (36)  
Woodland Works, Chadwell Heath,  
Essex.
- Fullotone Gramophones (1929), Ltd., (201)  
73, Camden Rd., N.W.1.
- G**AMAGE, A. W., Ltd., (195)  
Holborn, E.C.1.
- Garrard Engineering & Mfg. Co., (178)  
Ltd.,  
Newcastle St., Swindon, Wilts.
- Garratt Stores, (240)  
193, Garratt Lane, S.W.18.
- General Electric Co., Ltd., (24 & 77)  
Magnet House, Kingsway, W.C.2.
- Goodmans, (239)  
69, St. John St., E.C.1.
- Graham Amplion, Ltd., (75)  
St. Andrew's Works, Slough, Bucks.
- Graham Farish, Ltd., (32)  
Masons Hill, Bromley, Kent.
- Graham, R. F., & Co., (189)  
45-46, Cambridge Rd., Kingston-on-  
Thames.
- Greatrex, R. G., & Co., (197)  
184, Regent St., W.1.
- Gripso Co., (81)  
32, Victoria St., S.W.1.
- Grosvenor Electric Batteries, Ltd., (72)  
2-3, White St., Moorgate, E.C.
- Gutta Percha Co., (196)  
Wharf Rd., City Rd., N.1.
- H**ACKER, H., & Sons, (95)  
Perfecta Works, Ray Lea Rd.,  
Maidenhead.
- Halcyon Wireless Co., Ltd., (96)  
27a, Pembridge Villas, Notting Hill  
Gate, W.11.
- Harlie Brothers (Edmonton), Ltd., (84)  
Balham Rd., Lower Edmonton, N.9.
- Heayberd, F. C., & Co., (68)  
10, Finsbury St., E.C.2.
- Henderson Wireless & Electrical (170)  
Service,  
54, Queen's Rd., Brighton.

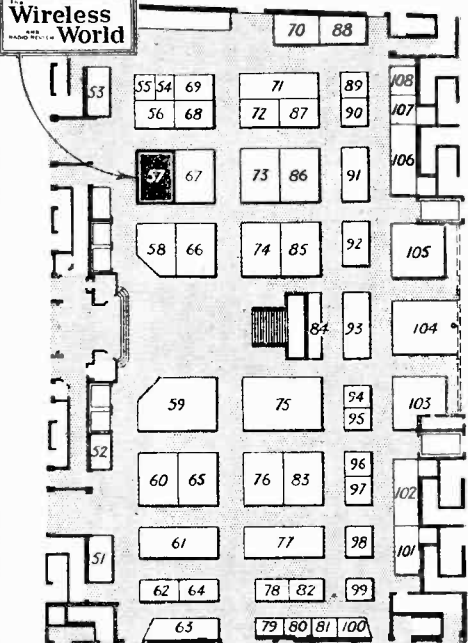


# OLYMPIA



# 1931

Wireless World

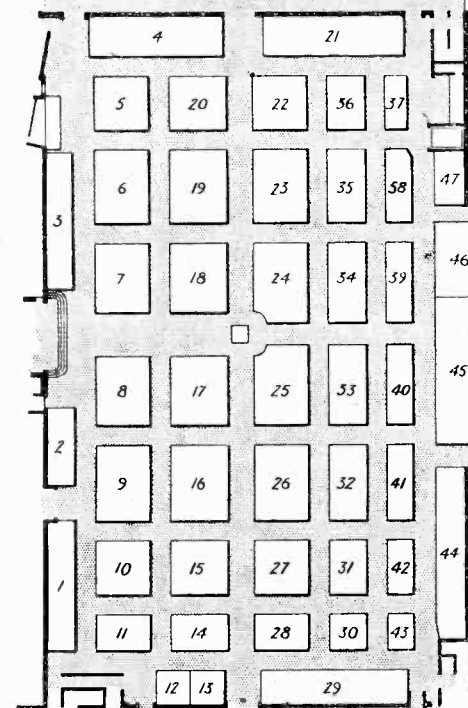


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## EMPIRE HALL

FIRST FLOOR →

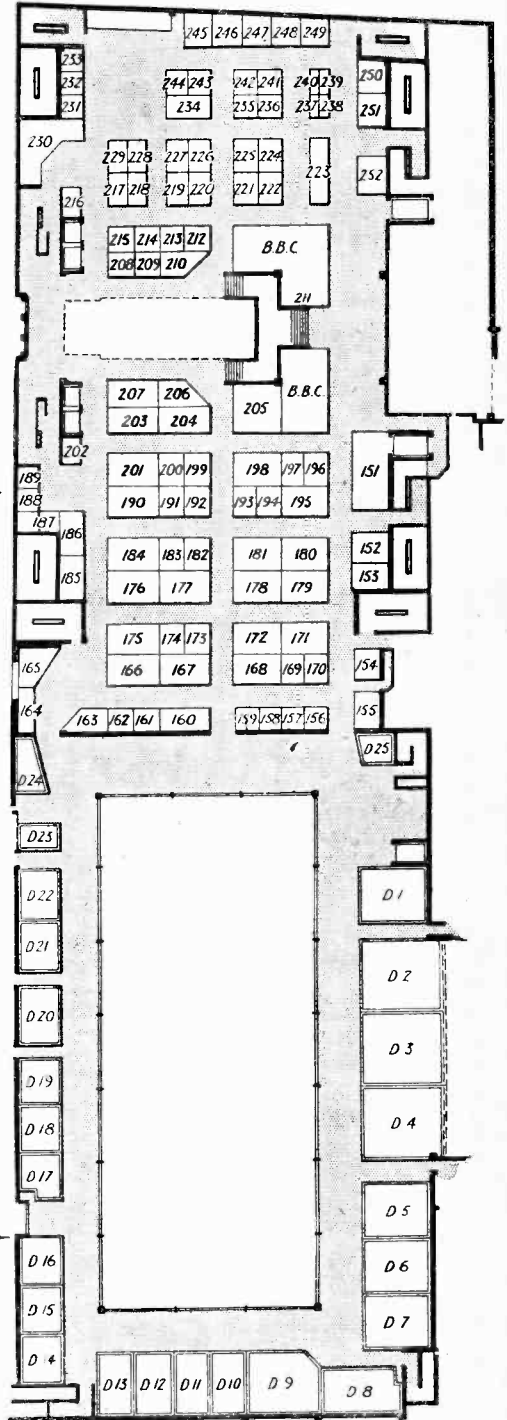
FRIDAY, SEPT. 18  
to  
SAT., SEPT. 26



← GROUND FLOOR

## NATIONAL HALL

FIRST FLOOR →



COOKE

**Exhibitors at Olympia.—**

- Hillman Brothers, Ltd., (166)  
123, Albion St., Leeds.
- Hobday Bros., Ltd., (175)  
21, Great Eastern St., E.C.2.
- Home Electric, Ltd., (214)  
24, Sackville St., W.1.
- Hunt, A. H., Ltd., (232)  
Tunstall Rd., Croydon, Surrey.
- Hunton, Ltd., (233)  
Fitzroy Court, Tottenham Court Rd., W.1.
- Hustler, Simpson & Webb, Ltd., (86)  
55-57, Tanner St., S.E.1.
- I**GRANIC Electric Co., Ltd., (28)  
147, Queen Victoria St., E.C.4.
- Itonia Gramophones, Ltd., (167)  
58, City Rd., E.C.1.
- J**ACKSON Brothers, Ltd., (62)  
72, St. Thomas St., S.E.1.
- Jewel Pen Co., Ltd., (156)  
21-22, Great Sutton St., E.C.1.
- Johnson Talking Machine Co., Ltd., (180)  
96, Clerkenwell Rd., E.C.1.
- Junit Mfg. Co., Ltd., (97)  
2, Ravenscourt Sq., W.6.
- K**ALISKY'S (Aldgate), Ltd., (151)  
146, Theobalds Rd., W.C.1.
- Kolster-Brandes, Ltd., (25)  
Cray Works, Sidcup, Kent.
- L**.E.S. Distributors, Ltd., (88)  
9, St. Martin's St., W.C.2.
- Lamplugh, S. A., Ltd., (168)  
89, Little Park St., Coventry.
- Lectro-Linx, Ltd., (202)  
254, Vauxhall Bridge Rd., S.W.1.
- Lissen, Ltd., (17)  
Worple Rd., Isleworth, Middx.
- Lithanode Co., Ltd., (249)  
190, Queen's Rd., Battersea, S.W.8.
- Lock, W. & T., Ltd., (160)  
St. Peter's Works, Bath.
- London Electric Wire Co. & Smiths, Ltd., (27)  
Church Rd., Leyton, E.10.
- Lotus Radio, Ltd., (23)  
Mill Lane, Old Swan, Liverpool.
- M**ICHAEL, L., Ltd., (5)  
Wexham Hd., Slough, Bucks.
- Magnavox (G.B.), Ltd., (108)  
89, Kingsway, W.C.2.
- Mains Power Radio Co., (229)  
Broadway House, South St., Romford, Essex.
- Mains Radio Gramophones, Ltd., (53)  
Vaughan St., Bradford.
- Manufacturers Accessories Co. (1928) Ltd., (186)  
85, Great Eastern St., E.C.2.
- Marconiphone Co., Ltd., (4)  
210, Tottenham Court Rd., W.1.
- Mellor, C., (255)  
154, King's Cross Rd., W.C.1.
- Montague Radio Inventions & Development Co., Ltd., Beethoven Works, Great College St., N.W.1.
- Mullard Wireless Service, Ltd., (18, 80, 199, 221)  
Mullard House, Charing Cross Rd., W.C.2.
- Murphy Radio, Ltd., (59)  
Broadwater Rd., Welwyn Garden City, Herts.
- N**ATIONAL Accumulator Co., Ltd., (15)  
50, Grosvenor Gardens, S.W.1.
- New London Electron Works, Ltd., (35)  
East Ham, E.6.
- O**LDHAM & Son, Ltd., (66)  
Denton, Manchester.
- Ormond Engineering Co., Ltd., (34)  
Ormond House, Rosebery Ave., E.C.1.
- Osborn, Charles A., (205)  
Regent Works, Arlington St., N.1.
- Overseas Trading Corporation, (173)  
18, Ganton St., Regent St., W.1.
- P**. R. Products, (187)  
P. R. House, 14, Newgate St., E.C.
- Park Royal Engineering Co., Ltd. (194)  
Cumberland Ave., N.W.10.
- Paroussi, E., (158)  
10, Featherstone Buildings, W.C.1.
- Partridge & Mee, Ltd., (177)  
74, New Oxford St., W.C.1.
- Partridge Wilson & Co., (43)  
Davenset Works, Evington Valley Rd., Leicester.
- Pegasus, Ltd., (238)  
10, Victoria St., Chapel Allerton, Leeds.
- Pertrix, Ltd., (39)  
233, Shaftesbury Ave., W.C.2.
- Peto Scott Co., Ltd., (179)  
77, City Rd., E.C.1.
- Pioneer Mfg. Co., Ltd., (188)  
Cromwell House, Fulwood Pl., W.C.
- Priestly & Ford, (69)  
3-11, Carrs Lane, Birmingham.
- Primus Mfg. Co., Ltd., (193)  
Primus House, Willow St., E.C.2.
- Pritchard & Simpson, Ltd., (243)  
16-18, Lisle St., Newcastle-on-Tyne.
- Pye Radio, Ltd., (9)  
Radio Works, Cambridge.
- R**.C. Radio Electric, Ltd., (257)  
York House, Southampton Row, W.C.1.
- Radio Gramophone Development Co., (11)  
Ltd.,  
18, Frederick St., Birmingham.
- Radio Instruments, Ltd., (29)  
Purley Way, Croydon, Surrey.
- Radio Service (Ldn.), Ltd., (162)  
105a, Torrion Ave., N.W.5.
- Radio Society of Great Britain, (246)  
53, Victoria St., S.W.1.
- Ready Radio, Ltd., (6 & 93)  
159, Borough High St., S.E.1.
- Rees Mace Mfg. Co., Ltd., (215)  
39a, Welbeck St., W.1.
- Redferns Rubber Works, Ltd., (163)  
Hyde, Cheshire.
- Regentone, Ltd., (22)  
21, Bartlett's Buildings, E.C.4.
- Rolls Caydon, Ltd., (56)  
77, Rochester Row, S.W.1.
- Rolls Radio, Ltd., (256)  
138, St. John St., Clerkenwell, E.C.1.
- Rooke Bros., Ltd., (79)  
32, Queensway, Ponders End.
- S**EL-EZI Wireless Supply Co., Ltd., (190)  
1, Soho Sq., W.1.
- Selectors (1931), Ltd., (83)  
Servis Works, Albion St., N.16.
- Selfridge & Co., Ltd., (234)  
Oxford St., W.1.
- Shapland & Petter, Ltd., (217)  
Raleigh Works, Barnstaple.
- Siemens Electric Lamps & Supplies, (74)  
Ltd.,  
Caxton House, S.W.1.
- Six-Sixty Radio Co., Ltd., (20)  
17-18, Rathbone Place, W.1.
- Smurthwaite, F. W., (107)  
15a, Onslow Gardens, Wallington, Surrey.
- Sovereign Products, Ltd., (64)  
52, Rosebery Ave., E.C.1.
- Speakeasie Home Recorders, Ltd., (236)  
63, New Broad St., E.C.2.
- Standard Battery Co., (94)  
184, Shaftesbury Avenue, W.C.2.
- Stratton & Co., Ltd., (98)  
Balmoral Works, Bromsgrove St., Birmingham.
- Sun Electrical Co., Ltd., (203)  
118, Charing Cross Rd., W.C.2.
- Swain, Charles, Ltd., (244)  
32, Queensway, Ponders End, Middx.
- Swift Levick & Sons, Ltd., (52)  
Clarence Steel Works, Sheffield.
- Synchrophone, Ltd., (223)  
24, Berners St., W.1.
- T**ANNOY Products, (63)  
1-7, Dalton St., W. Norwood, S.E.27.
- Taylor, Henry E., Ltd., (212)  
51-53, Church St., Greenwich, S.E.10.
- Telegraph Condenser Co., Ltd., (14)  
Wales Farm Rd., N. Acton, W.3.
- Telsen Electric Co., Ltd., (19 & 213)  
Thomas St., Aston, Birmingham.
- Thompson, Diamond & Butcher, (210)  
34, Farringdon Rd., E.C.1.
- Tonex Co., (231)  
Walker St., Blackpool.
- Turner & Co., (82)  
54, Station Rd., New Southgate, N.11.
- U**LTRA Electric, Ltd., (10)  
Erskine Rd., N.W.3.
- Umello, Ltd., (73)  
55, Great Marlborough St., W.1.
- V**ANDERVELL, C. A., & Co., Ltd., (91)  
319, Regent St., W.1.
- Varley (Oliver Pell Control), Ltd., (58)  
103, Kingsway, W.C.2.
- Voltron Electric, Ltd., (227)  
Queensway Works, Ponders End.
- W**ATMEL Wireless Co., Ltd., (100)  
Imperial Works, High St., Edgware.
- Westinghouse Brake & Saxby Signal Co., Ltd., (44)  
82, York Rd., King's Cross, N.1.
- Whiteley Electrical Radio Co., Ltd., (46)  
Nottingham Rd., Mansfield, Notts.
- Whiteley, William, Ltd., (198)  
Westbourne Grove, W.2.
- Whittingham Smith & Co., (103)  
Portadyne Works, Gorst Rd., N. Acton, N.W.10.
- Wilkins & Wright, Ltd., (90)  
Utility Works, Holyhead Rd., Birmingham.
- Wingrove & Rogers, Ltd., (60)  
Mill Lane, Old Swan, Liverpool.
- "Wireless World," (57)  
Dorset House, Tudor St., E.C.4.
- Wright & Weaire, Ltd., (152)  
740, High Rd., Tottenham, N.17.
- Y**AGERPHONE, Ltd., (222)  
Charlotte Cabinet Works, Ponders End, Middx.

# OLYMPIA 1931



## SHOW FORECAST

IN attempting to forecast the general trend of progress which the Olympia Radio Show, 1931, will disclose, we have to be careful to bear in mind that at the time of going to press with this issue there is still more than a week before Olympia opens, and many manufacturers are so jealous of the secrets of their new designs, which they have guarded closely during past months, that they will not be prepared to reveal them, even to *The Wireless World*, until nearer the date of the Show. Our forecast of the Exhibition cannot, therefore, be complete, and not until our next issue will it be possible for us to give a really comprehensive review of all that Olympia will have to disclose.

Next week's Special Show Review Number, as our regular readers know, is entirely compiled by *The Wireless World* staff after the Show has opened, and is, therefore, based exclusively on first-hand information. No other report of the Show attempts such a programme to provide early and detailed technical information for its readers.

The information which we have already gleaned, although, as we have said, incomplete, is yet sufficient to enable us to form a fairly accurate impression of the essential differences in technical trend which will be noticeable this year as compared with previous shows. Last year our principal comment on the Exhibition was that it marked a year of consolidation, when sets showed for the first time a degree of sound standardisation, and we pointed out that that state of affairs was in marked contrast to previous years when so many of the newest sets verged upon being "experimental models."

IT was fairly obvious during last year's Exhibition that the idea of a compact, self-contained receiver, mains-operated and entirely complete in itself—except, perhaps, for an external aerial—appealed enormously to a wide circle of wireless users. Consequently, it is not surprising to find that this type of set, greatly improved in details and generally reduced in size, is to be a prominent feature in most manufacturers' programmes for the new season.

As a rule, these "Consolette" or "Midget" sets, as they are sometimes called, are of the general-purpose type, with medium range, and with a power output, though large in comparison with that offered a short time ago, which must now be classified as average. These requirements are adequately met by the ever-popular H.F.-detector-L.F. three-

This year will, we consider, prove to be by far the most interesting Radio Show which this country has yet seen, because production methods have improved so greatly in the last two years, and the modern receiver of commercial design is built on the lines of a car chassis rather than a collection of components in a box wired together. The day of "experimental models" is past; the stage of consolidation which marked last year's Show has paved the way for real progress this year. The sets of this season will not be experimental; they will have been most thoroughly tried out, and by the time that they are shown at Olympia almost every set so exhibited will be in full production at the factories. The days of waiting first to gauge the public demand seem to have passed, and to-day the manufacturer has the confidence in his products which enables him to start production in advance of the Show, and so profit from his ability to meet public demand at once.

It might have been expected that the tendency with modern sets would have been towards a larger number of valves, principally for the purpose of obtaining better selectivity; it is true that we shall meet with many examples of the superheterodyne, which has gained substantially in popularity, but with the simpler types of sets for general reception purposes it is interesting to find that the number of valves has in most cases not been increased beyond three or four, but greater selectivity has been obtained by the introduction of more tuned circuits, and especially by the application of the principle of band-pass tuning, which *The Wireless World* has advocated so strongly in the past.



valve circuit, of which the past shortcomings in the matter of selectivity have now been offset by improved methods of tuning. But some makers have preferred a more ambitious circuit, with two H.F. stages, while others, catering for the demand that undoubtedly exists for a cheap and compact local-station set, have chosen a simple detector-L.F. arrangement.

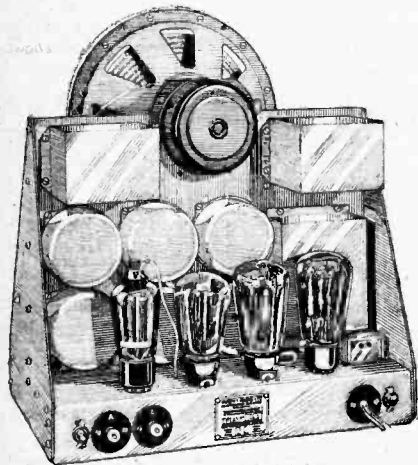
For comparatively short-range work, these sets are almost always sensitive enough to operate satisfactorily with the shortest of indoor aerials or with a mains-aerial connection, for which provision is often made; in other cases, a built-in capacity aerial is included. An outside aerial may be added for long-range reception.

One of the earliest receivers in this class was the R.I. "Madrigal," which, in improved and modernised form, is again to be shown this year. It embodies an H.F.-det.-L.F. circuit, with gauged and band-pass tuning, pentode output, and a combined radio and gramophone volume control—this is an instance of the general tendency to reduce the number of knobs. A built-in moving-coil loud speaker is included. Another self-contained A.C. receiver, and quite one of the

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most interesting of its type, is the Murphy A.3, recently reviewed in the pages of this journal. All the modern features that have met with universal approval are included in this set, and, as a great deal of care and skill has obviously been devoted to its design, it is to be hoped that a stripped chassis will be shown on the stand.

Modern design and construction is well exemplified in the latest Ekco sets, of which there are two "console" models. The first, with a three-valve chassis, has



Chassis of the Murphy A.C. receiver.

ganged tuning, balanced by a concentric external control, a pentode output valve, and a reed-driven cone speaker. Types for A.C. or D.C. supplies are manufactured, and the sets are mounted in moulded bakelite cases. The four-valve model, with a 2-v-1 chassis, is even more interesting, partly because it is fitted with the new Ekco station indicator dial; this combines a large diameter tuning dial, directly calibrated in station settings, a wave-range switch, and a radio-gramophone switch, all operated by rotation of one knob. The circuits associated with the two H.F. stages are, of course, tuned by a ganged condenser, and it seems impossible that any receiver could be easier to operate.

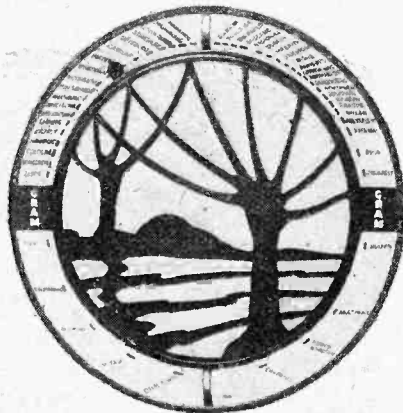
Another new self-contained mains set is the Marconiphone "Moving Coil Transportable Three." As this interesting set has just been reviewed in these pages, it is unnecessary to say anything about it beyond mentioning the fact that it includes band-pass ganged tuning and a moving-coil loud speaker.

The G.E.C. "Compact All-Electric Receiver" embodies a loud speaker of the inductor-dynamic type, and also has a 1-v-1 circuit with power pentode output.

Among the many new sets introduced by Kolster-Brandes is a three-valve A.C. mains set (Type K.B. 279), in which an H.F.-det.-L.F. circuit is embodied, together with a moving-coil loud speaker.

Prices of many of the new sets are temptingly low, and in this respect the Brownie "Dominion Grand Mains

S.G.3," with ganged tuning, wavelength calibration, and pentode output, is an interesting example, costing 13 guineas com-

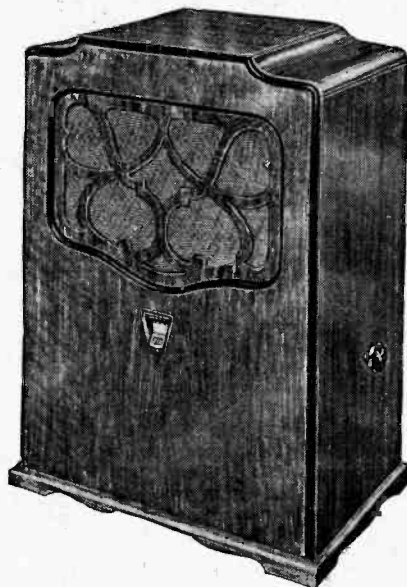


Station calibration, wave-range switching, and radio-gramophone change-over combined on a single large-diameter indicating scale: the new Ekco dial.

plete. Incidentally, a battery version of this set is also to be shown.

Although extremely low in price, the new Lotus 3-valve self-contained receiver, with an H.F.-det.-L.F. circuit, has a Magnavox moving-coil loud speaker and ganged tuning; it is mounted in a walnut cabinet. Both A.C. and D.C. models are available.

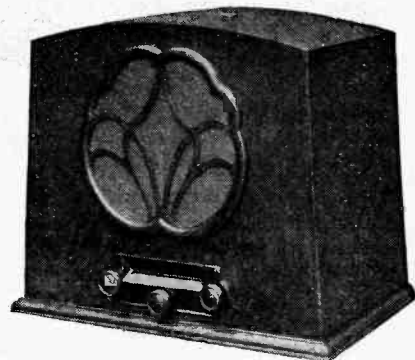
Hard-and-fast classification is hardly possible, but at any rate the Ultra "Tiger Two Console," with a det.-L.F. chassis and a built-in Ultra Air Chrome loud speaker, should be included in the class of receiver we are now discussing. Similarly, the "Amplion Six," although including a considerably more ambitious circuit arrangement than the majority of compact, self-contained sets, is of relatively small size, and so may



An interesting new Amplion set, with variable-mu valves and two H.F. stages.

be discussed here. This set, which promises to be quite one of the most interesting of all the new season's productions, has two H.F. stages, grid detector, and push-pull output, the sixth valve being a power rectifier. Tuning controls are ganged, there is a band-pass input filter, and this is one of the first sets, if not actually the first, to make use of the new variable-mu H.F. valves. The built-in loud speaker is of the moving-coil type, and the tuning scale is directly calibrated in wavelengths. Either an external aerial or a built-in capacity aerial may be used, depending on the user's requirements and his local receiving conditions. It is understood that the Table Model is to cost only 20 guineas; a larger "Console" set is also to be shown.

Another set that will be examined with more than usual interest is the H.M.V. "Model 435 Three-valve Radio Receiver," if only because this season marks the entry of the Gramophone Company into the "straight" wireless field; previously they have concentrated their efforts on radio-gramophones. Incidentally, this firm's exhibits will be housed, not in the main building, but in a hall nearly opposite Olympia, which has been specially fitted up for the purpose, and where, apparently, an exceptionally well-devised



The first "H.M.V." broadcast receiver.

exhibition and a series of demonstrations are being arranged.

A band-pass filter input, ganged tuning, a combination volume control, and a simplified switching system are among the many modern features included in this H.M.V. set, which operates on A.C. mains supplies, and has a built-in permanent-magnet moving-coil loud speaker.

It has already been inferred that the H.F.-detector-L.F. circuit seems to be holding its own well, although the total number of "straight" sets—without built-in loud speaker or gramophone turntable—with this circuit arrangement may at first sight appear to be comparatively few. The G.E.C., for example, are showing a three-valve battery receiver for A.C. mains supply, while the new Kolster-Brandes type K.B.281 is a battery-operated set with pentode output. Incidentally, it would appear certain that the choice of receivers, at any rate of the more ambitious type, for those who are

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forced to use batteries, is likely to be much more restricted than in previous years, but when the Show opens several sets of which we have as yet no information may come to light.

Modern production methods are exemplified in the Ultra "Tiger Three," which is built up on an all-steel chassis; provision is made for using a mains-aerial connection, and there is a combination switch. The output valve is a pentode.

Four-valve circuits, with two H.F. stages, will be included in a large number of radio-gramophones, but there are also to be a number of ordinary radio receivers with this circuit arrangement. For instance, the General Electric Co., who have specialised in the production of this highly satisfactory class of receiver, are showing an A.C. "Table Four," with such desirable features as wavelength

maker Two," a neat little battery-operated set of simple but adequate design, with a reed-driven loud speaker, is to be shown by Henry E. Taylor, Ltd.

lator circuits have been overcome, and, consequently, a number of makers have included single-knob control.

The McMichael A.C. Superheterodyne, with a total of six valves and a corrected output circuit, embodies this form of tuning control. Full details of this receiver, which, in view of the manufacturers' high reputation will be awaited with great interest, are not yet available.

There are to be several Tannoy superheterodynes, including a "Midget" set, with a stage of pre-detection H.F. amplification, band-pass tuning in both signal-frequency and intermediate circuits, and a corrected L.F. amplifier. Here, again, single-dial tuning is employed. A similar circuit is employed in a pedestal and radio-gramophone receiver to be shown by this firm.

Provision for the reception of ultra-short wavelengths, as well as of the medium and long broadcasting wavebands, is made in the design of the Kolster-Brandes Superheterodyne. Intended for operation on A.C. mains, this receiver has a signal-frequency H.F. amplifying stage, a separate oscillator, and a pentode output, there being a total of six valves. The wave ranges actually covered are 12.70 metres, 190-570 metres, and 800-2,000 metres. This set is complete with a built-in moving-coil loud speaker.

The "Gnome" Superheterodyne, made by Rees-Mace, would appear to be a



Regentone detector-L.F. set for A.C. mains

calibration, a combination switch, and a combined volume control. Tuning is controlled by a single knob. This is one of the comparatively few sets to include a "local-distance" switch—a valuable refinement nowadays. A four-valve D.C. mains model is also produced.

A similar four-valve chassis is mounted in the new "Gecophone Console" receiver, in which the set and an inductor-dynamic loud speaker are contained in a pedestal walnut cabinet.

If properly designed, and if too much is not expected of it, the detector-L.F. two-valve receiver still has a wide field of usefulness, and, in the matter of quality of reproduction, this arrangement is not excelled by any other. Practically every manufacturer is to show a two-valve mains-operated set, and the majority of these are to be offered at extremely low prices. For instance, the Kolster-Brandes "Pup" receiver, originally designed for battery feed, is now produced as an A.C. model, and, as it includes a built-in loud speaker, might have been included among the self-contained receivers.

The Regentone firm have produced a low-priced A.C. set, housed in a moulded bakelite case, while the Marconiophone "Super-Power Two," with a pentode, is stated to have an exceptionally large power output. The Burndept "Merry-



Lissen self-contained two-valve set.

Among the new Lissen sets is a detector-L.F. combination for A.C. mains operation; the cabinet is of moulded material, and the built-in loud speaker is of the balanced armature type.

The prophets who foretold a "superheterodyne year" seem to have been justified, as this type of circuit is to be employed in a number of receivers. It seems that the difficulties associated with ganged tuning of the receiver and oscil-



Rees-Mace Transportable.

marvel of compactness, as we believe that this set is contained in the same cabinet as that used to house the "Gnome" portable set, which is certainly one of the smallest of its class. A total of four valves is used in the new set, which has single-knob tuning.

Portable and transportable sets are again to be well to the fore, although it seems that the conventional type with two aperiodic H.F. stages has at last almost disappeared. This year, the popular circuit arrangement for a portable is a single H.F. amplifier followed by a grid detector and two L.F. stages. This type of receiver is well exemplified in the McMichael "Super-Range Portable Four," a completely redesigned version of a highly popular and extraordinarily sensitive receiver that has been on the



Kolster-Brandes superheterodyne.

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market for some time. This set now has fully ganged tuning, wavelength calibration, a longitudinal flat tuning scale of the type first introduced by this firm, and also automatic bias, which is gaining favour even for battery-fed sets such as this. Feed resistances are inserted in the anode circuits where necessary, and thus, as there are only two connections to the H.T. battery, the non-technical user is not troubled by the necessity of making tappings at various points.

In the transportable class, an interesting example of the same general circuit arrangement is the Murphy upright cabinet receiver, which embodies many interesting points in design.

The new Pye "Q" battery portable will also be examined with considerable interest, both because of its circuit arrangement and layout. It almost goes without saying that ganged tuning is employed in this set, in the design of which special care has been taken to economise in anode current consumption.

The new Marconiphone "Super-tuned Portable Four" also embodies single-knob control, and a 1-v-2 circuit, and is a neat and workmanlike piece of apparatus with a combination switching system with automatic indicator.



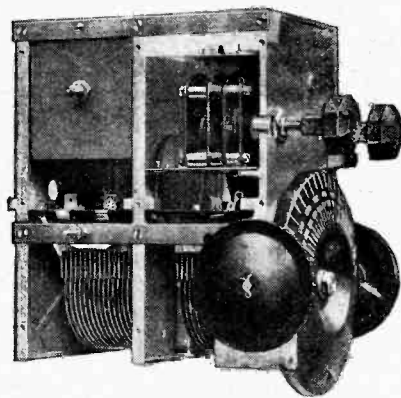
Improved  
McMichael  
Portable.

Reference has already been made to the tiny Rees-Mace "Gnome" portable, also with an H.F.-det.-2 L.F. circuit; it is stated that this set has been considerably improved since last season, and also that an upright cabinet model is to be introduced. An interesting tuning system will be found in the Beethoven "Minor S.G. Four"; instead of a fully ganged variable condenser, the controls of the two tuned circuits are operated by means of concentric dials, which may easily be rotated together or independently.

Several portable sets operate on the superheterodyne principle; amongst these is the Eldeco Supersonic Portable, with a total of six valves. The same firm are also to show a more conventional suitcase type of receiver, with a "straight" four-valve circuit. The Amplion portable and transportable models are retained, but the latter is now available for operation on A.C. supply mains.

Many of the receivers already mentioned

are available in radio-gramophone form, and in this section we are likely to find some of the most interesting examples of progress in design. The Gramophone



Tuning unit of the Pye "Q" Portable.

Company, which is, as already mentioned, showing at the "Modern Hall of Music," almost opposite the Exhibition building, have an extremely ambitious programme, and, from a technical point of view, their most interesting set will be a nine-valve superheterodyne radio-gramophone, for which it is claimed that eighty or ninety stations can be regularly received. In the space available it is impossible to describe this set adequately, but it should be mentioned that it is for A.C. operation, and includes single-dial tuning, direct wavelength calibration, and a "local-distance" switch. Power output is  $4\frac{1}{2}$  watts, and there is an automatic record-changing device.

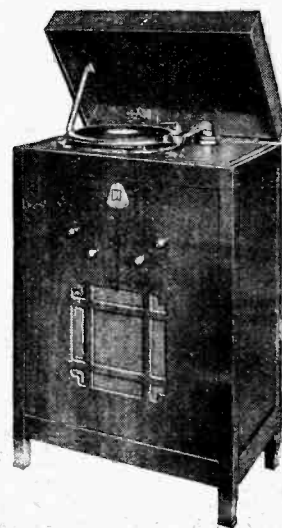
At the other end of the scale we are to see a compact and inexpensive H.M.V. table model radio-gramophone for A.C. or D.C. supplies, with an H.F.-det.-J.F.



A new style of radio-gramophone: the  
H.M.V. table model.

three-valve circuit, fully up to date in all essential details. The mains can be used as an aerial, and the tuning scale, calibrated in wavelengths, is of the horizontal, easily-read type. There is a combined volume control, and a single combination switch. Another model (with a four-valve, 2 H.F. circuit) has an automatic record-changing device.

The Radio Gramophone Development Company can generally be counted upon to provide something of interest, and this year their superheterodyne model would appear to be of extremely advanced design. With a total of eight valves there



R.G.D. radio-gramophone.

are nine tuned circuits, including band-pass filters in both the signal-frequency and intermediate-frequency stages; the latter are tuned to a frequency of 110 kilocycles. Push-pull output valves are fitted, and, like practically all others of its class, this receiver embodies complete ganged tuning.

The "Super Heterogram," a six-valve superheterodyne for A.C. or D.C. mains operation, is undoubtedly the most ambitious and interesting of the new Marconiphone productions. With band-pass tuning, local-distance switch, induction motor, and single-knob tuning, this set would appear to have practically all desirable modern features; it is also to be available as a "Radio Autogram," with the same circuit specification, but automatic record-changing mechanism. A less ambitious but nevertheless very attractive radio-gramophone, with a three-valve circuit similar to that of the self-contained A.C. set already described, is also to be shown.

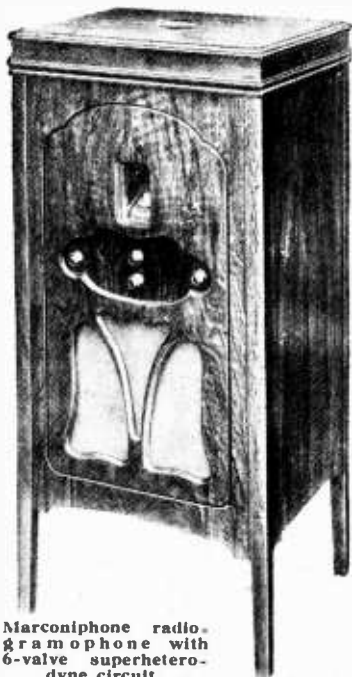
Two new Columbia radio-gramophones are to be introduced; the first is an H.F.-det.-L.F. three-valve model with screen grid valves acting as both H.F. amplifier and grid detector. The output valve is a pentode, and there is an input band-pass filter with completely ganged tuning of all circuits. Among other refinements

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included in what promises to be an exceptionally interesting production are a moving-coil loud speaker, automatic gramophone turntable stop, and a combined volume control. A still more ambitious instrument of a similar type but with an extra H.F. stage, also figures in the Columbia programme.

The new Ekco-indicating dial already mentioned is to be fitted in a radio-gramophone made by this firm, in which a standard four-valve chassis with two H.F. stages will be incorporated. This essentially modern idea of station calibration is also to be included in the M.R.G. Superheterodyne, of which the dial is marked with the names of the principal British and Continental stations.

It will already have been seen that band-pass filters are to be included in a number—if not in the majority—of radio-gramophones; the M.R.G. sets, both in pedestal and console cabinets, embody this form of tuning, in conjunction with a three-valve H.F.-det.-L.F. circuit. This same circuit arrangement is evidently to be as popular for radio-gramophones as it is for "straight" and self-contained



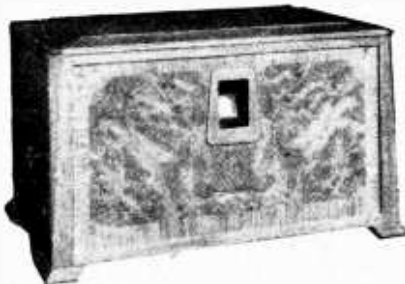
Marconiphone radio-gramophone with 6-valve superheterodyne circuit.

receivers; a good example will be seen in the Kolster-Brandes three-valve radio gramophone, fitted with a pentode output valve, an induction motor, and with a small moving-coil loud speaker. Incidentally, the use of this type of reproducer is this year not to be confined only to the more expensive outfits.

For local station reception, combined with gramophone reproduction, the simple detector-L.F. circuit can be as satisfactory for a radio-gramophone as for an ordinary receiver, and is to be adopted in several of the models to be shown, including those made by the M.R.G. and Fullotone firms.

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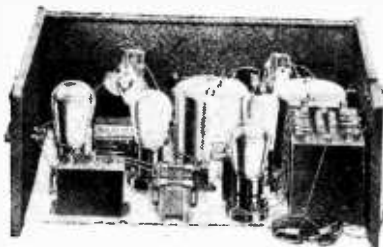
Sets of parts for the home construction of receivers are to be shown in greater number than ever before. Most of them



Gecophone 4-valve A.C. receiver.

are sponsored by well-known firms, and one of the most ambitious is the "Osram Four"—the latest version of the well-known "Music Magnet"—which will already be familiar to readers, as it has recently been described in this journal. As in previous years, the H.F.-det.-L.F. three-valve combination is clearly to be the most popular for these sets, and has been adopted for the new Cossor kits, which are to be available both in battery- and mains-driven form. The coils of this receiver are supplied already mounted in aluminium "pots"; there is a drilled metal baseboard, making for easy assembly, and the H.F. valve is one of the new Cossor metalised types. The new Mullard kit, with a similar circuit, embodies a gauged tuning system, and is built up on a cleverly devised metal chassis. Wave-range switching is arranged on rather unconventional lines, partly because the parallel-fed tuned grid circuit, which acts as an H.F. intervalve coupling, is tapped to operate as a step-up transformer on both medium and long wavelengths.

Pre-selection or band-pass tuning has, up to the present, not been popular among those responsible for the production of kit sets, in spite of the attractions it offers. This valuable feature is to be included in the new "Chassikit" introduced by the Six-Sixty concern; as its name implies, this set is assembled on a framework of sheet metal, in which a compartment is formed at the base for the accommodation of the ready-assembled coils for both input band-pass and intervalve coupling. The set, which is of the H.F.-det.-pentode type, is also to be available in mains-operated form, and will be

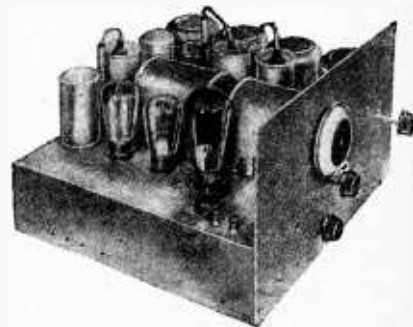


New Cossor mains-operated kit set.

supplied complete with a set of Six-Sixty valves. All three circuits are tuned by a ganged condenser.

Another kit set of extremely neat and attractive appearance, also built on a metal chassis, is to be sponsored by the "Radio for the Million" organisation. The popular H.F.-det.-L.F. circuit has been chosen, and there is a selectivity control in the form of variable magnetic aerial coupling. Both tuning condensers are linked mechanically, and there is an external "trimmer" for the input circuit. All the necessary parts for a battery version of this set, together with the three necessary Mullard valves, will be supplied by United Radio Manufacturers, Ltd.; it is understood that an A.C. model will also be produced.

Several unconventional receivers, either with unusual circuit arrangements or in-




Chassis of the R.I. Stenode receiver.

tended for use in exceptional circumstances, are to be exhibited. Among the most interesting of these is the new R.I. Superheterodyne set, embodying the Stenode Radiostat circuit, which now has controllable tone regulation, so arranged that the extent of correction for side-band loss in the tuned circuit can be regulated. This works in conjunction with a patented system of L.F. reaction.

Interest in short-wave reception seems to be growing, and the firm of Stratton and Co., Ltd., who have made this rather specialised branch of the radio industry their particular concern, are to be well to the fore with a wider range of sets than previously. It is interesting to note that the superheterodyne principle is to figure in some of their new productions.

In general, overseas listeners do not stand to gain much from long-wave reception; what they generally need is the ability to receive both the normal broadcast band and ultra-short waves. Their requirements are catered for by at least two interesting receivers—the first of these is the McMichael "Colonial Super-sonic" receiver, with a total of four valves, including pentode output. This set is battery-operated, and has two-knob tuning control; it covers wavelengths between 15 and 30 metres, and also the broadcast band. The G.E.C. "All-Wave Superheterodyne" also covers the normal medium waveband, and also receives short waves between 13 and 27 metres; it is a workmanlike piece of apparatus, constructed throughout to withstand the most difficult operating conditions; in fact, robustness and durability rather than mere prettiness is evident in the containers of both of these sets.

PROGRESS has been well maintained in the design of components generally during the past year, but it is in the development of ganged condensers that the greatest strides have been made. Completely screened assemblies will be shown by all the well-known condenser manufacturers, who now guarantee the matching of the various units to within much closer limits than hitherto. A new development takes the form of one or more trimmers controlled from the panel. This feature is incorporated in the Polar "Uniknob" two-gang condenser, which

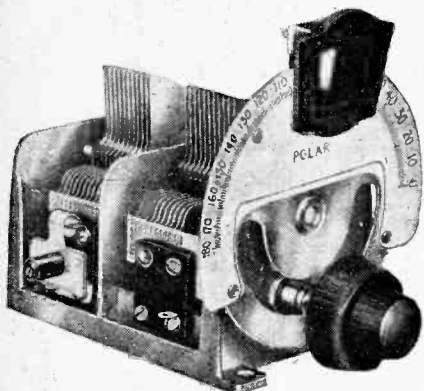


# Components

of condensers, plain, ganged, and totally enclosed, also unscreened types. The latest addition to their range is a two-gang model in which one of the trimmers is controlled from the panel. It is a fully screened assembly, and each condenser has a capacity of 0.0005 mfd. This capacity is favoured by many other makers of all-enclosed ganged condensers, and some fine examples will be shown by Wilkins and Wright, Ltd. ("Utility"), the Formo Company, and the British Radiophone, Ltd. This firm make their debut as condenser manufacturers with a new range including two-, three- and four-gang units, the design of which embodies a number of interesting features. Segmental end-plates are included in each set of rotors, and the small trimmers each have a capacity of approximately seventy micro-mfd. The rotors are mounted on a common spindle, but separate contacting strips are fitted to all condensers.

arranged for ganging and operated by a single knob. Another interesting component that will be seen on Varley's stand is a Thermal Delay Switch for use in sets fitted with indirectly heated valves. A period of approximately one minute is allowed to elapse before the heater closes the H.T. contacts. Other new Varley components include the Niclet L.F. transformer and the Nichoke II L.F. choke, and a compact volume control designed so that two or more can be ganged and operated by a single control.

Screened coils will figure among the



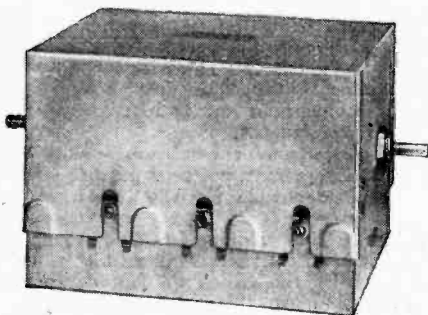
Polar "Uniknob" Condenser.

will be shown by Wingrove and Rogers, Ltd. One trimmer is mounted in the usual manner, but the other takes the form of a small air-dielectric condenser with its control knob concentric with the main tuning dial. A die-cast aluminium container, as used in the "Polar" Tub two-gang model—a recent addition to their range—is used. Each condenser has a capacity of 0.0005 mfd., and a modified version of the Polar Disc drive incorporating a lamp-holder is fitted.

Accurate matching over the full range of the condensers is made possible by the employment of segmental end-plates in each set of rotors, these being adjusted during the testing process. In addition, there is to be a comprehensive display of variable condensers, many of which will be familiar, but two new types are being shown for the first time, these being styled the No. 2 and the No. 4.

Jackson Bros. will show a wide range

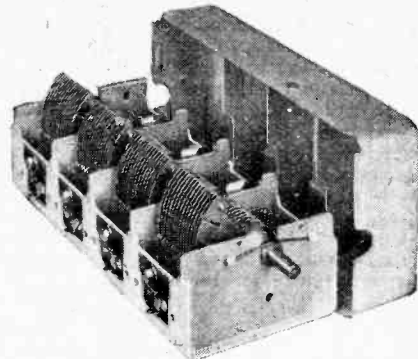
Screened coils of an entirely new style will figure prominently on the stand of Colvern, Ltd. They are dual-range coils fitted with built-in switches having gold-



Fully-screened Utility 3-gang condenser.

silver contacts, and are designated the type "K." Moulded formers of small diameter are employed, and the aluminium screening cases have been reduced to 2 1/2 in. in diameter. The "K" coils include a tuned-grid type, an oscillator assembly for superheterodyne receivers, and a band-pass coupling unit, comprising two separately screened coils which is officially described as the Colvern "Link" coil. These two coils are electrically coupled by a combination of negative inductance and a large capacity. Other interesting additions to the Colvern range include some new potentiometers and a series of 5-watt fixed resistances.

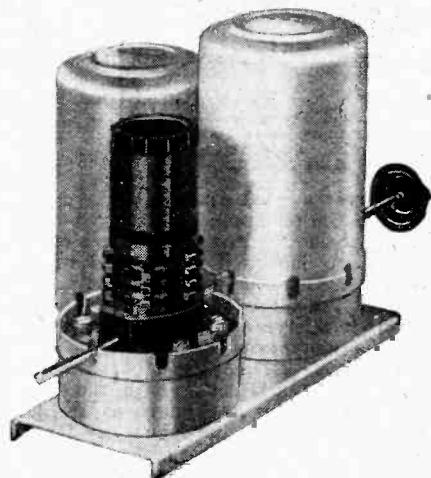
A new version of the constant-square-peak-type of coil will be shown by Varley. Each coil is separately screened and embodies a wave-change switch. A companion H.F. coupling coil is available to complete the range, the switches being



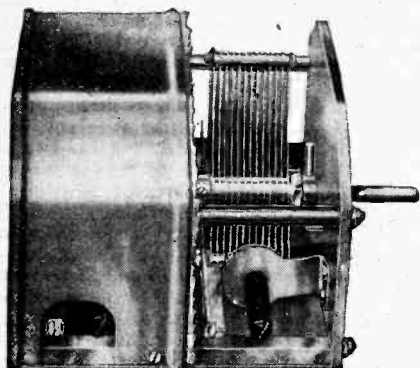
British Radiophone 4-gang condenser.

exhibits of the Watmel Wireless Co., Ltd., there being two types, the B.P.A. 1 and the B.P.A.S. 2. The former is a band-pass aerial unit, while the latter is the companion H.F. coil for tuned-grid coupling, and embodies a reaction winding.

The outstanding feature of the numerous L.F. transformers and L.F. chokes that will be seen this year is the general reduction in size and weight, while the electrical characteristics have improved immensely. The use of a bi-metal core has been responsible for this improvement, since the material employed possesses a higher permeability than ordinary transformer steel, thereby leading to a reduction in the quantity of wire required for a given inductance. Nickel-iron alloys figure prominently, and as a con-



Colvern "Link" band-pass coils wound on small diameter formers.

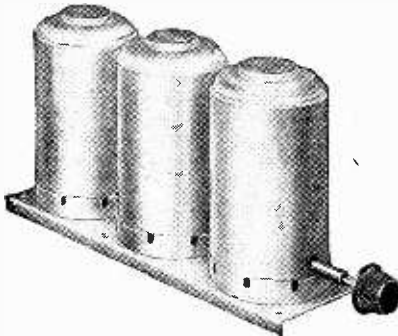


J.B. enclosed two-gang unit.



**Show Forecast.—**

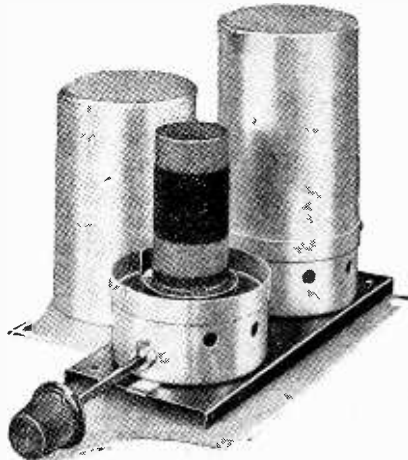
sequence the exhibit of the Gutta Percha Company will be of particular interest. Samples of "Mumetal" and "Radio-



New Varley coil unit, comprising constant square peak and H.F. coils.

metal" will be shown, together with some specimen L.F. transformers, chokes, etc., embodying these alloys.

The R.I. Parafeed L.F. transformer, made by Radio Instruments, Ltd., is an outstanding achievement in compressing a highly satisfactory L.F. transformer into the smallest compass so far seen. Publicity has been afforded this component recently, as likewise has been the case of



Warmel hand-pass coils, type B.P.A.1.

another new R.I. product, the Dux transformer, but both of these are of so recent production that they must be included in any mention of new developments.

Advance information has just come to hand regarding two new L.F. transformers that the Igranic Electric Co., Ltd., will show. One is the Parvo transformer for use with parallel-feed circuits. It is housed in a bakelite case measuring 2½ in. x 1½ in. x 1¼ in., embodies a bi-metal core, and has a nominal ratio of 1.3½. The primary inductance is of a high order, and the transformer shows quite remarkable characteristics for its size. The other new model, the Acme, is made in two types, the one with a ratio of 1:3 and the other with 1:6 ratio. This component can be connected in the anode circuit of the valve, as the first-mentioned

model will carry 7 m.A.s. while the 1:6 ratio is rated to carry 14 m.A.s. of D.C.

The Telsen Radio Company will have a complete new range of L.F. transformers and chokes, in addition to numerous other components, details of which have already been given publicity, while among the new components of Ferranti, Ltd., will be their B. 8 L.F. choke introduced a month or so back, but, nevertheless, a new season's product.

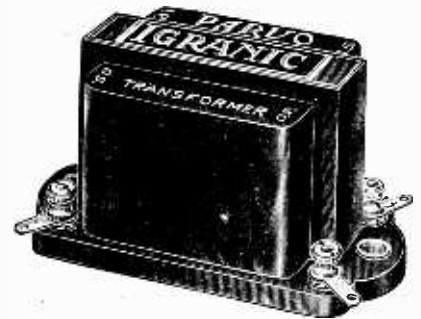
Turner and Co. are showing a range of L.F. chokes, mains transformers, and battery eliminators, which will include the S20/25, S20/50, and SP/100 L.F. chokes, these being recent additions to their range.



New R.I. "Dux" L.F. transformer.

Since no radical changes have occurred in the methods of obtaining power from the supply mains, battery eliminators obviously take much the same form as last year. Development in this direction, however, has not been arrested, and all those firms specialising in this type of accessory will have something new to show. E. K. Cole, Ltd., have reduced the number of models to the bare minimum compatible with complying with every demand. H.T. supply units for A.C. mains are divided into three classes, giving 12, 18, and 25 m.A.s. output respectively. These can be obtained with or without trickle chargers, and all units are designed to fit easily into every type of portable set. In addition, there will be a range of all-power units for A.C. and D.C. supplies. Westinghouse rectifiers are used in all A.C. models.

H. Clarke and Co. (Manchester), Ltd., will be showing a wide range of mains units; a few will be familiar, but the



For parallel feed; Igranic "Parvo" transformer.

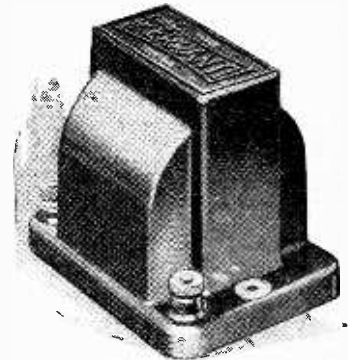
majority are new, or redesigned, models. One model, the A.C. 290, is an all-mains unit, providing two variable and one fixed output voltages at a maximum of



Telsen two-pole battery switch.

25 m.A.s. Grid-bias tappings giving the choice of four bias voltages and a trickle charger are included. The Westinghouse rectifiers are incorporated in all "Atlas" A.C. units.

Tannoy Products will have a number of new models for examination which, together with the few units retained, will meet practically every requirement. An interesting feature of their combined H.T. and grid-bias units is that all grid-bias voltages are entirely independent of the current drawn from the H.T. tappings.



Ferranti B.8 L.F. choke.

These units are styled the G.B. 1 and the G.B. 3.

Those possessing a flair for constructional work will be interested in the range of battery eliminator kits that will be shown by F. C. Heayberd. All necessary parts are included and complete wiring instructions are given. Westinghouse rectifiers of the full-wave type are incorporated in the kit. In addition, this firm will have a full range of finished mains units.

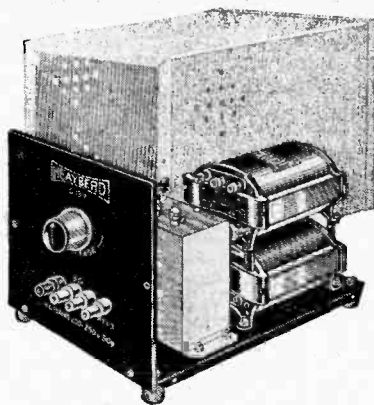
A mains unit of particular interest to set constructors is the Regentone Model S. 60, which has been designed for incorporating in A.C. sets. It provides a maximum output of 200 volts at 28 m.A.s. and supplies 4 volts at 6 amps. for the filaments of A.C. valves. The case is made of pressed steel, is well ventilated, and measures 7 in. x 7 in. x 3 in. A metal-oxide rectifier is incorporated. This firm will be showing, also, a complete range of

**Show Forecast.—**

A.C. H.T. units with outputs of from 12 to 100 m.A.s, two D.C. models, and a variety of combined H.T. and L.T. supply units for both A.C. and D.C. mains.

J. Dyson and Co., Ltd., have recently introduced a new series of Godwinex battery eliminators and the full range will be shown on their stand. The retained last season's models have been re-designed in most cases, and now give a larger output than hitherto.

Following the introduction of new power valves demanding a higher operating voltage than hitherto, rectifying units have had to follow suit. Thus we find the Westinghouse Brake and Saxby Signal



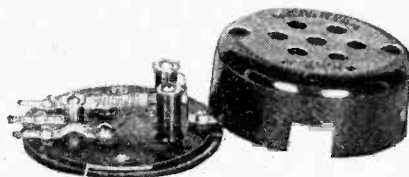
Heayberd eliminator kit.

in 66-, 99-, 108-, and 120-volt units, and triple-capacity types in 64- and 120-volt sizes. These are in addition to their wide range of H.T. and L.T. accumulators, many improved forms of which will be seen this year.

Improved designs of both Exide and Drydex batteries, and in many cases some reduction in prices, will be the principal features of the Chloride Storage Battery Co.'s exhibit, while more than usual interest should be shown in the useful "Tell-Tale" device embodied in the

useful accessory taking the form of a mains interference eliminator, the purpose of which is to prevent interference generated by electrical machinery from being conveyed to the receiver or battery eliminator.

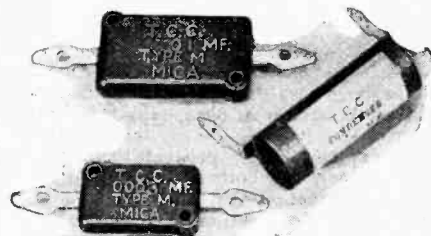
One of the most interesting components that will be found among the exhibits of A. F. Bulgin, Ltd., is the Thermal Delayed Action Switch. Its purpose is to safeguard the components in an all-mains set by allowing sufficient time for the heaters of indirectly heated valves to attain the correct working temperature before switching on the H.T. A period of from 15 to 30 seconds elapses before the heater in the switch closes the H.T.



Bulgin Thermal Delayed Action Switch.

contacts. Two types are to be shown, the one operating on 4 volts and the other operating on 7½ volts. Components for practically every conceivable occasion will be available for inspection, some of the latest including moving-coil measuring instruments, a new range of toggle switches, in single- and two-pole types, heavy duty spaghetti resistances, and a host of other items, a brief mention only of which would cover many pages in this journal.

The Telegraph Condenser Co., Ltd., have just introduced a number of new items. These include compact mica condensers described as type M, in sizes ranging from 0.0003 mfd. to 0.01 mfd., and there are some aqueous-type electrolytic condensers; also a new range of paper-dielectric large-capacity condensers styled type No. 65. These are made in

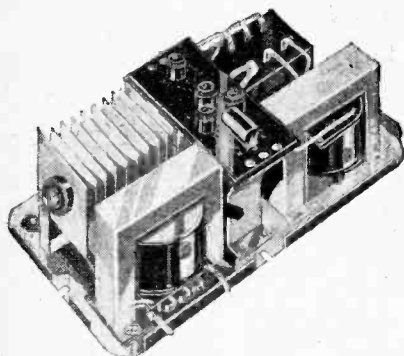


New range T.C.C. fixed condensers.

three sizes, viz., 1, 2, and 4 mfd., the operating voltage being 250 D.C.

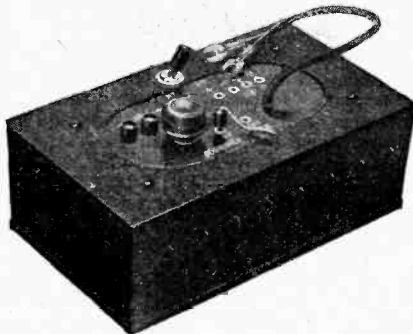
Electrolytic condensers are available in capacities extending from 2 mfd. to 4,000 mfd., and rated at working potentials of from 12 volts to 450 volts D.C.

Latest additions to the Dubilier range include two new types, No. 665 and No. 670. These are enclosed in moulded cases, the former being fitted with long soldering tags and made in sizes ranging from 0.0001 mfd. to 0.0005 mfd., while the type 670 has terminals and is to be shown in capacities extending from



Ekco eliminator with cover removed.

Co., Ltd., introducing a new model—the Style H.T. 8—to which some publicity has already been given since it was first introduced a month or so ago. It gives a smoothed D.C. output of some 250 volts at 60 m.A.s, which is ample to cope with present-day needs, as well as affording a reserve sufficient to meet the requirements for at least some time to come. All last season's models are retained, but at a considerably reduced price.

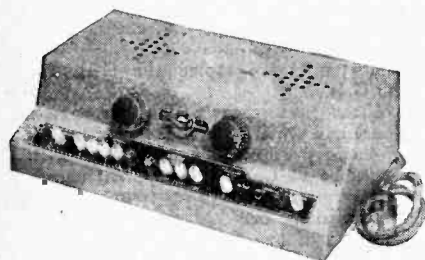


Dyson mains unit with trickle-charger.

accumulator batteries made by the National Accumulator Co., Ltd.

Machines for converting D.C. to A.C. are sure to attract considerable attention, and many improved models, totally enclosed in silence cabinets, will be shown by the Electro Dynamic Construction Co., Ltd., and the Crypto Electrical Co., Ltd.

Among the exhibits of the British Blue Spot Co., Ltd., will be an exceedingly



Clarke's Atlas combined A.C. unit; Model A.C. 290.

A special exhibit of commercial-type battery chargers has been arranged, and these will be demonstrated throughout the period of the Show.

Before leaving the subject of power supply, mention must be made of the new range of dry-cell H.T. and grid-bias batteries that will be shown by Oldham and Sons, Ltd. H.T. batteries are made in two styles, viz., standard capacities



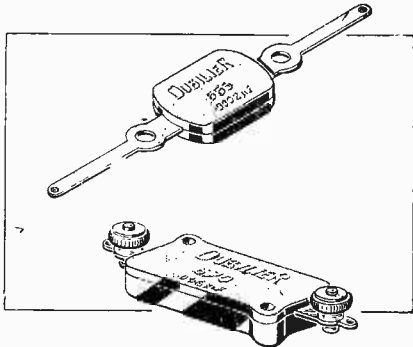
New Oldham dry cell battery.

**Show Forecast.—**

0.0001 mfd. to 0.006 mfd. Additional capacities are being made in the special non-inductive range, and the type BB will include a 4-mfd. size.

The very latest additions to the Lectro-Linx range of "Clix" products have already been given some measure of publicity. Attention, however, is directed to their new range of panel-type valve holders, as a number of interesting features are embodied. Plugs, sockets, and anode connectors in a variety of forms and sizes will form the principal exhibits of this firm.

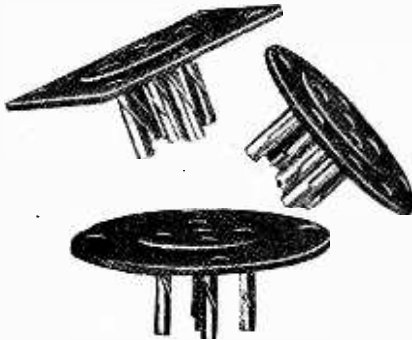
Measuring instruments are as essential to the experimenter as workshop tools, since without their aid any serious inves-



Dubilier Types 665 and 670 condensers.

tigation is well-nigh impossible. Some new and interesting types of moving-coil and moving-iron meters for D.C. and A.C. measurements will be shown this year by the Park Royal Engineering Co., Ltd. There will be a useful range of miniature instruments of the moving-coil type admirably suited for incorporating in receivers, and, in addition, a wide selection of precision-type meters for laboratory use.

Ferranti, Ltd., have augmented their range by the recent introduction of some moving iron-type A.C. voltmeters, am-

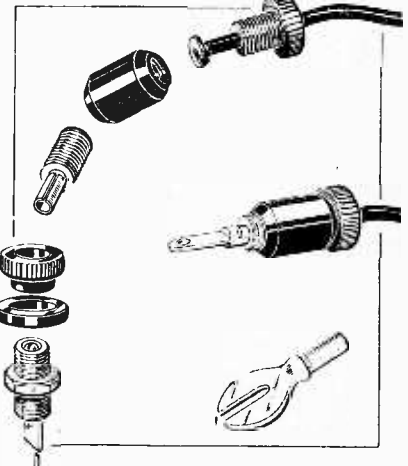


Range of "Clix" panel mounting valve holders.

meters and milliammeters, mention of which was made in this journal some little time ago. This firm present, also, a complete range of A.C. and D.C. battery eliminator kits for home construction.

Plug and socket connectors would appear to enjoy equal popularity with the old-fashioned, but by no means defunct, screw-type terminal, as the Electrical Devices Co., Ltd., will be showing an entirely new style of connector. It consists of two parts, a socket portion for panel

mounting and a plug part for attachment to the end of the loose lead. The former can be mounted on metal panels or insulated panels. A special wire-clamping device is embodied in the panel portion, which dispenses with the need for solder-



"Eldeco" plug and socket and adaptions.



Park Royal miniature voltmeter.

ing. It is operated by a long screw extending down the centre of the socket but leaving sufficient space round it for the insertion of the special tubular plug. Various versions of this new connector will be shown, such as S.G. anode connectors, spade-end terminals, and the like.

Elonite panels, guaranteed not to discolour if exposed to strong sunlight, and officially described as "Permcol," will be shown by the British Hard Rubber Co., Ltd. Panels with dual finish and in a variety of shades will be available for inspection.

THE happy relationship existing between the wireless and gramophone industries has been still further strengthened during the year. Not only do the majority of set makers produce radio-gramophone versions of their principal receiver chassis, but the gramophone industry is also turning its attention to the design of wireless apparatus. Radio-gramophones in general have been dealt with in an earlier section of this forecast, but mention should be made here of a special item of gramophone interest which will be found in the H.M.V. Demonstration Hall. We refer to the automatic record-changing mechanism incorporated in the Model 522 and Model 531 radio-gramophones. It is far less complicated than many previous examples of automatic gramophones; further, it is available as a separate unit for attachment to existing receivers or amplifiers at a very reasonable figure.

Among electric gramophone motors the induction A.C. motor has received more attention at the hands of manufacturers

## Gramophone Equipment and Loud Speakers

than other types. In addition to the slow-speed induction motor shown last year, the Garrard Engineering and Manufacturing Co., Ltd., are showing a new high-speed geared type (No. 202) which sells at 58s. 6d., complete with the well-known Garrard fully automatic starting and stopping switch.

The B.T.H. programme includes two new gramophone motors for A.C. mains—the "Golden Disc," a high-grade in-

duction motor, and the "Synchro-Blue," a synchronous motor of simple design.

Another example of the synchronous type of motor will be shown on the Wates (Standard Battery Co.) stand. This is of the low-speed type, in which the armature runs at turntable speed, thus eliminating all gearing, governors, etc. The armature disc is totally enclosed and runs in oil. A special model for heavy duty in theatres is also available. The power consumption of the smaller model is 9 watts, and its total depth is 2½ in.

Compactness is also a feature of the "Macon" series of electric turntables which will be exhibited by Messrs. Beta Electric Motors, Ltd. The motor is built into the turntable, and the total depth is less than 1½ in. The speed is variable from 70 to 90 r.p.m., and the motor, which is of the universal type, is suitable for A.C. or D.C. supplies of any voltage. Model "A," the simplest of the series, is a conversion type for fixing to the top of the motor board of existing spring-driven gramophones, while the

**Show Forecast.—**

Model "D" is a complete unit, consisting of motor turntable, pick-up and volume control and automatic stop.

Gramophone recording for the amateur



H.M.V. automatic record-changing mechanism.

will be represented by the "Ekco" home recorder and the exhibits of Messrs. Fay Home Recorders, Ltd.

If we except the Brown "Microbox" gramophone pick-ups in general will not show any startling novelty. The majority, if not all, will be of the well-tried "half-rocker" electromagnetic type, but prices have been reduced all round, and it will be found that more attention has been paid to neatness in the external appearance.

In addition to the well-known Senior B.T.H. pick-up, a new "Minor" model will be shown on the Edison stand. This is housed in a clean, moulded tone-arm, and is priced at 27s. 6d.

The Varley pick-up has again been redesigned, and is now enclosed in a black bakelite case combined with a bronze-



The Varley pick-up and tone-arm,

finished tone-arm. The Varley needle clutch is retained, and in the design of the tone-arm angle special attention has been given to needle track alignment for records of all diameters. The pick-up has been given a rising characteristic below 250 cycles, and the high-frequency cut-off has been set at 4,000 cycles to eliminate surface scratch.

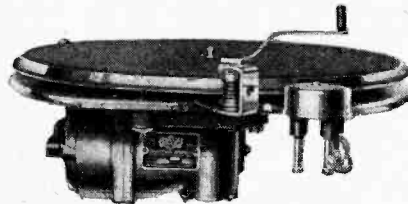
As an example of high-grade instrument work the "Unit" pick-up, to be shown by Messrs. Electric Gramophones, Ltd., should not be missed. This instrument is fully adjustable as regards tone-arm length and pick-up angle.

On the Harlie stand three different types of pick-up will be shown at prices ranging from 25s. to 39s. 6d. There will also be two accessories of special interest to gramophone enthusiasts—a bakelite pick-up rest with a rubber cushion designed to support the pick-up head itself,

and a motor-board lamp for illuminating any part of the turntable, with a switch incorporated in the rotatable bakelite shade.

The Gramophone Co., Ltd., have now reverted to the conventional "half-rocker" type of pick-up, and an example of the new design will be available in the Model No. 11 unit. This has been designed to fit existing tone-arms, and is provided with a volume control and all necessary leads. The same movement is incorporated in the Model 15 pick-up and tone-arm fitted to all H.M.V. radio-gramophones.

The Brown "Microbox" is a novelty which is certain to attract a good deal of attention. In appearance and size it is similar to the conventional type of pick-up and tone-arm, but the principle of operation is entirely different. The pick-up head contains a carbon granule microphone, which is energised by a 10-volt accumulator at  $\frac{1}{2}$  amp. No intermediate valve amplifier is required, and the loud speaker is operated directly through a special differential transformer. If desired, the unit can be operated from the mains, and a special mains unit has been produced for this purpose. The experience of Messrs. S. G. Brown, Ltd., in the design of microphone amplifiers is unrivalled, and the performance of this in-



Garrard No. 202 induction motor.

strument will be a matter of considerable interest.

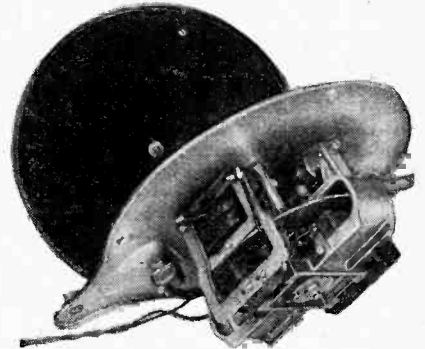
Among loud speakers, the miniature permanent magnet moving coil unit is likely to prove the outstanding feature of the Show. Hitherto, the moving-coil loud speaker has been available only to those whose receivers are capable of providing undistorted power outputs of 1 watt or more; but, by reducing dimensions all round, the "threshold" of good quality and efficiency has been lowered into the region of 350 to 500 milliwatts, and the moving-coil loud speaker is now within the scope even of small battery sets. Mains-energised, miniature moving-coil loud speakers will also be well represented, many of them being specially designed for inclusion in the H.T. smooth-



B.T.H. "Minor" pick-up.

ing circuits of A.C. mains receivers. At the same time, moving-iron units continue to hold their own, and at least two new examples of the inductor principle will be exhibited by firms of high standing.

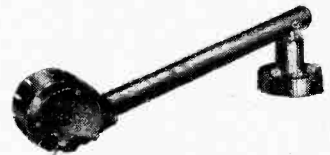
Messrs. Graham Amplion, Ltd., will be showing two new moving-coil loud speakers of the miniature type—the



B.T.H. "Golden Disc" induction-type gramophone motor.

M.C.6 with permanent magnet field, and the E.M.644, designed for mains excitation of the field magnet. These units have 7in. corrugated cone diaphragms and low-resistance speech coils, and a special output transformer is incorporated in the chassis.

In addition to their well-known range of super-power moving-coil loud speakers, Baker's Selhurst Radio will show a new series of inexpensive models of both the permanent magnet and energised types. The "Popular" model is priced at £2 15s. with electromagnet, and £3 15s. with permanent magnets, both types including an output transformer. The "Klock" loud speaker, to be shown on this stand, combines in one cabinet a



The Brown "Microbox"—a combined pick-up and microphone amplifier.

permanent magnet loud speaker and a synchronous electric clock. Where frequency-controlled A.C. mains are not available, a "Bulle" battery-driven clock is fitted. The complete instrument, in a burr walnut cabinet of modern design, costs £12. Other items on this stand which should not be missed are the variable loud speaker tone control and the new type "horn front" cabinets.

The British Blue Spot Co., Ltd., have an unusually comprehensive range of new models for the coming season. Their display will include a new mains-energised miniature moving coil (Model 72), a permanent magnet moving coil, and a new moving-iron unit of the inductor type (Model 100U). The well-known range of Blue Spot balanced armature movements will be continued, and several new styles of cabinet have been introduced.

An addition has been made to the range of B.T.H. moving-coil loud speakers, and the new model, which will be known as the "Minor" Permanent Magnet E.K., will be available for examination on the

**Show Forecast.—**

Ediswan stand. It will be produced in both cabinet and chassis form, the price of the chassis having been fixed at 50s.

The Epoch Radio Manufacturing Co., Ltd., who specialise in the manufacture of moving-coil loud speakers, will show models ranging in price from 27s. 6d. to £76. A midget moving-coil model (type C.6), only 3in. deep and 6in. in diameter, will be one of the principal exhibits. The field is designed for accumulator or D.C. mains excitation, and also for inclusion in the H.T. smoothing circuits of A.C. sets. The price will be disclosed at the Show. New permanent magnet models of all sizes and types will also be presented.

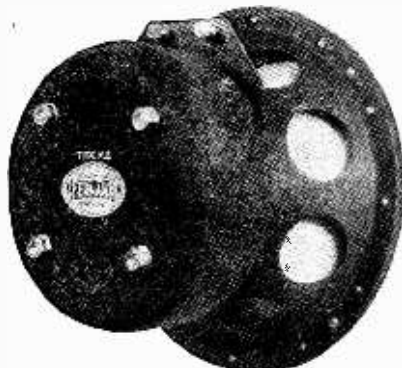
Hitherto, Messrs. Ferranti, Ltd., have produced only moving-coil type loud speakers, but this year they are showing a moving-iron unit operating on the inductor principle. The permanent magnets are of generous size, and every effort

material. In addition, a new D.C. loud speaker (type D2) will be shown. This has a field consumption of only 4 watts,

The Lamplugh "inductor dynamic" loud speaker has been redesigned, and will be shown in a new type of all-enclosed chassis.

The Primus Manufacturing Co. announce that, in addition to their triple cone-balanced armature loud speaker, they will be showing a new type of electrostatic loud speaker. Apart from the technical interest of this model, it is worth noting that the price will probably be in the neighbourhood of 10s.

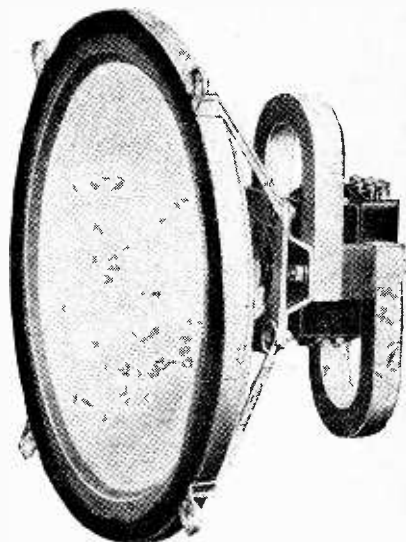
Finally, in view of the increasing importance of permanent magnets in con



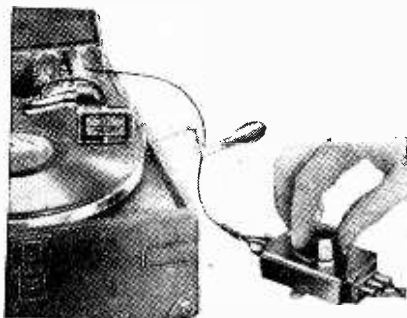
Ferranti type M2 permanent magnet moving coil.

and is produced with a variety of windings to suit supplies from 2 to 250 volts.

Small-type, moving-coil units, both of the permanent magnet and energised type, will be the principal feature of the exhibit of Messrs. Magnavox (Great Britain), Ltd. These units have been specially designed for incorporation in small, self-contained mains receivers, and in their design the requirements of both manufacturers and home constructors have been considered.



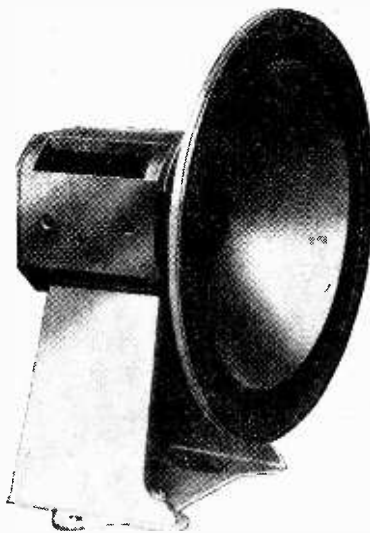
Ferranti inductor loud speaker.



E.M.V. pick-up head and volume control.

has been made to produce the highest possible degree of sensitivity. It will operate satisfactorily from a small power valve taking as little as 7 mA. at 120 volts. Two permanent-magnet, moving-coil loud speakers have been introduced in addition to the well-known type M1 loud speaker. The first of these (type

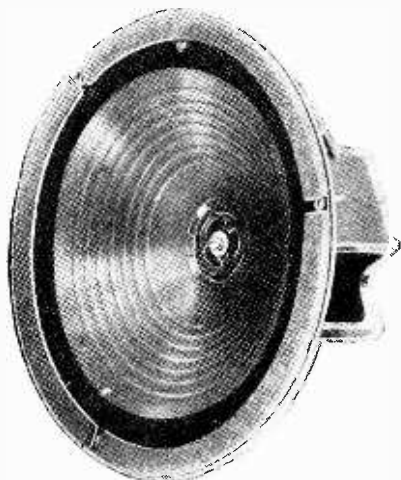
nection with the moving-coil loud speaker design, the stand of Messrs. Darwins, Ltd., of Sheffield, will be well worth a visit. In addition to a comprehensive display of magnets of all types, full information will be available on this stand



Whiteley Electrical Radio type P.M.3 permanent magnet moving coil.

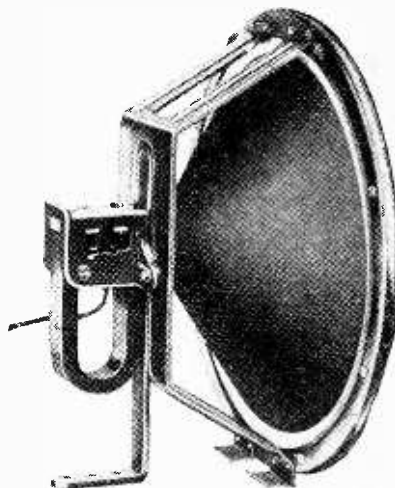
The British Rola Co., Ltd., are also specialising in small moving coils, and the models displayed will be representative of an exceptionally wide variety of types.

In company with the well-known Ultra air-chrome loud speakers a new permanent magnet moving-coil loud speaker, to be known as the "Imp," will be shown on the stand of Ultra Electric, Ltd. The chassis, complete with output transformer, is priced at £2 15s., and a cabinet model will be available at £4.



B.T.H. "Minor" permanent magnet loud speaker.

M2) has a similar diaphragm to the type M1, but has a smaller magnet. Type M3 has a larger diameter cone (9in.) of fabric



Blue Spot inductor loud speaker.

of the magnetic properties of various cobalt steel alloys and the methods of heat treatment and magnetisation.

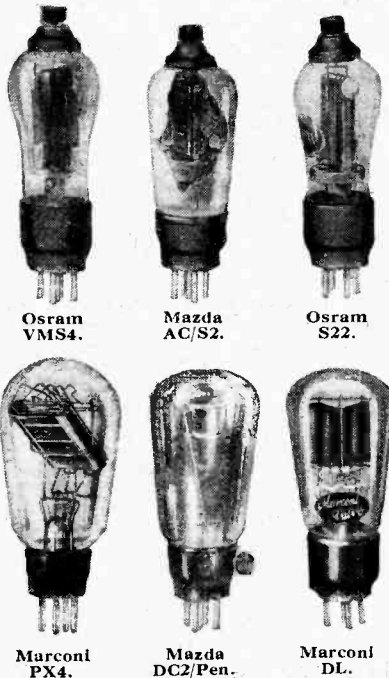
RECENT political events have left no stamp on the products of the valve designers; indeed, anything less suggestive of "depression" than the striking array of new valves it would be hard to find. Among the new valve developments promised for Olympia this year one which will probably attract considerable attention is the variable-mu high-frequency valve. The Marconi and Osram members of this new type are styled the VMS4, and details of the working characteristics can be obtained from an article which appeared in our last week's issue and is concluded this week. The ordinary screen-grid valve worked at normal bias suffers from a slightly curved characteristic, and when a greater bias is applied in order to increase the signal handling capacity, the characteristic becomes much more curved and the point of anode current cut-off is reached with comparatively small grid potentials. It is now well known to readers of this journal that undesirable secondary effects, namely, distortion of the modulated carrier wave, and the type of interference known as cross-modulation are produced by this disability of the S.G. valve. It is to remedy this and provide a new and more satisfactory pre-detector volume control that the variable-mu valve has been introduced. It has come at an opportune time when the increasing European ether congestion demands more and more attention to improvement in selectivity and to greater efficiency in volume control. An ideal pre-detector control by variation of grid bias is offered by the new valve.

The Mullard variable-mu tetrode is called the MM4V and has the remarkable slope of 3.5. The contribution to more linear H.F. amplification on the Cossor stand will be the MS/PenA lately described in *The Wireless World*. This valve is a screened H.F. pentode capable of handling comparatively large inputs without rectification, and in view of its low impedance and low interelectrode capacity it can be used as a power grid detector in which there is negligible input impedance to damp the preceding tuned circuit.

On the Ediswan stand will be seen the well-known Mazda range of valves now augmented by some particularly efficient newcomers. Although we have become accustomed to regard the AC/SG screened valve as giving the high watermark of H.F. amplification per stage, we shall see an even more sensitive S.G. valve—the AC/S2—with the remarkable mutual conductance of 5 mA./volt; for an A.C. resistance of 600,000 ohms the amplification factor is no less than 3,000. Translated into practical results, this means that when using 1½-inch screened coils the single-stage amplification can be as high as 400—a new record—and the set should be stable as the interelectrode capacity is only 0.0015  $\mu$ F. For those who must perforce use batteries for filament and H.T. current there is now a choice of three two-volt screened valves—the SG215, the S215A, and S215B, with impedances ranging from 360,000 to 830,000 ohms and all with high conductances.

In addition to the indirectly heated D.C. range of valves (DC/SG, DC/HL,

DC/P and DC/Pen) taking 0.5 amps, and so consuming some 120 watts, there is a very interesting new D.C. series (DC3/HL, DC2/P and DC2/Pen), with 40-volt heaters taking 0.1 amp.<sup>1</sup> The power consumption of a set embodying these valves will, therefore, be a little over 20 watts—considerably less than that of an ordinary electric light bulb and little more than that of a similar A.C. set. Owing to the small thermal capacity of the heaters it is advisable to use a choke in each feed to this electrode, but no difficulty should be



experienced in designing such a component to carry 100 mA. The makers are to be congratulated on putting the D.C. user almost in a position of equality with the A.C. consumer as regards upkeep.

For portable and other receivers equipped with a dry-battery high-tension supply a highly economical two-volt pentode—the Pen220—has just been developed. With only 0.2 amp. filament current and the extraordinarily low value of 3 mA. anode current (120 v. H.T.) an undistorted power output of 170 milliwatts can be obtained, whilst with 150 v. on the anode and 125 on the screen the anode current is only 5 mA. for an undistorted A.C. output of 370 mW.—sufficient volume for most medium-sized rooms. Passing from one superlative to another, there is the new Mazda Pen220A, a two-volt bat-

<sup>1</sup>The DC3/HL has a heater rated at 0.1 amp. at 30 volts.

tery pentode which will develop 900 mW. with 150 volts H.T. and a feed current of 18 mA. If 12 mA. only are available an output of 600 mW. is to be obtained, which means that a moving coil speaker is a feasible proposition with a 2-volt receiver using quite a modest H.T. battery. This is indeed an important advance in valve technique. The mains rectifiers UU60/250 and UU2 will be of interest, as their cathodes are indirectly heated and take some 12 seconds to warm up to full temperature, whilst the A.C. receiving valves made by this firm take about 10 seconds; the full no-load voltage of the rectifier is thus prevented from being developed across most of the by-pass condensers in a receiver when switching on. Condenser life should thereby be prolonged; furthermore, slow-heating filaments are an advantage in association with electrolytic condensers which will find wide application in the coming season. Before dismissing the Mazda series, mention should be made of the PF5/400, which has set a new standard of performance in the directly heated output range; for a signal of 32 volts (peak) it is possible to get 5,000 mW. of undistorted output; this efficiency being chiefly accounted for by the working mutual conductance of 7.0 mA./volt.

The General Electric Company will be showing a number of new Osram valves, among which should be mentioned a full range of indirectly heated D.C. valves with 0.25 amp. 16-volt heaters. In view of the fact that when a number of valves are wired in series, as they have to be in a D.C. set, there is a big difference in potential between the cathode and heater of the valve at the end of the series, special precautions have been taken to make the insulation between these two electrodes of a very high order. Each valve is guaranteed to withstand 100 volts between cathode and heater under working conditions. As a result, the cathodes may all be connected through their individual bias resistors to a common H.T. negative lead. The PT4 and MPT4 are new pentodes directly and indirectly heated respectively, each with an output of about 2 watts A.C. and mutual conductances of 2.2 and 3.0 mA./volt. For small public address systems and dance halls consideration should be given to the PX4, which has considerably improved characteristics. The maximum H.T. voltage is 250, and with a slope of 6 the valve is capable of 12 watts anode dissipation.

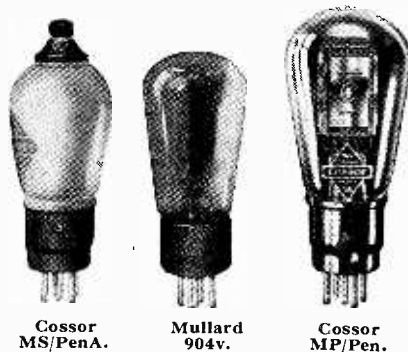
The Mullard Company, who can claim fairly to be the pioneers of pentodes in this country, will be showing a very comprehensive range of these power output valves. Besides three old friends, the PM22, PM24 and PM26, which belong to the low-voltage class, we shall see the PM24A, PM24B, PM24C, and PM24D, giving progressively 1,500 mW., 3,000 mW., 3,500 mW., and 8,000 mW. These last four valves are for mains operation and have directly heated filaments. The Pen.4V is an indirectly heated pentode with a slope of 3 and a maximum input of 11 volts. Among other new valves of importance should be included the PM202 belonging to the 2-volt battery class, which will give an excellent account of

Show Forecast.—

itself as a loud speaker valve using only 14 mA. anode current. To those with A.C. mains requiring a "generous" output the DO/24 should appeal. It belongs to the new class of high-efficiency output valve with a slope of 6 and an output of 5 watts (A.C.) for an input of about 25 volts. The range of indirectly heated A.C. valves has been increased by the addition of a large output valve, the 054V, with a conductance of 4. For efficient detection it would be hard to find a more suitable valve than the 904V with an amplification factor of 85 and an impedance of 17,000 ohms; with 150 v. on the anode and the grid returned to cathode, the characteristics suggest satisfactory power grid detection.

New valves on the Marconiphone stand include the S21 and S22, both extremely economical 2-volt battery S.G. valves, the first having a generous grid swing and a low mutual conductance—the second a high slope and good sensitivity. The

MS4B is a new addition to the indirectly heated screen-grid series with a slope of 3.2, capable of stage amplifications of over 200 with quite modest coils. Other new-



comers are the battery valves LP2 and P2, with slopes between 3.5 and 4.0, and the PT2—a battery pentode capable of giving

a large undistorted output with the small anode current available from modest H.T. dry batteries.

On the Cossor stand there will be a number of new S.G. valves. In addition to the MS/PenA already described, there will be the MSG/HA of comparatively high impedance for untapped tuned anode or tuned grid circuits, and the MSG/LA of very low impedance suitable for tapped circuits and tuned transformer coupling. Its impedance measured under working conditions is 200,000 ohms, and its slope reaches the high figure of 3.75. To the pentode range has been added a highly efficient indirectly heated valve—the MP/Pen with a conductance of 4, whilst in the battery range—especially in the 2-volt series—will be found many examples giving a high performance and a new economy in anode and filament current. Among the new A.C. valves, mention must be made of the 41MP and the 41MXP, both holding the highest conductance yet attained, namely, 7.5.

## CONSTANT PEAK BAND-PASS FILTERS.

IT is now generally appreciated that, under modern conditions of reception, some form of coupled circuit is necessary before the first valve. However great the overall selectivity of the receiver may be by dint of a multiplicity of tuned circuits in later stages, the effective selectivity may be determined by that of the aerial input circuit alone due to a peculiar property of the screen-grid valve. The principle of restricting the input resonance curve to well-defined limits, known as pre-selection, is best obtained by the use of band-pass filters, but it is a fact that no filter having a single fixed coupling component will give true pre-selection over the usual wavebands. The well-known filter with fixed capacity coupling, for instance, gives excellent pre-selection

first consists of arranging that the value of the coupling capacity in a filter of the type shown in Fig. 1 (d) changes continuously with change of wavelength. This is effected by ganging together the spindles of the rotors of the tuning condensers and the coupling condenser. Constant pre-selection is obtained by this means, and for those requiring further information, reference should be made to the description of "The Pre-Selection A.C.3" receiver (February 25th, 1931).

Another method, various modifications of which will be found at Olympia, depends upon the fact that a fixed negative inductance coupling, combined with a fixed capacity coupling known as a "mixed" filter, makes possible constant peak separation and constant pre-selection

vides very simple waveband switching, but as the coils  $L_1$ ,  $L_2$  do not have quite the same number of turns to give "matching," the initial ganging may not be easy, but, once corrected, there should be no difficulty. In Fig. 1 (b) is given the circuit of a mixed filter which was described in detail in the issue of February 18th, 1931. The tiny H.F. transformer  $L_3$ , wound on a one-inch tube, gives the negative inductance and  $C$  again is the common capacity. The tuning coils  $L_1$  and  $L_2$  are identical and ganging is simple, but a somewhat complicated waveband switch is required.

A highly satisfactory mixed pre-selector is given in Fig. 1 (c), and is embodied in "The Wireless World Three" set described elsewhere in this issue. A "link" circuit  $L_3$ ,  $L_4$  gives the negative inductive coupling, and  $C$  provides the common capacity. Identical tuning coils  $L_1$  and  $L_2$  are employed and ganging is quite simple, whilst waveband switching consists in shorting the long-wave windings only, since  $L_3$  and  $L_4$  serve for both bands. In Fig. 1 (e) there is a promising filter circuit in which  $C_1$  appears to func-

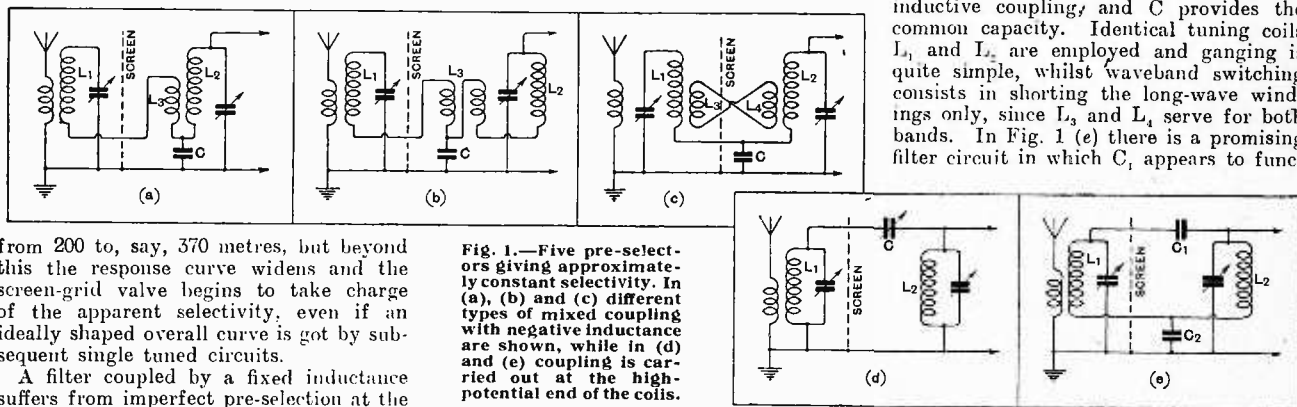


Fig. 1.—Five pre-selectors giving approximately constant selectivity. In (a), (b) and (c) different types of mixed coupling with negative inductance are shown, while in (d) and (e) coupling is carried out at the high-potential end of the coils.

from 200 to, say, 370 metres, but beyond this the response curve widens and the screen-grid valve begins to take charge of the apparent selectivity, even if an ideally shaped overall curve is got by subsequent single tuned circuits.

A filter coupled by a fixed inductance suffers from imperfect pre-selection at the lower end of the waveband, and any attempt to combine capacity and ordinary inductive coupling together—at first sight an obvious thing to do because their deficiencies are opposite to one another in their effect—results in an even greater lack of constancy of pre-selection over the tuning range. The problem has been solved by new methods of coupling. The

over the waveband. Incidentally, mixed filters are more efficient and give better signal strength than the simple filters. In Fig. 1 (a) is shown a mixed filter in which a few turns ( $L_3$ ) of the inductance  $L_1$  are wound in negative inductive relationship with  $L_2$ , and in which  $C$  is the common capacity. This pre-selector pro-

tion in the same way as a negative inductance, while  $C_2$  behaves as a normal capacity coupling. Now that pre-selectors with constant characteristics are available, attention will have to be given to the design of intervalve single-tuned circuits having more constant selectivity.

W. I. G. P.

## CURRENT TOPICS

Events of the Week in Brief Review.

## THE SHOW.

As we go to press it is suggested that Marchese Marconi may open the Olympia Radio Show on Friday next, September 18th. In any case, the Marchese will be heard in the B.B.C. programme on Saturday evening.

The Exhibition will be open from 11 a.m. to 10 p.m., and the admission fee will be 1s. 6d. With nearly 400 stand-holders, the 1931 Radio Show will occupy double the floor-space of last year's event.

Readers will be welcomed at *The Wireless World* Stand, No. 57.

## NORTHERN NATIONAL RADIO EXHIBITION.

The famous Manchester Radio Show, which has been sponsored by the *Manchester Evening Chronicle* ever since its formation eight years ago, will enjoy a still bigger status this year under the auspices of the Radio Manufacturers' Association. The Northern National Radio Exhibition, as it will be called, will be opened in the City Hall, Manchester, on October 7th.

The prizes offered in the Amateur Constructors' Section have been increased by the addition of a fourth prize in each of the sections. There are thirty-four awards, ranging from £25 downwards. Full particulars can be obtained from the Radio Editor of the *Evening Chronicle*, Withy Grove, Manchester.

## EDINBURGH RADIO SHOW.

The Radio Manufacturers' Association will give its patronage to the Edinburgh Radio Show, to be held in the Waverley Market, from November 11th to 21st. The show is to be twice the size of last year's.

## THE JUNK SECTION.

A museum of wireless antiques will be a feature of the Bristol Radio Exhibition

which opens at the Colston Hall on Monday next. The Exhibition coincides with Bristol's Wireless Week. Special broadcast programmes have been arranged, some of which will be transmitted from a glass-lined studio in the Exhibition Hall.

## AMERICA'S SHOW.

Modestly termed *The Radio World's Fair*, the American wireless exhibition opens on Monday next, September 21st, at Madison Square Garden, New York, and will continue until the end of the week.

## WIRELESS COURSES IN LONDON.

Splendid opportunities will be available for Londoners who wish to study wireless during the coming winter evenings.

The Regent Street Polytechnic Courses in Wireless and High-frequency Engineering will be resumed on September 28th, enrolments beginning on September 21st. The Polytechnic possesses a fully fledged telegraphy and telephony transmitter (6RA).

Electrical study at the Chelsea Polytechnic, Manresa Road, S.W.3, will concentrate on the accumulator. Special lectures have been arranged.

## SAYS MR. CALDWELL.

Mr. O. H. Caldwell, whose writings always give us pleasure, has been telling the American public a little more about the future of radio. On the last occasion the ex-member of the Federal Radio Commission wrote of the benign influence of the loud speaker in the chicken-coop; this time, in the September Journal of American Military Engineers, he foretells the inevitable extinction of the regimental brass band. In future, it appears, the troops will march to victory behind a band wagon fitted with thermionic "toobs" and a phonograph amplifier. This should soon put an end to war.

## £520,000 FOR FRENCH BROADCASTING.

Jealousy and mistrust among rival radio interests were referred to by M. Guernier, the French "P.M.G.," in his long-awaited speech in connection with the opening of the Autumn Radio Salon at the Paris Colonial Exhibition. M. Guernier said that the delay in regularising French broadcasting was due to the conflict of two schools—one wanting a State radio monopoly and the other a measure of private liberty with State supervision.

To abolish jealousy between large centres of population, each of which demands its own station, M. Guernier proposes to set up high-power regional stations of 60 kW. or more which would cover not merely individual towns, but definite areas of country. He revealed that the 1931-32 Budget allocates £520,000 solely for the development of broadcasting.

The only fear in French wireless circles, according to our Paris correspondent, is that this radio-minded "P.M.G." will be dethroned from his post before the proposals materialise. "The Government has already been in power for several months—a long period for a French Ministry!"

## LEIPZIG TO USE 150 KW.

The new transmitter now under construction in Berlin for the Leipzig broadcasting station will, we learn, have a power of 150 kW.

## CARDIFF RADIO COURSES.

The principles of broadcast reception and the electrical reproduction of sound are to be treated in elementary and advanced courses arranged by the Cardiff Technical College for the benefit of salesmen and others who have no previous radio training. The session opens on Monday next.

## AND NOW THE "BOOSTER."

American genius for choosing the right word is shown in the description of the proposed broadcast relay station at Washington. It is called a "booster." It is believed that this 250-watt station may be the forerunner of a chain of "boosters" leading to single wavelength working all over the United States.

A new battle is breaking out between America's two rival broadcasting chains—the National Broadcasting Company and the Columbia system—each of which is making frantic efforts to buy up stations whose owners are unable to make them paying propositions.

## CAMCO "WESTMINSTER" RADIO-GRAM CABINET.

With regard to the recent review of this cabinet, it would appear that provision has been made for visible controls and that they may be grouped on the recessed panel immediately below the loud speaker grille.



STUDIO AUDIENCES IN AUSTRALIA. This new photograph of No. 1 studio at the Melbourne Broadcasting station (3LO) goes to show that the studio *claque* is not frowned upon in the Antipodes.



# Broadcast Brevities

By our Special Correspondent.

## Sponsored Programmes: How We Escaped.

Few people were aware at the time how near we came last week to a régime of "sponsored programmes."

The Treasury officials were seriously discussing a proposal whereby the State would have appropriated the entire licence revenue, leaving the B.B.C. to take what steps it could to derive income from commercial advertisements.

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## "Living Dangerously."

What a "Changing World" it would have been then for Mr. Siepmann and his loyal followers in the Talks Department! "Living Dangerously" would have meant more than the title of a debate; it would have been the badge of several departments, with a halo as an alternative.

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## No Crippling "Cuts."

Fortunately for us all, I believe, the commercial sponsor is to be kept at arm's length. The forthcoming cuts in the B.B.C. revenue are to be substantial, but not crippling, which means that, although there are to be almost cruel economies all round, scarcely any change will be noticeable in the service which the B.B.C. renders to the public.

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## Empire Broadcasting.

Even the Regional Scheme, I understand, will go forward without interruption. (At one time the Control Board were considering the suppression of all except the two programmes originating in London, leaving the provinces with a bare minimum of time for local announcements.) Nor is it certain that the Empire broadcasting tests will have to suffer.

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## Strange Case of Broadcasting House.

The intention is that the economy axe shall take a chip off every department to a greater or lesser degree. It will fall heavily on Broadcasting House in the matter of interior decorations. Some of these decorations, of course, have already been completed, which makes me fear that this palace of broadcasting will resemble the average talkie palace in having all its frills in front.

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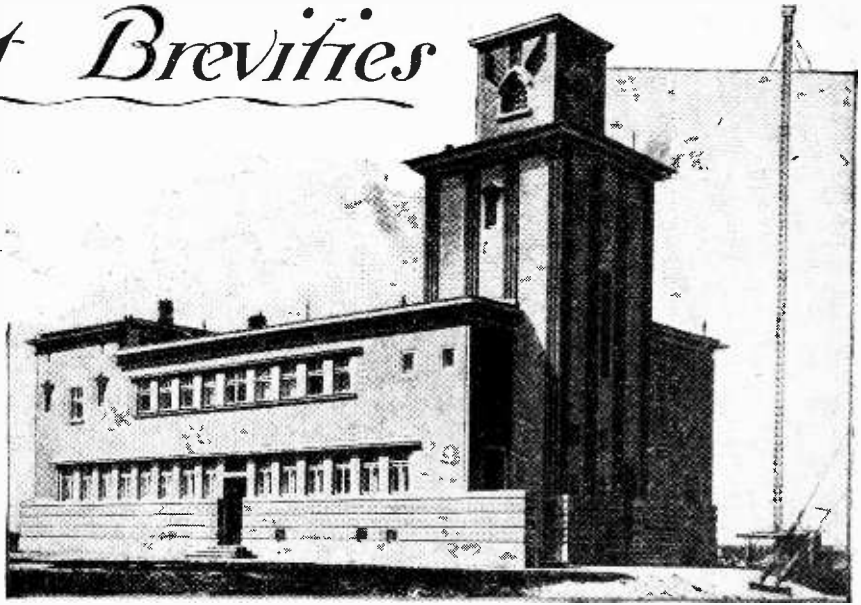
## Solemn Thought.

That beautifully finished entrance hall and equally dazzling council chamber may yet serve the purpose of impressing the buyer of "time on the air."

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## What Col. Val Myer Thinks.

I hear that the architect, Col. Val Myer, insisted on designing the entrance hall himself, his argument being that the public judge a building by its external appearance and the first impression they gain on entering it. This seems very sound. Besides, the Colonel might well



Roumanian broadcasting expresses its "personality" in the Bucharest station building.

dread the extremist touch within the B.B.C.

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## Angels and Angles.

Where the Corporation have a free hand in the matter they are introducing such monstrosities as a studio resembling a chapel (complete with Norman arch and altar table) and a studio "on mechanistic lines" with metallic angles, which, to me, sound too prickly to be comfortable.

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## Mr. Gandhi.

At the time of writing, it is not clear whether or not Mr. Gandhi will enter a B.B.C. studio or use a B.B.C. microphone during his visit to this country. Savoy Hill denies that the Corporation will grant the visitor facilities for his talks to America; at the same time, I think we may be sure that, if negotiations proceed happily, Mr. Gandhi will not leave this country without at least an invitation to give a valedictory speech by wireless.

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## No Football Boycott.

Natural irritation at the attitude of the Football Association in refusing to allow matches to be broadcast led the B.B.C. to consider "boycotting" professional Soccer to the extent of omitting all reference to it in the news bulletins. I am glad that no hasty decision has been taken. To have followed such a course would have hurt the listener far more than the "F.A.," and the B.B.C. have wisely arranged to include football results in the ordinary news bulletins.

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## International Matches.

Mr. Gerald Cock, chief of the O.B. department, fears that there is no likelihood of persuading the Football Association to change their policy. What he can definitely promise football "fans," however, are running commentaries on the semi-finals and finals, besides the Soccer and Rugger international matches.

## More Edgar Wallace Thrills.

That Mr. Edgar Wallace could throttle down his output to a single talk always seemed miraculous to me, so I am not in the least surprised to hear that the world's quickest word juggler is to give us a series of talks, beginning on October 10th. The title for the group will be "Stories for Broadcasting."

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## A Musical Constellation.

Once more the B.B.C. has combed Europe for the best soloists for the winter Symphony Concerts to be broadcast from the Queen's Hall. The pianists at these weekly festivals will include Backhaus, Harold Samuel, Stravinsky, Cortot, Harriet Cohen, and that versatile musician, Bruno Walter, who will both conduct and take the solo pianist's part on April 20th.

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## Instrumentalists and Singers

Among the other instrumentalists will be Szigeti, Harold Bauer, Lionel Tertis, Albert Sammons, and the famous organist, Marcel Dupré.

The list of singers sparkles with such names as Florence Austral, Elizabeth Schumann, Muriel Brunskill, Walter Widdop, and Frank Titterton.

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## B.B.C.'s Bath Night.

Members of the B.B.C. staff will make a splash on their own account at the Marshall Street Baths, Regent Street, W., on Wednesday, September 23rd, when they hold a Water Gala. A limited number of the general public can be admitted at 7.30 o'clock to witness the high diving, water polo, etc. Members of the orchestra who are not required at the Queen's Hall on that evening will play their instruments in the water.

I am told that the affair is not to be broadcast, which is a great pity. If Teddy Brown were there I should like to listen to him diving.



# The Variable-Mu Valve

## A New Method of Volume Control.

By R. O. CARTER, M.Sc., A.C.G.I., D.I.C.

(The Research Laboratories of the General Electric Company, Wembley, England.)

(Concluded from page 252 of previous issue.)

IN the instalment of this article in last week's issue it was pointed out that the ordinary screen-grid valve gives rise to modulation distortion and other secondary effects if comparatively large inputs are accepted. Furthermore, there is a distinct limitation if an attempt is made to control volume by variation in bias. The desirability of a new H.F. valve with a "tailing" characteristic and capable of handling a much larger input was pointed out. A valve of this type is the new Osram VMS<sub>4</sub>. For comparison, the curves for this valve corresponding to those already discussed for the MS<sub>4</sub> are shown on Figs. 6, 7, 8 and 9 (b). It will be seen that its initial mutual conductance (at -0.5 volt) is the same as for the MS<sub>4</sub>, but that the mutual conductance falls off more slowly especially at large bias. The initial anode current is larger, but this is obviously inevitable if a longer "tail" is to be obtained for the same initial mutual conductance or slope.

From Fig. 7 it will be seen that a larger bias is also necessary for the same reduction of amplification, but this also is inevitable if the rate of curvature is smaller. The actual bias required is still not inconveniently large. The advantage of the longer "tail" is seen from Fig. 8 (b), where it will be seen that the "distortion limit" occurs at -18 volts when the voltage amplification is 0.28. This corresponds to an input to the first

valve of  $\frac{I}{0.28} \times 1.4 = 5$  volts, which

is three times, or about 9 decibels, greater than when using MS<sub>4</sub> valves, and satisfies all normal requirements.

For convenience in comparison, a scale showing the reduction of mutual conductance in decibels has been shown on the right of Fig. 7. Considering the VMS<sub>4</sub> it will be seen that a change of bias from -0.5 to -15 volts reduces the mutual conductance 23 decibels, and we should therefore expect with two stages, and neglecting the effect of the load in the anode circuit, that

the overall gain of the set would be reduced 46 decibels. From Fig. 8 (b) it will be seen that it is reduced from +43 decibels to -4 decibels, or 47 decibels, which agrees closely with the previous figure, showing that to neglect the anode load is quite justified. The interval transformers were quite loosely coupled, as will be seen from the comparatively small overall gain obtained even at normal bias.

This is perhaps shown more clearly on Fig. 11, which shows the usual anode volts-anode current family of curves for the VMS<sub>4</sub>. They are similar to those for the MS<sub>4</sub>, except that, as would be expected, the curves for large grid bias values are not so crowded together. The line AB represents the slope of the load line for an anode load of 15,000 ohms, which is quite common in receivers having two H.F. stages, in which some amplification is sacrificed to obtain selectivity by using loosely coupled transformers.

At small grid bias the input will be only a fraction of a volt, while even at -10 volts the input will not exceed about 2 volts peak. This is represented qualitatively by the lines PQ and RS (anode voltage being assumed 200 volts). It will be seen that the curved portions of the characteristics are never approached, and the radio-frequency component of the anode current differs inappreciably from its value for zero anode load (vertical load line). Even if the anode load is 100,000 ohms, which can be obtained with efficient tuned anode couplings, the effect of the load is not great, and becomes less as the bias is increased.

This is merely another way of saying that the A.C. resistance of the valve is large compared with the load impedance, and becomes greater as the grid bias is increased. The effect of using a larger anode load will, of course, be to increase the stage gain considerably for any particular grid bias.

At large values of grid bias the amplification will still be proportional to the mutual conductance, and

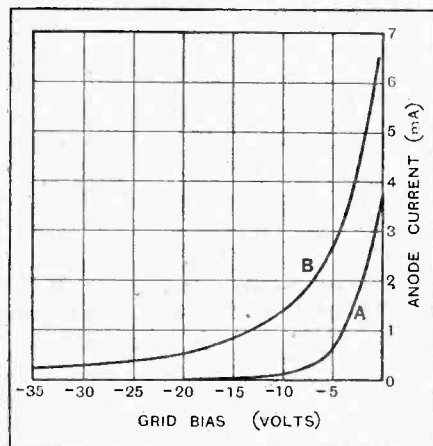


Fig. 6.—Grid volts—anode current curves of (A) the MS<sub>4</sub> valve and (B) the VMS<sub>4</sub> valve. Note the gradual "tailing" of curve B.

**The Variable-Mu Valve.—**

the shape of the gain-grid bias curve will be the same; but at small values of bias, when the anode load becomes comparable with the valve resistance, the dynamic mutual conductance will be slightly less than the static, and consequently the gain curve will turn over a little at the top. But this effect is very small; in the case of the VMS4 valves used above, for example, the anode A.C. resistance at  $-0.5$  volt bias is 400,000 ohms, and the gain at this value of bias for an anode load of 100,000 ohms is therefore about 20 per cent., or 2 decibels less than the value calculated, assuming the dynamic and static mutual conductances to be identical. Hence, for most purposes the effect of anode load may be neglected.

It will be seen from Fig. II, however, that it is necessary to employ a fairly high H.T. voltage; but this applies, of course, equally to an ordinary screen-grid valve.

The distortion limit in the high-frequency amplifier will, in general, be determined more by the input voltage than by the grid bias. For example, in the present set if the efficiency and tightness of the coupling transformers were increased so as to increase the amplification, the maximum input which could be handled without distortion would not be reduced much, but the grid bias would, of course, have to be greater in order that the overall amplification should remain the same. On the other hand, the available amplification for distant stations at low bias would be increased, so that the actual range of control without distortion would be greater. This is due to the fact that the rate of curvature of the characteristics of the VMS4 is itself changing very slowly when the bias is large.

It is therefore more accurate to specify a maximum input to the valve rather than a maximum grid bias. Both will vary with the individual set, but the latter will vary considerably with the number of valves and type of coupling, whereas the former will vary very little.

**Two and Three H.F. Stages.**

It will be noted that only the input to the first H.F. stage has been considered, and the question of distortion in the second valve left out of consideration. This is because, in the present set, distortion does not occur until the high-frequency amplifier is attenuating, so that the input to the second stage is less than the input to the first, which consequently overloads first.

In a set using power grid detection, however, in which a large input was required for the detector, distortion might occur before the attenuation stage was reached, and in this case the stage immediately preceding the detector would distort first, and the maximum input from the aerial which could be handled would, of course, be less. In a set employing more than two stages it would, in general, be necessary to graduate the bias on the different stages if maximum input-handling

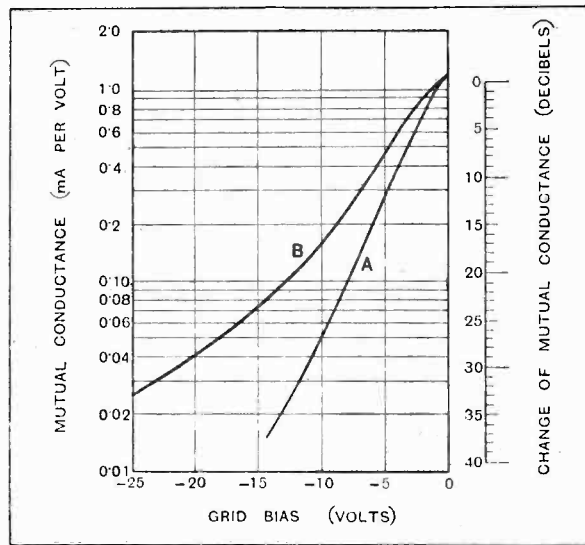


Fig. 7.—Variation of mutual conductance with grid bias of (A) an MS4 valve and (B) a VMS4 valve. At 40 volts negative the mutual conductance of this variable-mu valve is 0.005 mA/volt.

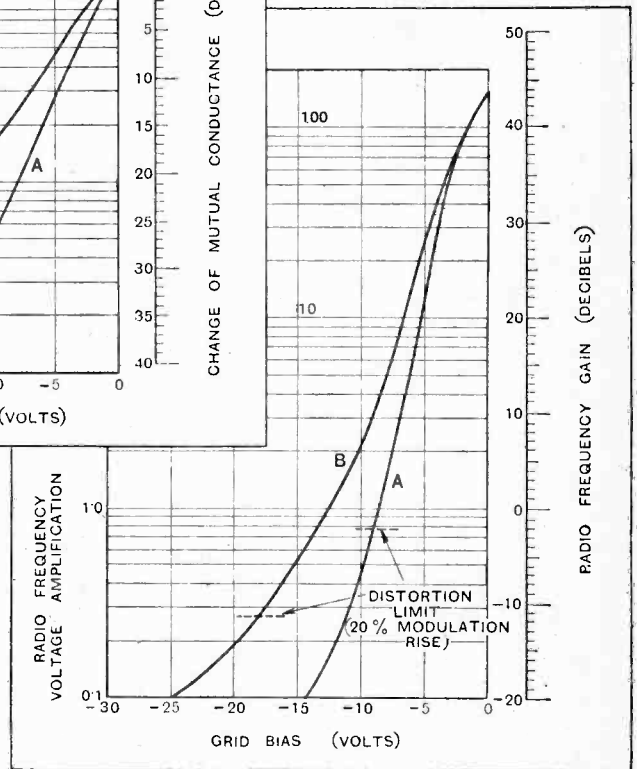


Fig. 8.—The variation of radio-frequency gain with grid bias of a typical commercial receiver using (A) MS4 valves and (B) VMS4 valves. The relative points of distortion limit should be noted.

capacity were desired. In the usual type of receiver using two H.F. stages it would be quite satisfactory to apply equal bias to both valves.

**Cross-modulation.**

This phenomenon has been described already several times in this journal. Due to the curvature of the valve characteristic, or to grid current, an unwanted signal intermodulates with the wanted signal, so that the unwanted is heard even though the selectivity of the tuned circuits later in the amplifier is sufficient to prevent direct interference; the wanted and unwanted appear to tune on the same wavelength, and if the wanted station shuts down, the unwanted ceases to be audible. The only way to cure the trouble, apart from improving the valve characteristic, is to increase the selectivity of the aerial circuit, generally by the use of a band-pass pre-selector circuit. It often happens, however, that, apart from cross-modulation, quite adequate selectivity

**The Variable-Mu Valve.**—

can be obtained from the three or four tuned circuits in the amplifier, without the extra complication and expense of band-pass tuning at the input. It is, therefore, definitely worth while to reduce the effect by improving the valve characteristic instead of relying entirely on the selectivity of the aerial circuit.

In a set using "variable bias" gain control, cross-modulation may occur in two ways:—

(1) At low bias, an interfering strong station may cross-modulate a desired weak station.

(2) At large bias, two strong stations may cross-modulate each other, so that both are heard when the set is tuned to either carrier.

As regards (1), the MS4 is known to be considerably better than many screen-grid valves on the market, due to the slow curvature of its characteristic. In fact, provided the aerial circuit is reasonably selective, as is usually the case with modern loose-coupled aeriels and moderately efficient coils, the local station will generally be heard by direct interference before cross-modulation occurs. In this case, of course, the only solution is to improve the selectivity by using a band-pass input circuit. Since the VMS4 and the MS4 have practically identical characteristics at low bias, the VMS4 will be equally good.

At large bias, where both the wanted and unwanted signals are necessarily large, it can be shown theoretically that the amount of cross-modulation which will occur depends on the same factors as the increase in depth of modulation, i.e., as the distortion of the wanted signal. Consequently, provided the "modulation rise" is kept small, one may rest assured that no trouble from cross-modulation will be experienced.

It will be realised that if the change-over from high mutual conductance at low bias to the low mutual conductance "tail" were sharp, so that there was a definite kink in the curve, bad cross-modulation and possibly also distortion might occur at this point, although on each side of it the valve might be perfectly satisfactory. In designing the VMS4 this has been carefully avoided, and it will be seen that the mutual conductance curve is everywhere smooth.

Mention should here be made of another method of gain control which has been tried, namely, variation of screen-grid voltage. If it is remembered that reduction of screen voltage has the same effect on the characteristic as reducing the anode voltage of a triode, i.e., the whole curve is moved to the right, it will be seen that the operating point can be brought to the same part of the curve by reducing screen voltage as by increasing grid bias.

Consequently, from the point of view of curvature of the characteristic, with its attendant distortion and cross-modulation, the method is neither better nor worse than grid-bias control, and the VMS4 would be an improvement on ordinary screen-grid valves. The method, however, has the disadvantage that grid current commences to flow as soon as the peak of the input swing exceeds the normal bias value of  $-1.0$  or  $-2.0$  volt.

When this occurs, distortion and cross-modulation due to grid current, as well as loss of selectivity due to damping of the tuned circuits, will occur. This will be equally bad with any type of screen-grid valve, and the method is not, therefore, to be recommended.

**Practical Circuit Considerations.**

In applying the VMS4 to existing sets due allowance must be made for the greater screen and anode currents of these valves and the various feed resistances altered to maintain the anode and screen voltages correct. If they are merely used instead of MS4 valves, without incorporating variable-bias gain control, this is the only point to be considered. Where, however, the variable-mu characteristic is being utilised, the circuit must be so arranged that the screen and anode voltages (especially the screen voltage) remain fairly constant when the grid bias is changed from low (or "normal") bias to the bias for full control.

At full control the anode and screen currents are practically zero, so that the circuits have to be arranged so that a change from zero to the normal value of both of these currents produces little change in the anode and screen voltage.

The anode voltage may be allowed to vary quite considerably, but the screen voltage should be kept as constant as possible. This may be done either by supplying the screens from a tapping on a potentiometer connected across the H.T. supply, the potentiometer being of sufficiently low

resistance so that the magnitude of the screen current has little effect upon the voltage of the tapping point, or, alternatively, a circuit such as that shown in Fig. 10 may be used. The potentiometer AE is bridged across the H.T. supply, and the screens are connected to a fixed tapping point S, and the grid-return leads are taken to the negative end E. The cathodes are connected to the slider C, which is moved up and down to vary the grid bias. When the point C is moved up towards S the screen voltage (the voltage between S and C) tends to fall; but as the screen current falls, due to the increase in grid bias, the voltage-drop down the resistance AS is also reduced, so that the potential of S above earth tends to increase. By

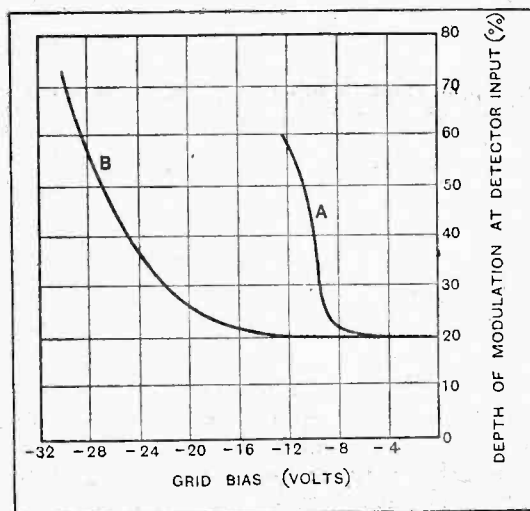


Fig. 9.—Showing the increase in depth of modulation (A) using an MS4 valve and (B) using a VMS4 valve.

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**The Variable-Mu Valve.—**

suitable choice of resistance values, these two effects can be made to counterbalance each other very nearly over the whole range, so that the voltage between screen and cathode remains practically constant.

The anode voltage will be reduced by the amount of the grid bias, but this is unimportant. This could also be maintained nearly constant by inserting a decoupled feed resistance in the anode leads of the valves.

The VMS<sub>4</sub> is, of course, the ideal valve for automatic-gain control sets. Most of these use an auxiliary detector in parallel with the usual detector valve, the anode current of which controls the grid bias on the H.F. valves. A slight rise in detector input causes a large increase in grid bias, thus reducing the gain. Consequently, the detector input varies very little for an enormous change in aerial input, producing the uncanny effect of tuning all stations in at the same strength, the only indication as to whether a station is weak or strong being the greater background noise (both "static" and "set" noise) on a weak station.

It should also find considerable application in superheterodyne sets, where the provision of a satisfactory gain control with adequate range on the intermediate-frequency amplifier has always been a problem of considerable difficulty.

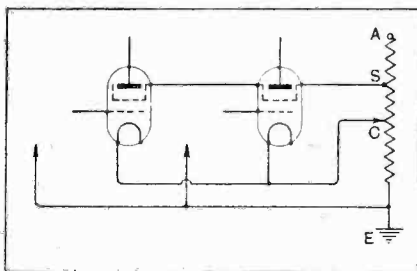


Fig. 10.—By means of a potentiometer across the H.T. supply a highly satisfactory bias volume control can be arranged with the variable-mu valve.

**Conclusion.**

It would, of course, be quite easy to produce a valve having a still longer "tail" and capable of handling larger inputs and giving a greater range of gain control. But the grid bias required becomes then inconveniently large, and introduces difficulties in set design, while in the case of automatic control the sensitivity of the arrangement would be much reduced.

The VMS<sub>4</sub> is capable of hand-

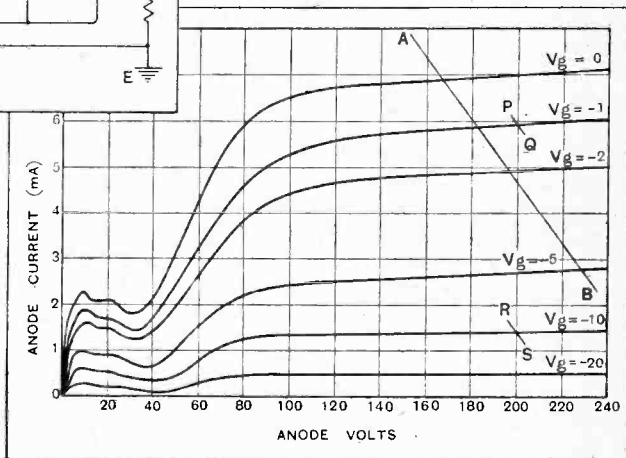


Fig. 11.—A family of anode volts anode-current curves of a VMS<sub>4</sub> valve. The load line AB represents a load of 15,000 ohms dynamic resistance.

ling as large an input as is normally necessary, while providing adequate range of amplification.

**SCREENED WIRING.**

**Eliminating the Last Traces of Feed-back.**

It is often found in a receiver that, due to some fault in the layout of the components, undesired effects are caused by the proximity of connecting wires. The grid and anode leads, for instance, may be too close together. This is quite likely to cause uncontrollable oscillation.

Sometimes the wiring cannot be spaced farther apart, owing to the disposition of the components, and it may be thought undesirable to alter the layout. The adoption of suitable screening will obviate the trouble, and if some of the important wires, such as grid and anode leads, are run in earthed metal tubing, the set can often be made completely stable.

**Earthed Metal Tubing.**

The tubing should, of course, be of fairly large diameter, otherwise its presence will throw a large unwanted capacity across the tuned circuit and render ganging difficult. The internal diameter of the tubing should be at least twice the external diameter of the wire, including its insulating sleeving.

It is necessary to fix the tubing rigidly in position,

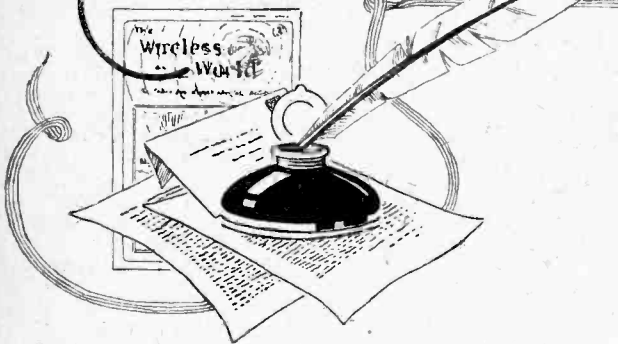
for if it be free to vibrate and it rubs against the screening, reception with a sensitive set will be rendered noisy. Soft copper or brass tubing can be obtained, and as it is little stiffer than wire it can readily be bent.

**Tin Foil Wrapping.**

It is in experimental and design work that screened leads are most required, however, owing to some fault in the layout. In such cases one rarely has the requisite tubing to hand. It is worth bearing in mind, therefore, that ordinary tinfoil makes a useful, if temporary, substitute. The insulating sleeving of the leads which require screening should be wrapped in tinfoil and held in place by binding with a length of thin bare copper wire, the free end of which can be connected to the nearest point at earth potential.

Tinfoil should not be relied upon for a permanent job, of course, and an early opportunity should be taken of replacing it with tubing, or else altering the layout and wiring so that the screening is unnecessary. Nevertheless, it serves a valuable purpose in temporary experimental work.

## 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.

## HINTS BEFORE THE SHOW

Sir,—Two years ago I visited the Manchester Radio Exhibition with the special objective of buying a loud speaker, and was prepared to pay up to £10 for an instrument suitable for my set. I was at the exhibition from 2 p.m. to 5 p.m., and at no stall could I obtain any technical information. "I'm sorry our engineer is not here at present." "I am expecting our expert to return any minute." "I'm sorry I'm only a salesman," were some of the replies I got. In every case you had only to mention one word to stop the flow of speech from the stall attendants. At one stall I obtained from one man—for whom I had to wait until he was disengaged—information in regard to output transformers. Result: I bought two transformers, but am still using the same loud speaker.

I forgot to mention that the word which frightened all stall attendants was

IMPEDANCE.

Lancaster.

## THE AMATEUR.

Sir,—I notice that Mr. Donisthorpe revives the dear old subject of the amateur, in *The Wireless World* of August 26th. He refers to my "slating" of the radio amateur. I cannot find any definition in the dictionary which gives an accurate meaning to the word "slating," so I cannot say if it is a just description or not, but I think a rereading of my letter by an independent person would convince him that I have no antagonism either to the amateur or to the amateur movement.

In claiming the responsibility of the first broadcasting in Britain, Mr. Donisthorpe supports my contention that we owe the inception of broadcasting to the professional, but, as I said before, what on earth does it all matter?

North Acton, W.3.

P. P. ECKERSLEY.

## 5XX.

Sir,—I should like to endorse the opinion of the writer who signs himself "No Axe to Grind," in your issue of August 12th.

I have been touring recently in Brittany, and have found that the majority of French listeners—in whom I have questioned prefer 5XX even to their own stations.

There is no doubt that the abolition of the English long-wave transmitter would be a great loss to a very large number of Continental as well as British listeners.

Finistère, France.

H. L. B. WOODYATT.

Sir,—Recent articles in your valued journal on the importance of an alternative long-wave station representative of British broadcasting have led me to try and give an idea of conditions prevailing on the medium-waveband after nightfall in this part of England, and I've no doubt in no way an isolated instance of the appalling reception conditions.

The London Regional can be received with excellent quality and strength on a 2-v-1 selective receiver similar to the excellent "Wireless World Four." In the evening this station is almost "wiped out" by Stuttgart—so much, in fact, that reception reminds one of the old days with an "Ora" valve and the headphones clamped tightly to the ears, while as a contrast Stutt-

gart will usually load a 2-watt valve. So much for one of the latest British transmitters.

Now we have recently received another nasty jolt in the form of Radio Trieste, which causes the London National to suffer in much the same way, and right through the medium-waveband after nightfall reception is in a sense a nightmare.

The only transmitter received consistently is poor 5XX, trying to make itself of some service to the British public in spite of the heavy attack of other European stations.

One can almost foresee a time when constructive articles in your journal will deal with high-quality amplifiers for gramophone reproduction, with provision for "occasional" wireless reception, unless there is a drastic alteration in the existing chaotic state of the ether, or a long-wave transmitter capable of keeping English broadcasting in the place it deserves.

Hastings.

H. C. BUTCHER.

## THE NIGHTINGALE.

Sir,—With reference to the "Nightingale," I quite agree with Mr. R. M. Lambert, whose letter was published in *The Wireless World* dated August 12th.

My conception is this: The B.B.C., assuming that the "Nightingale" broadcasts were derived from gramophone records, obviously made a very successful recording of the bird's song. The engineers took with them the necessary microphone, amplifier and gramophone, etc. They placed the microphone and utilised the amplifier in exactly the same manner to make the record as they would to make a broadcast.

Probably they made a simultaneous recording and broadcast of the bird; credit is due to them on their success in doing so.

If a record was made, they made it as a safeguard, for the bird might not have sang for days afterwards, with a result that many thousands of listeners would be disappointed. Therefore, it remains that the B.B.C. must have radiated the "opening night" of the bird's recital, be it either a record or the actual thing, and, to cut a long story short, listeners heard the song of the nightingale singing or which sang in some part of England; how we heard it only the B.B.C. can explain, so why this "Ado about Nothing"?—everybody enjoyed it.

Cardigan.

GRIFF THOMAS.

## GOOD REPRODUCTION.

Sir,—The letter signed "Super Six" was extremely interesting, inasmuch that it proves that at least the public are commencing to be educated regarding "100 per cent. reproduction." We are very thankful that you publish such letters, and we only hope there are many more like "Super Six."

Regarding the letter signed C. L. Yelland, I am afraid both he and Mr. Hartley have never heard a pick-up, amplifier, and speaker giving results that would defy even Sir Henry Wood and Dr. Adrian Boult to discern the difference between the original and the reproduced music. If both of these gentlemen would like to hear such an installation we will gladly give them an address where they will experience the delights of what should be an everyday occurrence.

When we read letters like those put in the technical Press by so-called great experts, about pick-ups, amplifiers, and speakers, it really makes us smile; they always miss the points that count and write a lot of nonsense that the merest novice knew years ago.

We desire people who really do know their job, and can prove it by their own apparatus. What we want in this world are works demonstrated, not beautifully written articles crammed full of technical data, which supply us the correct sound waves in theory only.

C. BERRAGE-MOULTON.

p.p. B.M. and A., Ltd.

READERS' PROBLEMS

Replies to Readers' Questions  
of  
General Interest.



Technical enquiries addressed to our Information Department are used as the basis of the replies which we publish in these pages, a selection being made from amongst those questions which are of general interest.

**High Note Loss in Extension Leads.**

I have a permanent magnet moving-coil loud speaker of the low-resistance type, with a built-in step-down transformer. The instrument is normally installed at a considerable distance from the receiver (in another room), and I have noticed that when working under these conditions quality of reproduction is much "duller," and generally less satisfactory than when the loud speaker is connected by a short lead.

Is there any fairly simple way of overcoming the bad effects of capacity in the extension lead?

We think it would be worth while to remove the built-in transformer, and to mount it in, or immediately adjacent to, the receiver. Extension leads from the transformer secondary terminals may then be run direct to the distant loud speaker, and the effect of capacity between the wires should then be much less serious than before.

**Push-pull Auto-transformer.**

In a push-pull output circuit, is it possible to use a tapped choke as an auto-transformer device? If so, will you please give me a diagram of connections?

Yes; a choke with suitable tappings can be employed for this purpose. Connections are given in Fig. 1.

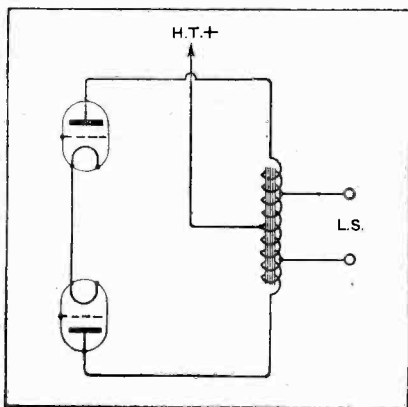


Fig. 1.—Push-pull output circuit with a tapped choke in place of the usual double-wound transformer.

The loud speaker should be joined to points symmetrically disposed with relation to the centre tap. If long extension leads are to be employed, it would be as well to insert large condensers in each lead

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as a precaution against short circuits, but this addition is not strictly necessary.

**Pick-up Transformer.**

Do you think that a microphone transformer would be suitable for insertion between a pick-up and a grid circuit of a detector valve, converted to act as an amplifier?

No; it is practically certain that the primary winding of the microphone transformer will have an insufficient inductance. It is desirable that the impedance of this winding should match that of the pick-up reasonably closely.

**A Noisy Set.**

After making comparative tests against other receivers of similar type, I have come to the conclusion that the "background" of my own "2 H.F." receiver is unduly noisy. This must be attributed, I think, to the H.F. amplifier, as the set operates very quietly when altered to a simple det.-L.F. circuit. Can you suggest where I should look for the cause of the trouble? I do not think it is due to an intermittent or faulty connection; the H.F. valves have been tested in another set, and seem to be quite satisfactory.

Experience shows that a noisy background is more often than not due to the application of excessively high screening grid voltage, which, incidentally, may also be responsible for reduced selectivity. Possibly these valves are fed through a resistance or potentiometer of incorrect value.

**Input Tone Correction.**

I have fitted a gramophone pick-up to my "Super-Selective Six," but results are not good. Although the quality on "radio" is excellent, reproduction on "gramophone" is lacking in bass and very shrill. Can you tell me how I can overcome the difficulty? I may mention that my pick-up is in order, as I have tried it with another set with good results.

A pentode output valve normally accentuates the upper audible frequencies, and so a compensating circuit must be fitted to reduce them to the correct strength. No such circuit is fitted to the

Super-Selective Six, as the high notes are deliberately reduced by the requisite amount in the I.F. amplifier. This automatic compensating action, of course, is no longer operative when a pick-up is used, and so a tone control must be provided for use only on "gramophone."

This control may consist of the usual resistance-condenser combination shunted across the loud speaker, but it will have to be disconnected when listening to broadcasting. It is more satisfactory, therefore, to connect the tone control across the pick-up itself, as shown in Fig. 2. The resistance R should be variable and have a maximum value of about 50,000 ohms, while for the condenser C various values between 0.0005 mfd. and 0.002 mfd. should be tried.

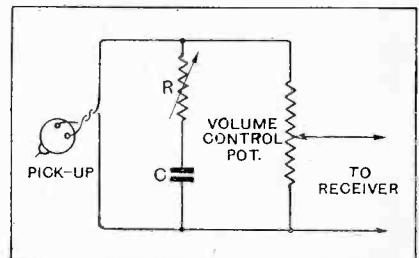


Fig. 2.—Tone control device connected directly across a gramophone pick-up; this method is particularly satisfactory when such a control is unnecessary for broadcast reception.

**Wasting H.T. Current.**

I find that the total anode current consumption of my receiver is nearly twenty-five per cent. greater than that anticipated after adding together the rated requirements of individual valves. This is rather a serious matter, as I have to use dry batteries for anode current supply. Will you please enumerate briefly the possible causes?

I should perhaps add that a careful search has been made for obvious faults, and also that grid, anode, and filament battery voltages have all been checked.

Trouble of this nature is generally traced to one or other of the following causes: (a) Incorrect bias voltages; although you have checked the voltage of the bias battery, it may be that there is an "open" grid circuit which prevents the application of bias voltage to the grid itself. (b) Short-circuited anode feed resistances, or resistances of incorrect value. (c) "Soft" valves. (d) Leakages or partial short-circuits; high-capacity by-pass condensers are always to be suspected.

**Stage-by-stage Superheterodyne Test.**

I have just completed the battery-fed "Super-selective Five," using an input filter of a different type from that specified. This part of the receiver does not seem to be working properly, and so I intend to check its behaviour independently of the remainder of the set. At which point should I "break into" the first detector circuit in order to make a test?

The anode circuit of the first detector in this receiver is rather unconventional,

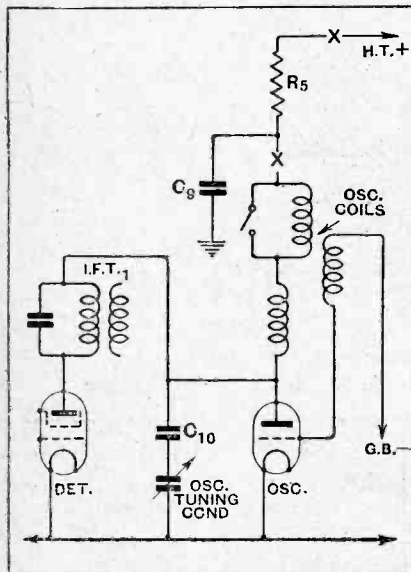


Fig. 3.—By isolating the input circuit of the "Super-selective Five" it is possible to carry out a test of the filter without complicating factors.

as the oscillator tuned anode coils are included in it. It would perhaps be simplest entirely to remove the present connections, but, if you wish to avoid disturbing the wiring, it would be possible to insert an indicating instrument in the positions marked X in Fig. 3. If phones are to be used, they should be joined between the oscillator coils and the feed resistance, but a meter should be connected between this resistance and the source of H.T. voltage.

o o o o

**Admitting Defeat.**

Since the Northern Regional Station started operations I have found that the selectivity of my present set is quite inadequate for long-distance reception. Rather than attempt to modify it, I have decided to rebuild, adopting a modern 2-v-1 circuit, with a band-pass aerial filter. Do you think that at the same time it would be wise to reduce the length of my aerial, which is at present nearly forty feet high and sixty feet long?

Although we know that there is a tendency nowadays to use short aerials, it always seems that to turn an efficient collector into an inefficient one is an admission of defeat, and it goes very much against the grain to recommend such alterations.

As you intend to use a band-pass filter, we think, in any case, it will be unnecessary to make any sacrifices of aerial input, but, of course, there is no harm in making provision for adjustable aerial coupling; if you do this, it will, at the worst, be possible to take full advantage of the effectiveness of your aerial system when receiving on wavelengths where local interference is not troublesome.

o o o o

**"Free Field Current."**

I take it that there is no reason why the principle of inserting the field winding of a moving-coil loud speaker in series with the H.T. rectifier output, as described under the above heading in your issue of July 15th, should not be applied to a D.C. mains set?

Theoretically, there is no objection to this plan, but there is nothing to be gained by adopting it. When D.C. mains are available it is generally preferable to connect the loud-speaker field directly across the mains, although there is the other possibility of inserting this winding in series with the heater circuit.

The advantages of the method outlined in the article to which you refer are really only apparent when dealing with A.C. sets.

o o o o

**On the Verge.**

My set works quite well as a receiver of wireless signals, but on connecting a pick-up in the grid circuit of the anode-bend detector it is found that there is a distinct tendency towards L.F. oscillation. It is possible to prevent this by reducing H.T. voltage, but I should be obliged if you could tell me the reason why this difficulty has arisen; the set has not been altered in any way, except for the addition of pick-up terminals.

No doubt a reduction in negative bias is made when the detector is converted to act as an amplifier. This would have the effect of increasing the overall magnification of the first stage, and so L.F. reaction (which is responsible for the trouble) will also be increased. There is the further possibility that coupling is taking place between the pick-up and the output circuit of the L.F. amplifier.

In any case, it would seem likely that this amplifier is normally working dangerously near to the border-line between stability and instability, and we think you will find that quality is improved if more effective decoupling devices are added.

o o o o

**Medium-wave Interference.**

Although my 1-v-1 receiver is reasonably selective, particularly in view of its simple design, I am troubled by interference from the local medium-wave station when receiving on the long-wave band on wavelengths from 900 metres up to about 1,100 metres. A circuit diagram of the set is enclosed. Can you suggest a fairly simple way of overcoming the difficulty?

Your circuit diagram shows a conventional type of receiver, having a single-tuned input circuit, with an "aperiodic" aerial; interference of the kind described

is generally due in such cases to the fact that the aerial system tends to resonate, when the set is operating on long waves, at a frequency within the medium band. We recommend you to try the expedient of inserting a loading coil between the aerial and the receiver, in order to change the point of resonance. An inductance of roughly 200 microhenrys is generally suitable for this extra coil, which, incidentally, should not be mounted in inductive relationship with other windings.

o o o o

**The Best H.F. Choke.**

I am about to rebuild my 1-v-1 receiver, using as many of my present components as possible, and should like your advice as to the best way to use two H.F. chokes already in my possession.

One of these is of a comparatively expensive, and I believe highly efficient type, while the other is small and cheap. Two H.F. chokes will be used in the set, one in the anode circuit of the H.F. valve in conjunction with a tuned-grid coupling, and the other in series with the detector anode for reaction purposes. In which position should the better choke be used?

Without question, in the H.F. coupling circuit. In this position, an efficient choke is definitely worth while, but, so far as reaction feedback is concerned, a relatively inefficient component will function quite satisfactorily.

**FOREIGN BROADCAST GUIDE.****LEIPZIG**  
(Germany).

Geographical position: 51° 20' N., 12° 23' E.  
Approximate air line from London: 537 miles.

Wavelength: 259.3 m. Frequency: 1,157 kc.  
Power: 2.3 kW. (temporarily).

Standard Time: Central European (coincides with B.S.T.).

**Standard Daily Transmissions.**

06.30 B.S.T., physical exercises relayed from Berlin (Sun.); 07.00, morning concert; 12.05, gramophone records; then continuous transmissions throughout day until 16.30, dance music; 19.30, main evening programme; 22.30, popular or dance music nightly.

Opening signal: short vibraphone melody (D, F sharp, A, D, E, G, B (pause); E, E, G, A, C sharp, D, A, F sharp, D).

Interval signal: metronome (240 beats per minute); opening signal is used if period between broadcasts is prolonged.

Male announcers.

Call: Hier Mitteldeutsche sender Leipzig und Dresden.

Closes down with usual German good-night greetings followed by the Deutschlandslid (National Anthem).

Relay: Dresden 318.8 m. (941 kc.), 0.3 kW.  
Interval signal: DR (morse).



# The Wireless World

AND  
RADIO REVIEW  
(19<sup>th</sup> Year of Publication)

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

## Is the Listener's Standard Worthy of Broadcasting?

At a time when so much attention is being paid to questions of economy it is interesting to observe that broadcasting is steadily increasing in popularity, and the demand for wireless apparatus is greater than it has ever been before in the nine or ten years which constitute the history of broadcasting in this country.

The real reasons for this state of affairs are not hard to discover, for there can be no argument against the fact that broadcasting provides the cheapest possible form of all-the-year-round entertainment, and has therefore come to be regarded as an economical substitute for other and more expensive recreations and entertainments. Recently we had occasion to mention, when reporting upon the Berlin wireless exhibition, that, although Germany has been passing through a time of acute industrial depression, yet in the wireless industry something in the nature of a boom has been experienced.

Now, in order to obtain the greatest amount of pleasure and profit from broadcasting as a service it is very necessary that we should participate in it under satisfactory conditions. There must be to-day an enormous number of wireless receivers in use which, by reason of their performance, are a disgrace to the name of broadcasting. Owners of sets have allowed them to become obsolete or have not troubled to maintain them correctly. The ear, unfortunately, perhaps, is capable of tolerating a good deal in the way of

dissimilarity with the original, especially in the case of music, and where the falling off in quality has taken place gradually and insiduously it is possible for persons still to believe that they are listening to a good rendering of the original, when, in fact, the reproduction is almost unbelievably bad in quality when judged by the standard of the original.

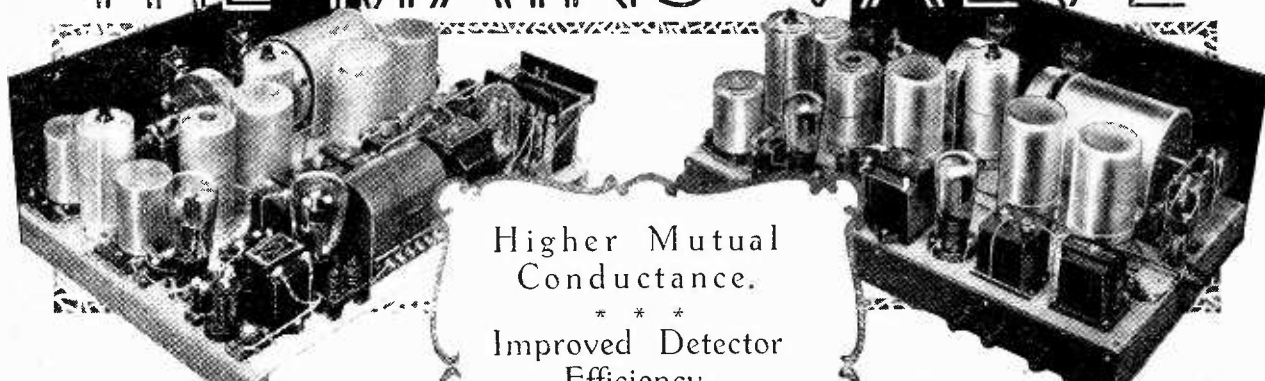
It should be up to all of us who are interested in the development of broadcasting and wireless generally to do what we can towards encouraging the public to appreciate the difference between good and indifferent reproduction. Those who own and still use sets designed four or five years ago should be encouraged to hear a modern receiver, especially if it is possible for it to be heard alongside the obsolete set for the purpose of comparison. When broadcasting, as a service, is capable of such high quality, it seems deplorable that a very large section of the public is putting up with so poor a substitute, very likely in blissful ignorance of the quality of reception available to them.

The Olympia Show offers a great opportunity for the public to bring their conceptions of standards of reception quality into line with modern developments, and now that so many manufacturers give facilities for demonstrations in the home before purchase, the opportunities for the public to hear real quality of reception are greater than ever before, and prices, it must be remembered, are far lower than any previous exhibition has been able to approach.

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# THE MAINS VALVE



Higher Mutual  
Conductance.

\* \* \*  
Improved Detector  
Efficiency.

+ - -  
Independent  
"Free" Bias.

*The Advantages of*

*Indirect Heating*

By W. T. COCKING.

IN ordinary battery-type valves the electron-emitting cathode and the heated filament are one and the same; the current from the accumulator passes through the filament and heats it to such a temperature that electrons are freely emitted. Consequently, any fluctuation in the filament current results in a fluctuation in the electron stream, for the density of the electron stream depends upon the temperature, which, in turn, depends upon the current. With the indirectly heated valve, on the other hand, the cathode and the heated filament are quite separate and distinct. The current passes through the heater and raises it to a high temperature; and, since the cathode and the heater are placed very close together, the cathode is heated sufficiently to bring it into the electron-emitting state merely by its proximity to the heater, and without any current passing through it.

Partly because the mass of a cathode can be made much greater than that of a filament, and partly because it is heated by radiation from the heater, its temperature can only change slowly. As a result, its temperature remains constant, even although the temperature of the heater is fluctuating rapidly, and A.C. mains working becomes possible.

The indirectly heated valve was developed in order to avoid hum in A.C. mains working; it is eminently successful in this, its main object, but other very important advantages accrue from the principle of the indirectly heated cathode, which alone would make its use advantageous.

*THE demand for receivers which draw their whole current supply from the electric light mains has led to the development of a special type of valve for the purpose. These valves are by now well known, and descriptions of them have from time to time appeared in the pages of this journal. In spite of this, however, it is often thought that they must have some distinct drawback to counterbalance the undoubted convenience of operation from supply mains. Just the contrary is true; except for one or two minor points, the indirectly heated cathode mains valve is in every way superior to its battery counterpart. Indeed, it is not too much to say that a three-valve mains set can be as efficient as a four-valve battery receiver, so great is the gain resulting from the use of these special valves.*

## The Equipotential Cathode.

In battery-type valves the current flowing through the filament creates an electric field round the filament, which has the effect of restricting the electron flow. In the indirectly heated valve, however, there is no current flow through the cathode, and, consequently, there can be no field round it and no restriction of the electron flow. It is largely due to this effect that the mutual conductance of an indirectly heated valve is about double that of a similar battery type.

Another very important effect of the absence of heater current in the cathode lies in the fact that its whole surface is at the same potential. It is common practice with battery valves to refer to the grid as being at a certain potential with respect to the filament, whereas, strictly speaking, we mean with respect to the negative end of the filament. The whole of the filament is supposed to be at the same temperature, and, therefore, to have the same electron emission. The use to which this electron emission is put, however, depends upon the potentials of the grid and anode with respect to the filament.

When there is a voltage drop along the filament, the grid and anode are not at the same potential when viewed from different points along the filament. To take a practical case, suppose that we have a valve with a 6-volt filament, and that at 120 volts H.T. it requires 3 volts negative grid bias. With respect to the negative end of the filament, the H.T. potential is, indeed, 120 volts, but with respect to the positive end of the filament it is only 114 volts; the emission from

**The Mains Valve.—**

the positive end, therefore, is slightly less than that from the negative. The grid bias, however, is even more serious. It is 3 volts negative with respect to the negative end of the filament, but it is 9 volts negative with respect to the positive end. It will be seen, therefore, that the density of the electron stream varies along the length of the filament, and is greatest at the negative end.

The performance of a valve as an amplifier is not greatly affected by this voltage drop, but it is of the first importance in the case of grid detectors. It has long been known that, due to this effect, a valve with a low-voltage filament makes a better detector than one which needs a high voltage; and, for the same reason, the best detectors of all are those with an equipotential cathode—that is, the indirectly heated valves.

It will be seen, therefore, that the indirectly heated valve scores all round, it offers the by-no-means negligible advantage of hum-free mains operation, its amplifying efficiency is double that of other types, and it is the most efficient detector known.

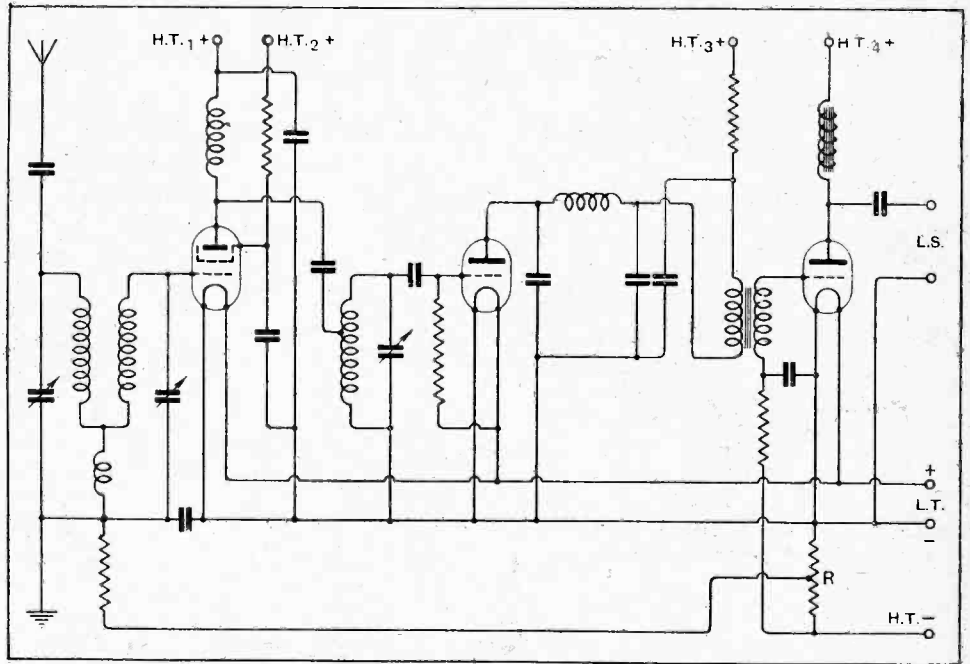


Fig. 1.—Free grid bias with battery-type valves can only be obtained by inserting a resistance R in the negative H.T. lead. In order to avoid feed-back, grid circuit decoupling resistances and condensers must be fitted to the H.F. and output stages.

**Practical Points.**

In addition to the foregoing, there are certain practical advantages which result from the electrical isolation of the cathode and heater. With battery-type valves it is quite difficult to arrange for free grid bias, and the only practical way is to arrange the circuit as shown in Fig. 1. A tapped resistance R is inserted in the negative H.T. lead, and the various grid return

leads are connected on to this. The disadvantages of the scheme are that each grid lead must be thoroughly decoupled to avoid feed-back; this means not only added expense, but in the case of H.F. valves an increase in valve hiss. As the value of bias depends on the total anode current of the set, any alteration in the current, due to the deterioration of one valve, or to an alteration in the tapping point for its bias in experimental work, alters the bias of all the other valves. No alteration can be made either to the H.T. or to the bias of any valve without affecting all the others.

With indirectly heated valves, on the other hand, the bias for each valve can be obtained independently by inserting a resistance in

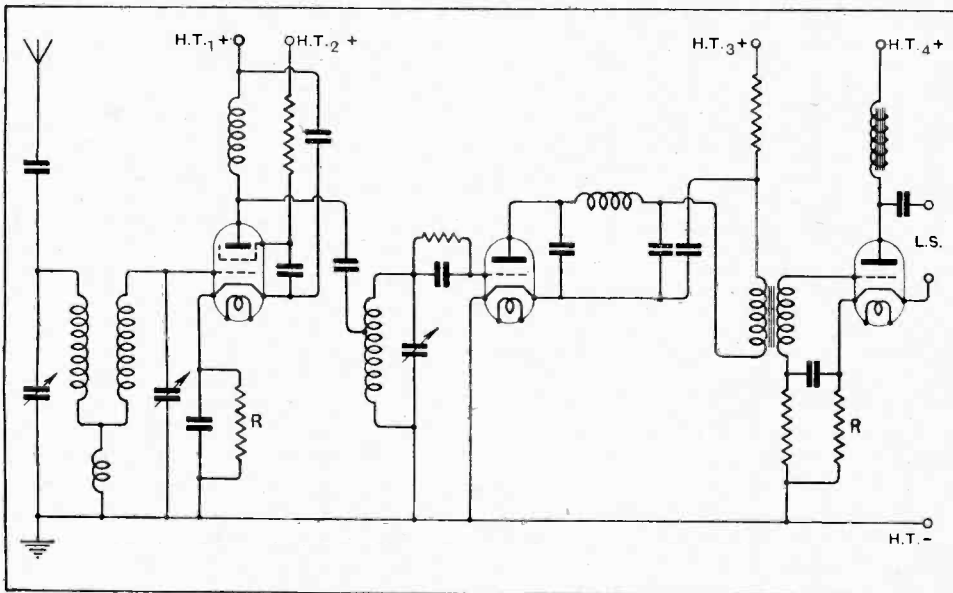


Fig. 2.—Free grid bias can be obtained for each valve independently when indirectly heated valves are used. A separate bias resistance R is used for each valve, and as a result no decoupling is required in the grid circuits, except in the L.F. circuits, where it is generally advisable to avoid a loss of bass.

**The Mains Valve.—**

the cathode lead of each valve. All grid return leads, and, what is more important, tuning condensers, can be connected to the common negative H.T. lead; feed-back between different valves cannot occur along the bias resistances; and, although there may be feed-back from the anode circuit of a valve to its own grid circuit, this is usually of no importance in H.F. circuits, and decoupling components can be omitted with a consequent gain in silent operation. In L.F. circuits it is hardly safe to omit decoupling, since any feed-back will result in a decrease in the amplification of the low notes.

The connections for this method of obtaining bias are shown in Fig. 2, and it will be seen that the bias on any valve can be altered without appreciably affecting that of any other merely by altering the value of the bias resistance, and a faulty valve in one socket will not affect the voltages on the others. We have thus made out a formidable list of advantages of the indirectly heated equipotential cathode valve over the battery type, and it now remains to see whether there are any disadvantages.

There are three, but none need be of great import-

ance. There is the danger of grid emission; this danger, however, is small with modern valves used under their rated conditions, and is becoming less as the design is improved. Grid current flows much more freely than with battery types, consequently greater care must be taken to avoid it in H.F. and L.F. amplifiers. Resistance coupling, in particular, is likely to give more trouble with indirectly heated valves, for grid blocking can easily occur. The greatest trouble, however, is undoubtedly valve noise. This is negligible in the detector and L.F. circuits, and it is rarely noticeable with only a single H.F.; it is when two or more stages of H.F. amplification are used that it sometimes becomes troublesome. In a mild case it takes the form of a gentle hiss which is hardly noticeable, but when it is bad it develops into a rushing noise which can be quite unpleasant. The noise is at its worst when high resistances are connected in the grid leads, and so it is advisable to use circuits, such as that of Fig. 2, in which grid circuit decoupling is unnecessary. A high value of screen-grid voltage also tends to make the noise greater. If care be taken in the general design of the receiver, however, the valve hiss can be kept below troublesome limits with any normal amount of amplification.

## WHATEVER YOUR POLITICS

WE have already announced in the last two issues the general details of the Competition which *The Wireless World* is again conducting, on similar lines to previous years, in connection with the Show. The success of this Competition and the value of the results depend entirely, in our view, on the support from our readers which the Competition receives. Year by year interest in the Competition has grown, and we hope that every reader will make an effort to participate this year and record his vote for what he considers to be outstandingly the best exhibits in this National Show.

### Making Your Choice.

This year we have made the task of entering up the reader's choice even simpler than before, because we have reduced the number of classes. We do not suggest, however, that the job of making a selection from amongst the enormous variety of first-class products has been simplified; rather, we imagine, it will be more difficult this year to discriminate. It is here, however, that the real interest in the Competition lies, because we shall eventually give the results of what is truly a representative opinion of technically minded people as to what are the best pro-

ducts of the manufacturers at Olympia.

Our classification of the exhibits this year is as follows:

(1) Receivers employing four or more valves, including radio gram-

at Olympia, no matter what may be the nature of the apparatus.

A form for entering the Competition will be found amongst the advertisement pages of this issue and of the issue for next week.

The forms should not be sent to us until the Wednesday following the appearance of the issue of *The Wireless World* of September 30th, which constitutes the last of the three special Show numbers. The reason for delaying the forwarding of the entry forms in this way is so that those readers who may not be able to visit the Exhibition personally can have the full benefit of the published reports of the Show which appear in the three special Show numbers.

### The Prizes.

Details of the prizes which are offered will be found on the entry forms. A cash prize of £50 is to be awarded by *The Wireless World* to the competitor whose vote agrees with the opinion of the majority in the selection of the outstanding single exhibit, and also in the largest number of additional classes. There will be second, third, fourth and fifth prizes to the total value of a further £50 in the form of vouchers for the purchase of apparatus.

WE WANT  
YOUR  
VOTE

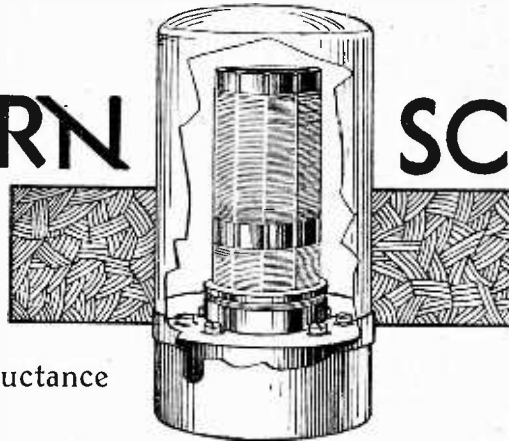
phones. (2) Receivers employing three valves or less, including radio-gramophones. (3) Component parts for home construction, including coils, condensers, resistances, etc. (4) Valves. (5) Loud speakers. (6) Accessories, such as pick-ups, gramophone motors, mains units, meters, etc.

In addition to entering the best in each of these classes, the competitor is required to state what he considers to be the outstanding single exhibit

# The MODERN SCREENED COIL

Part I.

The Influence of Screen Dimensions on Coil Inductance



By A. L. M. SOWERBY, M.Sc.

ON looking through a series of back numbers of *The Wireless World* it will be noticed that in the majority of receivers recently designed the tuning coils are screened from one another, and from the rest of the set, by being separately enclosed in small cylindrical metal boxes.

The purpose of this screening is primarily to restrict the magnetic field of the coil sufficiently to ensure that the receiver shall not go into uncontrollable oscillation even when adjusted for a high degree of amplification.

## The Screened Stage.

There are, of course, other ways of achieving this end; in particular there is the alternative system of screening in which each amplifying stage as a whole is completely enclosed in a large screening box. While this more elaborate scheme has advantages which the writer would be the last to deny, it involves considerable mechanical difficulties when it is required to gang the various tuning condensers together, especially to the amateur constructor without elaborate workshop facilities. With separately screened stages each tuning condenser has to be accommodated in the box containing the stage to which it belongs, with the result that the condensers are not very easy to "line up" with sufficient exactness for really smooth control; in other words, ganging becomes difficult.

If the various components are screened individually this difficulty disappears, since a three- or four-gang condenser can be purchased as a single unit and put straight into the set. Nor does such a condenser require to be completely enclosed in metal; its inductive field is negligibly small, and sufficient screening to render

## INTRODUCTION.

*THE present tendency towards single-knob tuning has enormously enhanced the popularity of the once-despised "potted" coil. But in spite of the wide adoption of coils closely screened by metal pots remarkably little is known of the effect of the screen on the inductance and resistance of the coil.*

*This article is the first of a series of four dealing in very general terms with the more fundamental aspects of the theory of screening, and giving the results of some measurements mainly directed towards the design of screened coils of reasonably high efficiency.*

*The next instalment begins with a consideration of resistance problems, and deals with the distinction between series and parallel losses. A clear picture of these two distinct types of loss is essential to an appreciation of some of the measurements, which are found to yield very unexpected results.*

*Preliminary measurements of a number of coils show that there is no justification for the current belief that so long as the screen is well away from the ends of a coil it may approach the sides quite closely without harm. Precisely the opposite is found to be the case.*

*In the concluding article designs will be given for the construction of two coils. Each is the most efficient coil that can be built by ordinary means in the particular screening-box within which it is intended to be used. Curves giving such information about the coils as is necessary for the design of receivers will also be included.*

its capacitative field harmless can be provided by simple flat plates of metal, but little larger than the vanes used for tuning, so placed as to isolate each section from the next. In such a layout as that implied by the "unit" multi-gang condenser the only convenient way of providing the very necessary screening for the coils is by enclosing each separately in a metal box—a box which, for compactness, is naturally made small. It is for the reasons just outlined that the vogue for screened coils has been undergoing rapid extension in the last year or two.

## Effect of Magnetic Field.

Although, since the publication of Butterworth's work on coil resistance, it is not too much to say that we know all about unscreened coils, yet it is quite certain that but little is known, in this country at least, of the properties of a closely screened coil. For there is no doubt that the proximity of the metal screen introduces a new factor which undermines the whole basis upon which Butterworth's work was erected.

The purpose of the screening box is to ensure that the magnetic field of the coil shall not extend beyond the limits of the screen, so that currents flowing in the coil shall not induce currents elsewhere by interacting with other parts of the receiver. Before we can appreciate the effects of the screen upon the coil we must have a mental picture of this magnetic field and of its importance to the coil itself. It will not be news to any reader to be told that when a current is passed through a wire a field of magnetic force is built up round that wire. Further, this magnetic field, while in process of growing, will induce an electrical voltage in any wire or other conductor in

**The Modern Screened Coil.—**

the neighbourhood, including the wire carrying the original current.

In the case of a tuning coil the voltage so induced in the successive turns of the wire carrying the current is quite large because the wire is deliberately so disposed that the passage of the current through each turn shall affect not only the turn through which it flows, but also all the others. Each turn, in fact, contributes twice to the effect; once because it carries current, and so sets up a field which affects all the other turns, and then a second time because it is affected by the field which all the other turns set up.

**Eddy Currents.**

The result of all this interaction between current and magnetic field is a retarding effect upon the flow of current; this effect is known as "inductance," and is measured (in the case of a tuning coil) in microhenrys.

The point that it is desired to make here is simply that the inductance of a coil depends entirely upon the intersection of magnetic lines of force with the turns of wire; anything that will increase or decrease the number or intensity of these intersections will raise or lower the inductance of the coil. For a fuller explanation of inductance than can possibly be attempted here the reader is referred to *The Wireless World*, Oct. 23rd, 1929, p. 466, and to the continuation of the topic in the two next succeeding issues.

Bearing these things in mind, let us look into the probable effect of surrounding a coil with a metal screen. First, it is evident that the screen, like the wires from which the coil is built up, will be subjected in a greater or lesser degree to the fluctuating magnetic field to which the coil owes its inductance. Just as this fluctuating magnetic field sets up voltages in the wire of the coil, it will set up voltages in the material of the screen.

These voltages will cause currents, known as eddy currents, to flow in the screening box, and these currents, in turn, will set up a new magnetic field of their own.

It can be proved that, provided the screening box is made of a metal having negligible resistance, the magnetic field due to the eddy currents will be such that the field due to the coil will be exactly and precisely counteracted at all points outside the box. The field due to the coil is not altered in any way whatever, either inside the box or outside it, when the box is put round it; but a new field is called into being by the eddy currents, and this new field is superimposed on the original one due to the coil.

At the moment we are not going to interest ourselves in the total field outside the box—unless, perhaps, to note, in passing, that the field due to the eddy currents will not *exactly* counteract that due to the coil unless the box has negligible resistance *all over*; unless, that is, there is perfect electrical contact at every point along every join. But this condition is so universally known to be necessary to perfect screening that there is no need to labour the point.

What are the effects produced inside the screening box by the eddy currents in the material of which it is made? It is not difficult

to see their field will oppose that due to the current in the coil, but that the coil's own field will now predominate, if only because the turns of the coil are so much closer to one another than to the screening box.

**Effect on Wavering of Screened Coil**

As we have seen that the inductance of the coil depends upon the intensity of the magnetic field in which it is bathed, the result of opposing that field by that set up by the screening box must necessarily be a reduction in inductance. With a given tuning capacity, a coil will therefore tune to a lower wavelength when screened than when it is in the open.

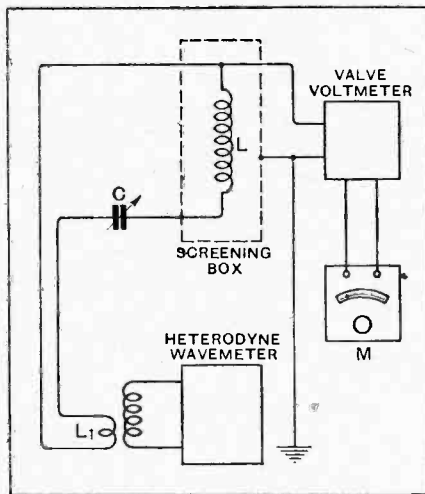
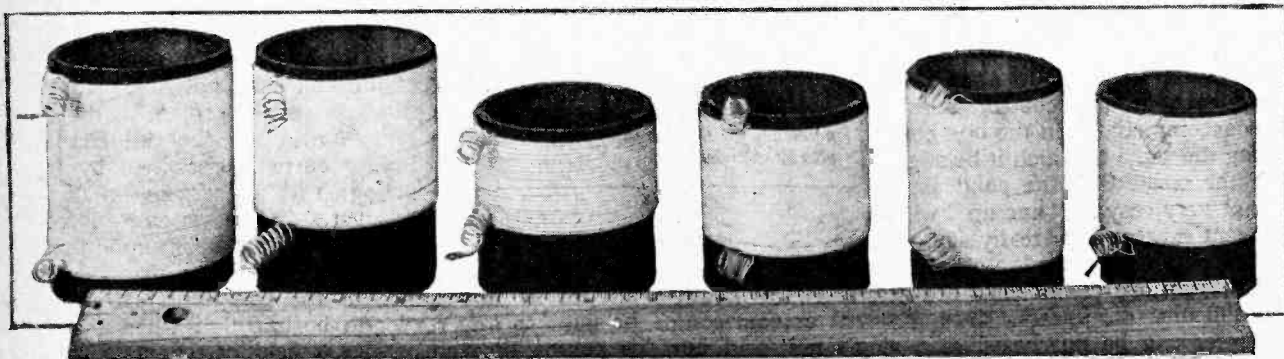


FIG. 1.—Schematic diagram of apparatus for determining the inductance of screened coils. The coil under investigation is shown at L.



A few representative examples of experimental coils specially prepared for investigating the effect of screening on inductance and H.F. resistance.

**The Modern Screened Coil.—**

At one time it was not unusual to take advantage of this fact to provide a method of tuning. One of the early Marconiphone receivers used "spade tuning," as it was called, in which the capacity across the coil was fixed, or adjustable in steps, and tuning was performed by covering up more or less of the surface of a flat "pancake" coil by a large brass plate in close proximity to it. The change in inductance brought about in this way served to adjust the receiver to the desired wavelength.

A more modern application of spade tuning is to be found in a very well-known ganged receiver; here a small movable metal plate is placed in the field of a coil, and its position is altered (by the makers of the set) until the inductance of the coil is brought to the exact value required to match the other coils in the receiver.

The uses just mentioned are those in which the change in inductance due to the proximity of metal is turned to good account; in the case where the coil is surrounded by metal simply for the purposes of screening, the loss of inductance is harmful rather than otherwise. Particularly is it disadvantageous when the coil is to be used following a valve amplifying at high frequency, for the dynamic resistance of the tuned circuit, upon a high value of which we rely for good amplification, depends upon the square of the inductance of the coil. If other factors were unchanged, halving the inductance would result in dividing the dynamic resistance by four, giving a very serious loss in amplification.

So far as is known, no theoretical discussion on the reduction of inductance by screening has been published, so that it is not possible to calculate the numerical value of the effects to be anticipated on screening a coil. The writer is certainly not competent to carry out the difficult mathematical work necessary to set the question on a satisfactory basis; as a rather sorry substitute, a series

of measurements on particular cases has been made instead.

For these measurements a series of coils of different diameter was wound, and the inductance of each coil was measured first in the open (unscreened) and then in each of four earthed screening boxes. Several difficulties and uncertainties cropped up in deciding upon a method of measuring the inductance of the screened coil, and in view of these no very high degree of accuracy can be claimed for the results. Ample accuracy for practical purposes has, however, been attained, as it is thought that the results are reliable to the nearest microhenry.

**Method of Measurement.**

Any direct and simple measurement of the change in inductance brought about by screening the coil is ruled out by the fact that the addition of the screening box changes the distributed capacity as well as the inductance. Since this difficulty can be got over by making measurements at two wavelengths, it would not be very serious were it not for the fact that it does not appear to be safe to assume, without direct evidence, that the addition of the screening changes the inductance of the coil to the same extent at all wave-

lengths. To check this point, certain coils have had their inductance values measured over several widely separated wavelength ranges; the change of inductance with wavelength was thereby found to be sufficiently small to be neglected.

Fig. 1 shows, in essence, the circuit used for measuring the inductance of the coils. An accurately calibrated heterodyne wavemeter was used as the source of oscillations, the "signals" from this being picked up by the small two-turn coupling coil  $L_1$ . This coil is connected in series with the coil  $L$ , whose inductance is being measured. The two coils are tuned to resonance with the wavemeter by the calibrated condenser  $C$ , the state of resonance being detected by observing the deflection of the milliammeter  $M$  attached to the valve

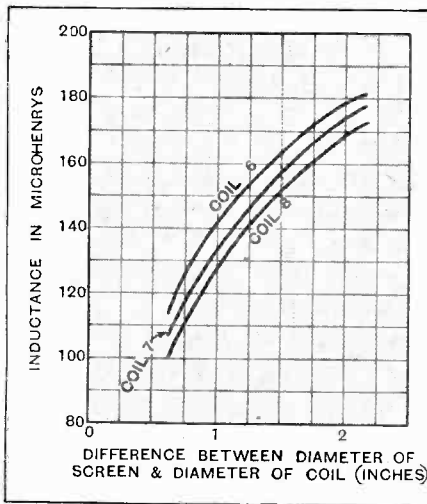
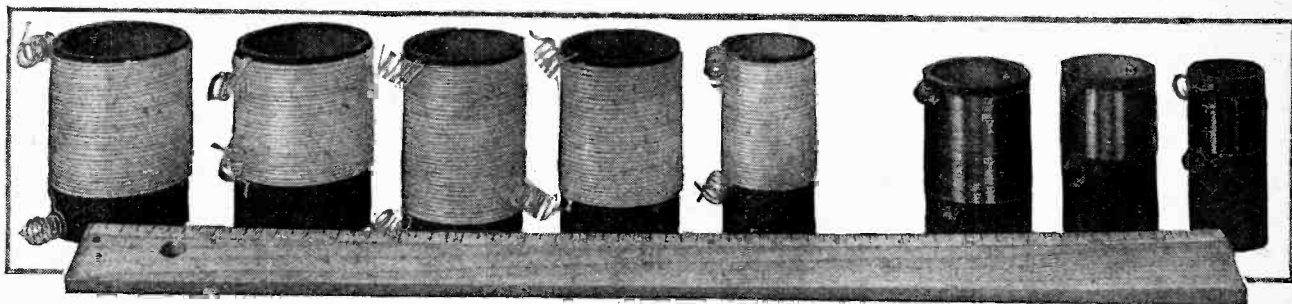


Fig. 2.—Curves showing the influence of the diameter of the screening box on the inductance of three representative two-inch coils.



In spite of the wide diversity of dimensions and gauge of wire, the inductance (unscreened) is in each case 200 microhenrys.

**The Modern Screened Coil.—**

voltmeter. The inductance of the coupling coil  $L_1$ , and of the leads was, of course, allowed for; it amounted to 2.27 microhenrys.

In making a measurement, the wavemeter was set to a known wavelength and the condenser C was varied until M showed maximum deflection. The capacity of C was noted, the wavemeter was set to a second (higher) wavelength, and the signal again tuned in by adjusting C. Knowing the two wavelengths, and the difference in capacity between the two settings of C, the total inductance of L,  $L_1$ , and the connecting leads could readily be worked out. (See Appendix.) Subtracting 2.27 gives the inductance of the coil L.

The results obtained are summarised in the accompanying tables, in which the inductance of sixteen coils is given in four different screening boxes. Each coil had an inductance of 200 microhenrys when unscreened. The blanks in the table indicate that the coil, with connecting leads, was too large for the screening box.

It will be appreciated that the inductance depends to some extent upon the relative positions of coil and can; in every case some pains were taken to ensure that the coil was exactly central in the box, but as it is naturally not possible to see the coil inside the screen there may have been slight deviations in a few cases. These

intended to be enclosed in screens have often been made of moderately large diameter, but have had only a small winding length.

The results given show that the inductance is more seriously affected by the sides of the screen than by the proximity of the ends; the curves of Figs. 2 and 3 perhaps make this point clearer than do the columns of the table.

In Fig. 2 the inductance of the three two-inch coils is plotted against the difference of diameter between coil and screen; it will be seen that all three coils show a fairly rapid change in inductance as the can is reduced in diameter.

In Fig. 3 the inductance is plotted against the difference between the axial lengths of coil and screen; each curve refers to a different diameter of screening box. The slope of these curves is but slight, indicating that the effect of the length of the can is not great.

From these results we conclude that if we are intending to design a coil which is to be screened, the coil should not be short and dumpy, but, on the contrary, rather long. It is difficult to know exactly where to draw the line, but it is fairly clear that with a screening box of normal shape the length

of the coil should be at least equal to its diameter. Since, however, it is consideration of coil resistance that will finally settle the best size and shape of coil for any particular screening box, further deductions must be postponed until the next instalment.

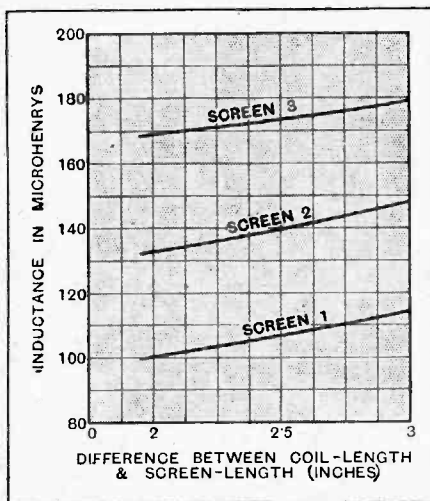


Fig. 3.—Variation of inductance of a representative coil with axial length of the screening box for three screens of different diameter.

TABLE I. DIMENSIONS OF COILS TAKEN FOR THE MEASUREMENTS.

Coil No.	Diameter. (Inches.)	Length. (Inches.)	Turns.	Wire.
1	1½	0.92	90	34 enam.
2	1½	1.10	80	30 enam.
3	1½	1.50	88	30 d.s.c.
4	1½	2.0	98	28 s.c.c.
5	1½	1.12	72	30 d.s.c.
6	2	1.0	62	28 enam.
7	2	1.38	67	28 s.c.c.
8	2	2.05	80	26 d.c.c.
9	2½	1.50	63	26 d.s.c.
10	2½	1.25	55	26 d.s.c.
11	2½	1.61	60	24 d.s.c.
12	2½	2.6	68	24 d.c.c.
13	2½	1.97	57	24 d.c.c.
14	3	1.45	51	24 s.c.c.
15	3	2.36	56	22 d.s.c.
16	3	3.10	62	22 d.c.c.

All the above coils have an inductance of 200 microhenrys when unscreened.

would not be large enough to be appreciable except where the can fitted the coil more closely than in any case likely to arise in a practical design.

Analysis of the figures shows that the reduction of inductance is greater for closely fitting screens than for those which allow more free space round the coil; this, of course, was to be expected.

It has been usual to assume in the past that the screen might be permitted to approach the side of the coil quite closely without appreciable loss of inductance, but that the ends of the coil should be kept at a very respectful distance from the metal. As a result, coils

TABLE II. The following table gives the measured inductance obtained when the coils given in Table I are put into screening boxes of various sizes.

Coil Number (See Table I.)	Resulting Inductance in Box No.			
	1	2	3	4
1	181	187	195	199
2	159	176	190	193
3	157	174	188	194
4	150	168	184	193
5	142	164	184	193
6	114	148	179	187
7	107	139	174	185
8	100	134	168	180
9	64	112	163	179
10	—	90	153	173
11	—	83	151	173
12	—	74	140	165
13	—	47	132	162
14	—	—	120	156
15	—	—	107	145
16	—	—	101	139

The screening box nos. referred to are no. 1, 2½ ins. diameter and 4 ins. length; no. 2, 3¼ ins. diameter and 4 ins. length; no. 3, 4 ins. diameter and 4 ins. length and no. 4, 4½ ins. diameter and 5 ins. length.

**APPENDIX.**

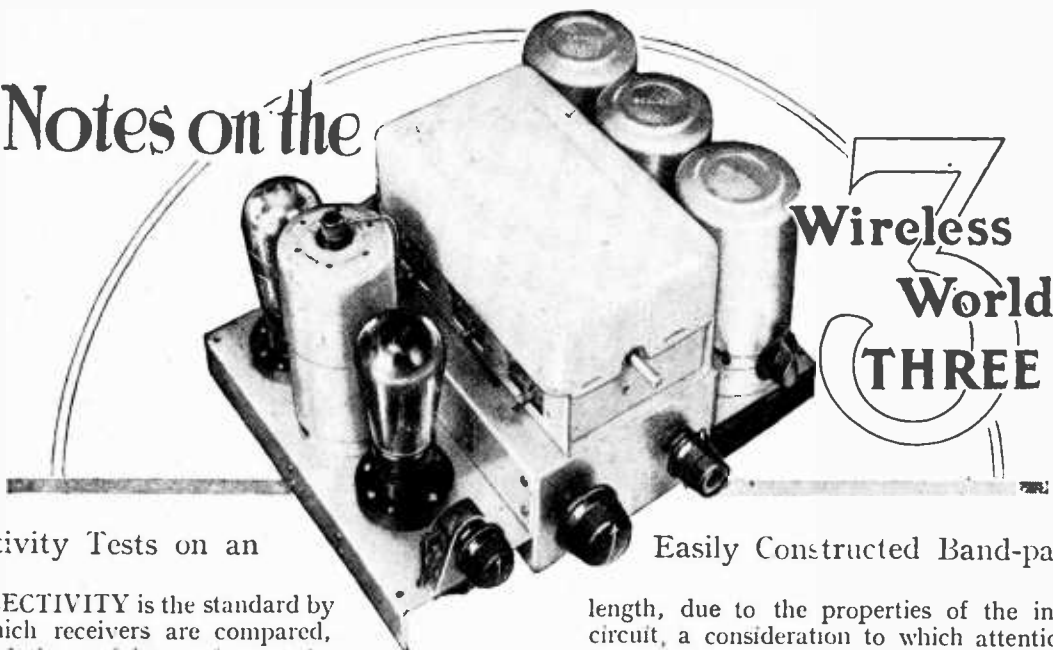
If  $\lambda_1 = 1885\sqrt{LC_1}$  and  $\lambda_2 = 1885\sqrt{LC_2}$  then  $\left(\frac{\lambda_1}{\lambda_2}\right)^2 = \frac{C_1}{C_2}$  and  $C_2 = C_1\left(\frac{\lambda_2}{\lambda_1}\right)^2$  therefore  $C_2 - C_1 = C_1\left(\left(\frac{\lambda_2}{\lambda_1}\right)^2 - 1\right)$  so that  $C_1 = \frac{(C_2 - C_1)}{\left(\frac{\lambda_2}{\lambda_1}\right)^2 - 1}$ . If, for example,  $\lambda_2 = 2\lambda_1$

then  $C_1 = \frac{(C_2 - C_1)}{3}$ . Knowing  $C_1$  and  $\lambda_1$  L can be found from the first expression in the appendix for  $L = \frac{1}{C_1} \left(\frac{\lambda_1}{1885}\right)^2 \mu H$  ( $\lambda_1$  = lower wavelength,  $\lambda_2$  = higher wavelength,  $C_1$  = smaller capacity and  $C_2$  = larger capacity).

(To be continued.)



# Notes on the



Selectivity Tests on an

Easily Constructed Band-pass Receiver.

**S**ELECTIVITY is the standard by which receivers are compared, and the usefulness of a set depends entirely upon its station-separating properties. The screen-grid valve that made single-dial tuning possible robbed sets of the highly selective properties given by triodes, but the development of band-pass tuning has now brought back an adequate degree of selectivity. This can be, largely, predetermined so that loss of quality and excessive sharpness of tuning may be avoided.

Particularly is a three-valve set benefited by band-pass coupling, and the accompanying curves show the overall performance of "The Wireless World Three" as governed by its "mixed" pre-selector. The vertical scale represents the energy fed to the loud speaker, and the horizontal scale the shifting of the tuning of a modulator oscillator away from the tuning of the set. With the station calibration given last week it can be gleaned from the curves what fraction of a division on the various wave ranges will bring about extinction of a transmission. It might be noted how uniform is the selectivity across the tuning range and how the receiver appears to be equally sensitive at the different wavelengths demonstrating the effectiveness of the mixed filter. A very slight broadening of the response curve is revealed at the lowest wave-

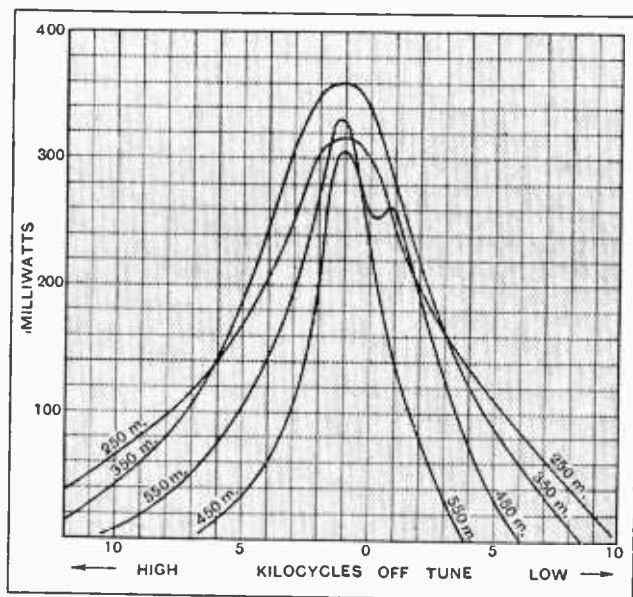
length, due to the properties of the intervalve tuned circuit, a consideration to which attention has recently been drawn.<sup>1</sup> Small irregularities in ganging, which are really of no significance, are conspicuously revealed by this method of test. To the ear the sharpness of tuning is not quite so well defined. For instance, a signal which falls in strength to one-tenth of its original value seems to a listener to be but a slight weakening. Reaction, too, results in spreading at the bottom of the

curves while bringing up the output from a weak signal from perhaps a few milliwatts to the full output of the power valve.

Excessive input, moreover, such as that from a nearby transmitter, which should, of course, be prevented by the use of the volume control, may give a very different result from that indicated by the curves. Band-pass, combined with complete screening, nevertheless, gives to the listener living within the shadow of a regional station complete separation of the two programmes and more programmes clear of interference than he could obtain by other methods. For distant-station listening band-pass tuning greatly reduces the babel of back-

ground which is encountered when using a sensitive set and increases the number of programmes that can be received.

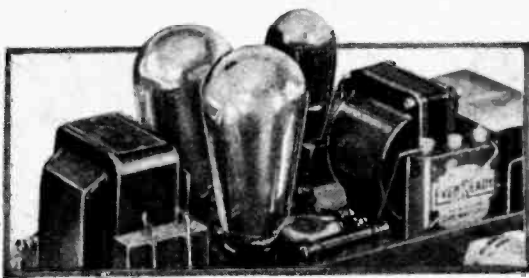
F. H. H.



Curves showing the output passed to the loud speaker as the wavelength is shifted by a few kilocycles on either side of the wavelength to which the set is tuned.

<sup>1</sup> Constant Peak Band-pass Filters, page 277, September 16th, 1931.

# The Evolution



# of the Output Stage

## Explaining the Purpose of Every Component

By W. I. G. PAGE, B.Sc.

“TOO complicated to tackle at present; I must wait till I have an evening to spare.” This is often our first thought on seeing an apparently involved diagram of connections, yet when we come to dissect it into component circuits and then build it up stage by stage we find that, after all, it is quite simple. Especially is this true of the modern output stage which it is proposed to discuss from first principles. Look at Fig. 8—a single output valve with all those embellishments which go to make an efficient link between the detector and loud speaker. On the assumption that A.C. mains are available and that a well-balanced and generous output from a moving coil is required, we shall probably find it expedient to arrange for self-bias, free field current for the speaker, decoupling of grid and anode circuits, a means to prevent that insidious form of distortion from parasitic H.F. oscillations which is becoming more evident with modern power valves, provision for “matching” the valve to its speaker load, and various other additions such as, for example, an anode milliammeter to ensure correct working conditions.

The circuit in question may appear a little complicated, but there is a simple explanation for the presence of each component and for the value assigned to it. Let us now take Fig. 1. Here we have the simplest possible output stage in which the speaker is connected directly in the H.T. positive lead. It is satisfactory enough in battery sets where, naturally, H.T. voltages are not dangerously high and shock, therefore, is of little

importance. There is the possibility, however, that as the H.T. battery gets old and develops a high internal resistance the speech currents of the last valve will build up a voltage across this resistance which is common to the other valves, and bad quality or even motor-boating may result. The isolation of speech currents to their respective stages, or decoupling, as this is called, arranged in the anode circuits of the earlier valves mitigates the trouble, and the circuit of Fig. 1 may be used with confidence if the power valve does not pass a very heavy anode current and some measure of decoupling is provided at the detector or H.F. valves.

When a battery set is converted for mains operation this is generally done in gradual stages—the first step being the use of an H.T. unit to eliminate the costly H.T. battery and a trickle charger for the L.T. accumulator. In this case a choke is necessary in the anode circuit, as shown in Fig. 2. One loud speaker terminal is earthed and the other is isolated as far as D.C. is concerned by the feed condenser C. There will, therefore, be no danger from high voltage which it is an advantage to employ whenever possible.

In this connection it may be pointed out that when using one of the larger output valves the power output varies in accordance with the power of  $5/2$ , that is, somewhere between the square and the cube of the H.T. voltage applied. This means that when the voltage is increased from 100 to 200 the power output increases *no less than 5.6 times*.

The output choke together with the feed condenser in series is in parallel

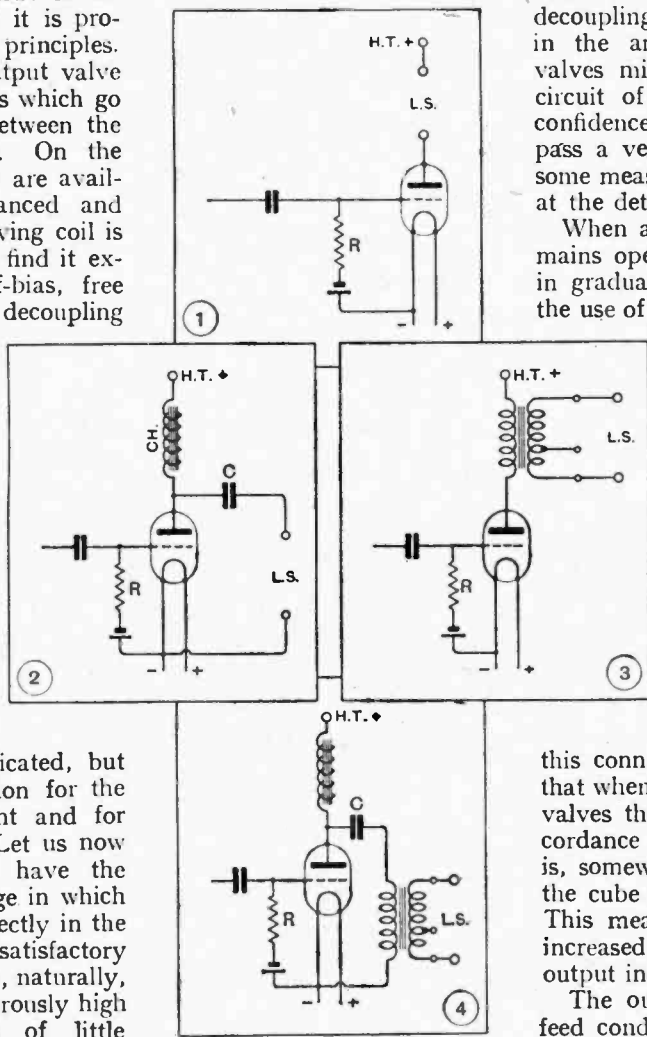


Fig. 1.—The simplest output stage in which the speaker is in the H.T. lead. Fig. 2.—Choke filter output—essential with H.T. eliminators. Fig. 3.—To match valve with speaker an output transformer is necessary. Fig. 4.—To prevent the steady anode current from flowing through the primary of the transformer this circuit can be used.

**The Evolution of the Output Stage.—**

with the speaker and the impedance of both varies with frequency. At the upper speech frequencies the impedance of the choke, which is practically the same as its reactance, is infinitely high when compared with that of the speaker and we can neglect its (the choke's) presence; but at, say, 50 cycles a choke of 6 henrys inductance may have an impedance equal to or even less than that of the speaker, with the unhappy result that the load into which the valve works is much reduced at low frequencies, and consequently the power output falls off. To prevent thin and "tinny" reproduction the choke should have an inductance of some 20 or 30 henrys under working conditions, for it must be remembered that the inductance varies with the amplitude of the anode current passing. Furthermore, a choke of small inductance allows some of the speech energy to reach the common high resistance of the H.T. eliminator, and the decoupling which it is sought to employ in the anode circuits is ineffective.

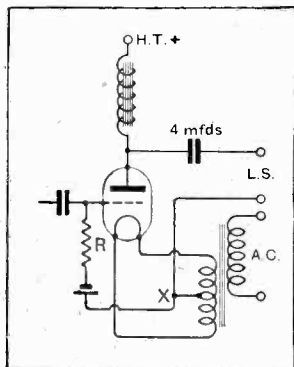


Fig. 5.—Battery bias with filament heating from the mains—an inefficient combination.

So far we have made no mention of the means of matching valve and speaker. This omission has been deliberate as we have up to now only assumed the use of battery valves of modest output. With them the great majority of moving-iron speakers match automatically, for the makers of both valves and speakers have arranged that the respective impedances of their products are of the right value and no step-up or step-down of energy is required. With small valves the speaker impedance or load should be twice the working A.C. resistance of the valve—this matching usually being effected at 256 cycles. The substitution of choke output for the direct speaker connection of Fig. 1 does not affect the matching as the choke acts as a one-to-one transformer. The simple matching ratio of two-to-one unfortunately is not the best to use with the more powerful output type of valve to be found in modern ambitious equipment. Large valves in which overheating may occur if the anode watts dissipation is not strictly limited must be used with loads two and a half to three (or even more) times their A.C. resistance. If the speaker does not happen to be wound to

give the correct load an output transformer should be used.

As the exact calculation of optimum load is somewhat complicated, it may be sufficient to say that this constant is now being published by some of the valve manufacturers and can always be obtained by reference to *The Wireless World* supplementary Valve Data Sheet issued each year. Knowing the best load for any given valve, also the impedance of the speaker at 256 cycles (this information is given from time to time in the pages of this journal), the correct ratio is:

$$\sqrt{\frac{\text{Required load}}{\text{Speaker impedance}}}$$

Taking an example, let us assume that we have an LS6A valve, also a moving-coil speaker with an impedance of 2,000 ohms at 256 cycles, what transformer ratio will be necessary to give the greatest undistorted output? Reference to *The Wireless World* Valve Data Sheet gives the optimum load of the LS6A as 3,700 ohms (nearly three times the nominal A.C. resistance of the valve, which is 1,300 ohms), the ratio is therefore  $\sqrt{3,700/2,000} = 1.36$  to 1 step-down. A simple transformer output stage is shown in Fig. 3, and, while

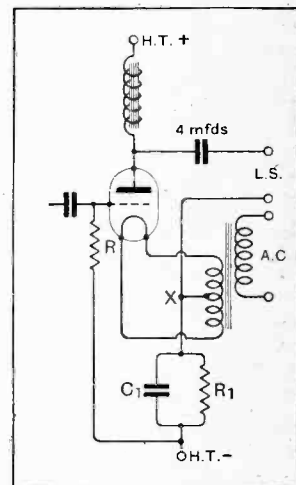
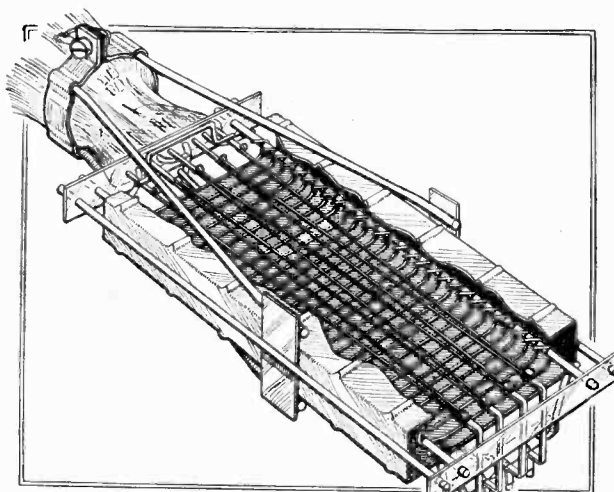


Fig. 6.—The essential circuit for self-bias in an output stage.

it provides an excellent means for linking speaker and valve with a ratio coupling, it does not entirely prevent the speech currents from passing through the H.T. source, and, further, if a valve like the LS6A is used with an anode current of 63 mA., the primary inductance is liable to be reduced to too small a value. The problem is solved by the circuit of Fig. 4, in which the decoupling advantages of choke filter are retained and the matching of valve and speaker is properly carried out by an output transformer, the primary of which does not pass the D.C. current. For reasons already explained, the choke must have a high working inductance. With ambitious output stages this circuit is finding increased application.

The next development assumes that the L.T. accumulator has been replaced by a mains transformer the filament winding of which is centre-tapped at X (see



The electrode assembly of the Mazda PP5/400. An output valve which would probably be used in a circuit such as that shown in Fig. 8.

## The Evolution of the Output Stage.—

Fig. 5). This point acts as the local earth, since the mean potential here is constant and is equivalent to L.T. negative in a battery set; therefore, both grid and anode return circuits are joined to it.

But with fluctuating mains voltages and battery bias the anode current varies, and self-bias, which almost entirely prevents this, should be substituted. As the anode current tends to increase, so does the bias voltage developed across the bias resistance, which, in its turn, reduces anode current. The circuit with the self-bias scheme is shown in Fig. 6, where the grid is returned to  $R_1$ , through which the anode current runs. The value of  $R_1$  is calculated by dividing the bias voltage required by the anode current, remembering that the anode voltage is robbed by an amount equal to the value of bias. The resistance  $R_1$  is an impedance in the output load circuit and should be by-passed by a 2- or 4-mfd. condenser; if the condenser is small in value the power output at the lower frequencies will suffer.

As the output choke is never of infinite impedance at the lower frequencies some of the speech current will find its way round the H.T. supply and pass through the bias resistance which is common to anode and grid circuits. As a result, L.F. oscillation may occur if  $C_1$  is not large; it is thus always safer to decouple the grid circuit (see Fig. 7). The grid oscillations are deflected by the resistance  $R_3$ , which offers an opposition of 100,000 ohms at all frequencies, and pass through the easy path of 1 mfd. to the local earth point X, and are prevented from reaching  $R_1$ . Provided that the decoupling ratio is a minimum of 10 to 1 at the lowest frequency, ample safeguard is assured. In the present case, at 50 cycles, one path offers an opposition of 100,000 ohms and the other 3,000 ohms (1 mfd.), so that an ample decoupling ratio of 33 to 1 is attained.

With efficient moving-coil speakers the field can often be energised with as little as four watts, which at once suggests the inclusion of the field winding in the H.T. negative lead. Here, incidentally, it will act, by reason of the gap in the magnetic circuit, as a constant-inductance smoothing choke, and give the necessary voltage-drop for self-bias of the valve (Fig. 8). Provided that the watts are sufficient for proper excitation,

the voltage developed across the winding is usually in excess of bias requirements, and the correct grid potential is obtained by taking the grid return to the slider of a 50,000-ohm potentiometer shunted across the field coil. As an example, we will suppose that a special Amplion moving-coil speaker is to be supplied with "free" field current,<sup>1</sup> the output valve being a PP5/400. The watts for excitation must be a minimum of four and a maximum of twelve. As the normal anode current of the valve at maximum rating is 63 mA. and the D.C. resistance of the speaker 2,500 ohms, the watts dissipated will be  $I^2R = 0.063^2 \times 2,500 =$

10 watts—ample for the purpose. The voltage developed across the field winding ( $0.063 \times 2,500 = 158$  volts) is greater than that required for optimum bias, which is 32; therefore the 50,000-ohm potentiometer already mentioned must be pressed to service and the grid-return circuit tapped into it at a point about one-fifth of the way from the end nearest X, that is, at a point such that 10,000 ohms is effective.

The value of the potentiometer resistance is purposely chosen at 50,000 ohms as it is then twenty times higher than that of the field winding and thus does not rob the latter of watts. To

complete the smoothing circuit a 2-mfd. condenser should be connected from X to H.T. positive.

The grid resistance  $R_2$  (which should be 5,000 to 10,000 ohms) and the 600-ohm resistance at the anode prevent parasitic H.F. oscillations at three to five metres which often cause distortion and reduced volume with modern valves of twenty watts dissipation upwards.

Correct working conditions are ensured by the use of an anode milliammeter connected as shown. The bias potentiometer slider should be moved until the meter reads the valve maker's value of anode current. An upward kick of the needle on loud passages indicates anode-bend rectification and therefore that the bias is too high, and a downward kick when R.C. coupling is used results from grid rectification by an excursion into grid current and shows insufficient bias.

In Fig. 8 a potentiometer has been added across the filament winding of the mains transformer to obtain freedom from hum. The slider is moved until a point of silence is obtained, which may vary from valve to valve. It will be seen that this component carries the anode current, and so adds to the bias to the extent of a quarter of its total resistance (since the resistance is centre-tapped the two halves are in parallel). The effect is negligible with a value of 40 ohms.

<sup>1</sup> See "Free Field Current," by F. H. Haynes, July 15th, 1931.

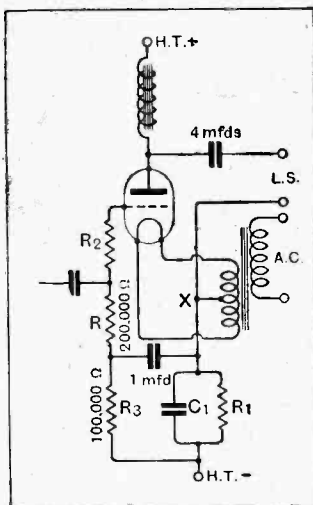
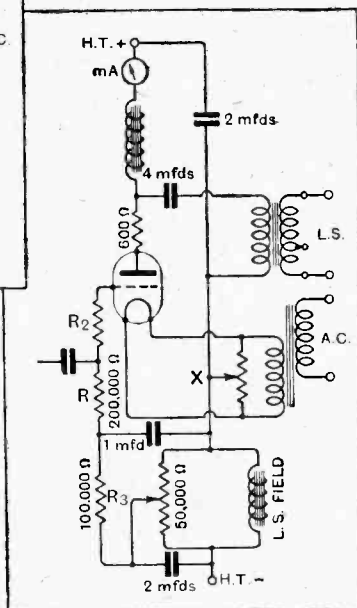


Fig. 7. (above)—Decoupling is here provided in both anode and grid circuits and the self-bias resistance is shunted with a condenser to prevent loss of power output.

Fig. 8 (right).—An output circuit with provision for free loud-speaker field current, free bias, decoupling of anode and grid circuits and prevention of anti-parasitic H.F. oscillation. There are also means for matching valve and speaker and a hum adjuster.



*Around the Show.*

IF I have walked round the Exhibition once I must have done it at least a dozen times this year, although not all on the same day. There can be no doubt that this year's show is a great advance on last year's, not only from the point of view of size, but in the matter of interest also. Sets and accessories are much better and very much cheaper than in past years.

Unfortunately, however, technical information is still lacking at many of the stands, and one is either fobbed off with a bag of childish literature or by an importunate siren, or handed a line of sales talk by a vapid youth whose technical knowledge is evidently culled from the "Radio Notes," which appear in our national "dailies."



Said it was "Colossal."

At the stand of one well-known valve maker I was totally unable to find the maximum undistorted output of several new super-power valves that were being exhibited. When I enquired the power output figure I was told that it was "terrific," and upon my gently remonstrating with the youth attending to me, he appealed to the bored-looking individual in charge of the stand, who said that it was "colossal." Enquiry concerning the optimum load elicited the fact that the output valves of this particular firm required no such thing, and the value of the load simply did not matter; "truly marvellous valves, sir," concluded the salesman, which was a sentiment with which I heartily agreed.

At another stand, which featured

*Unbiased*  
By FREE GRID.

complete receivers with pre-selection filters of a very elaborate type, I fared no better in the matter of obtaining technical information. One salesman even went so far as to assure me "that this wonderful set, sir, employs what is known as a band-pass filter, which enables it to separate the two Brookmans Park stations with ease, even in London." The pity of it is that I happen to have private information concerning this particular make of set, and know that it is of thoroughly sound design and capable of doing all that a good modern receiver can do. That particular firm must be losing a very large number of orders owing to their shortsightedness in not going to the expense of having at least one technical man on their stand.

*A Period Job.*

At yet another stand at which I stopped to make an enquiry, the salesman insisted upon dilating on the merits of the cabinet, which, he declared, was a beautiful piece of period furniture. Quite accidentally he betrayed the fact that he did not know what he was talking about,



"Period? What period?"

even in the matter of furniture, for when I asked "What period?" he looked at me with lofty contempt, and explained that good furniture was invariably described under the name of its maker, from which I gathered that he was under the impression that Period was a twentieth-

century furniture manufacturer who ranked with Chippendale and Sheraton in the matter of fame.

Gramophone motors were present in abundance this year, and I was glad to see that nearly all the baser sort of commutator motors had given place to well-designed instruments having carbon brushes properly bedded down. Automatic stops were available with most motors, and, so far as I could see, were far more reliable than hitherto. Incidentally, I may mention that a correspondent has sent me a very ingenious suggestion which I gladly pass on to



Suddenly and heavily.

inventors. Briefly, he suggests that an automatic device be produced which will close the lid of the gramophone slowly and carefully when the needle is pushed gently into the first groove of a record in the proper manner, not suddenly and heavily when it is dropped into about the tenth groove, a thing which is often done by certain Philistines who have the audacity to call themselves music-lovers.

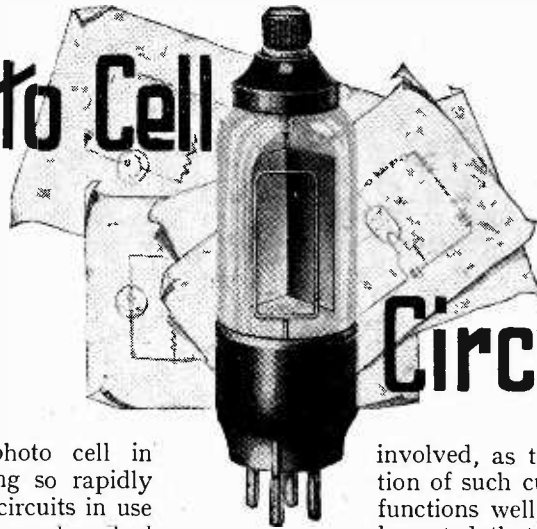
*A Happy Omission.*

The various demonstration theatres were much more numerous than last year, but I found that no improvement had been made in the matter of central heating.

The organisers of the Radio Exhibition are to be congratulated on keeping the Show free of the noisome pests who frequent other exhibitions held at Olympia, particularly the Motor Cycle Show. I refer to the slimy hangers-on who, immediately you stop to examine a motor bike or other exhibit, pounce upon you and start a sales talk. It is a relief to know that they are not tolerated at the Radio Show.

# Photo Cell

The Underlying  
Principles Simply  
Explained.



By  
R. C. WALKER, B.Sc.

# Circuits

THE applications of the photo cell in industry to-day are growing so rapidly that details of some of the circuits in use will probably be of interest. Those described are suitable for the modern caesium silver oxide cathode cell, though the remarks apply *mutatis mutandis* to the older potassium cell which the former has now almost entirely superseded.

Photo-cell circuits can be divided into two classes; the first contains those involving quantitative records, in which cases the law between incident radiation and indicated record must be known and reasonably constant, this latter condition frequently necessitating some sacrifice of sensitivity. The second contains those involving detection of light or darkness where the change from one to the other is relatively large.

Photo-electric currents being of the order of microamperes, the use of a robust relay directly in circuit is out of the question, and some form of amplification is necessary. Circuits under the second category are therefore made practicable by means of the grid glow tube or the thermionic valve, and it is circuits involving the thermionic valve we propose to discuss briefly in this article.

To be efficient, reliable, and not prohibitive in cost, the circuit must be simple, incorporate standard components, and include, if possible, not more than one valve. The obvious method of using the photo-cell in conjunction with a wireless valve is to arrange the former to control the grid potential of the valve, and include a relay in the valve anode circuit. There are two simple methods of doing this, shown respectively in Fig. 1 and Fig. 2.

Before discussing in detail the functioning of such circuits, it is necessary to understand clearly the currents

involved, as the relative magnitude and direction of such currents determine whether the set functions well, badly, or not at all. It should be noted that in the circuits shown in Figs. 1 and 2, and in any modification of them, the grid circuit of the valve is affected by currents from three sources, the first being the normal grid current of the valve due to thermions from the filament, which travel *via* the grid; the second the dark current of the photo-cell which, though quite small in the case of the older potassium cells, is partly due in the caesium cell to a thermal emission from the cathode. In some forms of electrode construction the total dark current is not a negligible factor. The third is the photo-electric current, or true cathode emission, due to the incidence of light on the cell. In darkness this is, of course, zero, and, with illumination from a gas-filled lamp, larger with the caesium type of cell than with any other type.

### Low Voltage Anode Supply.

In addition, there is also the possibility of another current path, due to leakage between the cell electrodes, either inside or outside the envelope and between grid and filament terminals of the valve. Modern valves and photo-cells are, however, so reliable that the existence of these current paths is only a remote possibility, and will not be further considered, though it should be noted that they become of greater importance the lower the current/light ratio of the photo-cell under consideration.

Fig. 2.—A second method of connecting the photo-cell in the grid circuit.

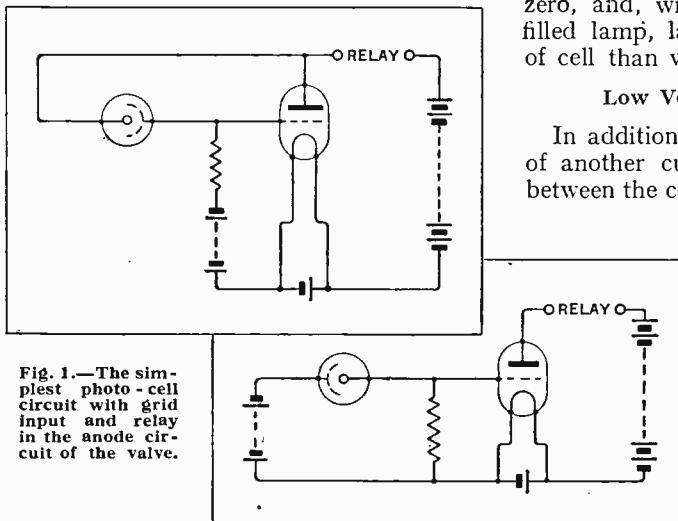


Fig. 1.—The simplest photo-cell circuit with grid input and relay in the anode circuit of the valve.

In Fig. 1 is shown the standard American practice of supplying the valve and photo-cell anode from a common H.T. supply. Current due to light on the cell in this case tends to maintain the grid at a slight positive potential. It is, therefore, necessary to incorporate a grid-bias battery to reduce the grid potential to a

**Photo Cell Circuits.**

slightly negative value and the anode current, through the relay, to zero. Light incident on the photo cell will then change the grid potential from slightly negative to positive, energising the relay coil and closing the contacts. The range over which the light change is effective can be adjusted by varying the grid bias, an increase in the negative bias decreasing the cell sensitivity to light changes. The cell, being fed from the H.T. anode supply, makes the circuit particularly useful where the voltage available is limited.

Fig. 3 shows the adaptation for a 20-volt supply, using the Osram D.G.2 valve. It is also to be noted that the condition of darkness corresponds to the condition which obtains when the valve filament circuit is opened. In consequence, if the set is to be used, for instance, for automatic control of illumination by daylight and darkness, any failure in the valve filament circuit will automatically bring the lamps on and announce the defect.

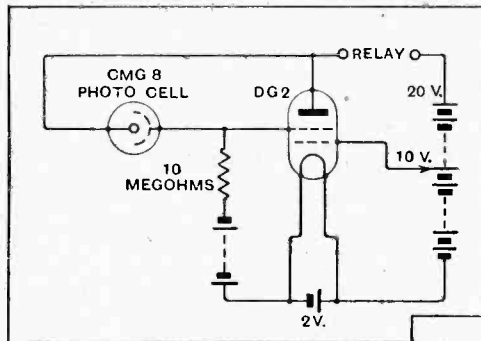


Fig. 3.—An interesting circuit for a 20-volt supply using a double-grid valve—the Osram D.G. 2.

In passing, it must be remembered that too high a voltage on the photo-cell will cause the glow discharge to pass, at which point the cell ceases to be sensitive to light changes. In addition, the glow discharge voltage varies with the light on the photo-cell, and is lower the larger the amount of light. Hence, if the light changes on the cell are large, it may be necessary to use a lower voltage tapping for the photo-cell in this circuit. In consequence, this circuit is not particularly adaptable to mains operation.

Fig. 2 depicts a circuit in which the photo-cell is connected with its electrodes reversed to that position in Fig. 1, and shows the arrangement for battery operation, a separate battery supplying the photo-cell. Although this appears an additional complication, the circuit is particularly adaptable for supply mains operation 200-250 volts. Considering Fig. 2, it will be noted that no grid bias is applied to the valve, the dark current and photoelectric current both being reversed in

direction to the normal grid current of the valve. Neglecting for the moment the presence of dark current, and considering the photo-cell to be dark, current will flow in the anode circuit of the valve. Light on the cell will cause the electron emission to flow towards the grid. As soon as this emission is great enough to neutralise the grid current, the grid becomes negative and the anode current ceases.

It should be clear, therefore, that in the case of the old potassium cells, where the sensitivity is low, the electron emission was generally too small to neutralise the grid current, and, in consequence, unless the light change was large, the set functioned badly, except where valves were selected to secure low grid current. It

should be obvious that as the amount of light in such a case required to reduce the grid current to zero is greater than that required to maintain it at zero, the set would be sensitive to light without the grid leak, but once having detected light, would depend on insulation leakage to restore the grid circuit

*SO widespread is the use of the photo-cell to-day and so allied in its principles to the wireless valve, it is felt that a description of the circuit arrangements employed will be welcome to readers. The maximum change of current in a photo-cell between light and darkness is very small and is, in fact, of the order of micro-amperes, which necessitates the use of a thermionic valve with a relay in its anode circuit for amplification purposes. Such circuits form the subject of the present article. In subsequent articles many interesting practical applications of the photo-cell will be treated.*

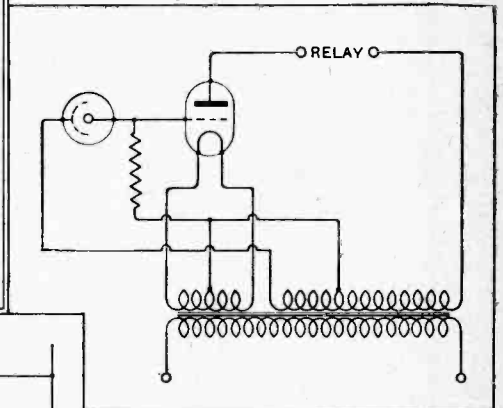


Fig. 5.—An alternative circuit arrangement for use on A.C. mains.

to its original condition—a condition which might take several seconds. The grid leak, which in the case of the potassium cell is of the order of 300 megohms, is inserted to secure quick resetting.

In some forms of electrode construction the dark current in the caesium cell is sufficiently great to make the grid permanently negative without a grid

leak when the cell is not illuminated, in which case the set does not function at all. Hence the necessity of a leak the optimum value of which is about 10-20 megohms. This is sufficient to make the set extremely quick in action, and the speed of response is limited only by the inertia of the relay armature, and not by the time constant of the grid circuit. Decreasing the grid leak reduces the sensitivity of the set to light and can be used as an alternative to covering the photo-cell with an adjustable diaphragm.

Fig. 4 shows the simplicity of the circuit when adapted

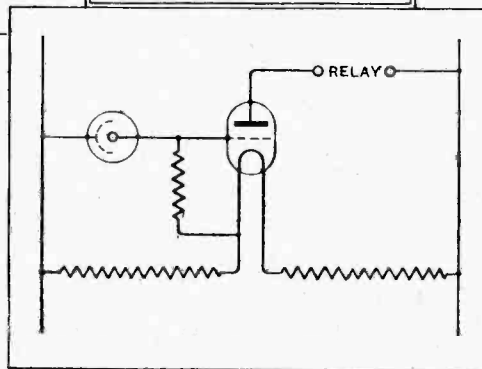


Fig. 4.—When operated from mains the photo-cell circuit is extremely simple.

**Photo Cell Circuits.**

for mains operation. The valve, a suitable type being the Osram P.610, has its filament in series with two resistances, the sum being that required to pass the necessary filament current, the ratio adjusted so that the anode voltage does not exceed that permissible for the particular valve. It may also be noted that this arrangement functions on A.C. circuits without any rectifying or smoothing apparatus, providing the relay is sensitive. In this case the positive half of the wave is effective in operating the set, the photo-cell and valve being self-rectifying, and the current pulses through the relay being unidirectional, of a frequency equal to that of the A.C. supply.

The satisfactory operation of the circuit in Fig. 4 makes Fig. 5 possible for A.C. mains working. The fact that the circuit of Fig. 4 functions equally well, irrespective of the type of supply, makes it in general preferable to that of Fig. 5, although it has a power consumption amounting to 20 watts.

In all these circuits a three-contact relay is desirable, so that light on the photo-cell can switch the external mechanism on or off as required. Increased sensitivity to feeble illuminations can be obtained by a small "priming" light with independent filament current control, and incorporated in the set. Maximum sensitivity can only be obtained by battery operation, the mains voltage variation being the limiting factor.

## GRID CIRCUIT DECOUPLING.

Avoiding a Loss of Bass in the Bias Resistance.

THE necessity for adequate grid circuit decoupling is often overlooked when designing L.F. circuits. The need for it has been pointed out in the pages of this journal, but due to the fact that its omission does not usually cause motor-boating it is often considered to be an unnecessary refinement.

The circuit of an output valve is shown in the illustration at (a) with no decoupling, and at (b) with full grid decoupling. The A.C. speech currents in the anode circuit of the valve have to pass through the bias resistance  $R$ , and there is consequently a voltage drop across it, which in the case of circuit (a) is communicated to the grid of the valve, resulting in feed-back.

needed if feed-back is to be avoided. The feed-back under normal circumstances, therefore, increases with a decrease in frequency, and as the phase of the feed-back voltages is such that the tendency is to reduce the amplification, it is found that the result of using the arrangement of (a) with a 1 mfd. or 2 mfd. condenser for  $C$  is a very distinct loss of bass notes. Frequencies below about 150 cycles are progressively attenuated, and a note of 50 cycles may easily be reduced to one-tenth of its proper value.

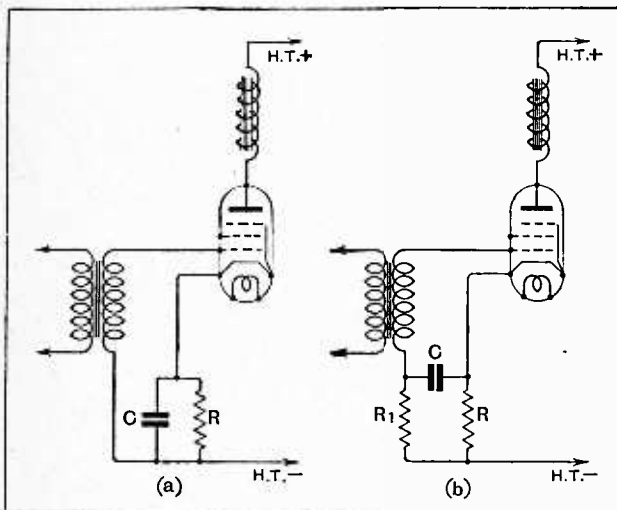
By inserting the decoupling resistance  $R_1$ , this feed-back may be avoided and full amplification of the bass obtained. The value of the resistance must be much higher than the reactance of the condenser at the lowest frequency. It has been found that a resistance of 100,000 ohms with a condenser of 1 mfd. is quite effective for frequencies down to about 30 cycles; the value chosen, however, is not at all critical, and a 0.25 meg. grid leak will prove perfectly satisfactory.

### Positive and Negative Feed-back.

It should be noted that in some cases the addition of grid circuit decoupling to a receiver may lead to motor-boating. This curious state of affairs is due to insufficient anode circuit decoupling, and the remedy is obvious. In such a receiver two types of feed-back are present, a positive feed-back in the anode circuits tending towards motor-boating, and a negative feed-back in the grid circuits tending towards anti-motor-boating. The net result, of course, is that the receiver is stable, although employing a minimum of decoupling material.

Provided that the receiver is carefully designed and that facilities are available for measuring the overall response curve, such a procedure is quite legitimate, and the omission of grid circuit decoupling will not necessarily result in a loss of bass, for it may be balanced by increased bass amplification in another portion of the set. Where no facilities are available for measuring the receiver response, however, the only safe course is to adopt extensive decoupling in every circuit.

W. T. C.



An output stage (a) without and (b) with grid decoupling.

The condenser  $C$  shunted across the bias resistance is intended to obviate this, but it will only be effective if its reactance is extremely small. Now the reactance of the condenser depends upon frequency, and although quite a small condenser will be effective for the upper audible frequencies, at 50 cycles about 12 mfd. is



# Broadcast Brevities

By Our Special Correspondent.

## American Relays.

The 7-metre complex has not gripped the B.B.C. engineers to such an extent that they are losing interest in the not unexciting short wavelengths around 20 and 30 metres. So far as broadcasting is concerned, the short wavelengths are only half tamed, as one can see from the formidable array of experimental apparatus which has arrived at Tatsfield in preparation for the winter relays from America.

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## Spaced Aerials at Tatsfield.

In addition to the receivers an interesting "lash-up" aerial system has been arranged very much on the lines of the spaced aerials which have been in use for two winters at Terling, near Chelmsford. At Tatsfield, however, the aerials (there are two of them) are vertical, and are rigged in such a way that the distance between them can be varied to suit any particular wavelength. Mr. Partridge, the famous ex-amateur "world-beater," who is now in charge at the B.B.C.'s official receiving station, is hopeful that the American transmissions will soon be romping in better than ever before.

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## Oh, Yeah?

By the way, I feel sure that these efforts to make American voices audible over here are not made with the convenience of the B.B.C.'s pronunciation experts. This is just another instance of the many-sidedness of the Corporation's work.

The right hand at Savoy Hill little knoweth what the left hand undoeth at Tatsfield.

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## Food for Thought.

Listeners' mouths will water during the North Regional relay from Buxton on October 3rd, for the occasion will be the banquet of the British Hotels and Restaurants Association.

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## North Region Plans.

Thanks to the collapse of the B.B.C.'s original economy scheme to cut out all provincial programmes, Mr. Edward Living, the Northern Regional Director, will have something to talk about on Monday next when he outlines to the Moor-side Edge listeners the plans for the coming winter.

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## Outside Broadcasts.

The outside broadcasts which have been so strong a feature of the North Regional programme this summer will undergo a change during the next few weeks, owing to the fact that many of the sources—such as seaside concert parties—will be drying-up.

That will not mean an end to "O.B.s" of this sort in the Northern programme,

however. The orchestras at St. Anne's-on-Sea and at the Imperial Hotel at Blackpool will continue to broadcast during the winter.

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## "Flying Squad" at Manchester Tattoo.

Arrangements are being made for the regular relaying of variety turns from theatres in the North of England, and a big job for the "Flying Squad" of O.B. engineers in the North will be a broadcast of the tattoo at Belle Vue, Manchester, on October 1st.

o o o o

## Does Scotland Lack Talent?

"There is not sufficient Scots material or Scots talent of high order to justify our increasing to any great extent the space allotted to Scottish material in our programmes."

This from Scotland itself, in a speech broadcast from all Scottish stations the other day by Mr. Cleghorn Thomson, the B.B.C.'s Scottish Regional Director.

o o o o

## The Scotsman's Dilemma.

I gather that the situation is not quite so serious as it sounds. Actually Mr. Thomson has to deal with two types of listener north of the Tweed. One type of Scot is constantly fretting at the inclusion

of Scottish items, not because they are uninteresting, but because he may be missing something better on the National!

The other type bewails the fact that the transmissions are not 100 per cent. Scotch, and to these Mr. Thomson addressed the remarks referred to above.

o o o o

## Better Days Ahead.

There seems little doubt that Scottish broadcasting is on the up grade after a period of depression during which neither the programmes nor the conditions of reception have given satisfaction. Mr. Thomson promises his flock that the new Falkirk transmitter will be operating when he gives his next autumn talk.

The only danger in extending the broadcast horizon is that more people will be given an opportunity to grumble.

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## General Smuts at the Microphone.

The presidential address by General Smuts at the British Association meeting at the Central Hall, Westminster, will be relayed to National listeners this evening (Wednesday).

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## What "H. G." Would Do About It.

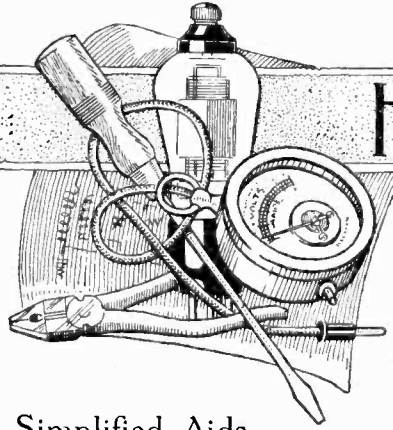
I think we are in for as big a batch of thrills in the forthcoming "What I Would Do with the World" talks series as in any detective novels yet written.

On Monday next, September 28th, Mr. H. G. Wells will start the series with his own reflections on the topic; and knowing something of Mr. Wells's philosophy, I fear that he has been put at the wrong end of the series. I hate anti-climax.



5-METRE TRANSMISSION IN U.S. "Outside broadcasting" in America involves a good deal of pure wireless work before the commentator's remarks reach the landlines. Our picture shows the National Broadcasting Company's new 5-metre transmitting and receiving equipment as used for the first time recently in reporting the American Open Golf Championship.

# Practical Hints & Tips

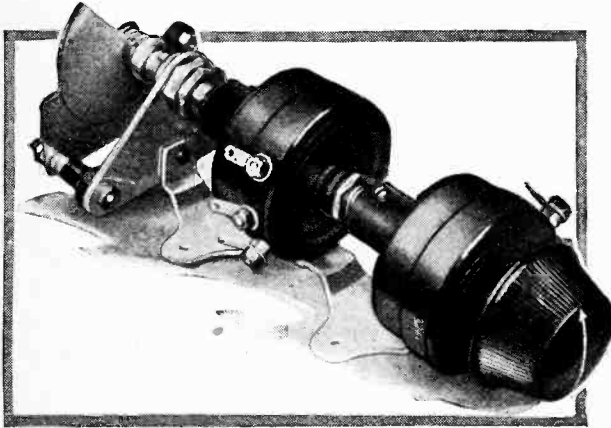


**S**INGLE-KNOB tuning is now widely used, but comparatively little attention seems to have been paid to the possibilities of mechanically linking together some of the subsidiary controls of a

## GANGED CONTROL ELABORATIONS.

receiver. True, a good start has been made in many commercial sets by fitting combined radio and gramophone volume controls, and in some cases ingenious double-acting sensitivity regulation is included in the new season's receivers; the latest *Wireless World* superheterodynes also embody a duplex method of volume control, whereby H.F. input and I.F. amplifier sensitivity are varied simultaneously.

But there are many other directions in which this principle might advantageously be applied. For instance, many variable condensers have a rotor spindle with two projecting ends; one of these is, of course, occupied by the drive mechanism, but the other is normally



A suggestion for duplex volume control combined with tuning compensation: Varley ganged potentiometers linked with a small variable condenser.

free, and would seem positively to invite the attention of those who do not object to minor complications if they are likely to bring about an improvement in performance.

## Simplified Aids to Better Reception.

This free end of the spindle might be made to drive some simple form of automatically variable aerial coupling, such as a rotary coil, or, more simply, a variable feed condenser, matters being so arranged that coupling is maintained, over the whole tuning scale, at a value much more nearly approaching optimum than that offered by the ordinary fixed coupling, which must always be determined on a basis of compromise. It is not beyond the bounds of possibility to introduce an increasing reaction feedback with increase of wavelength, thus compensating for the natural tendency of a set with an S.G. high-frequency valve to become relatively insensitive at the upper end of the wavelength scale.

Every form of pre-detection volume control introduces some disturbance of tuning; although this may be so slight as to be unobjectionable in many cases, it is often possible to improve matters, particularly when band-pass tuning is employed, by linking a compensating condenser to the spindle of the regulating device, whether it be a resistance, a capacity potentiometer, or a simple series condenser. A good

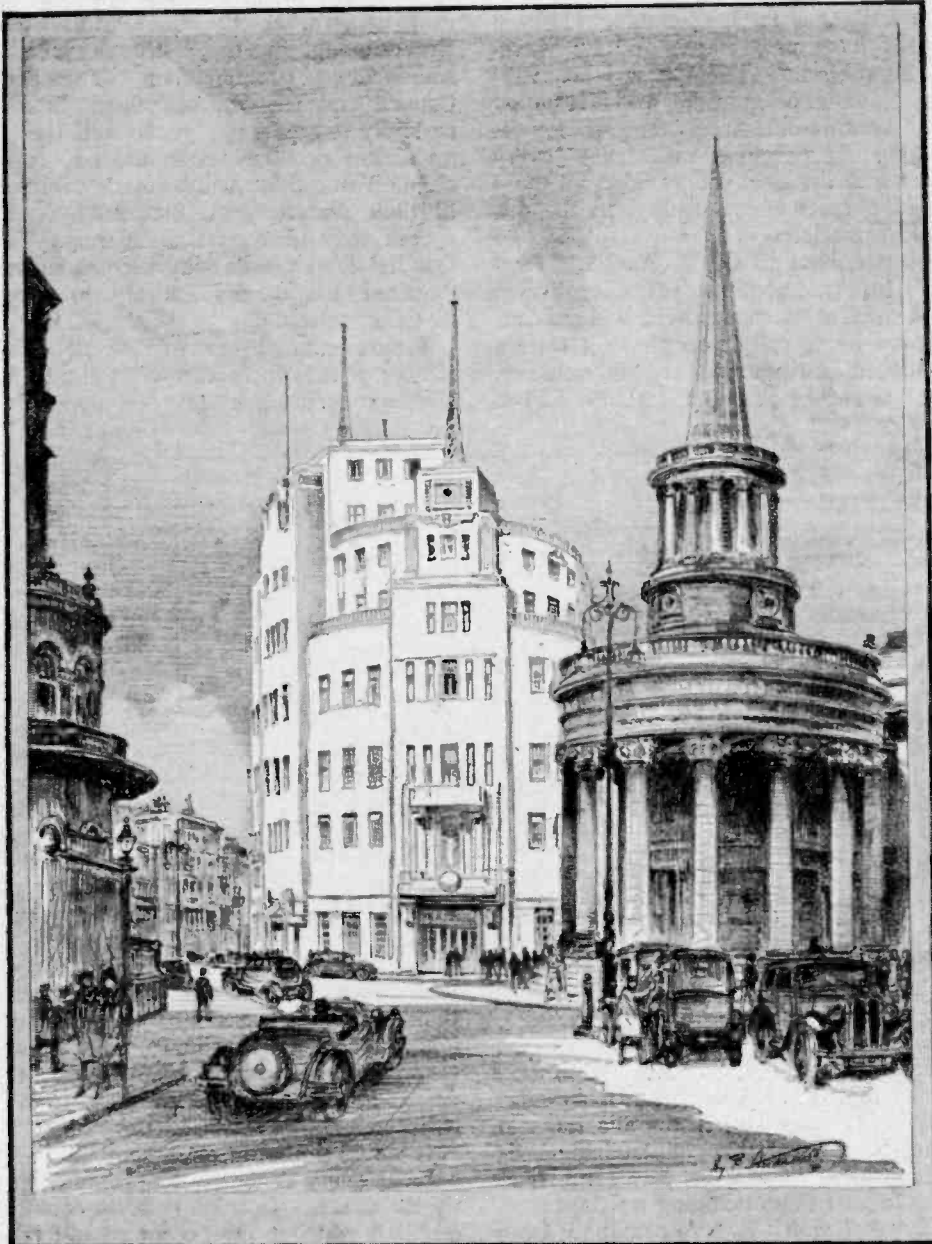
deal of patience is necessary to ensure perfect operation, and it may be necessary to modify the plate shape of the compensating condenser. It should be pointed out here that, by adopting the latest idea of "segmented" end vanes, it is possible to obtain, within limits, any condenser "law" that one may need, and, further, that the necessary amount of bending of the various segments can be determined by trial and error. A suitable condenser with one fixed and two moving vanes can easily be re-assembled from the parts of a commercial component.

## DIFFERENTIAL REACTION CONVERSION.

When replacing a reaction control condenser of the ordinary type by a differential condenser, it is almost always permissible—and often necessary—to use a component with a slightly higher capacity than originally. This is because the earthed section of the three-element type of condenser introduces a by-pass effect, thus reducing the amount of energy fed back through the "live" section at all settings of the rotor vanes except at maximum capacity.

When attempting to cure "threshold" H.F. instability — which manifests itself as uncontrollable self-oscillation at the lower end of the tuning scale—at least one simple expedient seems sometimes to be overlooked. Especially when parallel-tuned-grid coupling is employed in a receiver of modern construction, it will often be found that complete stability can be attained by screening the H.F. valve itself in one of the convenient metal containers that are now available commercially.

## A CURE FOR INSTABILITY.



*Specially drawn for "The Wireless World" by H. B. Andrews.*

**"BROADCASTING HOUSE."**  
*In this glimpse from the northern  
end of Regent Street our artist  
provides a study in contrasts, the  
new and strange dominating the  
old and familiar.*

## ~..~..~ THE ATTACK ON DIALECTS ~..~..~

WHEN all the Regional stations are finished, we understand that, as far as possible, each will transmit its local programme on one wavelength, while the alternative wavelength will be available for the general National programme, and it is hoped that the B.B.C., bearing in mind that it is the *British* Broadcasting Corporation, will use every endeavour to preserve in the local programmes all those turns of speech and phrases which distinguish the different parts of the British Isles.

The professor of phonetics in G. B. Shaw's "Pygmalion" could tell in a moment the exact locality in which every casual speaker he encountered had resided. This may or may not be actually possible, but certain characteristics of speech and inflexion are still common to various parts of Great Britain and Ireland, and it would be almost a national calamity if they were to be ironed out and reduced to the dead level of the B.B.C. standard pronunciation of English.

Classical drama would lose much of its effectiveness were such characters as Glendower, Sir Hugh Evans, or Sir Lucius O'Trigger to adopt the style of a southern pedant; indeed, a recent broadcast performance of "The Tempest" was, in our opinion, somewhat marred by the cultured tones in which Caliban's lines were spoken—a tribute, doubtless, to Prospero's early tuition, but sounding somewhat incongruous from the offspring of Sycorax.

But, in all seriousness, we are apprehensive lest the standardised English adopted by the B.B.C. announcers may eventually oust the native dialects and characteristics which impart a pleasing and distinctive tinge to the speech of different parts of this country—the little upward inflexion which marks a Welshman (and, incidentally, enables us to hear the concluding words of each sentence), the soft "ah" which falls so coaxingly from the lips of an Irishman, or the trilled "r's" of a Scot. "Desolate" and "pliable" are but poor, trite equivalents for the good Cornish words "whist" and "suent"—and the Lincolnshire "sloom" cannot exactly be translated into "idle" or "loaf."

There are already societies whose laudable aim is the preservation of folk-lore and dialects, and their efforts may in some measure counteract the present tendency towards the merging of distinctive speech into one indistinguishable uniformity. It would indeed be regrettable if broadcasting were to stultify their endeavours. We

are, therefore, somewhat doubtful about the experiment now being tried, by the Central Council for School Broadcasting, for the instruction of school-children in standardised pronunciation. The Secretary for the Council and Director of School Talks for the B.B.C. certainly stated that it is not the intention "that all dialect peculiarities should be suppressed, but that children who listen will be made conscious of the defects of their dialect, and, incidentally, of the defects of speech they hear on the American Talkies"; but we fear lest the children may become so imbued with standardised English as entirely to forget their native dialects.

From a musical point of view alone the broader vowel sounds of the North and West should be preserved, as a singer accustomed to good open "aw's," "ay's," and "ah's" has a decided advantage over one who constantly hears these primitive vowel sounds pinched until—as is so often the case with London church choirs—the words "For Thy name's sake" are sung almost as "For Thee neeme's seek."

Broadcast programmes have now become almost an essential part of our daily recreations, and should, therefore, be regarded as a valuable medium for keeping united the dwellers in our cities and dales. The country man whom fate compels to toil for his daily bread in the heart of a busy city welcomes with joy,

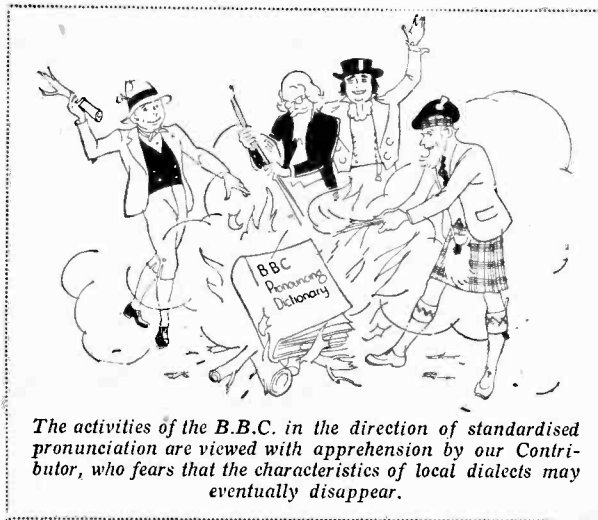
though perhaps a feeling of homesickness, the accent or idiom of his native county, and, conversely, those in remote districts feel less isolated when they can hear the doings of busier centres, or music from the best concert halls.

It would probably be difficult to find two people who agree in every case with the pronunciation recommended by the B.B.C. Opinion is fairly equally divided on the question whether the accent should fall on the first or the second syllable of "applicable," and a north-country man does not pronounce such words as "castle" in the same manner as a southerner.

The B.B.C. has exceptional opportunities for using its undoubted influence in preserving from destruction the dialects, idioms, and folk-lore of the British Isles, and in averting such a disaster as the merging of all the tongues of Great Britain into the dialect of Oxford University, seasoned, perhaps, with imported Americanisms.

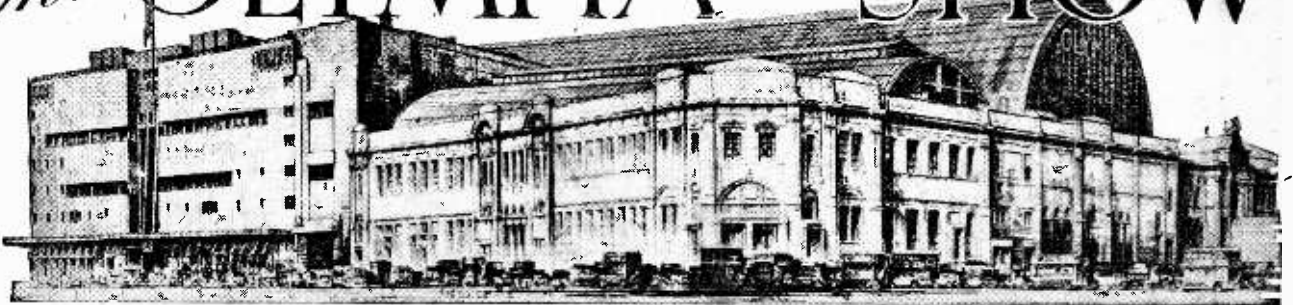
W. H. M.

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*The activities of the B.B.C. in the direction of standardised pronunciation are viewed with apprehension by our Contributor, who fears that the characteristics of local dialects may eventually disappear.*

# The OLYMPIA SHOW



Illustrated Report Compiled from Stand-to-Stand Visits.

LAST week, in the first of our three special Show Numbers, we gave a forecast of Olympia, endeavouring, from early information which we obtained, to indicate the general trend of development as revealed at Olympia this year, but we emphasised that no forecast prepared in advance of the opening of the Show could be comprehensive, nor indeed would it be possible for us to attempt to give our readers a satisfactory account of the Show until we had seen it ourselves.

The *Wireless World* Stand-to-Stand Report is unique, for whereas other special show numbers published in advance of the opening of the Exhibition are subject to the same handicap as our own Forecast Issue, our Stand-to-Stand Report which follows this introduction has been entirely compiled by the technical staff of *The Wireless World* after the opening of the Show from first-hand information obtained from personal visits to every stand. The photographs illustrating this report were also taken specially at Olympia by our staff photographers inside the Exhibition.

### The Best Show Yet.

In the introduction to our Forecast of last week we said that we expected that this year the Exhibition would prove to be by far the most interesting of the nine annual shows held in this country, up to date. A visit to the Show after the opening fully confirms this impression, for not only is the Exhibition bigger and brighter in every way, but the variety and excellence of the products on view is a revelation even to those who have grown accustomed to the steady improvement in design which has been taking place during the past year or two. In spite of this advance in quality and also in

appearance prices have come down to a remarkable extent, and certainly Olympia, 1931, offers a finer value in all-the-year-round entertainment and interest than it is possible to conceive from any other source.

Although our Show Report in the following pages has been prepared with a thoroughness of which we think we are entitled to be proud, yet we must confess that no report can really do full justice to such an Exhibition. It is a Show which everyone interested in wireless should

see for himself. Especially is it important that the visitor should make a point of entering the various audition rooms where demonstrations are held.

### The Demonstrations.

Many of the demonstrations are outstandingly good, and in addition, as in the case of the Marconiphone demonstration in particular, of very special interest by reason of the clever way in which some of them are staged.

We hope that every reader of *The Wireless World* will be able to pay a visit to the Exhibition, and having done so, his next task will be to complete our Competition Ballot Form, and so let us know what, in the opinion of our readers collectively, are really the best products at Olympia.

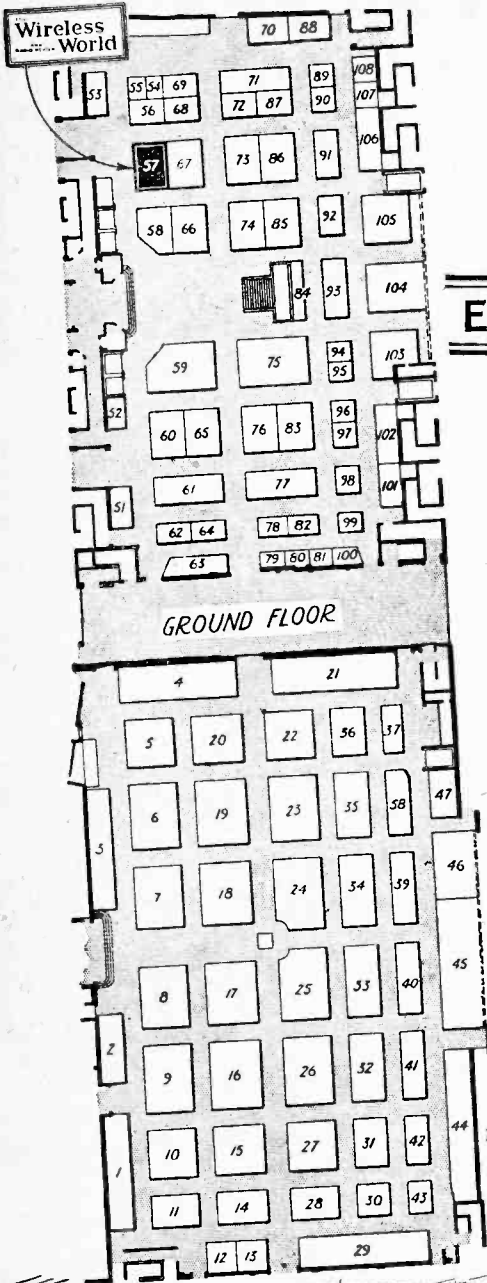
This occasion ought not to pass without a record of congratulation to the organisers of the Exhibition—the Radio Manufacturers' Association—who have produced what is without doubt the finest radio exhibition which Europe at least, and perhaps the world, has yet seen. We hope, too, that the manufacturer will be rewarded in his efforts by a keen demand for the products, exclusively of British manufacture, which Olympia displays.

11 a.m. to 10.30 p.m. Daily.  
Closes September 26th.

### AUDITION ROOMS AT OLYMPIA.

The following firms are conducting demonstrations in specially constructed soundproof rooms on the first floor of the National Hall :—

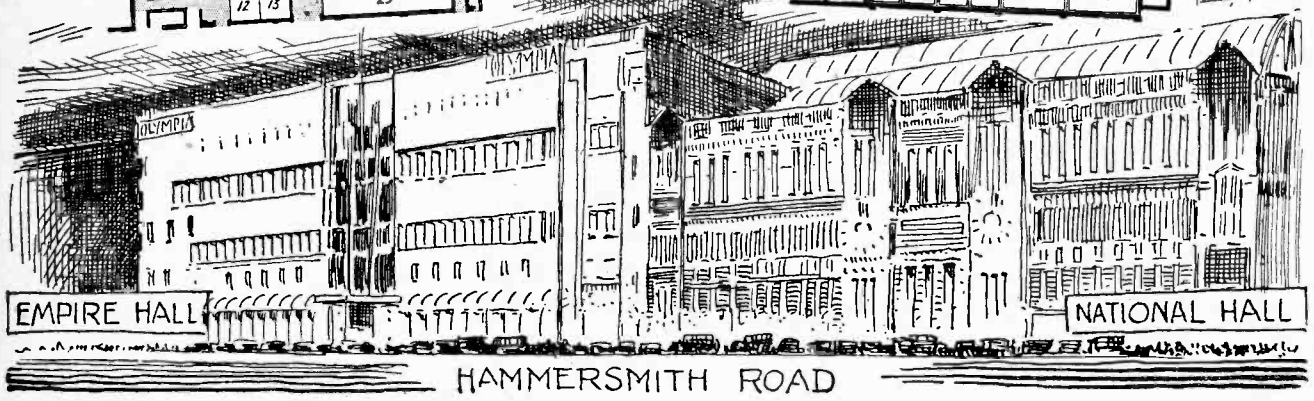
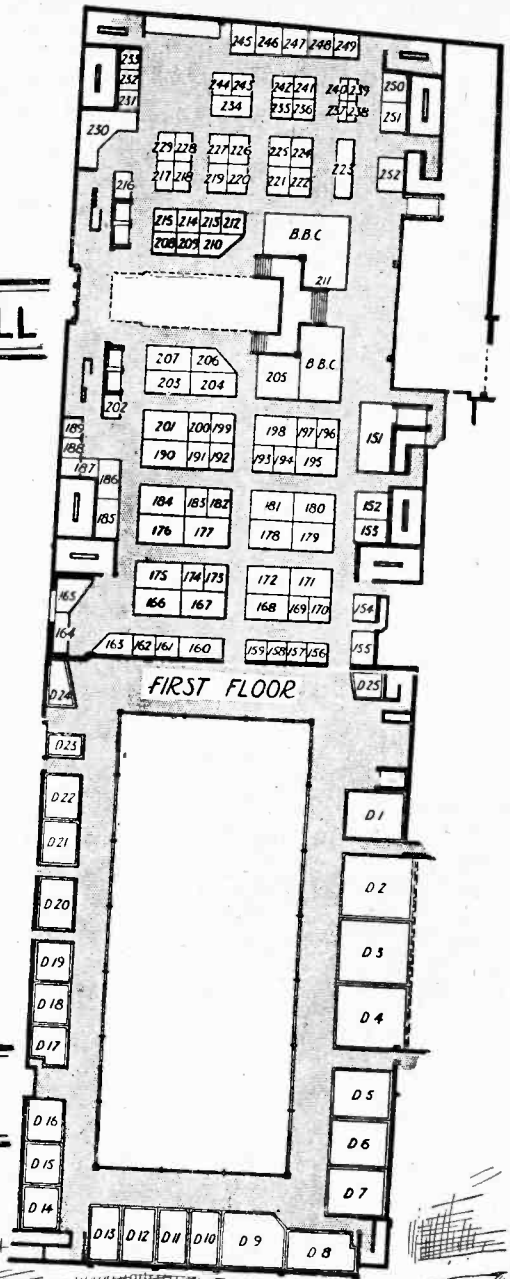
	Room No.
Baker's Selhurst Radio ..	D 23
British Blue Spot Co. Ltd. ..	D 22
British Rola Co. Ltd. ..	D 10
Celestion Ltd. ..	D 9
Cole Ltd., E. K. ..	D 4
Columbia Graphophone Co. Ltd. D	2
Edison Bell, Ltd. ..	D 25
Fay Home Recorders, Ltd. ..	D 7
General Electric Co. Ltd. ..	D 8
Kolster-Brandes Ltd. ..	D 5
Lamplugh Ltd., S. A. ..	D 20
Lissen Ltd. ..	D 6
Lotus Radio Ltd. ..	D 1
McMichael Ltd., L. ..	D 14
Marconiphone Co. Ltd. ..	D 3 & D 24
Radio Gramophone Development Co. Ltd. ..	D 15
Ready Radio Ltd. ..	D 11
Speakeasie Home Recorders Ltd. D	17
Synchrophone Ltd. ..	D 16
Ultra Electric Ltd. ..	D 18—19
Varley (Oliver Pell Control) Ltd. D	21



EMPIRE HALL

OLYMPIA 1931

NATIONAL HALL

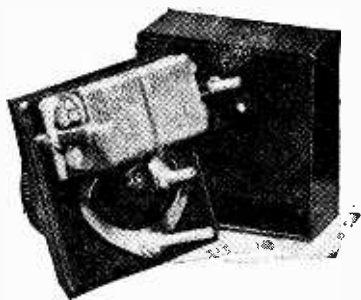


# STAND-TO-STAND REPORT



## A.E.D. (159)

A portable electrical gramophone is something a little out of the ordinary, and represents an attempt to convey the undoubted advantages of electrical reproduction into the sphere of the ordinary gramophone. A balanced armature speaker is fitted into the lid, and the two-valve amplifier and batteries are fitted into the main body of the instrument, in addition to the spring-driven motor. The A.E.D. "Beta" pick-up is fitted, together with a volume control, and the price complete is 11 guineas.



The A.E.D. gramophone fader.

The "Beta" pick-up itself is available at 30s., and is supplied complete with tone-arm, while the A.E.D. log-law volume controls occupy a prominent position. These are in the form of potentiometers, and their construction is unusual in that it consists of thin slices of resistance material assembled between brass plates, on the edges of which the moving arm makes contact. A four-terminal model, known as the fader, has a tapping at the centre of the resistance and is useful in affording a smooth change-over between two pick-ups. The resistance is 500,000 ohms on either side of the centre tap, and the price is 10s. 6d.

*Auto Electric Devices, Ltd., Diamond Works, Brighton, Sussex.*

## ADIE: (169)

On this stand will be found dry batteries for every wireless purpose. H.T. batteries are available in three different capacities, for various receiver requirements. A new range of inexpensive batteries is also shown, and one of the most interesting of these is the 66-volt size, which is priced at 5s. 3d. Great recuperation

and a long life are claimed for these batteries.

*Adie and Co., Ltd., 2, Aldermanbury Avenue, E.C.2.*

## AMPLION. (75)

The "Amplion Six," an all-mains A.C. set with built-in moving-coil loud speaker, is an exhibit that is attracting great interest. The receiver has a band-pass filter between the aerial and the first grid, followed by two stages of high-frequency amplification using the new multi-mu valves, a power detector, and a push-pull output stage. The sixth valve is, of course, the rectifier. Although an aerial is required if reception from foreign stations is needed, the local stations can be received very satisfactorily on the small capacity aerial fitted within the cabinet. Apart from a trimmer in the aerial circuit—and this is one to be adjusted when the set is installed, not one to be reset for every different station—the whole tuning is controlled by a single slow-motion drive which turns a dial graduated in wavelengths. The wave-range switch and the volume control bring up the total of knobs to three, but there is in addition a local-distance switch, changing over from power grid to anode band detection, situated at

the back of the chassis. A photograph of the front of this set was included in our "Show Forecast" last week; the accompanying illustration shows more intimate details of the receiver. It will be observed that the two screen-grid valves project through the metal baseboard; by this means wiring is shortened and screening improved, both tending to increase the amplification available. The two 8-mfd. electrolytic condensers suggest very complete smoothing. The price, as a table model, is the surprisingly low one of twenty guineas.

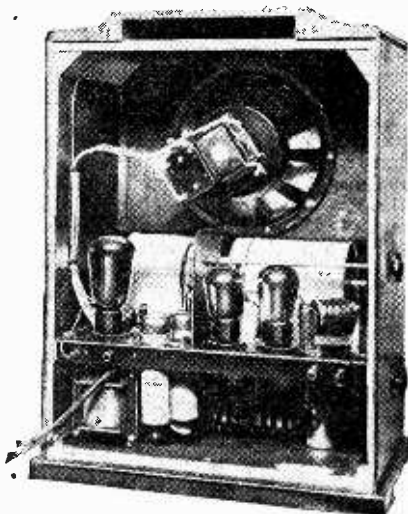


Amplion type M.C.6 permanent-magnet moving-coil loud speaker unit.

The Amplion range of sets is completed by three self-contained sets with built-in frame aerial and speaker; one of these, the "A.C. Mains Transportable," can be had either with moving-coil or balanced-armature speaker; the other two, driven by batteries, are normally fitted with balanced armature speaker only.

The selection of speakers is, as always, a wide and interesting one, ranging from a new version of the "Guinea Cone" at the attractive price of 15s. to a big permanent magnet moving-coil speaker at ten guineas. The energised moving-coil speaker, as used in the Amplion Six, is available as a unit at a very reasonable price.

*Graham Amplion, Ltd., St. Andrew's Works, Slough, Bucks.*



Interior view of the Amplion Six receiver.

**Stand-to-Stand Report.—****ARDING & HOBBS. (171)**

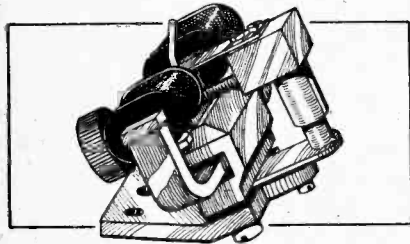
This firm of retailers is showing a range of receivers by the principal manufacturers, in addition to the Munt concert reproducer and amplifier. The receiver portion consists of a screen-grid H.F. stage with band-pass tuning, a power grid detector, and a single L.F. amplifier which feeds two D.A.60 valves in the output stage. The price is 100 guineas, and the gramophone equipment includes an electric motor, pick-up, and automatic record changer. It is interesting to note that the G.U.1 mercury arc rectifier is used to provide the H.T. supply.

This firm is also showing the Synchro-Talkiephone for making home talking pictures; the price is 25 guineas.

*Arding and Hobbs, Ltd., 315, Lavender Hill, S.W.11.*

**ARTAVIAN. (217)**

This firm is showing a range of loud speakers in which is fitted the Artavian unit. This is a single-acting reed movement incorporating a number of novel features. When mounted in position the armature is inclined at an angle to the axis of the cone diaphragm, which, in conjunction with the special method adopted of fixing the reed, imparts to the diaphragm a motion approaching very near to a piston-like action.



Artavian loud speaker unit.

Provision is made for the easy replacement of coils and magnet should at any time it be necessary to change these. The D.C. resistance of the coils is 600 ohms, and the windings will carry a steady D.C. current of 15 mAs.

The various models shown range in price from 32s. 6d. to 50s.

*Shapland and Petter, Ltd., Raleigh Works, Barnstaple.*

**ATALANTA. (191)**

On this stand is shown the well-known Atalanta screwdriver, which can be supplied fitted with detachable box spanners to fit the usual size of B.A. nuts. This is a particularly useful component, as it allows of nuts in awkward corners being readily tightened.

A new exhibit is a pair of special pliers which are designed for holding nails or tacks, while they are being hammered in. There is thus no risk of damage to one's fingers. The pliers may also be used for holding screws during the early portion of their insertion; owing to the

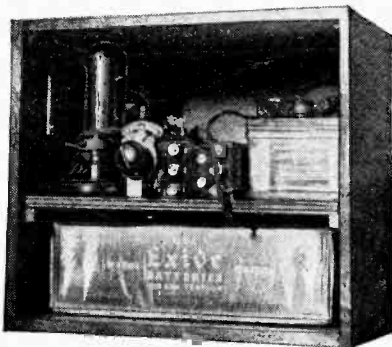
particular shape in which they are made, they may be held flat against a wall. They are priced at 3s. 6d.

Other Atalanta tools are shown, and these include drilling jigs, a chuck, and sets of buttons for the jig.

*Atalanta, 1-3, Brixton Road, S.W.9.*

**AUDIOVISOR. (226)**

This stand is devoted exclusively to a display of constructors' kits in which a highly sensitive light cell can be used. These include burglar alarms, automatic lighting circuits, signalling, and a host



Audiovisor Raycraft kit assembled in portable case.

of other uses dealt with fully in the literature accompanying the "Raycraft" kits. The price is £3 17s. 6d. complete.

*Audiovisor, Ltd., 28, Little Russell Street, W.C.1.*

**AUTOMATIC COIL WINDER.**

(207 & 208)

This firm have for long specialised in the development and production of automatic coil-winding machinery of the hand- and power-driven types. Hitherto it has been the practice to embody the electric motor in the winder, or arrange for it to be mounted in close proximity, and transfer the drive through a countershaft with different size pulleys, giving the choice of various speeds. This arrangement is adopted in the case of the "Douglas" No. 4 model.

The latest development, which is embodied in one of the "Macadie" coil-winders, is that provision has been made to drive the machine off a shafting. Where a large number of winders are required this will lead to a considerable saving in initial cost, since one motor will drive all the machines, or, alternatively, they could be run off the main shafting in the factory.

The "Macadie" range are entirely power-driven, one of the latest models accommodating any size of coil from 1/4 in. to 5 in. in length, and up to 4 in. in diameter. Winding can be done at any speed up to 6,000 revolutions per minute. It winds wire of any gauge from 50 S.W.G. up to 26 S.W.G., measures the length of wire, and records the number of turns.

The now well-known "Avometer" is shown in exactly the same form as last

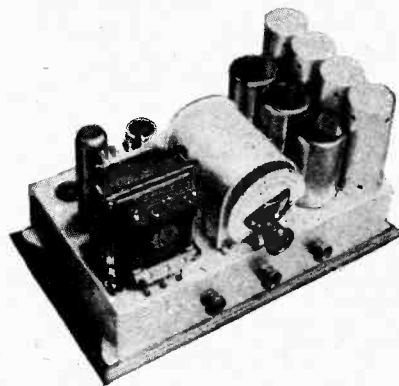
year, the demand for this versatile instrument being so great and its scope being so wide that there would seem to be no particular need to modify the design.

*Automatic Coil Winder and Electrical Equipment Co., Ltd., Winder House, Douglas Street, S.W.1.*

**B. & S. ELECTRICAL. (181)**

Superheterodynes form one of the principal exhibits on this stand; there is a six-valve portable with separate first detector and oscillator using triodes, and a two-stage screen-grid intermediate-frequency amplifier tuned to 126 kc.

A larger seven-valve superheterodyne is available in several different styles of cabinet work; this is the Spencer receiver and is being shown on this stand. The set is built on a cellulose-sprayed aluminium chassis, and the oscillator tuning condenser is gauged to those of the signal-frequency circuits in order to give single-control operation. The standard wave-range is from 250 metres to 2,000 metres, but for an extra cost of 5 guineas the set can be arranged for ultra-short wave reception.



The 7-valve Spencer superheterodyne; B. & S. Electrical.

The price for the complete receiver in midget form is 25 guineas, and as an all-electric radio-gramophone 39 guineas. It is understood that the screen-grid valves fitted to the latest models are of the variable-mu type, a pentode is used in the output stage.

*B. & S. Electrical Co., Ltd., 9, Brunswick Place, City Road, N.1.*

**BAIRD TELEVISION. (157)**

As might be expected, the Baird Television occupies a prominent position on this stand. The complete instrument, which is connected to a receiver in place of the usual loud speaker, is priced at 18 guineas, and is housed in a brown metal case. The size of the picture is about 3 in. by 4 in. For those who prefer to build their own equipment, a kit of parts is available at 12 guineas, and this includes the motor and synchronising gear, together with the lenses, neon lamp, disc, and various resistances. The components are also available separately.

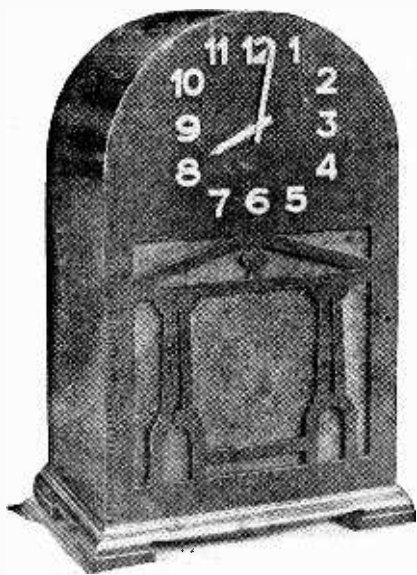
*Baird Television, Ltd., 133, Long Acre, W.C.2.*



**Stand-to-Stand Report.—**

**BAKER'S "SELHURST." (216)**

This firm specialises in moving-coil speakers of robust construction, designed primarily to give the highest efficiency and best quality of reproduction that can be



An effective novelty; the Baker "Klock" speaker.

attained. Claims made for high sensitivity are borne out by the N.P.L. measurement of flux-density, which was found to be 19,100 lines per square centimetre in the central portion of the gap; leakage-flux is not included in this figure.

Three main designs of energised speakers are made: the "Super-Power," "Standard," and "Popular" series, each of which is available in several forms to fill all needs. In every case the coil is specially wound to suit the particular output valve that the prospective purchaser intends to use, thus ensuring the most satisfactory performance. High-resistance coils are favoured, though low-resistance coils, entailing the use of an output transformer, can be had.

There are also three permanent-magnet speakers, each of which, like the energised models, can be had adapted for triode or pentode output.

The "Klock" speaker illustrated contains a special permanent-magnet speaker, with variable tone control, and a clock driven by a self-starting electric motor, the rate of which is controlled by the frequency of the mains. Where frequency-controlled A.C. is available, this is probably the most accurate type of clock short of a certified chronometer. Where the necessary controlled mains are not available, a "Bulle" battery-driven clock can be substituted at the same price of £12.

*Baker's Selhurst Radio, 89, Selhurst Road, S. Norwood, S.E.*

**BÉAVER. (165)**

H.F. chokes of the slotted-former type are one of the chief components shown on

this stand; the Major is priced at 3s. and the Minor at 1s. 9d. A binocular choke of the air-core type at 2s. is also shown. A gramophone pick-up of particularly light weight is priced at 7s. 6d.

In addition to the above Elite components, there is also a range of receivers and components which are factored by this firm.

*Beaver Electrical Supply Co., 5, Great Chapel Street, W.1.*

**BECOL. (153)**

A large number of Becol ebonite choke and low-loss coil formers are exhibited on this stand; 26 different types are listed, ranging from 1in. diameter to 4in., and with widely differing sizes of rib. Ebonite panels and tubing are also shown, and a feature is made of Becolettes, small packets of odd sizes of ebonite. The sheet carton contains five different sized pieces of sheet ebonite, and is priced at 2s., whereas the rod-and-tube carton contains a large assortment of round ebonite, and is priced at 1s. 6d.

*British Ebonite Co., Ltd., Nightingale Road, Hamwell, W.7.*

**BEETHOVEN. (47)**

For the coming season the resources of this firm will be concentrated on a single model—the Beethoven "Minor" suitcase portable—which sells at 10 guineas. This is an attractively finished model and has a sound specification. A Celestion loud speaker is standard, and the circuit consists of one screen-grid H.F. stage, detector, and two L.F. stages. Litz-wound coils 2½in. in diameter are used in the H.F. coupling, and the L.F. circuits are adequately decoupled.



Beethoven "Minor" portable.

The general finish is excellent, the interior panelling being of polished mahogany and the exterior covering of blue lizard grain rexine.

*Montague Radio Inventions and Development Co., Ltd., Beethoven Works, Great College Street, N.W.1.*

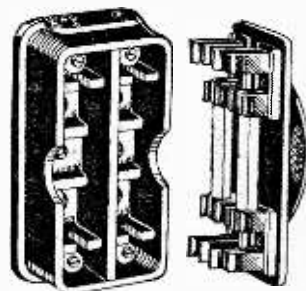
**BELLING-LEE. (13)**

"In connection with connections" might well be the slogan of this firm, who are exhibiting their usual wide range of

indicating terminals, plugs, sockets, and innumerable other small but, nevertheless, indispensable "gadgets," all of which are obviously designed with great care and forethought for the functions they are intended to perform.

Innovations for the new season include special accumulator connectors, with lead-plated non-corroding eye sockets for permanent connection to the battery terminals. Connection between these eyes and the receiver itself is made through sleeved plugs, appropriately shaped, lettered, and coloured to prevent all risk of accidental reversal of polarity; the design is such that short circuits at any point are impossible.

Those who believe in the principles of "safety first" should be interested in the Belling-Lee fuses of the glass cartridge type, which are available in various ratings between 60 milliamperes and 3 amperes. Several different mountings for



Belling-Lee twin fuse.

these fuses are manufactured; for instance, there is a small tubular container for wiring into a flexible lead of an existing set, or alternatively, special wander plugs with a built-in fuse. A bakelite moulded holder is suitable for mounting on a baseboard, while the latest safety device is a double-pole twin fuse for mains-driven receivers, in which matters are so arranged that the set is "dead" when the plug-in fuse carrier is removed.

*Belling and Lee, Ltd., Queensway Works, Ponders End.*

**BENJAMIN. (99)**

This firm is, perhaps, best known for its valve-holders, which have been before the public for some years. There are three in the present series, all being anti-microphonic.

Two rotary switches, in which the contact is made by the pressure of a spring-loaded phosphor-bronze ball on stout contact-strips, are offered. A stoutly built push-pull switch is also on view.

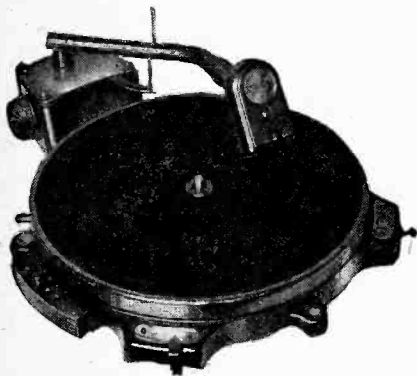
*Benjamin Electric, Ltd., Tariff Road, N.17.*

**BETTA ELECTRIC MOTORS. (218)**

Here are shown various models of "Macom" electric turntables, their distinctive feature being the very compact nature of the design. The unit occupies less than 1½in. in depth, and in its simplest form, as exemplified by the model A consists of a universal-type electric motor combined with a turntable and embodying voltage control and a

**Stand-to-Stand Report.—**

speed regulator. The fixed base contains a two-pole field winding, while the rotor is integral with the turntable. There is no reduction gear, the turntable runs at armature speed which can be regulated to run between 70 and 90 revolutions per minute. This model costs £2 12s. 6d.



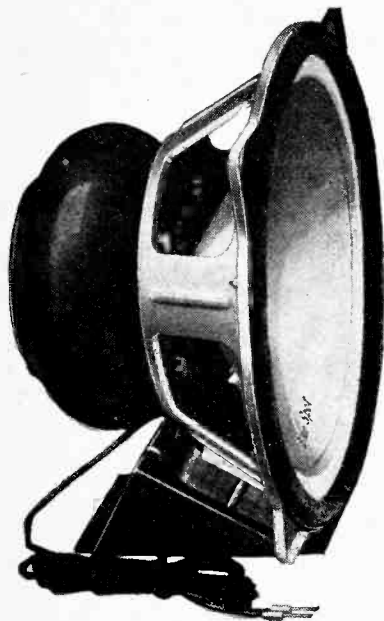
"Macom" model "D" electric turntable.

Model B, which costs £2 15s., has the addition of an automatic stop, while Model C is fitted with a pick-up carrier in which is incorporated a volume control. The Model D includes a "Macom" pick-up in addition to the other features embodied in Model C. The prices are £3 12s. 6d. and £4 12s. 6d. respectively.

Betta Electric Motors, Ltd., 119-125, Finsbury Pavement, E.C.2.

**BRITISH BLUE SPOT. (65)**

An extensive selection of loud speakers is shown at prices from 35s. for the well-known 65R type to 110s. for a beautifully



Blue Spot permanent-magnet loud speaker with output transformer.

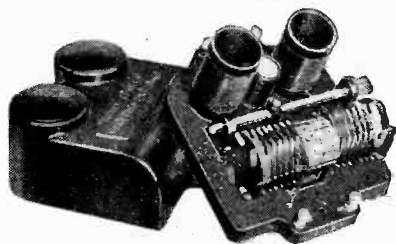
finished cabinet model. All types of movements are adopted, an inductor model, 100U, capable of handling an output of 1,200 milliwatts, and priced at 39s. 5d., a heavily built permanent-magnet model for 75s., which price includes the output transformer, and a wide selection of cabinet models.

Blue Spot radio receivers make their first appearance, and the chassis, which is so full of detail, is well worth examining. The front of the set displays a metal panel with recessed indicating dial calibrated in wavelengths, vernier trimmer, volume regulator, reaction control lever, and change-over and gramophone lever switch. Two screen-grid stages are used, followed by detector and power output valve and a fifth valve for rectification. Cabinet work and general finish are particularly attractive, and, as a gauge of price to the many models, all embodying this same chassis for all electric working, one may quote the W400 in a fine quality walnut cabinet which is priced at £18.

British Blue Spot Co., Ltd., 94-96, Rosoman Street, E.C.1.

**BRITISH GENERAL MANUFACTURING CO. (30)**

The outstanding exhibit on this stand is the new 10 kc. band-pass filter, which is produced as a compact unit, totally enclosed in a neat moulded case. Both long and short wavebands are covered, and it is interesting to note that a modified unit is available for H.F. coupling, the price



British General 10 kc. band-pass unit.

of either model being 14s. 6d. The coupling condenser is of the non-inductive type, and is adjusted and sealed before leaving the works. Special care has been taken to ensure reliability and maintenance of high insulation in wave range switch. Visitors to the stand will have an opportunity of comparing the resonance curve with that of a single-tuned circuit by means of a special test panel calibrated in kilocycles, and giving a visual indication of the circuit response.

British General Mfg. Co., Ltd., Brockley Works, Brockley, S.E.4.

**BRITISH HARD RUBBER CO. (182)**

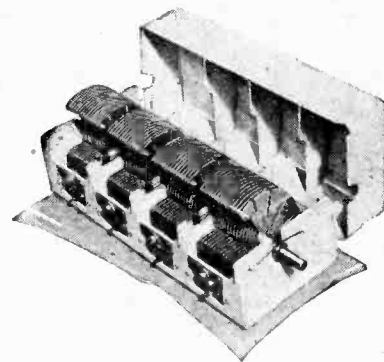
The main feature on this stand, where ebonite and ebonite products alone are shown, is a new non-discolouring ebonite known as Permacol. It is available with a highly polished surface and in three colours, black, mahogany, and walnut. It is claimed that it does not lose its colour in the strongest sunlight, unlike ordinary

ebonite, which, it is well known, often turns a green shade. It is an entirely British product.

British Hard Rubber Co., Ltd., Wharf Road Works, Ponders End, Middlesex.

**BRITISH RADIOPHONE. (155)**

The outstanding exhibit on this stand is the range of completely screened gang condensers. These are available in three sizes, the two, three and four gang, and in each case the capacity is 0.0005 mfd. Each section of the condenser is fitted with a trimmer giving a total variation



British Radiophone 4-gang condenser.

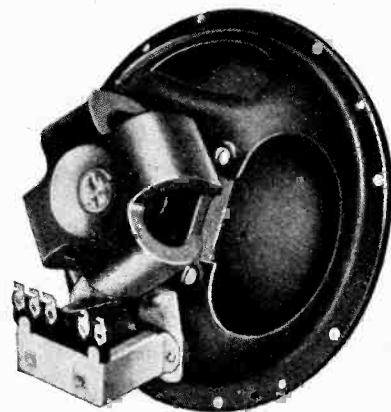
of capacity of 60 mmfd., a value which has been found to meet the needs of the majority of modern receivers. Each section is guaranteed to be matched within  $\frac{1}{2}$  mmfd., plus  $\frac{1}{2}$  per cent. The outer vanes of the moving plates are slotted, so that they can be bent in order to compensate for variations in coil inductance, and to allow of perfect ganging being obtained under all conditions.

A number of inexpensive loud speaker units is also shown.

British Radiophone, Ltd., Aldwych House, Aldwych, W.C.2.

**BRITISH ROLA CO. (250)**

These loud speakers, which have proved very popular in the U.S.A., are now made entirely in this country. There are three



British "Rola" permanent-magnet moving-coil loud speaker.

**Stand-to-Stand Report.—**

separate models, the types F, K, and P.M.J. Type F is a midget unit fitted with a 7½ in. cone, and requires 5 watts minimum for field excitation. The field winding has an unusually high inductance, and it can be used as a smoothing choke in mains-operated sets. In addition, this class includes models for low-voltage excitation, such as 6-10 volts, and for A.C. operation. The prices range from £1 15s. to £4 5s., according to the nature of the unit.

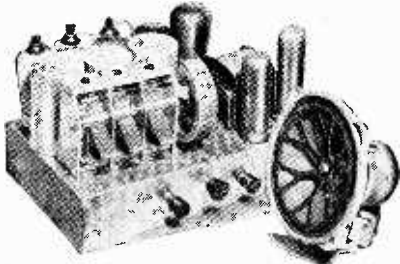
The K series are much larger, being fitted with 10 in. cones. Models are shown for all voltages, ranging from six volts D.C. to 250 volts A.C. The price of the speaker only is £2 10s. An input transformer must be used, as the speech coil is of the low-resistance type.

The P.M.I. models have permanent magnets, and, therefore, do not require exciting. They are fitted with 7½ in. cones, and the prices range from £2 10s. to £2 17s. 6d., according to the type of input transformer fitted.

*British Rola Co., Ltd., 1a, Willesden Lane, N.W.6.*

**BROOKS. (225)**

Here the student of design will find a wealth of detail to interest him as the various chassis-type receivers embodied in the range of radio-gramophones shown follow American practice. They are British made counterparts of the Zenith receivers. The two principal chassis are



Zenith five-valve chassis with three H.F. stages; also loud speaker.

a ten-valve superheterodyne and a six-valve circuit embodying three screen-grid H.F. stages. There are other models of considerable interest also, but complete details of the circuits are not yet available.

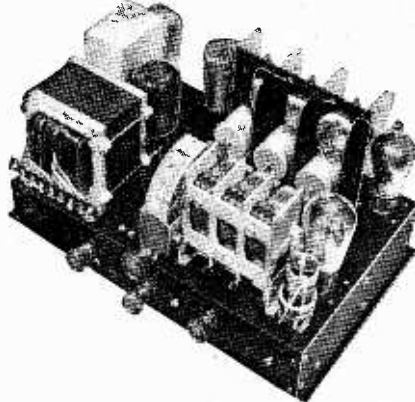
One interesting feature included in the Model 82 radio-gramophone is the provision of buttons which give the choice of nine alternative programmes. The selected stations must, of course, be tuned in beforehand. The superheterodyne chassis is used, together with a moving-coil loud speaker. It is electrically driven, and the price is 45 guineas.

*Kenneth Brooks, Ltd., 72-86, Oxford Street, W.1.*

**BROWN BROS. (105)**

Besides a full range of products of all makers, these wholesalers are showing the Gambrell-Halford A.C. radio-gramophone, using an 8-valve superheterodyne receiver. A band-pass input is followed by a screen-grid first detector, two stages of inter-

mediate amplification, second detector, and push-pull pentodes in the output stage. On the gramophone side an A.E.D. pick-up is followed by a Novotone, there being a moving-coil speaker to do justice to the whole. The tuned circuits are completely ganged on both wave-ranges, and a tone-control is included.



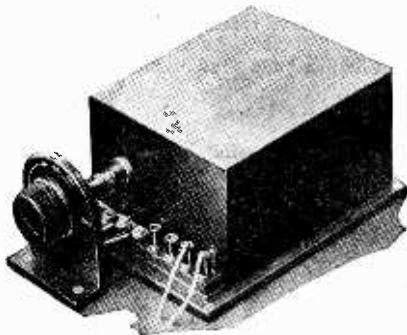
Chassis of the Gambrell-Halford 8-valve superheterodyne.

In a figured walnut pedestal cabinet, it sells complete at 48 guineas, while the set only costs 31 guineas. It is to be released shortly, and will be followed as soon as possible by a model for D.C. mains.

*Brown Bros., Ltd., 26, Great Eastern Street, E.C.2.*

**BROWN, S. G. (2)**

Visitors to this stand seem to be greatly intrigued by the Brown "H.T. Battery Superseder," an H.T. eliminator operated by an accumulator cell. In essentials, this device consists of an induction coil with an interrupter in the primary circuit, which is fed from a 2- or 4-volt accumulator battery. The stepped-up secondary output, after rectification by a metal unit, is passed through a smoothing circuit, and thence to the output terminals. The unit is rated to



S.G. Brown H.T. Battery Superseder.

deliver 6 or 7 milliamps at 90 volts when fed from a single accumulator cell, the primary current amounting to between 0.5 and 0.75 amp. By increasing primary voltage to 4 volts, output rises to some 10 to 12 milliamps. at between 100 and 108 volts.

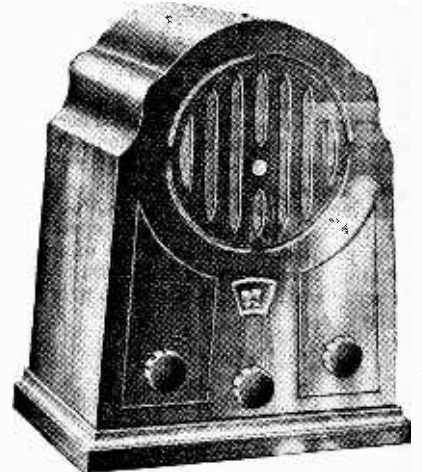
Another novelty introduced by this firm is the "Microbox," which is a gramophone pick-up, complete with tone-arm, and with a built-in microphone amplifier of the differential type. In this way gramophone records may be reproduced electrically through a loud speaker without the use of valves. Complete with a transformer, this device costs 5 guineas; microphone current (0.5 amp.) is drawn from a 10-volt accumulator, or can be supplied from a special eliminator unit.

Battery-fed receivers with really modern features are not too easily found, even at Olympia, and those who must depend on this source of supply should be interested in the new Brown three-valve receiver, which has a band-pass input filter, followed by an H.F.-det.-L.F. circuit.

*S. G. Brown, Ltd., Western Avenue, N. Acton, W.3.*

**BROWNIE. (37)**

An interesting new range of receivers is being exhibited, amongst which mention should be made of the "Dominion Grand Battery S.G.3." The tuning condensers are ganged, and special attention is paid to the matching of the coils, which are screened. The popular circuit of screen-grid H.F., followed by leaky-grid detec-



Brownie Dominion Grand S.G.3 receiver.

tor and pentode, is employed, and there is provision for a gramophone pick-up. The price, including royalty, is £9 17s. 6d.

Another new set is the mains S.G.3, with built-in loud speaker. There is again single-dial control, and the tuning scale is illuminated and calibrated in wavelengths; the price is 13 guineas, which represents extremely good value for money.

An inexpensive two-valve all-mains receiver, selling at £7 10s. complete, is the "Baby Grand," with detector and pentode output circuit, and with provision for gramophone pick-up. The receiver is housed in a handsome cabinet of solid oak, which also contains a loud speaker. Similar in appearance to the last receiver is the "Baby Grand" battery receiver. The same basic circuit is used, but the space taken up by the mains equipment is used for accommodating the batteries. The price, inclusive, is £3 15s.

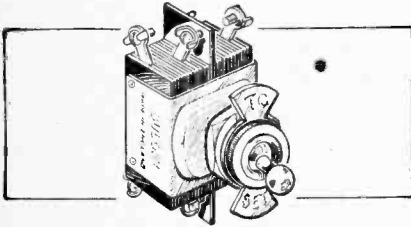
The well-known crystal sets and selec-

**Stand-to-Stand Report.**—  
tivity unit are retained for the coming  
season.

*Brownie Wireless Co. of G.B., Ltd.,  
Nelson Street Works, Mornington  
Crescent, N.W.1.*

#### BULGIN. (102)

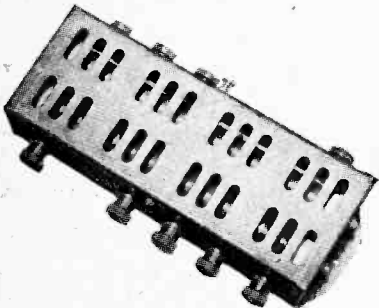
It is utterly impossible to review, even  
sketchily, the contents of this stand,  
which consists of an enormous variety of  
small components and useful "gadgets."  
The reader must be content to know  
that, whatever set he may decide to build,  
he will find a use, somewhere or another,



Double-pole double-throw toggle switch.  
(Bulgin).

for one or more articles of the Bulgin  
range.

The delayed-action thermal switch,  
illustrated last week in our "Show Fore-  
cast," is applicable to many problems in  
connection with mains sets. There are  
heavy-duty wire-wound volume-control  
potentiometers with frictionless contact-  
arms, switches to solve every possible  
switching problem, and plugs, sockets,  
and fuses, both enclosed and open, for  
every purpose. A new range of panel-  
mounting moving-coil instruments, of con-  
veniently small size, is shown this year.



Series filament resistor for D.C. mains  
valves, universal pattern (Bulgin).

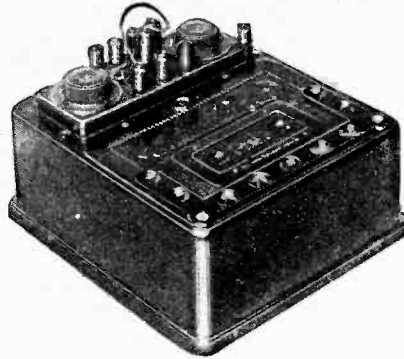
Some faint idea of the range of com-  
ponents offered may be gathered from the  
size of the catalogue, which the visitor to  
the Show should not fail to acquire.

*A. P. Bulgin and Co., Ltd., Abbey  
Road, Barking, Essex.*

#### BULLPHONE. (12)

An H.T. eliminator, for operation on  
A.C. mains, is one of the most prominent  
exhibits on this stand. Mounted in a  
neat bakelite moulded case with ventilat-  
ing apertures, this unit has a rating of  
20 milliamperes at 150 volts, there being  
one fixed and two variable outputs; the  
latter are regulated by rheostats, which,

it should be noted, are of the wire-wound  
type, an unusual thing in an inexpensive  
appliance of this type. The price is only  
£3, or £4 with a trickle charger.



Bullphone H.T. eliminator.

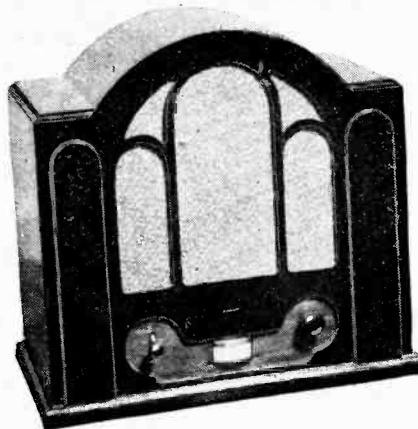
Complete receivers, and also kits of  
parts for home assembly, are also shown;  
these are mounted in moulded bakelite  
cabinets. There is a practically complete  
range of components, including a set of  
coils for a three-valve "H.F." set,  
comprising band-pass input coils and an  
intervalve coupling.

*Bullphone, Ltd., 38, Hollywell Lane,  
E.C.2.*

#### BURNDIPT. (212)

Having acquired the goodwill, patents,  
trade marks and stocks of Burndipt  
wireless apparatus, it is the intention of  
this firm to continue to market the more  
popular products of this make and also to  
introduce from time to time new models  
bearing the same trade mark.

Their programme for the 1932 season  
includes the retention of the "Merry-  
maker" range of receivers, to which a  
new model, the Burndipt Super Mains  
"Merrymaker Two," has been added.  
This is housed in an attractive walnut-  
finished cabinet, complete with a mov-  
ing-coil loud speaker, with an energised  
field. A valve rectifier is fitted, and the  
price is £12 12s. Another new item is a  
reed-driven cone loud speaker selling at



Burndipt Super Mains "Merrymaker  
Two" for A.C. operation.

24s. 6d. A number of Burndipt com-  
ponents is being exhibited.

*Henry E. Taylor, Ltd., 51-53, Church  
Street, Greenwich, S.E.10.*

#### BURTON. (31)

In addition to the well-known range of  
Burton condensers, valve holders, trans-  
formers, etc., there are three new items  
of special interest: (1) the Empire Three  
receiver, (2) a range of cabinet cone loud  
speakers, and (3) a series of new power  
units for A.C. and D.C. mains.



Burton "Empire Speaker Three"  
receiver.

The "Empire Speaker Three" is a  
straightforward detector-2 L.F. set, and,  
as its name implies, includes a cone loud  
speaker in the attractive modern type of  
cabinet. Including valves the price is  
£7 15s., and the receiver may be had in  
console form for £9 15s.

Two new loud speakers make use of a  
recently developed moving-iron movement  
which can be obtained separately for  
7s. 6d. The W.T. cabinet model in wal-  
nut costs 35s., and the type M.T. in  
moulded case with a radial silk front is  
priced at 27s.



Burton A.C. battery eliminator.

The new eliminators are exceptionally  
neat productions, and are cased in neat  
moulded containers of compact dimen-  
sions. Actually, the D.C. model measures  
only  $5\frac{1}{2} \times 3\frac{1}{4} \times 3\frac{1}{4}$  in. There are two D.C.  
models at £1 8s. 6d. and £1 17s. 6d.  
respectively, while the A.C. units, which  
incorporate Westinghouse rectifiers, range  
in price from £2 12s. 5d. to £4 7s. 6d.,  
according to the number of tappings pro-  
vided.

*C. F. and H. Burton, Bernard Street,  
Walsall.*

**Stand-to-Stand Report.—**

**C.A.V. (91)**

At this stand we find a complete range of the M.L. rotary transformers (Rotax), the battery-charging rectifiers of Newton's, and the accumulators and H.T. dry cell batteries of C.A.V. Batteries, Ltd. M.L. products are well known, and consist of 40-watt high-voltage generators running from low and medium D.C. supply, 100-watt D.C. to D.C. rotary transformers for use mainly with heavy-duty amplifiers and transmitting sets, D.C. to A.C. rotary transformers operating A.C. receivers on D.C. supply and motor generator sets. These are all described in a publication, the "Book of the M.L. Rotary Transformer."

Newton's battery-charging rectifiers are of the valve type and generously equipped for continuous service. Valves are covered by a 2,500 hours' guarantee, and outputs range from 30 volts 6 amps. to 75 volts 17 amps. The price of the small charger is 10 guineas, and is equipped with regulating resistances and a moving-coil meter. It is all-metal built, and charging rate can be controlled.

C.A.V. accumulators and dry batteries are well established, the former being available in the mass type in glass and celluloid containers and H.T. accumulator batteries in an all-moulded type built like miniature car batteries. Dry-cell H.T. batteries, for which no fantastic claims are made, are available in three capacity types of various voltages as well as in specified sizes to suit all portables.

*C. A. Vandervell and Co., Ltd., 319, Regent Street, W.1.*

**CADISCH. (184)**

These factors are showing a wide range of the products of the principal manufacturers, and one of the principal exhibits is a large battery-charging plant, the Crypto, which is intended for accumulator-charging stations.

*R. Cadisch and Sons, 5-6, Red Lion Square, W.C.1.*

**CALDERS. (183)**

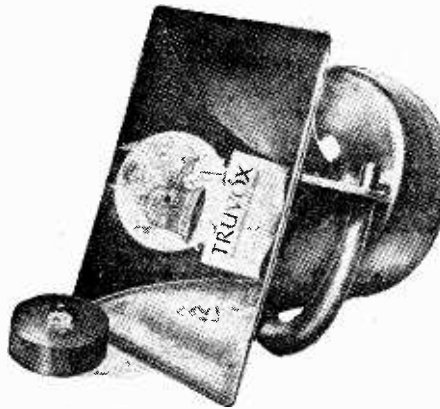
This stand is shared by two firms, Calders and Truvox. The former firm are showing a range of cabinets suitable for most ordinary requirements.

Truvox are exhibiting exponential horns and speaker units. The smallest of these horns has an air column of 66in., and is priced at 21s.; it is very compact, and the balanced-armature unit to fit is stated to handle about 1.5 watts, and costs 37s. A larger horn of the square-mouth type has an air column of 72in., and is quite small enough to fit into many radio-gramophone cabinets; this size is priced at 34s., and the same type of unit is used.

Moving-coil units are shown, and are intended for use with the really large horns; the smallest unit costs £12, and is stated to have a very large power-handling capacity, as well as an excellent frequency response.

*Calders, Ltd., 29-31, Regent Street, S.W.1.*

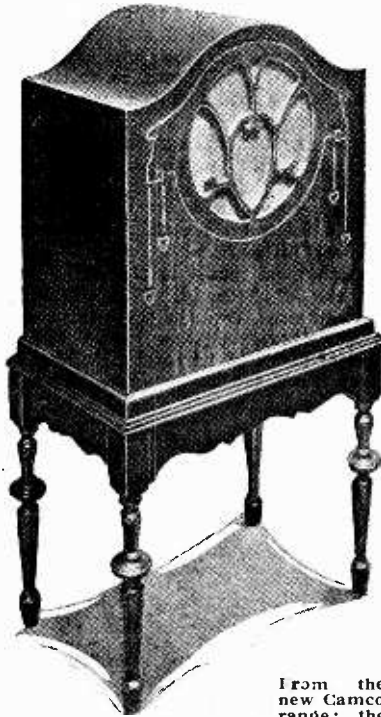
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The Truvox 72in. exponential horn and magnetic unit; Calders.

**CAMCO. (51)**

Among a very complete range of cabinets suitable for housing all types of receivers and loud speakers four outstanding examples illustrate this season's "Camco" products. Those interested in the home construction of a radio-



Windsor cabinet for housing an entirely self-contained set.

gramophone will find it worth their while to examine the "Westminster" cabinet. It houses set, speaker, motor and pick-up. Constructed of shaded walnut, it forms an attractive piece of furniture, a sunken framed panel being provided for the controls and loud speaker grille. The lid is flat and when raised does not give the unsightly effect that is produced by a framed cover. A piano hinge secures the lid, and access to

the apparatus is obtained through a movable and fretted-out back panel. A modified model is the "Lincoln," which is of similar design, excepting that provision for a gramophone motor is omitted. The cabinet that will prove exceedingly popular, as it is specified for the "Radio for the Million" kit receiver, is the "Windsor," shown in an accompanying illustration. For the home-constructed set it forms an ideal housing. From the extensive range of table-type cabinets mention might be made of the new "Embassy" model, which, with its sloping sides and cut-away top corners, represents a dignified design, possessing modern severity of line. It will accommodate most of the kit sets of this year, together with loud speaker and eliminator.

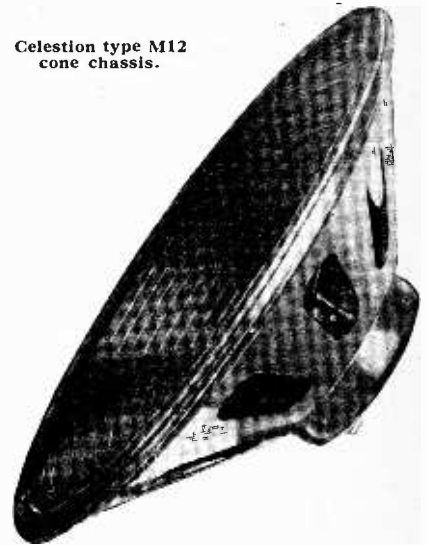
*Carrington Mfg. Co., Ltd., 24, Hatton Garden, E.C.1.*

**CATESBYS. (245)**

This stand is devoted almost exclusively to a range of "Orbit" receivers and radio-gramophones which are made by Catesbys, Ltd. A particularly neat three-valve all-electric chassis is embodied in many of the models shown. It consists of one H.F. stage using a screen-grid valve coupled by a tuned-grid circuit to the detector and followed either by a pentode or a super-power output valve according to the model in which it is used. A valve rectifier is favoured.

One of the most attractive models is the "New Orbit" radio-gramophone, in which is fitted a moving-coil loud speaker, and the price is £19 10s. The various other models fully justify close examination.

*Catesbys, Ltd., Tottenham Court Road, W.1.*



Celestion type M12 cone chassis.

**CELESTION. (40)**

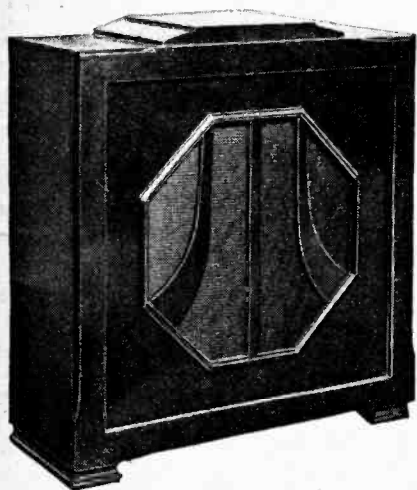
This company has now reverted to its original policy of specialisation in loud speakers, and is concentrating on three

**Stand-to-Stand Report.—**

high-grade chassis which form the basis of their new-season's range of cabinet models.

The Model M12 is a large-diameter cone chassis with a totally enclosed moving-iron unit of original design. A ring-type magnet is employed and the armature, which is double acting, is adjustable. A reinforced diaphragm is, of course, employed. The chassis itself costs 35s., and the cabinet model £3 12s. 6d.

The R.P.M.12 permanent-magnet moving-coil chassis is already known to readers of this journal, and is listed at £6, a special step-down transformer being available at £1. One of these units may be examined in action under the stroboscope on this stand. The loud speaker is driven at 50 cycles, and viewed through a stroboscope disc running slightly out of phase. The diaphragm then appears to rise and fall about once



Celestion R.P.M.8B cabinet moving-coil loud speaker.

every two seconds, and its piston-like action at this frequency is convincingly demonstrated. Cabinet models of the R.P.M.12 range in price from £10 to £12.

In the R.P.M.8 we have a smaller edition of the R.P.M.12. The chassis costs £3 10s., and its transformer 15s. The cabinet models vary in price from £5 10s. to 6 guineas.

At the last moment a new model, the J12, has been introduced. This, in spite of its low price, is housed in a cabinet of standard Celestion quality and is fitted with a differential cone unit and a tapped winding. The price has been fixed at 38s. 6d.

The Celestion pick-up and the "Tiltatone" tone and volume control are continued.

*Celestion, Ltd., London Road, Kingston-on-Thames.*

**CHURCHMANS. (200)**

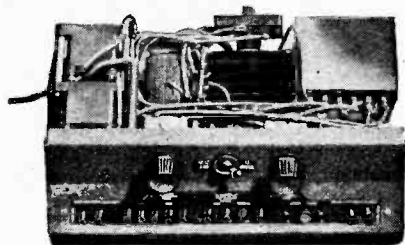
This firm are factors only, and are consequently exhibiting a wide range of re-

ceivers and components by the leading radio manufacturers. This stand affords an excellent opportunity of comparing the different products.

*Churchmans, Ltd., 79, Maidenburgh Street, Colchester.*

**CLARKE'S "ATLAS." (33)**

The familiar green crystalline enamelled mains units predominate on this stand, and the principal exhibit is the

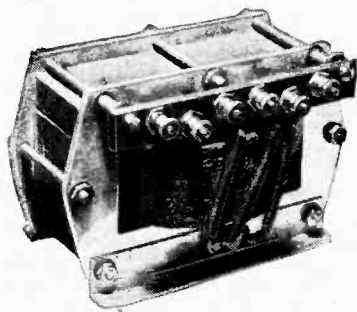


Atlas A.C. 290 mains unit (cover removed).

new A.C. 290 model at £6 10s. In addition to a trickle charger for 2-, 4-, or 6-volt accumulators at 0.5 amp., four separate H.T. and four grid-bias tapplings are provided, viz., H.T. 0-100 and 0-120 variable, 150 fixed, and 150 volts output at 25 mA C.B. 1½, 3, 9, and 16 volts. Incidentally, the grid bias is separate from the H.T. supply.

In the new A.K.260 and A.C.244 models the variable H.T. tapplings are provided with plugs giving minimum, medium, and maximum voltages between the limits available, instead of the usual continuously variable adjustment.

The cheapest model in the A.C. range is the new A2 at 52s. 6d. This is intended for simple one-, two-, or three-valve sets, and has three tapplings giving voltage ranges of 60-80, 90-100, and 120-150 volts, depending on the load. The output is 12 mA.



Atlas type C.P. pentode output choke.

All the A.C. units are provided with Westinghouse rectifiers, and British components are used throughout. The D.C.18 and D.C. 16 units are continued at reduced prices.

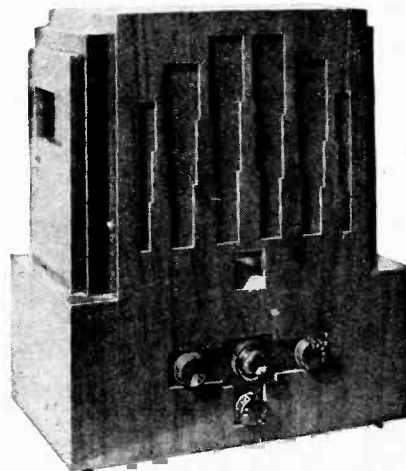
A well-designed series of mains transformers, smoothing chokes, and pentode output chokes is also shown.

*H. Clarke and Co. (M/C), Ltd., Eastnor Street, Old Trafford, Manchester.*

**CLIMAX. (42)**

The Climax All Mains Four (three valves and rectifier), which is housed in a distinctive modern cabinet and incorporates a built-in moving-coil loud speaker, represents extraordinarily good value at 14 guineas. The popular S.G.-detector-pentode arrangement is followed, and the single tuning control with concentric trimmer is calibrated in wavelengths. D.C. and A.C. models are available at the same price.

The All Mains Three (two valves and rectifier) is a detector-pentode set for local station reception, which is probably unique in being equipped with a moving-coil loud speaker. It is built into a very compact cabinet with the tuning controls at the side, and sells for 9 guineas (A.C. or D.C.).



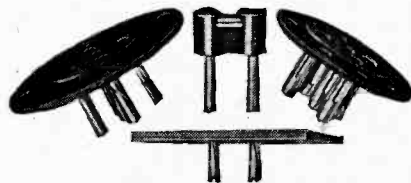
Climax "All Mains Four" with built-in moving-coil loud speaker.

The Autobat D.C. mains unit is being continued and an equivalent A.C. model (M.A.20) makes its first appearance. There are three tapplings, giving 60-75, 80-100, and 120-150 volts, with a maximum current of 20 mA. The price is 52s. 6d.

*Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, N. IV.3.*

**CLIX. (202)**

A very large range of plugs and sockets of every conceivable kind is shown. The new type are built in the same way as the modern valve base, that is, with solid pins in the plugs and resilient sockets, and it is claimed that a much better contact can be obtained in this way. The old type of resilient plug is, of course,



Clix sub-panel valveholders and plug connector.

**Stand-to-Stand Report.—**

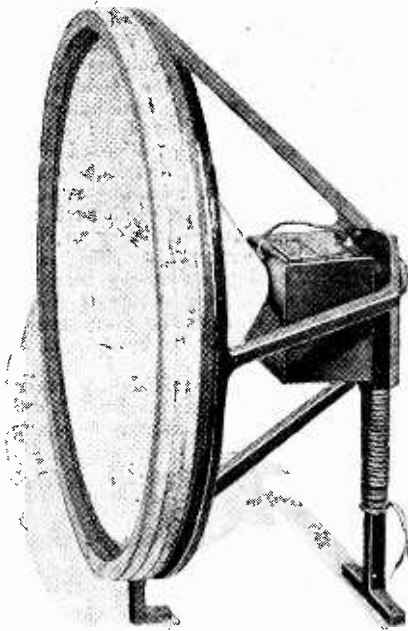
retained for wander plugs, which must of necessity fit into plain sockets. A new engraved terminal is being shown, and is obtainable in a number of different markings.

The old baseboard-mounting valve-holder is still made, but several new types have been added to the range. These are intended for mounting beneath the baseboard, a circular hole being cut for the valve base. They are really intended for use with metal chassis, with which form of construction they are ideal.

*Lectro-Linx, Ltd., 254, Vauxhall Bridge Road, S.W.1.*

**COLASSION. (209)**

The "Colassion" exhibit consists of a wide range of reed-driven cone loud speakers, models being shown in chassis form and in cabinets. There are six different types in all. Of these, three consist of small units officially known as the "Midget," priced at 8s., the "Baby" at 9s., and a superior model, the "Junior," at 12s. 6d. In cabinet form these range in price from 35s. to 50s.



Colassion Hyper loud speaker chassis.

The de luxe model in the Colassion series is described as the "Hyper" chassis, which is claimed to handle very large A.C. inputs without overloading. It is fitted with a 14in. cone, and the price is £3 10s. Various cabinet models of this loud speaker are available for inspection.

*Colassion, Ltd., Mark Lane Station Buildings, Great Tower Street, E.C.3.*

**COLUMBIA. (7)**

As examples of modern design, the new Columbia three- and four-valve chassis

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are worthy of the closest attention. None of the features that go to make up a successful set, capable of satisfying present-day needs, seems to have been omitted, and, what is still more im-

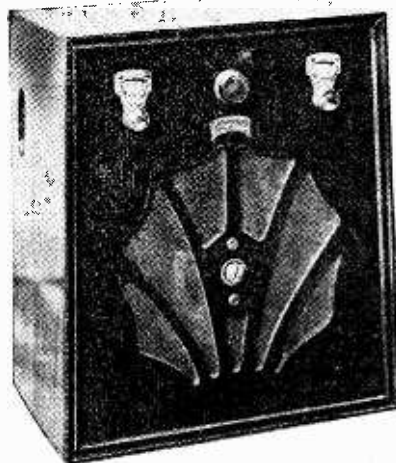


Columbia table receiver.

portant, our own observations would indicate that great care and discrimination has been exercised in applying the latest developments.

Starting at the aerial input end of the more ambitious of the new sets, there is a "mixed" band-pass filter, designed to give constant band width, followed by two H.F. stages. All four circuits are tuned by a ganged condenser with "segmented" end vanes, and we are informed that the methods of adjusting and checking are such that no errors of sufficient magnitude to affect either sensitivity or selectivity can possibly arise.

After the H.F. amplifier comes an S.G. valve operating as a grid detector—or as a first-stage gramophone amplifier—which



Columbia cabinet battery receiver.

is coupled to an A.C. pentode by a resistance-fed transformer. A combination volume control, which is automatically operative either in the radio-frequency

circuits or on the pick-up output, depending on the setting of the change-over switch, is fitted. All valves and coils are screened, and provision is made for using a mains aerial.

With obvious exceptions, most of the above applies equally to the three-valve model, which has only one H.F. stage, and choke-capacity L.F. coupling between the screen-grid detector valve and output pentode. This set is available as a table model as well as a radio-gramophone.

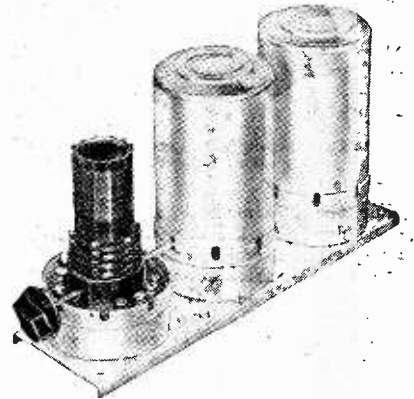
At the other end of the scale there is a cheap and compact two-valve battery-operated set, which, with valves, batteries, and built-in loud speaker, sells at £5.

As an indication of ruling prices, it may be stated that the four-valve chassis (five valves with rectifier) costs, as a pedestal radio-gramophone with moving-coil loud speaker, 40 guineas complete.

*Columbia Graphophone Co., Ltd., 92, Clerkenwell Road, E.C.1.*

**COLVERN. (38)**

Screened coils form the most important of this firm's exhibits. In view of the ever-increasing demands for greater



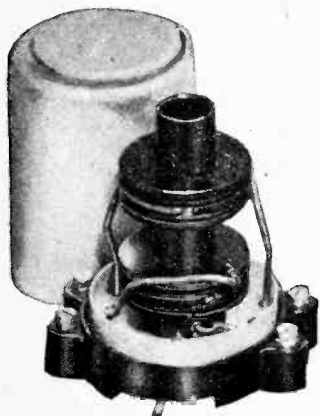
Colvern link band-pass filter and intervalve coupling.

selectivity due to the growing number and power of transmissions, the new constant peak band-pass filter with "link" circuit will undoubtedly have considerable appeal. It consists of a two-member filter having the tuning inductances totally screened in cylindrical aluminium pots—the dynamic resistance at resonance being about 110,000 ohms. The "link" coupling contains a mixture of capacity and negative inductance so proportioned that the selectivity and the square top of the resonance curve remain constant over the waveband, which should provide the ideal type of pre-selection before a screen-grid valve. Cross-modulation and other secondary effects will thus be prevented. The coils of this filter are carefully matched with the standard Colvern screened coils for use in intervalve couplings, so that ganged tuning and waveband switching is facilitated.

The new "K" coil is a screened dual-range inductance of universal application, with a built-in switch having a multiplicity of gold-silver contacts to allow

**Stand-to-Stand Report.**—

for the use of any of the conventional couplings and switching schemes. It is claimed that this coil has the most efficient length-to-diameter ratio for the size of cylindrical screen into which it is built, and that a much larger inductance in a correspondingly larger screen would not give substantially greater magnification. Now that one-dial control has firmly established itself, and that separately screened coils have become essential, a visit to this stand is well worth while, since for a long while the energies of the company have been concentrated in producing the ideal screened inductance.

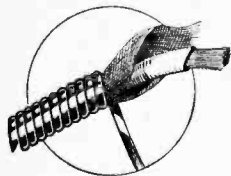


The Colverdine intermediate frequency transformer.

For the intermediate amplifier of the superheterodyne the screened Colverdine is a specialised band-pass unit for 110 kc., with a semi-variable condenser for final balancing built into the base. The distance between the two slot-wound coils forming the filter can be altered so as to change the coupling, and an ingenious locking device ensures that once the optimum coupling has been found the coils cannot be moved accidentally.

There are also ultra-short wave Colverdines, wire-wound variable resistances, and a full range of fixed resistances wound on glass, having a dissipation of 10 watts. The metal chassis and screening cans for "The Wireless World Three" receiver are being exhibited.

Colvern, Ltd., Mawneys Road, Romford, Essex.



Concord anti-inductive flex.

**CONCORDIA. (248)**

In addition to a comprehensive display of instrument wires, Constantan resistance wires, and connecting wires in a variety of colours, a special feature is

made of a range of extra heavily enamelled wires for use on secondary windings of mains transformers. This year Concord metal-armoured "anti-inductive flex" is introduced, which possesses good shielding properties, and, furthermore, is armoured with spirally wound tinned copper strip to facilitate soldering. There is a wide range of multiple-wire cables suitable for radio-gramophones, public address apparatus, and cinema "talkie" installations.

Concordia Electric Wire Co., Ltd., Trent Mills, New Sawley, near Nottingham.

**COSSOR. (16)**

Here are many new valves and receivers. To take the valves first, of outstanding interest are the additions to the screen-grid range. The MS.PEN.A is a high-frequency screened pentode which will accept quite large grid swings without rectification and, having a remarkably low inter-electrode capacity, will give high stage amplification. As there



(Left) Cossor 41 MP valve.  
(Right) 230 PT pentode.



is an earthed grid next to the anode, no secondary emission takes place, and high screen voltages up to 150 can be used with impunity. The MSG-HA is a S.G. valve of high A.C. resistance and sensitivity for use where the whole impedance of the intervalve tuned circuit is in the anode, such as in tuned-anode and tuned-grid coupling. Where there is a step-up ratio of coupling, such as is encountered

in tuned transformer or tapped tuned grid, the new MSG-LA valve is eminently suitable, as its impedance under working conditions is as low as 200,000 ohms.

To the pentode series has been added the MP/Pen—an indirectly heated valve with a mutual conductance of 4.0 mA./volt, and among the indirectly heated triodes mention should be made of the 41 MP and the 41 MXP, both of which have a slope of 7.5, which it is safe to say has not been equalled by any other valve existing.

Those interested in single-valve frequency changing schemes with the superheterodyne will learn with interest that a mains bi-grid valve will soon be available. In common with the general practice in vogue to-day, practically all H.F. and detector valves can be supplied with metallised bulbs.

The Cossor All-Electric Regional Set belongs to the category of "midget" receivers and comprises a two-valve circuit with a regenerative power-grid detector, followed by resistance-fed auto-transformer coupling to a 41 MXP output stage. The smoothing circuit is particularly complete, and contains electrolytic condensers, while the field of the speaker acts as an output choke. Although the price of this attractive little receiver is only £10 15s., it includes a Cossor-Utah moving-coil loud speaker.

Another receiver is the 4-valve all-electric Model No. 244, containing two screen-grid stages, followed by power-grid detection and a parallel-fed auto-transformer linked to a triode output stage. Comprehensive screening is to be found, and triple-ganged condensers provide single-dial control with drum drive calibrated in wavelengths. To ensure the highest quality on nearby transmissions, a local-distance switch is incorporated which changes the decrement of the first tuned circuit by introducing resistance.

The well-known Cossor Melody Maker is now available as an all-mains kit, selling complete at the remarkably low figure of £9 19s. 6d.

A. C. Cossor, Ltd., Cossor House, Highbury Grove, N.5.

**CRAUFURD WIRELESS. (242)**

Two receivers, the Craufurd Transportable Three, and the Transportable Five, embodying a patent acceptor circuit, of which actual details are not yet available, form the chief features of interest on this stand. The acceptor is shown as a separate unit for use in conjunction with an existing receiver the selectivity of which requires improving to cope with present-day problems arising out of the Regional system of broadcast. This costs 2s. 6d.

Craufurd Wireless, 24-26, Holborn, E.C.1.

**CROWN CABINETS (DOWNING). (54)**

Detailed reference cannot be made to the wide variety of cabinets shown. The designs are unique and attractive, and a cabinet is available for every purpose while the prices are competitive. Most



Cossor four-valve all-electric receiver model 244.



**Stand-to-Stand Report.—**

cabinet work to-day is finished by cellulose spraying, but hand french polishing is adopted with the Crown products. Specially designed cabinets are available for all kit sets, and possessors of the Corsor home-constructed set will be interested in the battery cupboard shown which forms a base support exactly fitting around the receiver, bringing the total height up to approximately 3 feet.



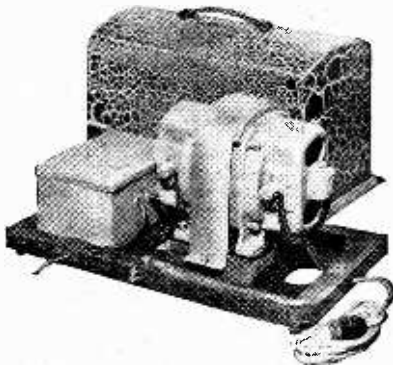
A Crown cabinet by Downing specially designed for the "Radio for the Million" kit.

Cabinets for the construction of high-class radio-gramophones in figured walnut are also exhibited. For constructors of this year's "Radio for the Million Three" receiver a solid oak cabinet has been produced. It is shown in an accompanying illustration and sells for 15s.

John S. Downing and Sons, Ltd., Commercial Street, Birmingham.

**CRYPTO. (235)**

A special feature is made this year of a range of battery chargers fitted with valve rectifiers for use on A.C. mains. The simplest model shown will deal with eighty-four two-volt cells, and it has two



Crypto 100-watt rotary transformer.

separate circuits, each controllable independently, and rated to pass up to one ampere. The prices of these units are from £12 10s. upwards. In addition, there are numerous examples of their rotary rectifier-type charging models with two and more separate circuits.

An extensive range of rotary transformers for operating A.C. receivers, radio-gramophones, etc., from the D.C. mains occupies a prominent place on the

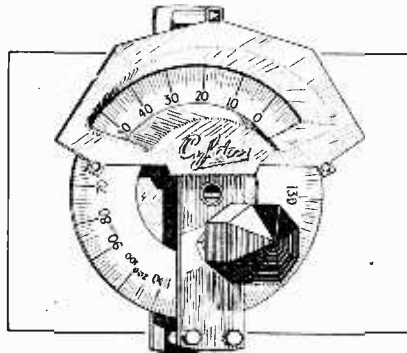
stand. Smoothing units with the latest modifications embodied, together with sound-proof cabinets, are shown also. A popular size is the 100-watt model, as the output from this will meet the needs of most present-day A.C. sets and household-type radio-gramophones. The complete equipment costs £16 10s., the machine alone being available at £12 10s. A 200-watt model, complete, is listed at £19 5s.

Crypto Electrical Co., Ltd., Acton Lane, Willesden, N.W.10.

**CYLDON. (172)**

A number of interesting new components are shown on this stand. There is a friction-drive slow-motion dial with a ratio of 8 : 1; it fits behind the panel, and only the sector-shaped escutcheon and the control knob appear on the panel. It is suitable for condensers with a 1/4 in. shaft. The price is 7s. 6d.

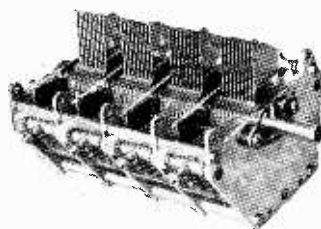
A new gang condenser is the Commodore Midget, and is notable for its small dimensions. It is available in all sizes up to four-gang; a 3/8 in. shaft is used, but the ends are turned down to 1/4 in. in order



Cyldon sector vision slow-motion dial.

to fit standard dials. The moving vanes run in ball bearings, and steel races are fitted. Trimmers are not fitted as standard, but the condenser frame is drilled for mounting the Cyldon trimmer condenser, which has a capacity of 50 mmfd., and is priced at 1s. 6d. The price of the four-gang condenser alone is 33s. 6d.

These ganged condensers are also available fitted with a new type of drum dial, which employs a cord drive, and is fitted



Cyldon Commodore four-gang condenser.

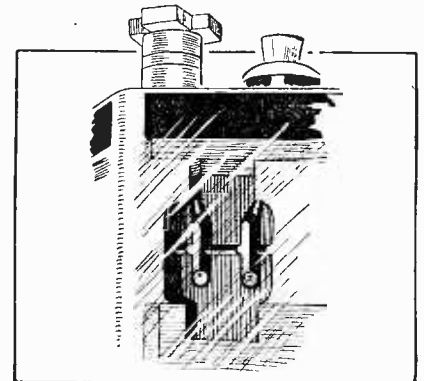
with a bakelite escutcheon. The dial is not supplied separately.

A number of small-capacity compression-type condensers mounted on porcelain bases and intended for tuning the intermediate frequency circuits of superheterodynes are shown, in addition to a range of useful gauging accessories.

Sydney S. Bird and Sons, Ltd., Sarnesfield Road, Enfield.

**DAGENITE. (15)**

Floating hydrometer beads, which give a visual indication of the state of charge, have always been included in a number of the L.T. accumulator cells made by the National Accumulator Company. This useful feature has now been adopted for



Indicating floats in Dagenite H.T. battery.

low-priced cells of the slow-discharge type and also for high-tension batteries; the latter are fitted with two beads (instead of the usual three) mounted in the end cell of each unit.

Certain other accumulator batteries have been entirely redesigned, and, it would appear, greatly improved. The float chambers are now moulded into the glass containers, and new separators, in the form of perforated ebonite sheets with integral spacing ribs, are fitted.

Many of the batteries are provided with a label for the owner's name; this is prepared by coating a small cast-in frame with special acid-resisting paint. Non-interchangeable terminals, which are easily identified, are fitted to many models, and carrying handles to all.

National Accumulator Co., Ltd., 50, Grosvenor Gardens, S.W.1.

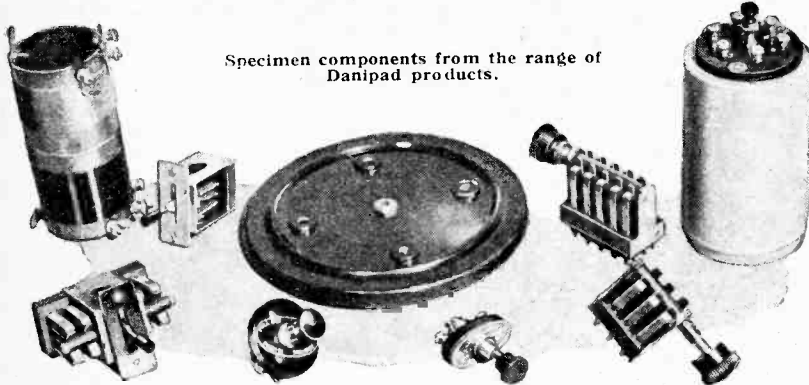
**DANIPAD. (70)**

While essentially ebonite manufacturers producing all forms of sheet and tube, a complete range of components is exhibited. A new coil styled the "Kiloceptor" is fitted with internal trimming as well as being totally screened, and is intended for use in band-pass circuits or where a number of tuned stages are employed. Slow-motion tuning condensers, all brass built and fitted with knob and dial, are priced at 7s. A popular type of turntable for portable sets running on ball bearings and being built of bakelite so that frame tuning will not be affected, sells at 3s. A wide variety of components is described in the new season's list available at the stand. A four-valve all-electric

**Stand-to-Stand Report.—**

radio-gramophone for A.C. or D.C. supply makes its first appearance, and employs two screen-grid stages, power-grid detector, and pentode output, and is fitted with a moving-coil loud speaker.

Much interest is being shown at this stand in the home talkie equipment, said to be suitable for use with all types of home cinema equipments. Briefly, the output consists of a flexible shaft coupling between the sprocket wheel of the camera or the projector and the turntable with the recording or reproducing gramophone,



Specimen components from the range of Danipad products.

so that synchronising is effected. A lead screw geared from the centre of the turntable carries the cutter or pick-up across the aluminium recording discs. Details are obtainable from Cairns and Morrison, of 33, Percy Street, London, W.1.

*Danipad Rubber Co., Ltd., 5-7, Market Street, E.C.2.*

**DARWINS. (101)**

Permanent magnets of all types are on view here. A departure is being made from the "four-claw" type of speaker magnet, both "pot" and built-up forms now being available. The latter especially offers certain advantages from the price point of view without loss of efficiency. A 60 lb. magnet, with 8,000 lines/sq. cm. in the gap, is shown as part of a speaker.

*Darwins, Ltd., Fitzwilliam Works, Sheffield.*

**DAVENSET. (43)**

This stand is devoted to the "Davenset" range of A.C. rectifying equipment and battery chargers for accumulator service stations, garages, etc., and is primarily of interest to the trade. The new series of automatic H.T. accumulator chargers is, however, worthy of special note. These instruments are capable of charging a number of banks of accumulators, each at a specified rate, which is controlled by a barometer lamp. Excessive initial currents and the necessity of continually adjusting the rate during the charge are obviated. An ammeter is unnecessary, and coloured indicator lamps are used to show that current is passing in each circuit.

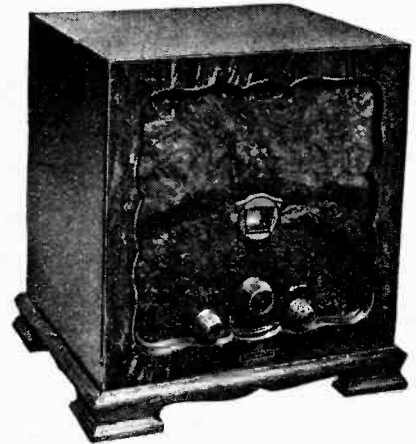
*Partridge Wilson and Co., Davenset Works, Exvington Valley Road, Leicester.*

**DAYZITE. (251)**

Since the activities of this firm are devoted mainly to the distribution to the trade, their exhibit this year takes the form of a display of receivers, loud speakers, and components by the leading wireless manufacturers. A feature is being made of a new development officially described as a "Sound Head." This is for attaching to a film projector to enable talking films to be handled. The accompanying amplifiers are being featured also.

*Dayzite, Ltd., 17, Lis'e Street, W.C.2.*

sentative example is the "Monarch Cadet," a two-valve detector-L.F. set with a conventional circuit arrangement, completely self-contained except for the aerial-



Dibben Monarch Scout receiver

earth system. The present tendency to revert to the use of magnetic reaction is exemplified in this set, which, for A.C. or D.C. mains feed, costs ten guineas.

Typical battery-fed sets are the "Monarch Yeoman," with a detector-2 L.F. circuit, and the "Monarch Marshal," an H.F.-det.-L.F. three-valve receiver, with a built-in Amplion loud speaker.

*Wm. Dibben and Sons, Ltd., St. Mary's Road, Southampton.*

**DUBILIER. (92)**

One-, two-, and three-watt metallised resistances are an important addition to the range of Dubilier products, and their use is essential in the construction of mains-operated sets. These resistances are compact and mechanically strong, and are constant in their resistance values. Considerable space is saved by their use, making it possible to avoid the large wire-wound resistances when only a low value of watts is to be dissipated. As an

**DE LA RUE. (164)**

Mouldings for every conceivable purpose are shown on this stand; cabinets, clock cases, and transformer bobbins with inset soldering tags are representative of the wide range. A new and slightly flexible material for transformer bobbins is interesting on account of its high strength.

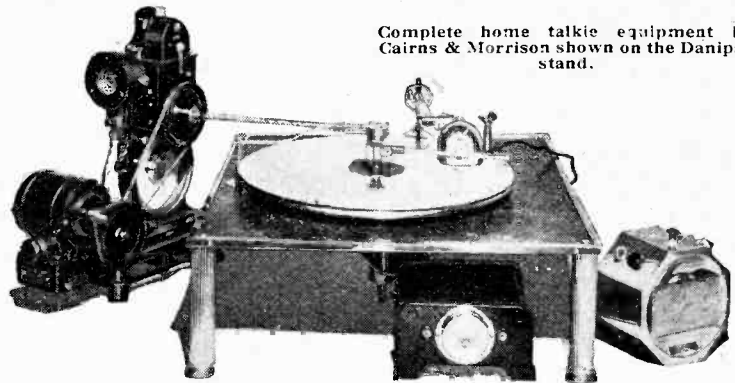
*Thos. De La Rue and Co., Ltd., 90, Shernall Street, Walthamstow, E.17.*

**DEW. (104)**

A wholesaler's stand showing, for the trade, a full range of sets, components, and speakers by all makers.

*A. J. Dew and Co., Ltd., 33-34, Ruthbone Place, W.1.*

Complete home talkie equipment by Cairns & Morrison shown on the Danipad stand.

**DIBBEN. (1)**

The exhibit of this firm consists of a range of moderately priced receivers for both battery and mains feed. A repre-

example, the 1-watt type will pass as much as 1.4 mA. in the 0.5 megohm size, whilst 10 mA. is safely passed by the 10,000 ohm size. Prices of the three

**Stand-to-Stand Report.—**

sizes are 1s., 2s., and 3s., and each is available in over twenty-five different resistance values.

Another new component is a special non-inductive condenser intended for use where the introduction of a small value of inductance might appreciably modify results. An addition to the range of small mica condensers are the moulded-in types 665 and 670, the former terminates on tags and can be held by the wiring or terminals of other components. The latter, being slightly larger and going up to higher capacity values, has small screw terminals and fixing-down holes. Reference need not be made to the well-known Dubilier paper-type condensers which have so long been produced, and as a guide to price the 1 mfd. size, tested at 500 volts, sells at 2s. 8d., and tested at 800 volts, 3s. 9d. A popular-priced condenser in bakelite case, suiting most of the needs of the set constructor and tested at 400 volts, is priced at 2s. 6d. in the 1 mfd. size. A new pamphlet is available giving full details of Dubilier products.

*Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, N. Acton, W.3.*

**DONOTONE. (161)**

The unusual feature of Donotone loud speakers, the inclusion of tuned gongs, is still retained in the larger models, but



New model Donotone loud speaker.

has been omitted in some new and inexpensive types. The cases of these are similar in appearance to those of the gong type, and they are of about the same size; an adjustable unit of special design is now used, however, with a cone for the reproducing mechanism. Two models are available, one is priced at 3 guineas and the other at 30s. A public address amplifier is also shown.

*Donotone (Regd.) Loud Speakers, 40, Furnival Street, E.C.2.*

**DULCETTO-POLYPHON. (230)**

Besides a complete range of sets,

D 19

speakers, and accessories of all makers, this wholesale firm is offering a radio-gramophone of their own design. Priced at 27 guineas, it includes a three-valve radio chassis of exceptionally clean design, as well as provision for high-quality reproduction of records.

*Dulcetto-Polyphon, Ltd., 2-3, Newman Street, W.1.*

**EAST LONDON RUBBER CO. (176)**

A comprehensive display of wireless receivers by prominent manufacturers is shown on this stand. A well-assorted variety of components also forms a part of an interesting exhibit, which traders would do well to visit.

*East London Rubber Co., Ltd., 29, Great Eastern Street, E.C.2.*

**EDDYSTONE. (98)**

This firm is very well known indeed as specialists in short-wave reception, catering as well for the needs of the amateur transmitter. Their "All-Wave Four,"



The Eddystone Kilodyne—a four-valve short-wave set.

which, by the use of interchangeable plug-in coils wound on skeleton formers, covers all waves from 12 to 2,000 metres, can be had for either battery or mains operation; in the latter case a separate power unit is employed.

A less comprehensive outfit is the "Kilodyne Four," illustrated here; this employs an untuned aerial circuit, and so is suitable for wavelengths up to 85 metres only.

Among a wide selection of short-wave components a short-wave choke, space-wound in a single layer on a ribbed former, was singled out for especially favourable comment.

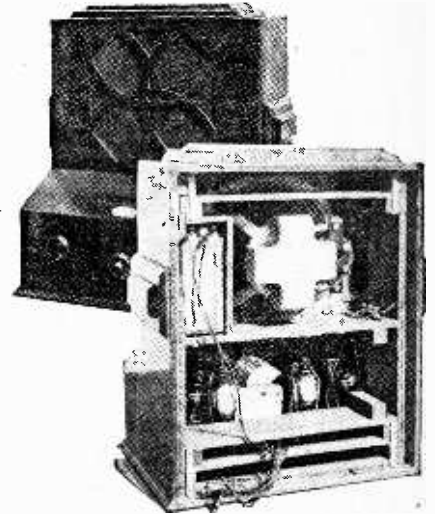
*Stratton and Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.*

**EDISON BELL. (41)**

A five-valve battery superheterodyne with built-in permanent-magnet moving-coil loud speaker at 20 guineas alone justifies a visit to this stand. It is built as a table model on a rotating turntable and is provided with a single tuning control (and trimmer) calibrated in wavelengths. The valves are arranged as follows: Detector-oscillator, two I.F. stages, second detector, pentode. The latter valve is of the new low-consumption type, and the total H.T. battery current is only 6 mA.

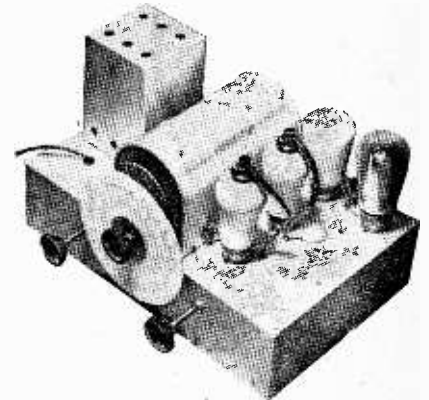
A modern all-metal chassis forms the

basis of a series of new table models, consoles and radio-grams. The chassis is available with either one or two H.F. stages, the four-valve models costing



Edison Bell battery superheterodyne.

one or two guineas more than the three-valve. The prices of the latter are as follows: table model, 19 guineas; console, 21 guineas; Radio-gram, 29 guineas. The chassis are thoroughly up-to-date, and include variable- $\mu$  screen-grid valves, mixed filter band-pass tuning with 7 k.c. separation, and a built-in moving-coil loud speaker with H.T. excitation for the field. The tuning dial is calibrated in wavelengths, and also carries the names of 40 stations. It is viewed through two windows, one of which is automatically illuminated green on medium waves, and the other red on long waves.



Edison Bell four-valve A.C. chassis.

There is a new permanent-magnet moving coil speaker at £3 7s. 6d. in chassis form with output transformer, and £4 15s. in cabinet, and an improved pick-up for cinema use.

*Edison Bell, Ltd., Edison Bell Works, Glengall Road, S.E.15.*

## Stand-to-Stand Report.—

## EDISWAN. (21)

There are many new additions to the well-known range of Mazda valves. It is believed that this firm now has a valve giving record amplification for the high-frequency stage, the detector, and the



(Left) Mazda  
A. C. 2 / H. L.  
valve.  
(Right) S215B  
Valve.  
(Ediswan.)

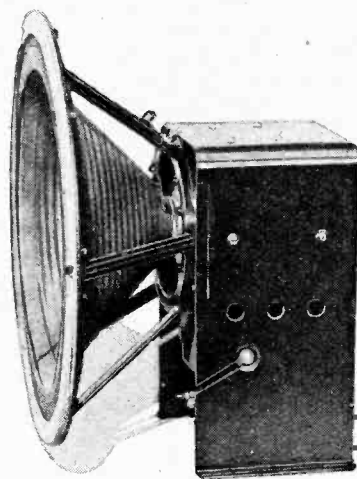


power output stage. As regards the first category, the new A.C./S2—a screen-grid valve—has a slope of 5, an amplification factor of 3,000, and an interelectrode capacity of only 0.0015 mmfd. It can be shown that with these constants a stage gain of 400 can be obtained using the popular type of diminutive screened coil. Surely this constitutes a record?

The new detector of importance is the A.C.2/H.L., having a comparatively low impedance, an amplification factor of 75, and a slope of 6.5. Used as a grid detector, the rectification efficiency can be shown to reach a new level. The new 2-volt battery pentode, the PEN220, shows remarkable efficiency when it is appreciated that with an anode consumption of only 5 mA. at 150 volts it is possible to extract an undistorted A.C. out-

heated D.C. range (the D.C.3/H.L., D.C.2/P, and D.C.2/PEN), with 40-volt heaters, requiring but 0.1 ampere current. Mains consumption of a set containing these valves will thus be some 20 watts, and not much more than that of a similar A.C. set. On the score of upkeep costs, the D.C. user has now little reason to complain. There is a new 2-volt battery pentode, styled the PEN 220A, which will develop 1,000 milliwatts A.C. output with 150 volts H.T. and a feed current of 18 mA. If the anode current is limited to 12 mA, 600 milliwatts are still obtainable, which means that moving-coil speaker output is brought within the scope of the listener who performs has to use H.T. batteries of modest capacity.

The steep-slope directly heated output valve—the P.P.5/400—sets a new standard of output valve efficiency, since it is



Senior R.K. speaker (Ediswan).

possible to obtain 5 watts A.C. speech energy for a grid swing of only 32 volts; this performance being accounted for chiefly by the remarkable mutual conductance of 7.0 mA/volt. Visitors to this stand should not fail to see the indirectly heated mains rectifiers, the heaters of which do not reach full temperature until after those of the A.C. receiving valves when both are incorporated in a set, thus preventing high no-load voltages from being developed across the various bypass condensers.

There are a number of R.K. speakers exhibited, including the "Senior," which is now fitted with a metal rectifier. A newcomer is a permanent-magnet model selling at 50s. and having a flux density of about 8,000 lines per sq. cm. Of the pick-ups being marketed by this firm, mention should be made of the "Minor," selling at 27s. 6d., including bakelite tone arm; its operating weight is only 4½ oz., and it is designed to be used with a 10,000-ohm potentiometer.

Edison Swan Electric Co., Ltd., 123-5, Queen Victoria Street, E.C.4.

## EELEX. (252)

During the past few months some notable additions have been made to the "Eelex" range of Eastick's specialties. The most noteworthy is the Short Wave Adaptor Type A, which costs £3, and when used in conjunction with a broadcast set converts it into a highly satisfactory superheterodyne short-wave receiver. A full description of this unit accompanied by a test report was published recently in this journal.

Another recent addition is the "Byldurone" range of cabinet fittings and material which obviates the need for laborious constructional work or access to a complete kit of woodworking tools. The appearance of the finished cabinet is considerably enhanced by using one of the various styles of covering materials available; these include crocodile, lizard, antique leather, or wood-veneer, and angle pieces are shown to tone with each. They cost 4s. 6d. and 5s. 6d. per set of four, according to finish.

In addition, there is a new version of the "Eelex" triple-duty indicating terminal and redesigned testing "Prods."

J. J. Eastick and Sons, 118, Bunhill Row, E.C.1.

## EFESCAPHONE. (87)

So many mains sets are now produced that the requirements of the battery-set user are apt to be neglected. Several new designs are shown covering the entire range of valve combinations. The sets are moderate in price and totally self-contained models are available, including loud speaker. Mains-operated receivers are, however, shown in addition to a range of particularly low-priced battery eliminators. A model priced at £4 gives 30 mA. at 150 volts, and is fitted with three voltage tappings in addition to an S.G. potentiometer and four grid-bias voltage points. A junior A.C. model giving 25 mA. at 120 volts, and provided with two voltage tappings as well as the S.G. potential, is priced at £3 10s. Falk, Stadelmann also market high-tension batteries, and the now well-known Puravox loud speaker movement is also to be seen.

Falk, Stadelmann and Co., Ltd., 83-93, Farringdon Road, E.C.1.

## EKCO. (26)

The four-valve all-electric set recently reviewed in this journal is the outstanding feature of the Ekco programme for 1932. The metal chassis is of advanced design, and carries a built-in moving-coil loud speaker. Two stages of H.F. amplification ensure more than ordinary range and selectivity, while the power pentode in the output stage provides ample volume and good quality. The large-diameter tuning scale and station indicator surrounding the loud speaker diaphragm and the automatic wave-range and radio-gram switch incorporated in the single-tuning control are features which at once establish the individuality of this set. It is available as a console,

D 27



R.K. Minor permanent-magnet speaker and Minor pick-up (Ediswan).

put of some 370 milliwatts, which is sufficient volume for all ordinary-sized rooms. This means that for an anode dissipation of 750 milliwatts, 370 milliwatts A.C. energy is possible, representing an efficiency of 49 per cent., whereas hitherto an efficiency of 33½ per cent. has been considered high.

Other new valves include the indirectly

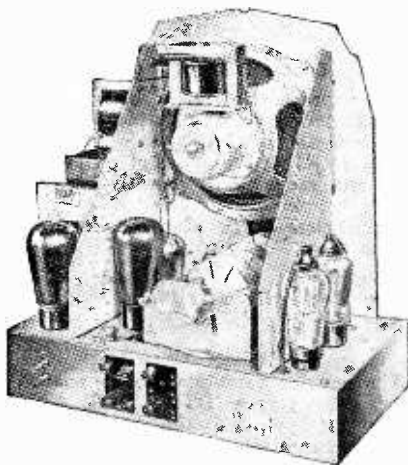
**Stand-to-Stand Report.—**

consolette, or radio-gramophone, and may be obtained for A.C. or D.C. supply mains. In its simplest form—the consolette—the price is 24 guineas.



Ekco type R.G.5 radio-gramophone.

The type R.S.2 is a three-valve (S.G.-det.-pentode) chassis incorporating a conical loud speaker, the balanced-armature unit of which has a special high-impedance winding to match the pentode valve. Like the four-valve consolette, it is available for A.C. and D.C. mains, and is housed in a high-grade moulded cabinet of attractive design. In the D.C. model the filament current is controlled by a bar-



Ekco four-valve all-electric receiver chassis.

D 23

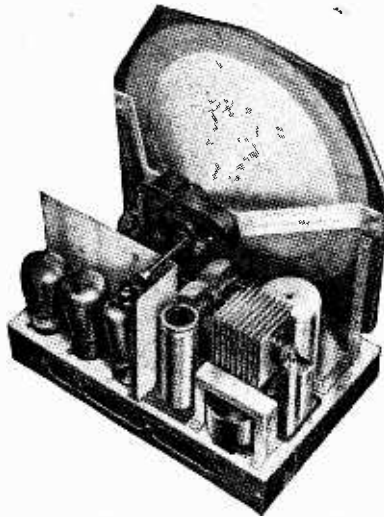
reter lamp. It sells for the very reasonable figure of 15 guineas for either A.C. or D.C. supplies.

Last year's model 312 and 313 receivers have proved so successful that they are continued at the reduced price of £10 17s. 6d. and £17 10s. respectively.

The whole of the range of Ekco trickle chargers and power units has been redesigned, and the new models are housed in attractive bronze-finished metal cabinets.

Finally, there is the recently introduced Radiocorder, which forms an integral part of the R.G. radio-gram., and may also be obtained as a separate unit for 5 guineas.

*E. K. Cole, Ltd., Ekco Works, Southend-on-Sea.*



Ekco type R.S.2 three-valve chassis.

**ELDECO. (185)**

Two interesting portable sets are shown on this stand; the first is a four-valve screen-grid receiver with two L.F. stages, the first of which is R.C. and the second transformer coupled. It is of the suitcase type, with the loud speaker and frame aerial in the lid, and is fitted with a turntable. It is priced at 17 guineas, and it is claimed that the current drain on the 120 volts H.T. battery is only 6.5 mA.

The second portable is also of the suitcase type, but is much more powerful, inasmuch as it is a six-valve superheterodyne. A two-valve frequency changer is used, and is followed by two screen-grid valves in the intermediate frequency amplifier, which employs band-pass filters tuned to 126 kc. The volume control operates on the screen grids, and a triode output valve is fitted as standard, although a pentode can be fitted if desired; the use of a pentode, however, increases the current consumption, which is commendably low, being only 13 mA. at 120 volts.

In addition to these sets a new range of plugs and sockets is shown; one of the chief features of these is the secure way in which the connections are made. A grub screw passing down the centre of

the socket locks the wire firmly against the base, and the plug, instead of being solid, is tubular and slit both longitudinally and crossways. As a result, the plug fits easily into the socket, and yet makes a sound connection.

*Electrical Devices, Ltd., 12, Great James Street, W.C.1.*



The Eldeco S.G.4 portable.

**ELECTRICAL & RADIO PRODUCTS. (3)**

So far as we are aware, this firm was one of the first to produce a compact receiver with a built-in moving-coil loud speaker; consequently, it is only to be expected that this year their "star"



E.R.P. five-valve pedestal receiver.

exhibit should be a set of this class. The new self-contained table model has two H.F. stages, transformer-coupled, the three tuned circuits being fully gang-

**Stand-to-Stand Report.—**

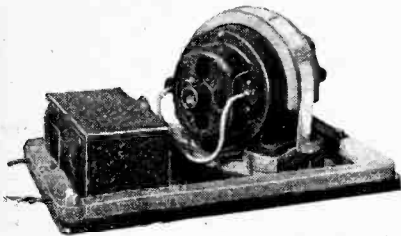
controlled by means of the latest type of variable condenser with "segmented" end vanes, by means of which a high degree of accuracy in tuning can be ensured. An unusual refinement, in the form of a "local-distance" switch, is included, and the set is assembled on a metal chassis of clean design. The price is 22 guineas; a pedestal model is also shown, as well as a radio-gramophone in which the same chassis is fitted.

*Electrical and Radio Products, Ltd., Empire Works, Salfords, Redhill, Surrey.*

**ELECTRO-DYNAMIC CONSTRUCTION CO. (228)**

Machines for converting a direct current to one of an alternating nature sufficiently free from D.C. commutator ripple to operate a highly sensitive all-electric receiver, or gramophone, are available here for inspection in a variety of types. There are small machines giving between 40 and 50 watts output, which, complete with smoothing equipment and mounted in a sound-proof cabinet, cost £14. The largest size, with a rated output of 600 watts, costs £31 with its smoothing unit, but not enclosed in a cabinet.

In addition, there is a range of anode converters built on similar lines to the rotary converters, but fitted with a commutator in place of slip rings for the A.C.



Model 90 Electro-Dynamic D.C. to A.C. converter.

output. These are made in sizes of from 20 watts output up to 200 watts, and can be obtained mounted in sound-proof cabinets embodying a special filter unit. The prices range from £14 5s. to £28 complete.

*Electro-Dynamic Construction Co., Ltd., Devonshire Grove, Old Kent Road, S.E.*

**ELECTRON. (35)**

Designed to meet the needs of those who cannot erect an outside aerial pole, the Electron screen aerial, selling at 15s., is of interest. It consists of an octagonal piece of coppered metal gauze, about 2ft. x 2ft., to which is attached a length of flexible conductor. It can be attached to the side of the house, the chimney or under the roof. Another variety of this accessory takes the form of a fire-screen with an attractive wooden border.

Another exhibit is an insulator pin with pierced erinoid body to guide and insulate a lead-in wire or indoor aerial. It is made in different colours, and sells at 6d. per box of six. Different types of Electron aerial wire are displayed.

*New London Electron Works, Ltd., East Ham, E.6.*

**ELO. (206)**

This firm are specialists in mouldings of every description, and their exhibit consists of numerous examples showing the nature of the work they are prepared to undertake. The material used is officially known as "Elo," and consists of a synthetic resin for which is claimed exceptionally good electrical properties.

*Birkbys, Ltd., Liversedge, Yorks.*

**ENSIGN (HOUGHTONS). (85)**

Wholesalers exhibiting the leading make of sets and accessories.

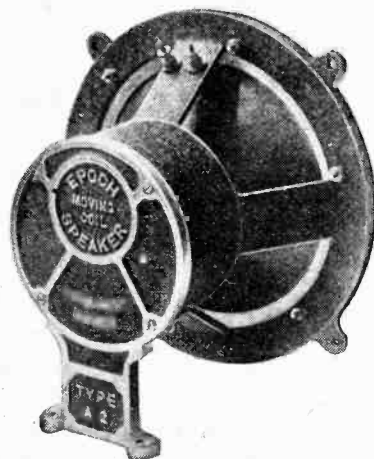
*Ensign, Ltd., 88-89, High Holborn, W.C.1.*



Epoch midget energised moving-coil speaker.

**EPOCH. (106)**

A large selection of loud speakers, all of the moving-coil type, are shown here. The centrepiece of the stand is an enormous speaker for which a range of 25 miles is claimed when carrying its maxi-



One of the Epoch range of permanent-magnet speakers.

imum signal load. At the other extreme is a small energised speaker, with 4in. cone, which sells, complete with input

transformer, at the price of 27s. 6d.

The popular "Domino" model appears this year in an improved form; there are types for accumulator, D.C. mains, and A.C. mains, as units or in cabinets of various finishes.

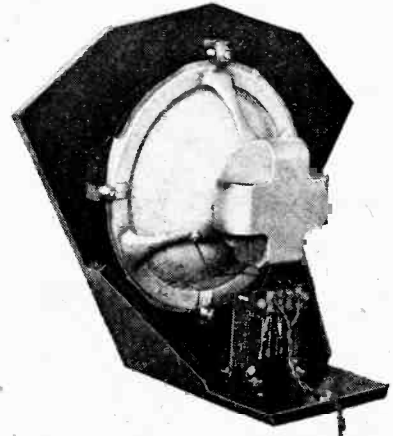
Permanent-magnet speakers are also shown, at prices from two guineas upwards. Most models, whether permanent magnet or energised, have interchangeable diaphragms, so that the high-note response can be suited to individual needs.

*Epoch Radio Mfg. Co., Ltd., Exmouth House, Exmouth Street, E.C.1.*

**ERICSSON. (219)**

This stand is devoted to a display of loud speakers of rather unusual design. The cabinet is fan-shaped, and models are shown finished in a variety of colours. A model is available to tone with every colour scheme.

One type of chassis is standardised throughout; this is a permanent magnet moving-coil unit having a low-resistance



Chassis of Ericsson permanent-magnet loud speaker.

speech coil and a step-down input transformer. These loud speakers cost 6 guineas, irrespective of finish. The chassis alone is available at £4 10s.

*Ericsson Telephones, Ltd., 71, Kingsway, W.C.2.*

**EVER READY. (76)**

A comprehensive range of dry batteries for every possible purpose is shown here. Users of last year's catalogue should note that the prices of all but the Standard range have recently been reduced.

A complete range of accumulators is also on view.

*Ever Ready Co. (G.B.), Ltd., Ever Ready Works, Hercules Place, Holloway, N.7.*

**EXIDE. (8)**

The popular mass-type Exide accumulator cells (types DTG, DFG, etc.), which are intended for comparatively slow discharge rates, have been considerably improved this year. For instance, the glass containers have been redesigned, there is now a screw-on vent in

**Stand-to-Stand Report.—**

place of a simple rubber plug, the carrier is distinctly better, and a tab for the owner's name is provided, in order to avoid the risk of substitution at the charging station. Prices are unchanged.

All other Exide accumulator batteries, except those for H.T. supply, are considerably reduced in price. Unspillable cells, both with free electrolyte and those of the Gel-cel type, are now produced in a wider range of sizes and ampere-hour capacities. Here, again, prices are considerably lower in many instances.

Drydex dry-cell batteries are considerably cheaper for the present season; as an example, a triple-capacity battery of 120 volts, capable of feeding quite an ambitious set, costs only 24s. A wider range of special H.T. batteries for portable sets is now available.

*Chloride Electrical Storage Co., Ltd., Clifton Junction, near Manchester.*

**FARADEx. (79)**

An all-mains three-valve set (detector, L.F., output; resistance-coupled through-out), which sells at £8 17s. 6d. complete with balanced-armature speaker, is shown here. There are also a number of inexpensive components.

*Rooke Bros., Ltd., 32, Queensway, Ponders End.*

**FAUDELS. (192)**

Although the main activity of this firm is factoring, they are showing in addition to a range of proprietary products, two receivers of their own manufacture. These are the Coronet sets; one is a three-valve self-contained set with a frame aerial and built-in speaker; it is priced at 6 guineas in an oak cabinet. The circuit consists of a detector with two L.F. amplifiers.

The other receiver is also a three-valve, but is of the screen-grid H.F. type, with a pentode output valve. It is A.C. mains operated with a permanent-magnet moving-coil loud speaker. The tuning circuits are ganged, and the single tuning dial is calibrated in wavelengths; it is of the full-vision type.

*Faudels, Ltd., 36-40, Newgate Street, E.C.4.*

**FAY HOME RECORDERS. (220)**

Home recording is quite a new development, and is in many respects closely allied to wireless, since the apparatus can be used to put on permanent record broadcast matter. The various models shown on this stand include an inexpensive outfit priced at two guineas, which is used in conjunction with a gramophone. The record is made by speaking into an acoustic cone attached to a special sound box fitted with a diamond stylus.

For more ambitious recording there is an electric model which can be used in conjunction with a wireless receiver and is fitted with a microphone; the price is six guineas. The electric model de luxe is a superior piece of apparatus, consisting of a three-stage amplifier, a microphone, a recording pick-up, and all asso-

ciated components. The price complete with batteries is twelve guineas.

*Fay Home Recorders, Ltd., 121, Victoria Street, S.W.1.*



"Fay" home recorder No. 4, incorporating a three-stage amplifier.

**FERRANTI. (45)**

The activities of this firm during the past year are to be seen chiefly in the new loud speakers, mains transformers, power units, and components which make their first appearance at the show.

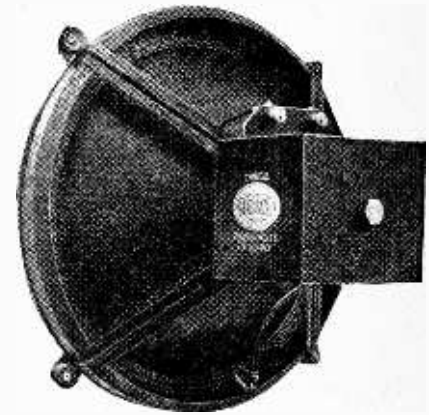
*Receivers.*—If we except the new band-pass kit set for home constructors no new models have made their appearance, but the three-valve A.C. mains set known as the Model 31 in wood cabinet and Model 32 in rexine-covered metal are being continued with minor improvements, such as the provision of an alternative mains aerial connection. The chassis is also available in radio-gram.



Ferranti type M1 moving-coil chassis and OPM8 output transformer.

form and as a self-contained console model with either a moving-coil or one of the new Ferranti inductor loud speakers. The prices compare very favourably with last year's figures, and as example we may quote the Moving-Coil Console at 28 guineas and the Inductor Console at 22 guineas.

*Loud Speakers.*—The well-known "Magno Dynamic" permanent-magnet moving coil has been redesigned with a new type of permanent magnet, and shows a 10 per cent. increase in sensitivity. The new designation is type M1. Provision is made for mounting the OPM8 output transformer in the base, and the price of £9 10s. is unaltered. Two new models with 9in. fabric diaphragms have been added to the moving-coil series—type M2 at £5 10s. and type M3 at £3 15s. Smaller magnets are used in the M2 and M3, but the air gap has been reduced to 50 mils instead of 62.5 mils as in the M1, and the sensitivity of all three units is approximately the same.

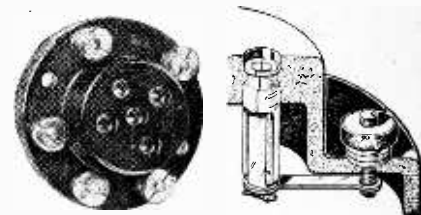


Ferranti type D2 moving-coil chassis.

A new moving coil known as type D2 is designed for D.C. excitation, and is available for voltages from 2 to 250. This should prove a useful component to set constructors, since field windings are available for accumulator, D.C. mains, or rectified H.T. supplies. The power required is 4 watts.

The new Inductor loud speaker is a well-designed job, and is provided with a pair of massive permanent magnets. It is sensitive, and will give good results with a power valve taking 7mA. at 120 volts. The impedance is 5,000 ohms at 800 cycles. The chassis alone costs £3 10s., and in cabinet form the price is £5 10s.

*Components.*—The full range of Ferranti intervalve transformers and chokes is displayed, and a notable addition is the B8 choke. This has an inductance varying from 35 henrys at zero D.C. to 10 henrys at 50 mA. It is shrouded in a moulded case, similar to that of the AF8 transformer, and the price is 7s. The



Ferranti valveholder and double-contact socket.

**Stand-to-Stand Report.—**

same case is used for the new OPM8 output transformer at 12s. 6d., which has alternative output ratios of 1:1 and 15:1 for low impedance loads.

A well-designed solid valve holder with double-wiping contacts makes its appearance for the first time, and there is a new series of heavy-duty fixed resistances rated at 10 watts.

The range of mains transformers has been considerably augmented, and includes a transformer for use with the new Westinghouse H.T.8 rectifier. The majority of these transformers are now fitted with ebonite-shrouded connectors. The SV7A is an interesting model. It is designed for high-power amplifiers with the U8 rectifier.

Four new H.T. supply units make their first appearance, and the type E1 may be cited as a typical example. This makes use of a U12 valve, and gives 200 volts at 115 mA.

Kits of parts are supplied for constructor's supply units. The type E makes use of the H.T.8 Westinghouse unit and delivers 250 volts at 70 mA. There are, in addition, A.C. tappings at 4 volts 5 amps and 4 volts 1 amp.

In conclusion mention should be made of a new power amplifier known as the A.C.6. This is A.C. operated, and has three stages. The final stage consists of two L.S.5s in push-pull giving 6 watts undistorted power. The characteristic is flat from 50 to 8,000 cycles, which is a noteworthy achievement for three stages.

*Ferranti, Ltd., Hollinwood, Lancs.*

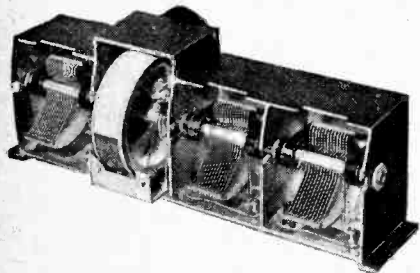
**FLINDERS. (204)**

The apparatus on this stand comprises a representative range of receivers, accessories, and components made by the principal radio manufacturers. These are of particular interest to retailers from the Eastern counties, since the apparatus shown is that most suitable, in the opinion of the exhibitors, for use in that area.

*Flinders (Wholesale), Ltd., East Stockwell Street, Colchester.*

**FORMO. (61)**

As one of the first manufacturers of totally screened gang-operated condensers, this firm now offer a new popular-priced model which, incorporating



New type Formo ganged condenser in cast metal housing.

drum dial and escutcheon, is built as a solid unit. To suit practical requirements, the three rotors are driven on a single shaft, but an additional control

operates for trimming purposes a ganged pair of stators. This would seem the correct condenser for a three-valve set embodying a band-pass filter. In addition to the main indicator on the drum dial, a shadow pointer, seen through the illuminated scale, shows the setting of the adjustable stators.



The Formo Multivo eliminator.

A new slow-motion condenser has been added to the Formo range which, with knob and dial, sells at 6s., while a single-unit variable condenser of good construction is priced as low as 4s.

Formo first introduced the pre-set condensers now to be found in profusion, and various sizes are available at 1s. 6d. Small fixed mica condensers of the tag type are low in price, and of equally good value are the new Formo Mansbridge condensers in metal cases, and fitted with terminals. Many other components are included in the Formo range, and are all described in a useful little booklet obtainable at the stand.

Eliminators make their first appearance among Formo products, and are offered at competitive prices. They are built almost entirely with Formo equipment. The "Multivo" model working from A.C. supply gives three outputs, the S.G. terminal being controlled by a wire-wound potentiometer and delivering 150 volts to the maximum voltage terminal with a current up to 25 mA. Battery charging is provided in the unit, which makes use of the Westinghouse rectifier. Another model is available, the "Minivo," which is similar, except that it does not provide for battery charging. This is shown connected up to meters reading the rated output.

*Formo Co., 23, Golden Square, W.1.*

**FULLER. (36)**

The products of this firm are accumulators and dry batteries. In the former category there is an exceptionally complete range of cells with a number of unique features. To prevent acid corrosion the terminals are fitted with two grease-filled cups, and the polarity signs are prominently moulded on the top, enabling easy identification in the dark. As a further precaution, to prevent wrong connections, different threads are given to the two terminals. With each accumulator cell is arranged a device con-

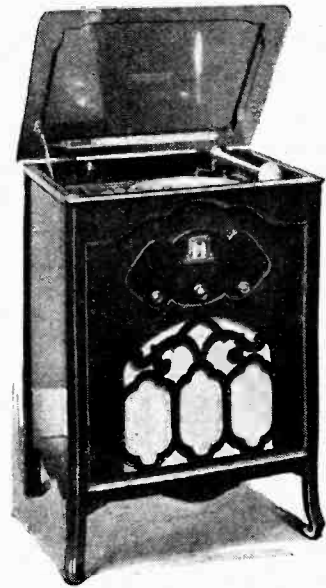
sisting of two coloured beads which float on the top of the electrolyte when the battery is fully charged. When the two beads sink the battery needs recharging.

A number of non-spill jelly acid cells and metal carriers are on view. The "Sparta" H.T. dry batteries are capable of a maximum discharge of 10 milliamperes, and the 120-volt type sells at 10s. 9d. In addition to this, there is a triple-capacity battery for 20 to 30 milli-ampere loads, selling at 19s. 6d. for 100 volts.

*Fuller Accumulator Co. (1926), Ltd., Woodland Works, Chadwell Heath, Essex.*

**FULLOTONE. (201)**

An interesting two-valve radio-gramophone is being shown on this stand; a Celestion loud speaker is fitted, together with a Collaro motor, and it is completely A.C. operated. There is also a three-valve radio-gramophone, of the screen-grid H.F. type. In this case either a Rola or a Magnavox speaker is fitted, according to personal preference; a D.C. model of this receiver is also available, and it employs Mazda indirectly heated valves.



Fullotone two-valve radio-gramophone, Model 204.

A four-valve battery radio-gramophone is exhibited, and this is priced at 16 guineas; it includes a double-spring motor.

*Fullotone Gramophones (1929), Ltd., 73, Camden Road, N.W.1.*

**G.E.G. (24 & 77)**

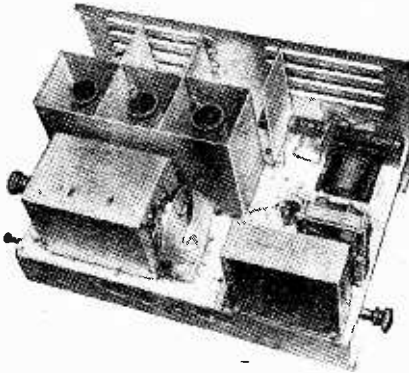
The enviable reputation gained by this firm is well maintained in the new season's programme. Probably one of the most popular constructor's kit sets is the "Osram Four," which is retained for the coming year and has been so successful that little modification has been found necessary. There is now provision for a gramophone pick-up and the series-aerial condenser has a different plate shape so as



**Stand-to-Stand Report.—**

to obtain a lower minimum. Five-pin valve holders are standardised, with the result that subsequent conversion for mains operation is facilitated.

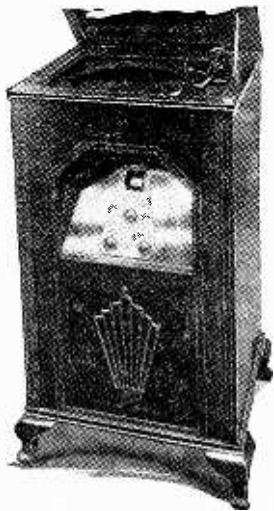
The Gecophone all-power unit, selling at £6 1s. 6d., is specially designed for converting the old and new "Music Magnet" (now called the "Osram-Four") for A.C. mains operation. Indirectly heated valves must be used, but



Four-valve all-electric screen-grid receiver by G.E.C.

practically no other alteration is required in the receiver proper, as both H.T., L.T., and grid bias are provided in the mains unit, together with adequate smoothing and decoupling.

A new receiver belonging to the "Midget" class is the Gecophone "Compact Three-valve Receiver," lately reviewed in detail in the pages of this journal. It is an all-mains set with built-in inductor dynamic speaker. The circuit comprises a single screen-grid H.F. stage, with parallel tuned-grid coupling,



Gecophone all-electric radio-gramophone (G.E.C.).

followed by a regenerative leaky-grid detector, which in turn is linked by a transformer to a directly heated high-voltage

pentode. There are two tuning controls with illuminated dials, and selectivity is controlled by a series-aerial condenser. Metal pressings are freely used in the chassis construction, which lends itself well to production in large quantities.

Of advanced design is the Table Model "All-Electric Four" receiver, with two screen-grid stages. The metal chassis construction is boldly conceived, and careful attention is paid to the screening of practically every component. There is one-dial tuning control and an illuminated scale calibrated in wavelengths. Particularly ingenious is the seven-contact switch controlling wave-band change, radio-to-gramophone, and the on-off mains switch. A positive action is ensured by spring-loaded ball and socket contacts, except for the mains switch, which is cam-operated. A ganged control of the series-aerial capacity and of reaction is so arranged that regeneration does not take place until the aerial coupling is tight. Both condensers concerned are of unconventional design and contain a single moving plate which is able to rock only through a small angle. To enable the



(Left) Osram ML4 A.C. valve.



(Right) PT4 — a directly heated pentode (G.E.C.)

highest quality to be obtained on nearby transmissions, a local-distance switch is fitted, which brings into action a resistance shunted across one of the tuned circuits. The output valve is a P.T.4 pentode, which delivers to the loud speaker some 1,800 milliwatts undistorted output. The price of the receiver is 20 guineas.

With regard to new Osram valves, there is a keen interest being taken in the V.M.S.4—a variable-mu tetrode with suitable characteristic to prevent modulation distortion and lack of selectivity due to cross-modulation. This valve provides an ideal form of distortionless volume control by variation of grid bias, and should find application in multi-valve sets, especially those with two or more S.G. stages.

A particularly efficient power valve giving from 2 to 3 watts A.C. output is the Osram P.N.4, with the exceedingly high slope of 6.0. New pentodes include the P.T.4 and the M.P.T.4—the latter having an indirectly heated cathode. There is a full range of indirectly heated D.C. valves, with heaters consuming only 0.25 amps. at 16.0 volts, so that a D.C. set can now be built with highly efficient valves consuming from the supply mains only 60 watts. This company is showing

an interesting film in the demonstration room in the gallery, depicting methods of valve testing and components in manufacture.

General Electric Co., Ltd., Magnet House, Kingsway, W.C.2.

**GAMAGE. (195)**

This firm is showing a range of the products of the principal manufacturers, but is also showing a few lines of its own. There is a five-valve portable set, employing two stages of aperiodic H.F. amplification, which is priced at £7 17s. 6d., and a four-valve portable with one screen-grid stage at £9 15s.

A special feature is being made of a single-valve set which is being sold complete with aerial wire, valve, accumulator, and H.T. battery for 29s. 6d.

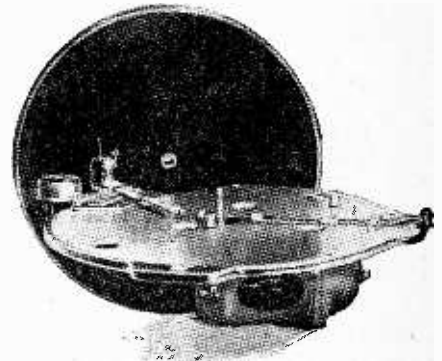
A. W. Gamage, Ltd., Holborn, E.C.1.

**GARRARD. (178)**

The main exhibit at this stand is undoubtedly the new 202 induction motor, which is priced at 58s. 6d. complete with 12in. turntable and fully automatic stop. It is suitable for A.C. only; four terminals are provided, so that connections for 100-130 volts and 200-250 volts can be made. A special point is made with regard to the ease of fitting; the whole unit is mounted on a 12in. plate, which is fixed to the gramophone cabinet.

The Garrard Universal motor is also shown; this is a higher-priced motor, for it is listed at £5 15s., but it is suitable for any supply voltage between 100 and 250 volts, and it will run equally well on direct current or alternating current. In the case of A.C., any frequency between 25 and 60 cycles is satisfactory.

In addition to other electric motors, there is a wide range of the spring-driven type. The cheapest of these, the No. 20,



The new Garrard 202 induction motor.

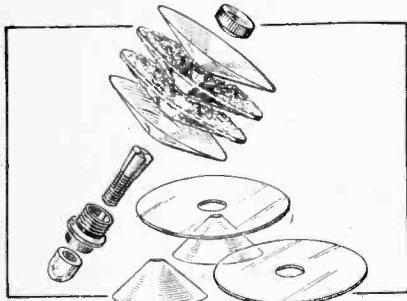
is of the single-spring type, and will play one side of a 12in. record with one wind. It is sold complete with turntable and the usual accessories for 20s. Larger double-spring motors are available for those with no electric supply, and it is claimed that the No. 10B, at £2 13s. 6d. will play five sides of 10in. records at one wind.

Garrard Engineering and Mfg. Co., Ltd., Newcastle Street, Swindon, Wilts.

## Stand-to-Stand Report.—

**GARRATT STORES. (240)**

Improved models of the "Tonax" cone adaptor are shown on this stand. These now include an attachment for double-cone diaphragms, the special feature being the provision of felt washers and special flexible washers by the aid of which a



Garratt "Tonax" cone adaptor.

good mechanical connection is made to the centre of the diaphragm. Single-cone type attachments cost 1s. each, and the double-cone model is priced at 1s. 6d.

Garratt Stores, 193, Garratt Lane S.W.18.

**GODWINEX. (78)**

On this stand can be seen a complete range of the "Godwinex" eliminators and mains units. Since there are twenty-eight or more to choose from, it is reasonably certain that every enquirer will find something to his taste. A variety of mains transformers and chokes are also shown, while any others will be made to special order.

J. Dyson and Co. (Works), Ltd., 5, Godwin Street, Bradford.

**GOODMANS. (239)**

The most attractive model in the whole range of loud speakers shown on this stand is probably the "Dreadnought" permanent magnet moving-coil loud speaker, priced at 3 guineas, and fitted in a solid oak cabinet. It is of the low-resistance type and will require the addition of a suitable step-down transformer. The component shown as suitable for this purpose is a universal-type having three tappings, one of which is intended for use when a pentode valve is employed in the set. It costs 12s. 6d.

A cabinet cone speaker, also in a solid oak case and priced at 19s. 6d., is certainly an attractive proposition, and the unit only is obtainable at 10s. 6d. There are many other models, all of which will justify examination.

Goodmans, 69, St. John Street, E.C.1.

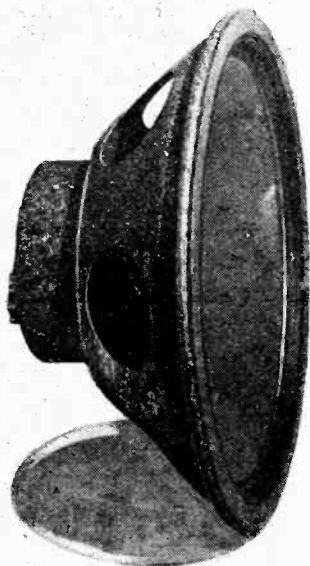
**GRAHAM. (189)**

This stand is principally devoted to Citex fire extinguishers, which are installed on every stand throughout the exhibition. Plugs and sockets, terminal labels, insulating bushes, crystals, and crystal detectors are also shown.

R. F. Graham and Co., 45-46, Cambridge Road, Kingston-on-Thames.

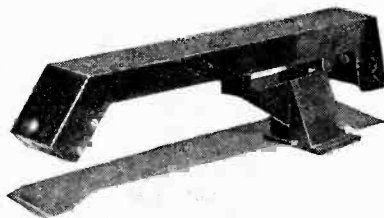
**GRAHAM FARISH. (32)**

This firm is noted for small components, such as fixed resistances, H.F. chokes, small bakelite dielectric condensers, and valve holders. The rigid-type valve holders have been reduced in price, and the 4-pin now costs 6d. and the 5-pin 8d.; the anti-microphonic type is sold at 9d. Pre-set condensers are available in all the usual capacities at a fixed price of 1s. 6d., and the 0.5 megohm volume control sells for 3s. 6d.



Graham Farish A.C.4 cone chassis.

The new A.C.4 loud speaker chassis in a frosted black aluminium housing, with adjustable four-pole unit at 21s., and the equivalent cabinet model at 42s., are newcomers to this stand. The Graham



Graham Farish pick-up and moulded tone arm.

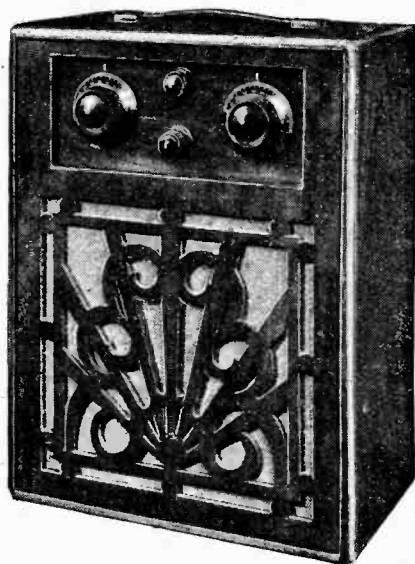
Farish pick-up is now fitted in a strikingly modern moulded tone arm, which is shown in the photograph. The unit has the unusual feature of a concealed counter-balance weight and a ball-bearing pivot.

Graham Farish, Ltd., Masons Hill, Bromley, Kent.

**GREATREX. (197)**

Sound design, compactness and simplicity of operation are the three main features of the Greatrex all-electrical transportable receivers. Two models are shown, one a three-valve set embodying

a screen-grid H.F. valve, with detector and pentode output, the price of which is 20 guineas, and the other a simple two-valve model costing only 12 guineas.



Greatrex three-valve A.C. transportable receiver.

An advance model of a new range of receivers officially described as the "Lion-Radio Electric Three," is shown also. This is fitted with one H.F. stage with a pentode output, has ganged condensers and costs 21 guineas.

A special display is made of the Newton charging equipment. Models are shown ranging from small units for handling 100 two-volt cells per week, up to a large constant-voltage generating plant giving 100 amperes output.

R. G. Greatrex and Co., 184, Regent Street, W.1.

**GRIPSO. (81)**

A useful range of small accessories, in-



An ingeniously simple shrouded plug and socket (Gripso).

**Stand-to-Stand Report.**

cluding indicating switches which contain revolving plates automatically showing "long" or "short," "radio" or "gramo," and other combinations, together with labels, tags, and other unconsidered, but indispensable, components is offered by this firm. A shrouded plug and socket for mains use, with an exceptionally quick and easy means of connecting the flex to the plug, is shown in an accompanying sketch.

*Gripso Co., 32, Victoria Street, S.W.1.*

**GROSVENOR. (72)**

As a firm specialising exclusively in the manufacture of batteries for all purposes, H.T. batteries are shown in wide variety. A pamphlet is available giving comprehensive data of six different types of H.T. battery, and should prove valuable reference to the battery user. By way of example of price one may take the new 108-volt-capacity Red Line battery, which sells at 10s. Generous mercantile treatment so as to ensure long life is claimed for "Grosvenor" batteries.

*Grosvenor Electric Batteries, Ltd., 2-3, White Street, Moorgate, E.C.*

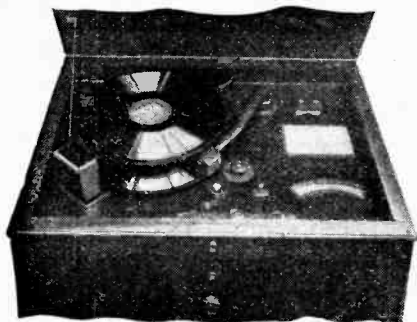
**GUTTA PERCHA. (166)**

As magnetic alloys are used extensively in the construction of present-day L.F. transformers and chokes, special interest will attach to the display of "Radio-metal" stampings shown on this stand. This is the product of their associated company, the Telegraph Construction and Maintenance Co., Ltd., who make, also, that high-permeability alloy described as "Mumetal." This is used in the construction of some makes of gramophone pick-ups.

*Gutta Percha Co., Wharf Road, City Road, N.1.*

**H.M.V. (THE GRAMOPHONE CO.)**

Being unable to obtain large enough space to adequately show their range of new products within the exhibition, the Gramophone Company have arranged a



An outstanding set—the H.M.V. single dial superheterodyne combined with gramophone equipment and incorporating a record changer.

demonstration room directly opposite the approach road to Olympia. Equally, adequate space is not available in this report to deal other than briefly with the extensive range of new products. The

following short specifications do not convey the superior merit of design, manufacture and finish.

The model 501 is a useful three-valve table radio-gramophone available for use with A.C. or D.C. supply. This instrument incorporates band-pass tuning, and is controlled by a single dial calibrated in wavelengths. The volume control has a single knob which regulates radio or gramophone as well as reaction, and the moving-coil loud speaker is built into the cabinet.



Another view of the H.M.V. radio-gramophone (Model 531), incorporating a nine-valve superheterodyne and record changer.

The model 116 playing desk is a unit for connecting to the input of a radio receiver, and comprises a new H.M.V. pick-up, electric motor with automatic start and stop, and volume control.

Model 455, a three-valve radio receiver embodies all those refinements in set design which the enthusiast would hope to find, including band-pass filter input. The power output exceeds 1½ watts. An ingenious switch enables different illuminated scales for long or medium waves to be introduced automatically, and facilitates clearness of reading. The price is 22 guineas, and includes the new type permanent-magnet moving-coil loud speaker.

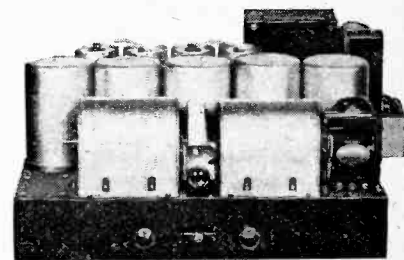
Model 117 is an automatic record-changing cabinet playing desk, an instrument of particular interest to radio set owners in that it provides a continuous playing radio-gramophone. An inlet switch determines the number of records to be played, the mechanism switching itself off after the last record is completed. A single record may be repeated up to eight times, automatically, while by pressing a button a new record may be placed on at any time.

H.M.V.'s ace set is the model 531, being a nine-valve superheterodyne with automatic record-changing radio-gramophone. It is one of the first single-dial superheterodynes, and has no less than ten tuned circuits embodying band-pass filters. A "local distance" switch cuts down the H.F. amplification about 1,000 times for the reception of comparatively near-by stations. The output is over 5 watts, and the loud speaker is of the energised-field moving-coil type. This is an amazing instrument, both in design and construction, and is priced at 70 guineas, which, it is interesting to note, is less than that of the best spring-driven H.M.V. acoustic gramophone of six months ago. The H.M.V. exhibit includes a number of accessories.

*The Gramophone Co., Ltd., 363-367, Oxford Street, W.1.*

**HACKER. (95)**

Two high-grade receivers, sold in radio-gramophone form only, make up the exhibit of this firm. One, the U53, begins with a band-pass filter, continues with two stages of high-frequency amplification, using screened pentode valves, following these with a power detector and a push-pull output stage delivering about three watts of undistorted signals. The high-frequency gain, from grid of the first valve to the grid of the detector, is about 15,000 times. Unconventional features, besides those mentioned, include provision for interchangeable power units for A.C. or D.C., meter-jacks in detector and output plate circuits, and a static screen between primary and secondaries of the mains transformer to cut down parasitic noises. The whole is robustly built and very fully screened, as the illustration shows.



Chassis of the Hacker U53 radio-gramophone.

The less ambitious model, the U31, is a three-valve set built on very similar lines.

*H. Hacker and Sons, Perfecta Works, Ray Lea Road, Maidenhead.*

**HARLIE. (84)**

The main display here is made up from pick-ups, of which three types are made at prices from 17s. 6d. for one to fit an existing gramophone, up to 39s. 6d. for a de luxe model with tone-arm and self-contained volume control, and variable pressure adjustment enabling the effective weight of the pick-up to be varied over a wide range.

An item of interest to those who are contemplating the purchase of a gramo-

**Stand-to-Stand Report.—**

phone is a small "portable gramophone" consisting of a constant-speed motor, with automatic stop, mounted in a neat case with a de luxe pick-up and volume control. Only a wireless set is required to complete an all-electric radio-gramophone.



Portable microphone, including battery and transformer (Harlie).

Moving-coil speakers, both energised and permanent magnet, are also shown, while the experimentally inclined will welcome the portable microphone, complete with transformer and battery, shown in the illustration.

Harlie Brothers (Edmonton), Ltd., Balham Road, Lower Edmonton, N.9.

**HALCYON. (96)**

The "Europa" series of sets, two for batteries and one for A.C. mains, use a standard superheterodyne circuit with big-grid frequency-changer and pentode output.



The Halcyon "Europa" portable superheterodyne.

The "Utopia" radio-gramophone uses three screen-grid H.F. stages, of which one is untuned.

Halcyon Wireless Co., Ltd., 27a, Pembroke Villas, Notting Hill Gate, W.11.

**HEAYBERD. (68)**

Eliminators for all requirements are exhibited, including kits of parts for easy home construction. All types make use of the Westinghouse rectifier, and outputs range from 25 mA. at 120 volts to 60 mA. at 220 volts, the high rating eliminators being suitable for operating nearly every class of set, including generous superheterodynes. All models are supplied, when required, with provision for battery charging and all requirements of H.T. and L.T. supply are met by the wide range of combined outputs. Heayberd mains units are enclosed in metal containers, and carry a three years' guarantee. Clearly set out practical circuit diagrams remove all difficulty in the way of the home constructor, and a comparison of prices shows an approximate saving of 10s. The eliminator kits only require wiring.

F. C. Heayberd and Co., 10, Finsbury Street, E.C.2.

**HENDERSON WIRELESS & ELECTRICAL SERVICE. (170)**

These wholesalers are showing a wide range of wireless receivers and components of well-known makes, and the great variety of apparatus allows of easy comparison between different products.

In addition to these purely wireless components, an interesting exhibit is apparatus for radio relays.

Henderson Wireless and Electrical Service, 54, Queen's Road, Brighton.

**HILLMAN. (166)**

This well-known firm of wholesalers has an interesting display of receivers manufactured by the chief radio companies, and the range includes portables, radio-gramophones, and table model sets. Numerous components help in making this stand representative of the latest developments.

Hillman Brothers, Ltd., 123, Albion Street, Leeds.

**HOBDAY. (175)**

This well-known firm of wholesalers has confined its exhibit to receivers and components by the principal British manufacturers, and the representative range affords an easy comparison between the different products.

Hobday Bros., Ltd., 21, Great Eastern Street, E.C.2.

**HOME ELECTRIC. (214)**

Of the various "Guest" receivers shown on the stand, considerable interest attached to the "Super-Het Radiogram," which embodies a seven-valve receiver with band-pass tuning and many other up-to-date features. It is entirely self-contained, and operates on A.C. supplies. Fitted in a handsome walnut cabinet, the price is 39 guineas. A console model fitted with the same receiver

chassis and having provision for an external gramophone pick-up is shown, also, the price being 29 guineas.

Other receivers shown include a two valve radio-gramophone, all-electric transportable sets, and some battery-operated models.

Home Electric, Ltd., 24, Sackville Street, W.1.

**HUNT. (232)**

This stand is intended for the trade only.

A. H. Hunt, Ltd., Tunstall Road, Croydon, Surrey.

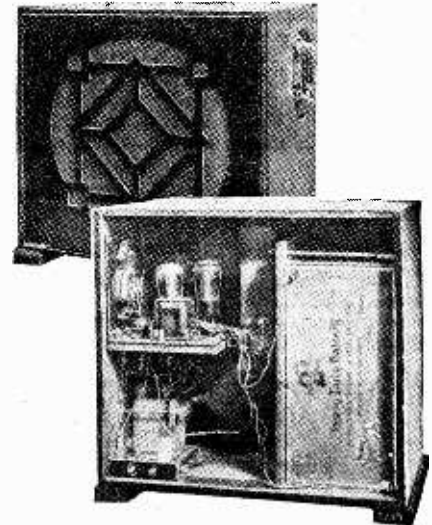
**HUNTON. (233)**

This exhibit shows equipment of interest solely to manufacturers.

Hunton, Ltd., Fitzroy Court, Tottenham Court Road, W.1.

**HUSTLER, SIMPSON & WEBB. (86)**

This stand will interest those seeking a low-priced set, a complete receiver being shown at four guineas. This set, the "Super Two," is enclosed in a well-finished oak cabinet exposing on the front the grille of a four-pole balanced-armature loud speaker. The equipment includes, in addition, detector and L.F. valves, 100-volt H.T. battery and accumulator, and the set is sold with a six months' guarantee.



The Super-Two, by Hustler, Simpson & Webb, one of the lowest-priced sets in the Exhibition.

Another popular-priced set is the Melodeon radio-gramophone. This is a console model three-valve set complete with gramophone equipment, housed in a walnut cabinet, and sells at 16 guineas. The set is battery-operated, and the equipment includes Garrard double-speed motor, A. E. D. pick-up, 120-volt super-capacity Fuller batteries, 60-ampere-hour accumulator, and four-pole balanced armature loud speaker. The circuit is a detector and two-L.F. arrangement with resistance and transformer coupling.

Hustler, Simpson and Webb, Ltd., 55-57, Tanner Street, S.E.1.

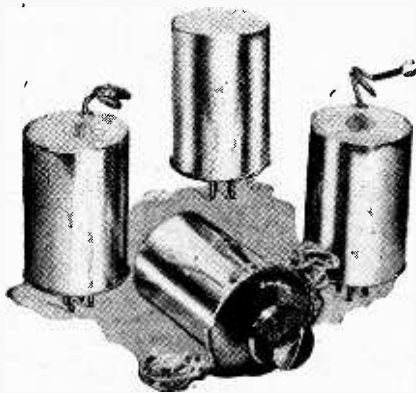
**Stand-to-Stand Report.—**

**IGRANIC. (28)**

While a number of new components have been added to the extensive range of Igranic devices, the principal feature of their new season's programmes is a revision in prices of all their existing lines. In some cases this is accompanied by slight modification in the component, as in the case of the L.F. chokes, the C15 model now carries 20 mA. and the C30 40 mA. The C60 has been replaced by a model styled the C80, rated to carry 80 mA., the new prices being 8s. 6d., 12s. 6d., and 15s. 6d. respectively.

New components comprise the "Parvo" L.F. transformer for parallel-feed circuits at 7s. 6d., a super L.F. transformer styled the "Acme" at 21s., three types of dual-wave coils with built-in switches but not screened, a range of "Spaghetti" resistances, a set of superheterodyne coils, a modified version of the "Phonovox" pick-up and tone arm and a new special "Phonovox" without tone arm.

The superheterodyne coils consist of a triple wave-band oscillator tuning from 19 metres to 2,100 metres, a three-position switch on the unit selecting the wave-band required. The L.F. coils, of which there are three, are adjusted to a wavelength



Set of superheterodyne coils; an Igranic product.

of approximately 2,400 metres, and all coils are enclosed in cylindrical screening boxes, and the price is 50s. the set.

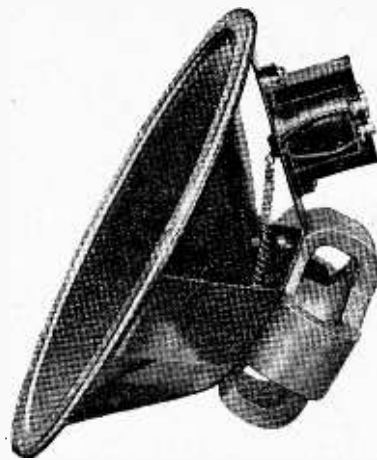
In the new special "Phonovox" gramophone pick-up the armature damping has been redesigned, giving greater sensitivity than formerly with the elimination of armature resonance; the price is 27s. 6d.

Another new item has been developed, this being an uncased potential divider of 15,000 ohms, rated to carry 35 milliamps., and costing 5s. 6d. Seven intermediate tappings are provided.

The very latest addition to their range, and one which was released only on the opening of the Exhibition, is a permanent-magnet moving-coil loud speaker. Full details are not yet available, but it embodies an input transformer, and the price is £3 7s. 6d.

Igranic Electric Co., Ltd., 147, Queen Victoria Street, E.C.4.

D 37



Igranic permanent-magnet loud speaker.

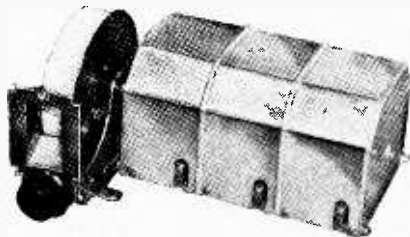
**ITONIA. (167)**

In addition to a range of proprietary receivers, this firm are showing a number of all-electric radio-gramophones. One of the most interesting of these is the Model 505, which is priced at 19 guineas for A.C. mains and at 21 guineas for D.C. It is a three-valve set, comprising a screen-grid H.F. stage, detector and pentode output; a metal rectifier is employed in the A.C. model. An unusual feature is the use of a screen-grid valve as an anode bend detector, and this is probably due to a desire to simplify the design of the ganged tuned circuits. A moving-coil loud speaker is fitted, and the electric gramophone motor is provided with an automatic stop.

Itonia Gramophones, Ltd., 58, City Road, E.C.1.

**J.B. (62)**

This stand is exclusively devoted to the display of all types of tuning condensers. Reference will only be made to the new models, the most important being, probably, the gang-type R.M. and the Dreadnought Gang. The former, selling at 22s., is specially intended for use in the construction of single-dial three-valve sets, for, in addition to a main drive to two totally screened ganged sections, an auxiliary concentric knob provides the required



A new J.B. product—a three-gang condenser with baseboard mounting drum drive.

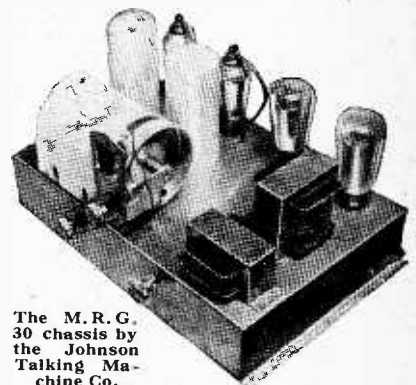
trimming. The other model is a substantially built totally screened condenser available in two or three sections. It can be mounted with its spindle either at right angles or parallel to the panel, for which

purposes suitable geared drives are supplied. In this connection a baseboard drum dial has been added to the range of J.B. condenser drives possessing the great merit that it can be mounted on the baseboard and is therefore independent of the panel. J.B. products are completely described in a new publication now obtainable on request.

Jackson Brothers, Ltd., 72, St. Thomas Street, S.E.1.

**JOHNSON TALKING MACHINE CO. (180)**

A very wide range of receivers, radio-gramophones, and loud speakers is shown on this stand, and it is not possible to mention more than one or two of the more interesting. There is a three-valve radio-gramophone at 32 guineas with a moving-coil loud speaker, the field winding of which is used to replace a choke in the H.T. smoothing circuit. Three valves are employed in the radio portion of the apparatus, with a screen-grid H.F. stage and a pentode output valve. The detector is of the leaky grid type, and it is interesting to find that a screen-grid valve is employed in this stage, doubtless in order to lighten the load upon the tuned input circuit.



The M.R.G. 30 chassis by the Johnson Talking Machine Co.

Smaller sets are shown, for there is a battery two-valver at 5 guineas and an A.C. model at 10 guineas; solid dielectric variable condensers are employed in these models in order to conserve space.

There are cabinet-type moving-coil speakers at prices ranging from 57s. 6d. to 15 guineas; no chassis are shown.

Johnson Talking Machine Co., Ltd., 95, C'lerkenwell Road, E.C.1.

**JUNIT. (97)**

A valve-holder designed for mechanical excellence combined with low dielectric loss is a special feature. Mains units, with outputs ranging from 18 mA. at 120 volts, together with mains transformers and chokes, are also offered.

Junit Mfg. Co., Ltd., 2, Ravenscourt Square, W.6.

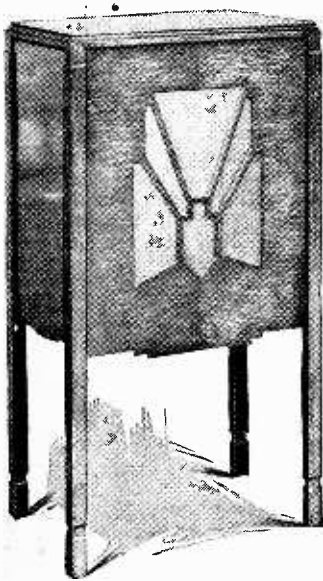
**KABILOK. (160)**

A very wide range of cabinets for all purposes is shown on this stand. The Lynton pedestal loud speaker cabinet is

**Stand-to-Stand Report.—**

suitable for the largest moving-coil speakers. It stands 39in. high and is 21in. wide, and owing to the large dimensions the baffle area is considerable, and low notes should be well reproduced. The price in oak is £3 7s., and in walnut £4 7s.

Another cabinet, illustrative of the modern tendency towards incorporating the speaker and receiver in the same cabinet is the Moderne. The speaker grille is fixed in the upper portion, and a baffle board with a 7in. diameter hole is provided. The receiver rests on the base, and is inserted from the rear; the vignette panel opening is 12½in. by 7¼in., and the price is 43s. 6d. in oak.



The Kaoflok Lynton loud speaker cabinet.

The exhibit is completed by a number of radio-gramophone cabinets, of which the Beaufort at £6 12s. is a good example, and a range of receiver and transportable cabinets.

W. and T. Lock, Ltd., St. Peter's Works, Bath.

**KALISKY. (151)**

Occupying a prominent position among what is probably the most extensive display of proprietary components and accessories is the range of "Sopranist" specialities handled by this firm. The latest addition to the range is "Jellit," which, when added to the ordinary electrolyte in an accumulator solidifies it, thus rendering the cell non-spillable. Sufficient for a 2-volt 20-ampere-hour cell costs 9d. Another useful product is the "Sopranist" cone dope sold in 1s. tins, which contains sufficient to treat three cone diaphragms.

Kalisky's (Aldgate), Ltd., 146, Theobalds Road, W.C.1.

**KOLSTER BRANDES. (25)**

The 1932 receiver programme of this firm is unusually comprehensive and

covers a wide range of types. There are no fewer than eight distinct models, ranging from the well-known K.B. "Pup" to the "Kolstar" mains-operated superheterodyne.

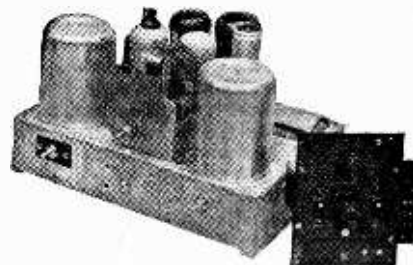
**Battery-operated Receivers.**—The popular two-valve K.B. "Pup," which incorporates an adjustable cone loud speaker, and is sold complete with valves and batteries for £5 3s. 9d., is being continued. It is now supplemented by two new three-valve receivers, the "Kobra" and "Kobra Junior"—which include an additional L.F. stage (resistance-capacity coupled). A cone loud speaker is built into the "Kobra" cabinet, and there is accommodation for H.T. and L.T. batteries, whereas in the "Kobra Junior" the cabinet is smaller, and does not accommodate the loud speaker or batteries. The prices of these models are £9 17s. 6d. and £7 5s. respectively, inclusive of valves and batteries, but excluding loud speaker in the case of the "Kobra Junior."

The K.B. 281 three-valve set is an excellent example of up-to-date battery receiver design. It has a screened grid-detector-pentode circuit similar to that of the Model 279 mains receiver described below, and is provided with automatic grid bias. This is a refinement which is long overdue. Much of the distortion in battery sets is due to overbiasing of the L.F. valves when the H.T. battery voltage is nearing its end-point. With automatic bias the bias voltage falls with the H.T. and quality is maintained to the end, although the volume available may not be so high. The receiver is housed in a walnut cabinet, and there is provision for a gramophone pick-up. The price is £9 15s., including valves.

**Mains Receivers.**—The new Model K.B. 279 three-valve A.C. mains receiver is a good example of modern metal chassis construction. The screen-grid H.F. valve is of the metallised type, and its associated tuning circuits are ganged, the single-tuning dial being illuminated and calibrated in wavelengths. The volume control is of the pre-detector type. A metallised valve is also used in the detector stage which operates on the power-grid principle, and the output

valve is a high-voltage pentode. A built-in miniature moving-coil loud speaker is an important feature of the specification, and it is also interesting to note the use of an electrolytic condenser in the H.T. smoothing circuit. The price of this receiver, which includes provision for gramophone reproduction, is 18 guineas, and for a slight extra charge it can be supplied with a 25-cycles mains transformer.

The K.B. Electric "Pup" is an A.C. version of the battery "Pup," and is similar in general specification and external appearance. The valves are, however, of the indirectly heated type, and a full-wave valve rectifier is used to provide H.T. current. The price is £8 10s. A D.C. "Pup" is also in production.



Kolster Brandes radio-gram. chassis and tone-control panel.

**Superheterodyne.**—The "Kolstar" six-valve superhet., as its name implies, is the "high spot" of the K.B. receiver range. Designed for A.C. mains operation, it has three wave ranges, including short waves from 12 to 70 metres. It should, therefore, be capable of receiving every worthwhile broadcast transmission. The six stages are arranged in the following sequence: (1) Screen-grid signal-frequency H.F. amplifier; (2) oscillator; (3) screen-grid first detector; (4) screen-grid intermediate amplifier; (5) second detector; (6) power pentode output valve. The chassis is of all-metal construction, and a built-in miniature moving-coil loud speaker is provided. The price in walnut cabinet is £27, and a console stand is available for a further 30s.

**Radio-Gram.**—This model (K.B.283) incorporates the K.B.279 three-valve A.C. chassis, which is capable of delivering 2 watts to the self-contained moving-coil loud speaker unit. The gramophone motor is of the induction type, and a model K.B.158 pick-up is fitted. A moulded panel let into the side of the cabinet carries both volume and tone controls for the pick-up and the radio-gram. change-over switch. The walnut cabinet is of excellent quality, and the price complete with valves is 30 guineas.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.

**L.E.S. DISTRIBUTORS. (88)**

Wholesalers exhibiting the leading makes of sets and accessories.

L.E.S. Distributors, Ltd., 9, St. Martin's Street, W.C.2.



K.B. Kolstar six-valve superheterodyne

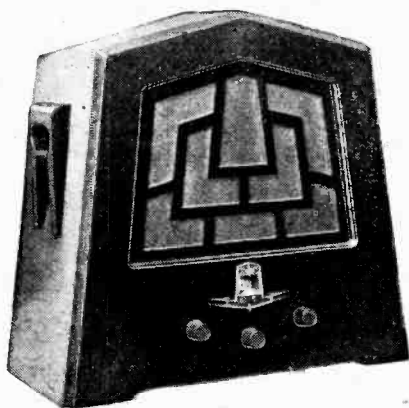
**Stand-to-Stand Report.—**

**LAMPLUGH. (168)**

The well-known Inductor Dynamic speaker has been re-designed and is now available with windings tapped to match either triode or pentode output valves. The tappings are so arranged that it is possible to use the speaker with a push-pull output stage without the necessity of using either a transformer or a choke output circuit.

This speaker is included in a number of receivers, one of which is a two-valve A.C. set employing a valve rectifier for the H.T. and an A.C./PI output valve with choke filter circuit. It is housed in a two-tone walnut cabinet. The price is 17 guineas. The same chassis is also supplied in radio-gramophone form at 27 guineas; a Collaro induction motor is employed.

*S. A. Lamplugh, Ltd., 89, Little Park Street, Coventry.*



The Lamplugh two-valve inductor set.

**LEWCOS. (27)**

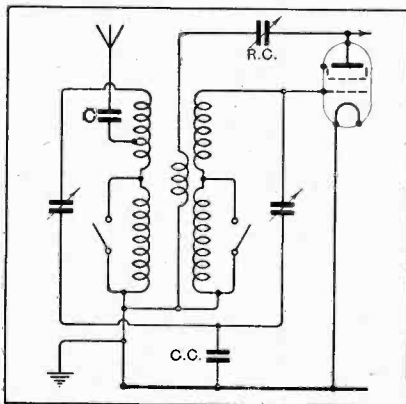
In view of the present interest in pre-selective tuning, it will probably be agreed that the new Lewcos "Band Pass Filter" deserves special attention. Comprising a pair of medium- and long-wave coil assemblies in inductive relationship, and mounted at an angle of about 50 degrees on a moulded base, this unit is intended for use as an input filter, in which coupling between component circuits is effected by a combination of mutual inductance and common capacity. A reaction coil is fitted to the secondary coil assembly in order that the filter may be operated with simple detector-L.F. sets, but this winding will, of course, be ignored when precise ganging is to be considered or H.F. stages are used.

It is stated that inductance values are matched, so that the filter circuits may be tuned by a ganged condenser; further, there is available a suitable H.F. coupling coil, also with a reaction winding, for use with the filter unit. Both assemblies include a built-in wave-range switch with provision for mechanical linkage of the control rods.

A rectangular screening box is available at 2s. 6d. for the filter unit, which

costs only 12s.; the companion H.F. coil, in a cylindrical screen, costs 8s. 6d.

Another new coil assembly, for use in superheterodyne receivers, is known as the Lewcos "Triple I.F. Unit," and is

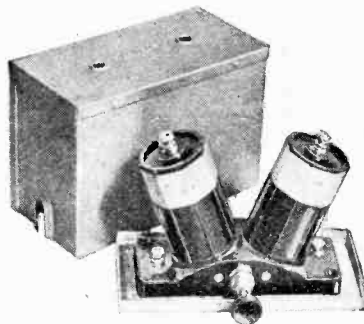


Circuit of Lewcos band-pass filter preceding H.F. stage: reaction connections also indicated for detector sets.

mounted in a three-compartment screening case. An input transformer and two L.F. coupling transformers, all matched to resonate at 126 kilocycles, are included; a sub-baseboard carrying valve-holders and terminals is also available, and everything is arranged for easy and simple connection.

It is good news to hear that the well-known Lewcos H.F. choke, which is quite one of the most efficient components of its type, is reduced in price from 7s. 9d. to 6s. A new small-size choke, in disc form, has just been introduced, and costs 2s. 6d.

*London Electric Wire Co. and Smiths, Ltd., Church Road, Leyton, E.10.*



Lewcos band-pass filter and screening cover.

**LISSEN. (17)**

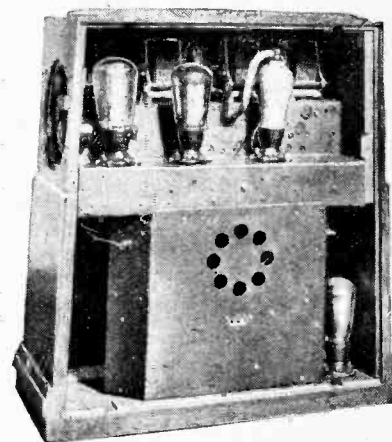
Among the new Lissen receivers is an up-to-date three-valve cabinet set for A.C. operation, including such features as band-pass input, completely ganged tuning, and direct wavelength calibration. Completely self-contained except for an external aerial-earth system, this receiver is normally fitted with a cone loud speaker, operated by a four-pole unit, but a moving-coil instrument is available at an extra cost.

There is also an economical two-valve mains-operated cabinet set, costing only 8 guineas complete. In addition, one finds the self-contained cabinet type; a pentode output valve feeds a built-in balanced-armature loud speaker.

Several new components have been introduced, including variable condensers with die-cast frames and hollow spindles, which are thus suitable for ganging. Vanes shaped to have either "straight-line capacity" or "straight-line wavelength" characteristics are available.

A new valve-holder, costing only 4½d., is designed on the simplest possible lines, but, nevertheless, would appear to be effective; contact is made by spring clips bearing against the outer sides of the valve-pins.

*Lissen, Ltd., Worple Road, Isleworth, Middlesex.*



Lissen band-pass receiver with back cover removed.

**LITHANODE. (249)**

Accumulators of all types and for every possible occasion constitute the exhibits on this stand. A special display is made of unspillable free-acid-type cells for portable and transportable sets. The latest addition to the Lithanode range in this class is the Type E.I., which is a small 20-ampere-hour battery fitted with a simplified, but very satisfactory, acid trap. The price is 11s. 6d.

The G.C.S. series in glass containers have been reduced in price, while the price of the G.C.T. type has been returned to its former one of 5s. The G.C.M. is a new two-volt cell in glass container with a capacity of 20-ampere-hour, the price being 4s. 3d.

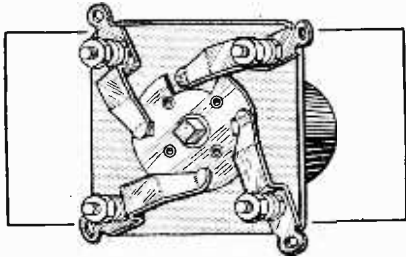
*Lithanode Co., Ltd., 190, Queen's Road, Battersea, S.W.8.*

**LOTUS. (23)**

For sheer good value for money it would be hard to find a receiver to rival the all-mains self-contained Lotus table model, selling at 14 guineas. The three-valve circuit consists of the popular combination of S.G.-det.-L.F. The detector is of the regenerative type, and is linked to an AC/PI valve by a transformer. There is a Magnovox moving-coil loud speaker

**Stand-to-Stand Report.**

incorporated employing the principle of free field current, and Mazda valves are used throughout. By ganging the condensers, one-dial tuning control is effected, and, in addition to this, there are the usual controls of volume, reaction, and wave-change. The price is the same for D.C. or A.C. mains.



Lotus universal switch.

There are a large number of components exhibited, including a new shrouded H.F. choke for use in parallel tuned-grid circuits; one connection takes the form of a flexible lead with spade-end for the anode of an S.G. valve. Many L.F. transformers, ranging in price from 5s. 6d. to 12s. 6d., are being shown, and it is interesting to note that where bakelite shrouding is used an earth terminal is provided which connects with the core. A dual-range totally screened binocular inductance unit is being shown, selling at 10s. 6d. The long- and short-wave windings are arranged on separate formers, and wave-band switching is provided. In view of the popularity of one-dial control, the ganged condenser units should excite interest. Each unit is totally screened, and the drive is arranged optionally by disc or drum. The price of the three-gang variety is 30s., and the two-gang 20s.

Other exhibits include a universal switch, which can be easily ganged, and contains rotary, self-cleaning contacts; it sells at the modest price of 1s. 6d.



Lotus table console receiver.

The well-known remote-control equipment is still retained.

*Lotus Radio, Ltd., Mill Lane, Old Swan, Liverpool.*

**M.R.G. (53)**

Specialising in the production of all-electric radio-gramophones. A console set is shown in an oak cabinet having the distinctive feature of pre-set tuning, so that the choice of three programmes is provided by a simple lever switch. The circuit of this set is the detector, two-L.F. arrangement, operating a moving-coil loud speaker. This set, the "Regionogram," is priced at 26 guineas.

Of more particular interest are the M.R.G. Console Four and Pedestal Four models. These are fitted with band-pass filters followed by two screen-grid stages, power detector and power pentode output delivering the generous output of 2 watts to the loud speaker. Moving-coil loud speakers are fitted.

M.R.G. sets are wavelength- and station-calibrated, an illuminated indicator on which a beam of light moves revealing the station setting. An entirely new form of housing is adopted in the M.R.G. Grandmother Clock model, which may form a harmonious addition to a decorative scheme, and takes up very little floor space. It is equipped with the same chassis as in the console and pedestal models.

*Mains Radio Gramophones, Ltd., Vaughan Street, Bradford.*

**McMICHAEL. (5)**

Among the outstanding sets of this year's show is an entirely new production by McMichael—a "Moving-coil Mains Receiver." A new fashion is set by the substitution of the indicating dial by the medium and long-wave vertical scales seen on either side of the loud speaker. Pointers traversing these scales indicate both wavelength and frequency operating in conjunction with a single-dial tuning knob. A volume control combines the action of a gramophone switch, and rotating in either direction from the central position fades into either the medium- or long-wave range. Switching on and off is clearly indicated by double-action push buttons. Internally, this receiver consists of a metal-frame chassis serving as a base-piece from which project the totally screened coils and the valves, which are the Mullard S4VA, followed by the Mazda AC/HL and Mazda AC/Pen. This model is, as yet, only available for use with A.C. supply, and incorporates the Westinghouse metal rectifier. The moving-coil loud speaker is energised from the H.T. supply circuit. High quality of reproduction is claimed with considerable power output if required. Housed in a high-grade walnut cabinet the set is priced at 24 guineas.

One of the best portables of previous years has been the McMichael "Super Range Four." This year's model embodies further improvements, the design having undergone considerable change. Tuning is by single control operating a straight recessed scale under a glass cover fitted with a travelling pointer indicating directly in wave-

lengths. A trimming control is fitted in addition to compensate for small aerial differences and to provide the utmost sensitiveness in conjunction with the reaction control. A wave-range switch is combined with the volume control as in the mains receiver described above. The valves are housed in recesses on either side of the operating panel, and are immediately accessible, being attached to hinged and plug-in panels. A judicious choice of the best valves of various makers leads to the adoption of the Mazda 215 SG, followed by the metallised Cossor detector HL210, an Osram or Marconi HL2 in the first L.F. stage, and the LP2 in the output. With the modified circuit and better valves this set, which is the same price as formerly, gives greater range with improved quality and selectivity. The customary large number of trailing battery leads is avoided, and all necessary anode voltages, together with grid-biasing potentials, are obtained with but a pair of leads to the H.T. battery. Economical running results from a total H.T. current consumption of 7.8 mA. The containing case is of better quality than formerly, being of real hide and pig skin, grained.



The McMichael mains set, a completely revised design with single-dial control operating indicators on clearly visible wavelength scales.

Just the set for the colonial short-wave listener or the short-wave enthusiast at home is the "Supersonic Four," embodying the now established method of short-wave reception. The first valve is an autodyne detector, followed by a screen-grid intermediate amplifier operating on 9,000 metres, a screen-grid second detector and a pentode output valve. A single tuning knob only is required, while changes of wavelength are effected by withdrawing the coil unit, which is housed in a recess in the panel, and returning it after rotation so as to expose the required wavelength scale. The inconvenience of using a number of interchangeable plug-in coils is thus avoided, and a calibrated wavelength scale, which also includes the broadcast band, is exposed for each range. £15 is the modest price for this well-built set.



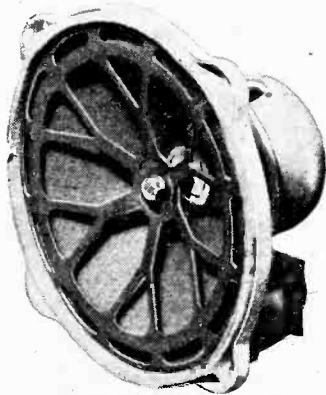
**Stand-to-Stand Report.—**

Much attention is being aroused at the stand by the exhibiting of an exact scale model of the L.N.E.R. express locomotive, the "Flying Scotsman," symbolising the equipping of the London-Leeds express so that travellers may listen to the radio programmes.

*L. McMichael, Ltd., Wexham Road, Slough, Bucks.*

**MAGNAVOX. (108)**

From the design standpoint Magnavox loud speakers represent the highest grade of British mass production applied to radio, and the set manufacturer will be the first to appreciate the merit given to a receiver equipped with a Magnavox dynamic speaker. This well-designed job,



The British built Magnavox — model 140/144 for incorporating in the all-mains receiver.

so pleasing to the eye, is backed up as to performance with a budget of purely technical information, giving detailed operating instructions and showing the user by reference to measured data how to ensure quality reproduction. Magnavox loud speaker units are available at popular prices, and the home constructor will be well advised to spend a few minutes at this stand before deciding on the type of loud speaker to fit into a home-built mains-operated set.

Three models are available differing in the size of diaphragm, while the resistance of the field may be 2,500 or 7,500 ohms in each case. Output transformers to match the moving coil to the various valves, including pentodes, are supplied bracketed on to the loud speaker. Well-finished cabinet models are exhibited.

*Magnavox (G.B.), Ltd., 89, Kingsway, W.C.2.*

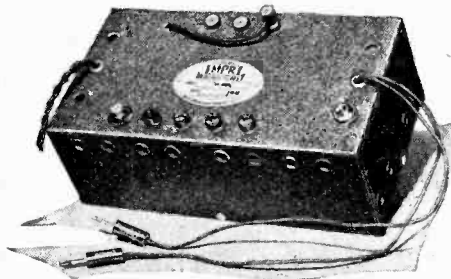
**MAINS POWER RADIO. (229)**

This firm specialise in battery eliminators of the type suitable for fitting into the battery compartment in portable and transportable sets. There are various models, each giving three output voltages, and, in the case of one A.C. model, the "A.C.4," provision is made for a four-volt A.C. output at four amps. for the heaters of indirectly heated A.C. valves.

Only one D.C. model is shown, but

D 43

there are three A.C. models. Each of the A.C. models can be obtained with or without a trickle charger embodied. The smallest A.C. model, the A.C.1, costs



Model AC3 mains unit by Mains Power Radio.

£2 2s. 5d., or, with a trickle charger, £1 extra. This model gives a maximum of 15 mA.

The largest size, the "A.C.4," will supply up to 30 mA., and the price is £4 10s.

*Mains Power Radio Co., Broadway House, South Street, Romford, Essex.*

**MANUFACTURERS' ACCESSORIES CO. (186)**

This well-known firm of factors is showing, in addition to numerous proprietary sets, two three-valve receivers of their own manufacture. The first is an A.C. set of the detector, L.F., and power type; it incorporates a balanced-armature speaker, and is priced at £7 17s., royalty extra. It is known as the Lintola Consolette. The other receiver is a transportable, the Macotone; it employs the same circuit arrangement, and is sold at £5 17s. 6d.

*Manufacturers Accessories Co. (1928), Ltd., 85, Great Eastern Street, E.C.2.*

**MARCONIPHONE. (4)**

Judging by the difficulty of approaching this stand, even on the opening morning, the popularity of the exhibits can



Marconiphone Super-tuned portable four.

well be gauged. Speculation is always rife concerning the innovations which this company has prepared for the new season, and there is likely to be no disappointment over the remarkable range of receivers now being marketed. We find throughout excellent examples of the most advanced principles in circuit design which are put into practical form with real engineering skill.

There is the "Super-Tuned Portable Four"—model 66—which has a four-valve circuit consisting of an 8.21, two H.L.2 valves, and a P.T.2 pentode, the total anode consumption being but 7 mil-



Marconiphone Radiogram Three. Model 330.

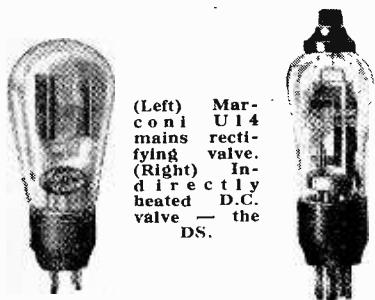
liamperes. The tuning is by a single dial controlling a two-gang condenser, and, so as to ensure perfect resonance, the trimmer on the aerial side is panel-mounted. The tuning scale is calibrated in metres, and is viewed through a countersunk curved window. Volume control is carried out by an interesting component, the rotation of which for the first half revolution increases the filament brilliancy of the H.F. valve, and, when this is at a maximum, reaction is then applied by further rotation.

An examination of the chassis of this receiver reveals a very generous screening scheme which includes metallised valves up to and including the first L.F. stage. A balanced-armature speaker with 12in. cone is included, and the price is only 16 guineas with turntable.

Another receiver which has lately been reviewed in *The Wireless World* is the "Moving-coil Transportable Three," for

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A.C. or D.C. mains, selling at 20 guineas. Our test, carried out within five miles of Brookmans Park, on an outside aerial, at once proved the efficacy of the capacity-coupled band-pass pre-selector, as the selectivity was adequate to receive some fourteen stations without interference from the B.B.C. transmissions. The screen-grid H.F. valve is parallel-coupled to a power-grid detector, which, in turn, is coupled by a transformer to an indirectly heated pentode, whilst mains rectification is carried out by a U.10 valve. A triple-gang condenser gives one-dial tuning control, and wavelength calibration is provided.



(Left) Marconi U14 mains rectifying valve. (Right) Indirectly heated D.C. valve — the DS.

of 0.25 amps., enabling a D.C. receiver to be built consuming but 60 watts.

Visitors to the Exhibition should not fail to hear an ingenious "robot" musical entertainment given in the Marconiphone demonstration room in the Gallery. An extraordinarily realistic performance is given by a number of radio-gramophones and sets, which carry on a conversation with each other, and also take parts in the well-known song, "Widdecombe Fair."

Marconiphone Co., Ltd., 210, Tottenham Court Road, W.1.

**MELLOR. (255)**

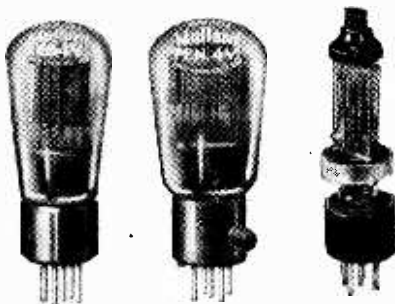
The activities of this firm are devoted to distributing to the trade the products of the leading wireless manufacturers, and details of the various lines they handle form the principal exhibits on the stand. In addition, a special feature is made of the Burgoyne five-valve suit-case portable receiver, the price of which is £5 19s. 6d.

C. Mellor, 154, King's Cross Road, W.C.1.

**MULLARD. (18, 80, 199, & 221)**

The activities of this firm are mainly concerned with the manufacture of valves. There are a large number of modifications of past types, as well as completely new examples for the new season.

Of special interest is the new M.M.4V, a mains screen-grid valve with a variable-mu characteristic. To those who have not studied the articles which have lately appeared in *The Wireless World* concerning this new type of valve, it may be mentioned that, in brief, the grid-volt-anode current curve "tails" off far more gradually than with the ordinary S.G. valve; in fact, it is possible to apply 40 volts negative grid bias and still have a measurable flow of anode current. This lengthy curve lends itself well to the application of large signals without rectification, and so the bugbear of modulation distortion, and cross-modulation is



(Left) Mullard 054V output valve. (Centre) PEN4V output valve. (Right) M.M.4V variable-mu S.G. valve.

avoided. There is another important feature—volume control by variation of the self-bias resistance becomes possible—a system which does not affect gauging.

The P.M.202 is a new two-volt battery output valve, capable of delivering about 350 milliwatts undistorted output into a load of 4,000 ohms. The maximum signal required for this large output is only 13

volts, which can be accounted for by the high mutual conductance of 3.5mA./volts. There are few pentodes of which mention might be made—the P.M.24C and P.M.24D, with outputs respectively of 3,500 and 8,000 milliwatts; also there is the PEN.4V, an indirectly heated pentode with a slope of 3. A new and highly sensitive power-grid detector, styled the 904V, has lately been developed; although handling a smaller input than the 354V, it should give about twice the output when a small signal is applied. Where simplicity of bias and heater circuit arrangement is desired in an all-mains receiver, the new indirectly heated output valve—the 054V—is to be recommended, as its equipotential cathode ensures high efficiency. The impedance of this valve is 1.250 ohms, and the amplification factor 5.0.

The "Mullard Three Receiver"—the 1932 Kit set—comprises a three-valve circuit, screen-grid H.F., followed by a re-



New Mullard kit set.

generative leaky-grid detector, which in turn is linked by a transformer to a pentode. The receiver is built upon a metal chassis and the components are held by bolts, no soldering is required, and the number of connecting wires has been kept down to a minimum. There is a separate sub-base for the coil and wave-change switch, and also a vertical screen to which the ganged tuning condensers are attached. The medium-wave coils are wound on 2½in. formers, whilst the long-wave windings are of smaller diameter and at right angles. The price, without cabinet, is £6 10s. Users who have found Mullard valves so robust that occasion has not arisen to see their interiors, will find that on Stand 221 the valves remove their own bulbs and then take off their anodes, so revealing the details of construction!

Mullard Wireless Service, Ltd., Mullard House, Charing Cross Road, W.C.2.

**MURPHY RADIO. (59)**

The type B4 four-valve battery portable which was introduced at Olympia last autumn has already established for this firm a reputation for sound design and reliability of performance. This set continues unchanged for the coming season at the original price of 17 guineas.

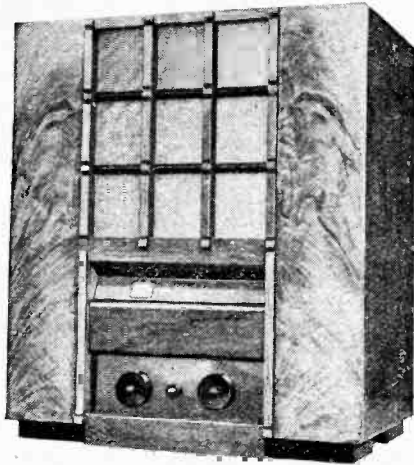
The new Model A3 mains receiver is, however, the star exhibit on this stand. It is unnecessary to give a detailed technical description of the circuit, as the set has already been reviewed in a recent

Without doubt, one of the most attractive exhibits at the Show this year is the Radio-Autogram—model 536—a six-valve automatic radio-gramophone for A.C. or D.C. mains, at 52 guineas. The radio portion of the equipment, which has wavelength calibration, comprises a six-valve superheterodyne with one-dial tuning control, for the design of which the Marconiphone Company are to be freely congratulated. They are one of the first in the field to achieve this on both wave-ranges. The necessary change in law of the oscillator condenser is effected by the use of tracking condensers, and final balancing is carried out with split end vanes. One stage of amplification is effected at the fundamental frequency, and there is a screen-grid first detector, followed by an oscillator and single S.G. intermediate stage. A very generous output of 2½ watts (A.C.) is developed by the new P.X.4 output valve. Into the top of the cabinet is built the automatic record-changing mechanism, by means of which eight records, either 10in. or 12in. in diameter, can be left to play without attention, or, should it be so desired, any record can be stopped, repeated, or changed at will. The system employed is ingenious, and so arranged that only eight seconds elapses between each record. This is accounted for by a vertical feed, the tone-arm operating between used and unused records.

New Marconi valves include the M.S.4B, a new screened H.F. valve with a mutual conductance over 3 mA./volt, also the V.M.S.4, a variable-mu tetrode, which affords an ideal method of volume control without introducing distortion. The new indirectly heated D.C. valves—the DS, DH, DL, and DPT, have a heater voltage of 16, and a current consumption

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issue of this journal. There are three valves (screen-grid H.F., power-grid detector, and power pentode), and adequate selectivity for modern conditions is assured by the use of a band-pass input



Murphy type A3 three-valve mains receiver.

filter. In pursuance of the firm's declared policy of "Making Wireless Simple," there is a single tuning control calibrated directly in wavelengths, supplemented by a volume control which gives simultaneous control of the aerial input and reaction. The layout of the chassis and the design of the cabinet work are in keeping with the best modern traditions, and a high standard of quality is assured by the employment of a built-in moving-coil loud speaker.

The whole of the stand is devoted to these two receivers, and specimen chassis in various stages of completion are open for inspection.

Murphy Radio, Ltd., Broadwater Road, Welwyn Garden City, Herts.

**OLDHAM. (66)**

Improvements in this season's Oldham accumulators include a modified form of



Oldham unspillable cell now available with jelly electrolyte.

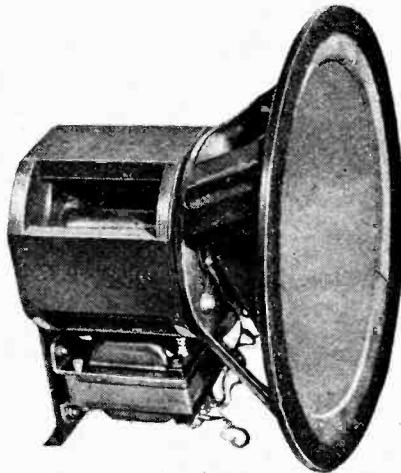
terminal with brass inserts into the lead terminal posts arranged to avoid the possibility of corrosion. In the celluloid-case types the terminals come almost flush with the top, and in addition all models are now fitted with porcelain vents of generous diameter. Jelly acid cells are now available, as well as the ordinary unspillable models. A good feature of previous years found in Oldham H.T. accumulators with air-spaced cells was the positive clamping screw connector. This has been adapted to combine, in addition, the advantages of the plug-in connection. It is to be noted that Oldham interleaved plate-type batteries are now fitted with corrugated ebonite separators.

Oldham manufacture a complete range of H.T. dry-cell batteries, from popular types at competitive prices to heavy-duty batteries. In the new green-band series a 99-volt battery costs 9s.

Oldham and Son, Ltd., Denton, Manchester.

**ORMOND. (34)**

Among the wide variety of components made by this firm, variable condensers hold a prominent place. The well-known No. 4 condenser is now available with a hollow spindle enabling any number to

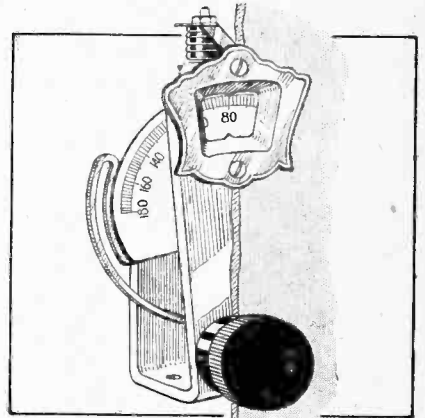


Ormond permanent-magnet moving-coil chassis.

be ganged on a 1/4 in. spindle. The "Midget" air-dielectric condenser, in which the two sets of fixed vanes can be connected either in series or parallel, is now provided with a slow-motion movement and is sold, complete with dual knob, for 4s. A similar improvement has been made in the specification of the solid-dielectric differential condenser.

An entirely new model—the No. 6 log condenser—has been introduced. The fixed vanes are mounted in slotted spacers supported between the end-plates on ebonite insulators. An all-aluminium model (without dial) sells for 4s., and there is another model in brass with slow-motion movement and dial at 6s. 6d. Both types may be had in the usual sizes of 0.00025, 0.00035 and 0.0005 mfd.

The new disc-drive illuminated dial is exceptionally neat, and is offered at the attractive price of 2s. 6d. It is assembled in a stout aluminium U-shaped frame, which is suitable for base-board or panel mounting. A 9:1 reduction is provided, and the dial, which is clearly graduated and viewed through a small bronze escutcheon, rotates in the same direction as the tuning knob.



Ormond disc-drive illuminated dial.

Another new component worthy of note is a single-pole toggle switch designed for 750 watts, and selling at 1s. 3d.

The four-pole adjustable cone unit is being continued at 12s. 6d., and is now accompanied by a permanent-magnet moving-coil chassis of workmanlike design. The field consists of four magnet bars built up between laminated circular end-plates. A paxolin spider behind the apex of the cone centres the 22 ohm speech coil in a 50-mil. air gap, and an output transformer with three ratios of 9:1, 15:1 and 22½:1 is incorporated in the base. The price of the chassis alone is £3 5s., and a cabinet model at £4 19s. 6d. is also displayed.

Ormond Engineering Co., Ltd., Ormond House, Rosebery Avenue, E.C.1.

**OSBORN. (205)**

This firm specialise in cabinet work of every description, and although their business is devoted largely to the supply of ready-to-assemble cabinets, they are showing this year only completed models. Many fine examples of their craftsmanship are on view, and the handsome graining of the wood in some of the unpolished cabinets exemplifies the fine quality of the material employed.

There are many types and sizes of loud speaker cabinets, and some special models of pedestal-type cabinets, designed for the more recent *Wireless World* sets are available for examination.

Charles A. Osborn, Regent Works, Arlington Street, N.1.

**P.R. PRODUCTS. (187)**

A range of P.R. valves is exhibited on this stand, including two-, four- and six-

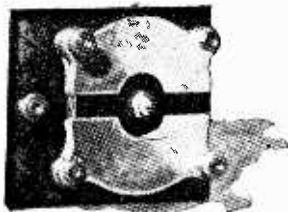
**Stand-to-Stand Report.—**

volt filament types, together with indirectly heated mains valves and an H.T. rectifier. A three-valve transportable at £6 5s. and a number of kit sets are also shown.

*P. R. Products, P. R. House, 14, Newgate Street, E.C.*

**PAREX. (158)**

On this stand screens and metal cabinets of every description are to be found. Both aluminium and copper



Solid dielectric Porex reaction condenser.

screens are available, and finished with a highly polished or a mottled surface. It is stated that the copper screens are treated by a special process to render them untarnishable.

Coils for *The Wireless World* receivers are shown, as well as a number of useful components. A new horizontal mounting screen-grid valve holder is priced at 1s. 6d., and a 0.00015 mfd. differential reaction condenser is interesting, since it is built on the lines of an air condenser, even although a solid dielectric is used.

*E. Paroussi, 10, Featherstone Buildings, W.C.1.*

**PARK ROYAL ENGINEERING. (194)**

This stand is devoted to a wide and comprehensive range of measuring instruments. Of particular interest are the 1½ in. and 2 in. instruments, which are available as milliammeters with scale readings of from 5 mA. to 250 mA., and as voltmeters with ranges up to 300 volts and a resistance of 1,000 ohms per volt.

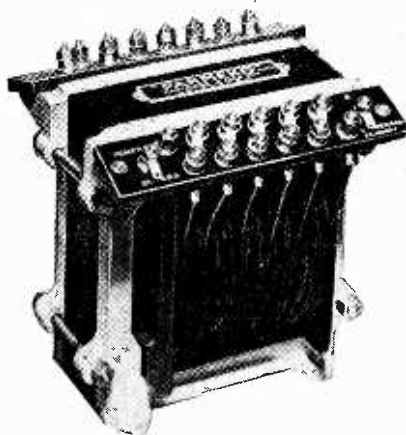


Park Royal bench-type ohmmeter and circuit tester.

The milliammeters are priced at 30s., and are eminently suitable for building into a receiver. They are very compact, and require only a single 1½ in. hole in the panel for mounting.

Another useful component for the wireless experimenter is a combined set tester and ohmmeter; this is available in two models, a bench type and a portable. Both are electrically the same, and the difference is merely in the case. The portable model is priced at £4 4s., and measures only 4½ in. by 2½ in. by 1½ in., and weighs 1 lb. A pair of testing leads is included, and with its aid it is readily possible to make rapid continuity tests, for a 1½-volt dry battery is included in the case. The meter scale is calibrated in ohms, and when a resistance is connected across the terminals its value can be read off directly from the scale. As the accuracy of calibration depends upon the battery voltage, an adjustment is provided by means of which any fall in voltage can be compensated. This adjustment takes the form of a magnetic shunt in the meter, and is carried out in a few moments.

*Park Royal Engineering Co., Ltd., Cumberland Avenue, N.W.10.*



The Parmeko multi-ratio output transformer.

**PARMEKO. (177)**

Power transformers for every purpose occupy the principal positions on this stand, and they range from small instruments for two-valve receivers to shrouded transformers with outputs running into hundreds of watts. The mains transformer for *The Wireless World* Super-Selective Six is shown, and a multi-tapped output transformer enables the accurate matching of speaker and output valve in almost any circumstances. This transformer is now priced at £4, and the primary inductance with 80 mA. D.C. is 32 henrys; this is with the whole winding in use.

The Parmeko moving-coil loud speaker is well in evidence, and is supplied either as a unit alone at £6 10s., or with base and output transformer at £8.

One of the most interesting portions of the exhibit is a number of large-power

amplifiers, rated at between 25 watts and 120 watts. The larger of these are most impressive in appearance, and look like miniature broadcasting stations. A gramophone console is also shown.

*Partridge and Mee, Ltd., 74, New Oxford Street, W.C.1.*

**PEGASUS. (238)**

Portable and transportable receivers form the principal exhibits on this stand. There are models suitable for those desiring an all-mains receiver with or without a self-contained aerial. The most attractive shown is the four-valve model fitted with a permanent-magnet moving-coil loud speaker, and the price is £15 15s. Some inexpensive loud speakers are featured also.

*Pegasus, Ltd., 10, Victoria Street, Chapel Allerton, Leeds.*

**PERTRIX. (39)**

Pertrix H.T. batteries need no introduction, and it is sufficient to record that a comprehensive display of all types is available for inspection on this stand.

Several changes have taken place, however, in the specifications of Pertrix accumulators. The "Kaptive Karrier" type of handle is now fitted to all types in glass containers, and a novel "soap dish" type of charge indicator is fitted to certain types.

An important new addition to the range of 2-volt glass cells is the P.Z.2, which has an ampere-hour capacity of 35 and an overall height of 4½ in. It has been specially designed to simplify the construction of battery compartments, and is of approximately the same height as a medium-size H.T. battery.

*Pertrix, Ltd., 233, Shaftesbury Avenue, W.C.2.*



Pertrix type P.Z.2 accumulator.

**PETO-SCOTT. (179)**

A wide range of kit sets is shown on this stand, and a special feature is made of an ultra short-wave adaptor. This firm specialises in the building of published circuits, and a representative range is on view.

*Peto-Scott Co., Ltd., 77, City Road, E.C.1.*

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**PIONEER. (188)**

Various types of switches are shown on this stand, and, in fact, switches form the principal exhibit. They are chiefly of the push-pull type, and range from a make-and-break switch at 1s. 3d. to a four-point switch at 2s. 3d.

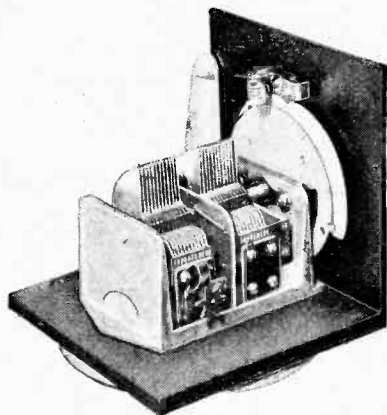
Packets of silk for loud speaker cabinets are also available, and a particular point is made of the silk being rolled to avoid creasing.

*Pioneer Mfg. Co., Ltd., Cromwell House, Fulwood Place, W.C.*

**POLAR. (60)**

Judged from the standpoint of attractive appeal and utility, the Uni-knob Tub is of special interest to the set constructor. As a ganged two-section condenser it is ideally suited to the construction of a simple three-valve set. Internal trimming is provided for the back section and a knob concentric with the operating control trims the front section. A bakelite escutcheon is fitted in front of a white dial, and the condenser is arranged so as to provide particularly easy fitting.

A change is to be noted in the form of escutcheon now fitted to drum-drive Polar condensers. In place of the oxidised metal plate an attractive moulding is now



Polar twin-ganged condenser with externally controlled trimming on the front section.

supplied. Neglecting from this report the standard Polar lines, brief reference might be made to the low-priced condensers, No. 4 and No. 2 selling at 4s. and 6s. 6d. respectively. These condensers are of four-pillar construction, are rigidly built, being fitted with ball bearings, and the rotor vanes are bolted together. The No. 2 model includes slow-motion drive, and is complete with knob and dial. All requirements in differential reaction condenser are met in the Polar range, which includes both air and solid dielectric types with, or without, slow-motion adjustment. The short-wave enthusiast is reminded that special condensers are available having double-spaced plates in order to provide maximum efficiency on the ultra-short wavelengths.

*Wingrove and Rogers, Ltd., Mill Lane, Old Swan, Liverpool.*

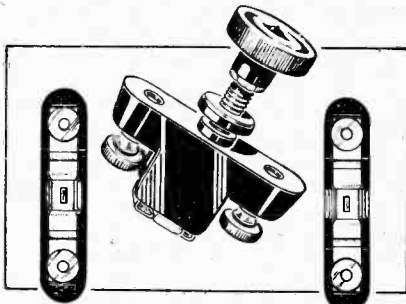
**PORTADYNE. (103)**

Three semi-ganged screen-grid portable sets are shown here. In two models one of the tuning drums is set to the wavelength required, and the other is brought up into tune by an ingeniously devised cursor. The other set uses dual thumb control.

*Whittingham Smith and Co., Portadyne Works, Gorst Road, North Acton, N.W.10.*

**PRIESTLY & FORD. (69)**

This firm of wholesalers serving the Birmingham and Nottingham areas is showing the equipments of the principal manufacturers. A product exclusive to the



A specimen Busco switch shown on the stand of Priestly & Ford.

stand, however, is the "Busco" push-pull switch. It is carried on a bakelite moulding, has a good snap action, and is available for a number of purposes. In addition to "on" and "off," two-position and three-point radio-gramophone switches, there is a combined fuse switch, which, serving as an "on" and "off" in the H.T. and L.T. leads, includes a fuse lamp in circuit. All switches are of the one-hole fixing type, have phosphor-bronze contacts, a non-rotating inset, and are suitable for either ebonite or metal panels.

*Priestly and Ford, 3-11, Carrs Lane, Birmingham.*

**PRIMUS MANUFACTURING CO.**

(193)

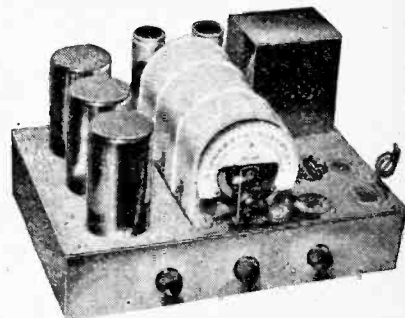
An unusual exhibit is an electro-static loud speaker. The diaphragm forms one plate of a condenser, which is connected in the circuit of the receiver output valve. Under the influence of the electro-static strain in the dielectric the diaphragm vibrates, setting up sound waves. It will be seen that the usual magnets and coils are eliminated; the speaker is listed at 37s. 6d. Extremely high quality of reproduction is claimed, and it is also stated that the need for a polarising D.C. voltage is eliminated. The speaker can be connected to any ordinary set which employs either a choke-feed output circuit or an output transformer.

The major portion of the stand, however, is devoted to batteries, for which a long life is claimed. A special rechargeable cell is also shown.

*Primus Mfg. Co., Ltd., Primus House, Willow Street, E.C.2.*

**PRITCHARD & SIMPSON. (243)**

A well-designed three-valve chassis, embodying an inductively coupled band-pass input circuit, together with many other up-to-date features, forms the electrical nucleus of most of the radio-gramophones featured on this stand.



Three-valve chassis embodied in Pritchard & Simpson's receivers.

What will probably prove a very popular model is the "Radio Babygram," priced at 28 guineas and designed for all-mains operation. It contains a moving-coil loud speaker with energised field.

There is a special model fitted with a Capehart automatic record-changing device, listed at 48 guineas.

*Pritchard and Simpson, Ltd., 16-18, Lisle Street, Newcastle-on-Tyne.*

**PYE. (9)**

Introduced on the eve of the exhibition, the Pye "MM" is an entirely new and interesting example of the highly popular H.F.-det.-L.F. three-valve cabinet receiver for mains operation. It is completely self-contained, differing from the great majority of similar sets in that



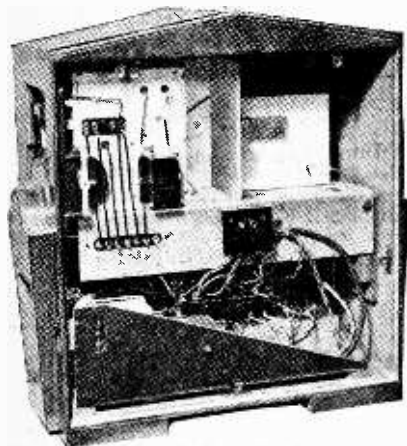
New Pye cabinet receiver with moving-coil loud speaker.

it has a built-in frame aerial, although an external aerial can be used. A moving-coil loud speaker is fitted. The circuit

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arrangement comprises a single H.F. stage, coupled by the tuned-anode method to a power-grid detector, of which the output is passed to a Mazda AC/PEN valve through a parallel-fed L.F. transformer. A Westinghouse metal unit is employed for rectification. Both tuning condensers are operated by a single edge-wise disc, and an external trimmer is controlled in the same way. These discs, together with a pre-detector volume-control, a reaction condenser, and a combination switch, are mounted on a small panel set into the side of the cabinet, which is of distinctive Pye design, in figured walnut. The general arrangement of the metal chassis is similar to that of other Pye sets, but there are one or two new features; for instance, resilient suspension is provided, in order to minimise the risk of damage during transit and to prevent microphonic noises. The set costs 17 guineas complete.

Another new receiver is the "Q" model, a battery-fed transportable, with an H.F.-det.-2 L.F. four-valve circuit, which, in spite of its moderate price of 14 guineas, seems to be well up to the usual Pye standard in the matter of solidity of construction and workmanship.



Pye "MM" receiver chassis.

By fitting one of the new high-efficiency Mazda pentode output valves, anode consumption has been brought down to the very reasonable figure of 7 milliamps. without sacrificing volume, which, indeed, should be considerably greater than that of the average set in this class.

Among the many modern features included in this set are ganged tuning (with external trimmer) and direct wavelength calibration. An interesting point was noticed with regard to the volume control, which is mechanically linked to the reaction system.

As in the case of the "MM" receiver, the control panel is mounted on the side, and is sunk below the level of the cabinet in order that the knobs may be protected from damage. By mounting the metal chassis to the case by means of large rubber bushes, the possibility

of damage is minimised, and microphonic troubles are avoided. A Celestion loud speaker, specially wound to match the new pentode, is fitted.

The "Twintriple" receivers, with two H.F. stages, for A.C., D.C., and battery feed, are retained for the present season.

*Pye Radio, Ltd., Radio Works, Cambridge.*

**R.C. RADIO ELECTRIC. (237)**

A special display is made here of various kinds of indoor aerials, including cage-type and those of spiral form. In addition, there is a range of electric soldering irons and a number of other interesting accessories.

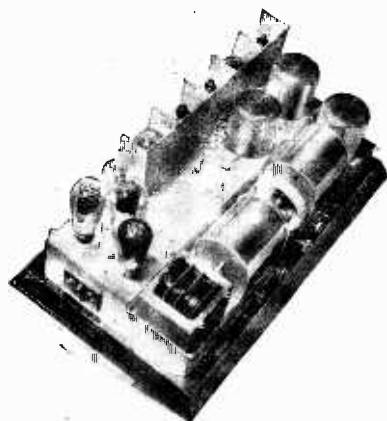
*R.C. Radio Electric, Ltd., York House, Southampton Row, W.C.1.*

**R.G.D. (11)**

The opinion expressed in our Show Forecast to the effect that the Radio Gramophone Development Company could be depended upon to provide something of interest has been fully justified; their new sets embody practically all the new features that we have already learned to expect in the new season's sets, and more than a few special refinements that do not seem to be found elsewhere.

Pride of place must be given to the new superheterodyne, built on a cadmium-plated steel chassis. The circuit arrangement comprises a band-pass input filter, coupled by capacity between the high-potential ends of the circuits, a first detector, an oscillator valve, two I.F. stages with screen-grid valves, and a power-grid detector. This is followed by a low-gain L.F. stage, resistance-coupled, which feeds into a pair of push-pull output valves by means of transformer coupling.

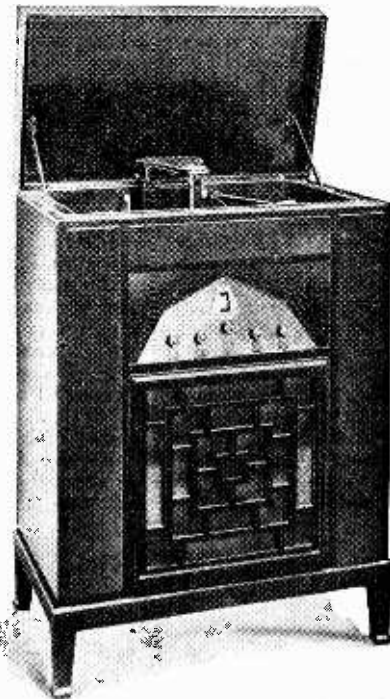
A radio-gramophone "fader" as well as a tone control are included, and the width of the input band-pass filter is under control of the user, or, if preferred, it may be permanently set to suit local receiving conditions when the instrument is installed.



R.G.D. superheterodyne chassis.

All intermediate-frequency couplings operate on the band-pass principle, and

tuning is fully "ganged"; indeed, this operation is regarded as so important that the trimming condensers are actually soldered up at the works. Tuning of the medium- and long-wave oscillator circuits is carried out by entirely separate condensers, which are, of course, linked to the main spindle.



R.G.D. superheterodyne radio-gramophone, with automatic record changer.

The "Popular" chassis, introduced since the last exhibition, embodies a straightforward 2-H.F.-det.-L.F. four-valve circuit. All switching is carried out by an ingenious four-position cam switch, and operation is further simplified by a combined radio and gramophone volume control.

An unusual form of wavelength indicator (all R.G.D. sets are directly calibrated) is fitted to this chassis; a spot light, focused through a black printed rotary celluloid disc, projects the appropriate part of the scale on to a ground celluloid screen.

If less attention than they deserve is paid to the R.G.D. "de Luxe" models, the makers have only themselves to blame; last year they had the temerity to produce a set that was well ahead of current technical practice, with the result that nothing more than minor alterations have been found necessary in order to keep it quite up-to-date. Incidentally, automatic record-changing apparatus can be fitted to this and all other models.

Finally, there is a new short-wave superheterodyne adaptor, either battery- or mains-operated, for use in conjunction with almost any receiver having H.F. amplification. Matters are so arranged that the unit may be permanently connected; by the act of

**Stand-to-Stand Report.—**

switching on, the appropriate aerial circuit changes are effected automatically.

*Radio Gramophone Development Co., Ltd., 18, Frederick Street, Birmingham.*

**R.I. (29)**

A group of four "Stenode" receivers in walnut, white sycamore, weathered oak, and snakewood cabinets of strikingly beautiful design occupy the centre of this stand. The "Stenode" employs the superheterodyne principle with very high selectivity, after which is incorporated a tone filter to restore the loss of high notes resulting from sharp tuning of the intermediate amplifier circuits.

heated output pentode, which delivers between two and three watts to the "Madrigal" moving-coil loud speaker. The price of the "Madrigal" receiver, complete with loud speaker pedestal, has been reduced to £35.

The name of R.I. is inevitably associated with nickel-iron core chokes and intervalve transformers. and the already wide range of types offered has been recently augmented by two new intervalve transformers, viz., the "Parafeed" and the "Dux." As is clearly shown by the large-scale reproductions of the N.P.L. curves displayed on the stand, the "Parafeed," in spite of its small size, is a component of the highest grade. It is designed essentially for use with a resist-

Several new mains transformers have been added to an already comprehensive list, and a new method of mounting with aluminium cheeks and paxolin terminal strips has been introduced. The Model E.Y.33 may be quoted as an example. This has been designed for the new Westinghouse H.T.8 rectifier, and is provided, in addition, with a four-volt six-amp. winding for indirectly heated valve filaments. It is priced at 37s. 6d.

In conclusion, mention should be made of the "Unigrad" volume-control potentiometer at 5s. 6d., which is available in three ranges: 50,000 ohms, 500,000 ohms, or 1 megohm.

*Radio Instruments, Ltd., Purley Way, Croydon, Surrey.*

**RADIO SERVICE. (162)**

The activities of this firm are devoted to battery service within 12 miles of Charing Cross. Accumulators, both H.T. and L.T., are collected regularly, charged, and returned. If the listener has no spare accumulator, one is lent him while his own is being charged, and it is not even necessary to possess one at all, for suitable accumulators for any set can be hired.

The charges for this service necessarily vary with individual requirements, and depend largely upon the current consumption of the set, and whether the accumulator is merely charged or hired.

*Radio Service (London), Ltd., 105a, Torriano Avenue, N.W.5.*

**RADIO SOCIETY OF GREAT BRITAIN. (246)**

This is the recognised rendezvous of amateur radio enthusiasts, both in this country and from abroad, who are interested in experimental short-wave communication. The latest developments in receiver and transmitter technique are embodied in the several special exhibits on the stand. Members of the Society are in attendance, and information relating to the special problems besetting the amateur experimenter will be willingly given.

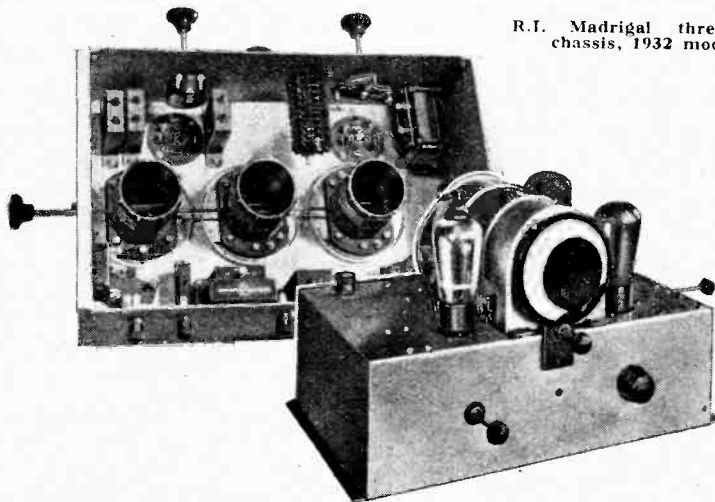
*Radio Society of Great Britain, 53, Victoria Street, S.W.1.*

**READY RADIO. (6 & 93)**

The difficulty of matching an output valve and loud speaker by aural means is generally accentuated by the fact that the ear does not retain its impressions for long; even if a suitably tapped output device of the usual type is available, it is a matter of real difficulty to determine definitely to which terminals connection should be made for best results.

The new "Instamat" matching transformers produced by the Ready Radio firm should overcome this trouble, as stud switches are provided for making instantaneous connection to any tapping point on either primary or secondary windings. Two models are available; the "Junior" giving ratios of between 1:1 and 3:1, and the "Senior" between 10:1 and 25:1.

A complete range of components is also exhibited. Among the most interesting



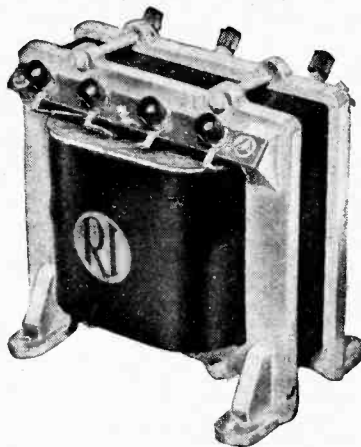
R.I. Madrigal three-valve chassis, 1932 model.

Actually five-kilocycle separation of stations is obtained without affecting the reproduction of frequencies up to 5,000 cycles. The seven stages are arranged as follows: (1) Oscillator; (2) first detector; (3) first intermediate-frequency amplifier; (4) second I.F. amplifier; (5) second detector; (6) first L.F. with variable tone corrector; (7) power output valve. In its latest form the circuit has been modified to eliminate second-channel interference and the single-tuning control, which now operates four gauged circuits, is calibrated in wavelengths. The loud speaker (a Senior R.K. moving-coil) is fed with an output of from three to five watts from the last valve. In view of the specification and quality of material, £75 cannot be regarded as a high price.

For 1932 the three-valve "Madrigal" A.C. receiver is still to be housed in the transportable pedestal cabinet which has proved so successful in the past. The selectivity has been considerably improved by the inclusion of a band-pass filter, and the chassis layout has undergone several changes which give a much neater external appearance; all components other than the enclosed triple-gang condenser unit and the valves are now contained in the interior of the chassis. A "Parafeed" transformer is used to couple the detector to the directly

ance-capacity filter, and has a primary inductance of 100-120 henrys.

Of slightly greater size, the "Dux" intervalve transformer, which sells at the very reasonable price of 6s. 9d., is a useful general-purpose transformer with a primary inductance of 30 henrys, and a

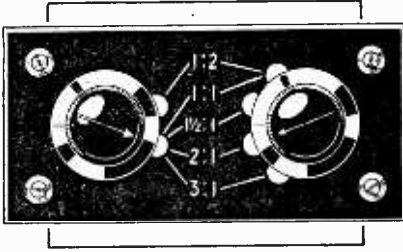


R.I. type E.Y.33 mains transformer (new type mounting).

ratio of 3½:1. It may be used with parallel-feed or direct connection, and will carry D.C. up to five milliamperes.

**Stand-to-stand Report.—**

of these is a dual-range frame aerial, wound with litz wire. Mounted on a rotating base, this frame embodies a convenient system of sockets for wave-range changing.



Control panel of Ready Radio Instamat transformer.

This firm specialises in the supply of complete kits of parts for popular receivers.

*Ready Radio, Ltd., 159, Borough High Street, S.E.1.*

**RED DIAMOND. (156)**

A display of Red Diamond crystal detectors, which are priced at 2s., occupies a prominent position on this stand. Lead-in tubes and lightning arresters are also shown, together with switches for various purposes, and 'phone connectors and adaptors.

*Jewel Pen Co., Ltd., 21-22, Great Sutton Street, E.C.1.*

**REDFERN. (163)**

Black and mahogany Ebonart panels occupy a prominent position on this stand; they are available with either a non-metallic polished surface or with a black moire surface. The principal feature, however, is the new "2-in-1" panel. This is an ebonite panel polished on both surfaces, but while one side is black, the other is mahogany.

A range of ribbed-ebonite formers is also shown, together with battery boxes, accumulator trays, and rubber feet for cabinets.

*Redferns Rubber Works, Ltd., Hyde, Cheshire.*

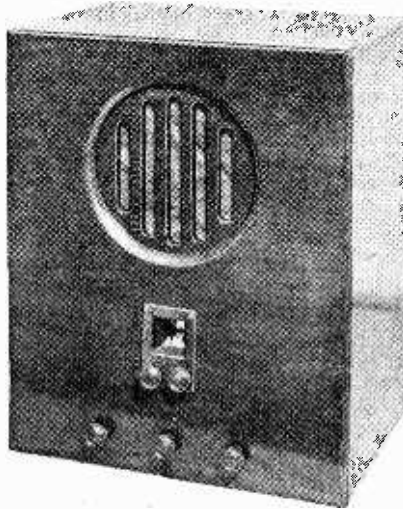
**REES MACE. (215)**

The very latest addition to the Rees Mace range of receivers is the Transportable Four A.C. model. It is entirely self-contained. A four-valve circuit is used, having two H.F. stages using screen-grid valves, a power-grid detector, and a pentode output stage. A moving-coil loud speaker is fitted, and all tuned circuits are ganged. A valve rectifier supplies the H.T. An examination of the elaborate metal chassis alone will show the amount of thought and care given to the design, all circuits are very completely screened, and each valve is mounted in a separate compartment. The price is 24 guineas.

Other models shown include an improved "Gnome" portable, a four-valve suit-case portable superheterodyne, one of the smallest sets of its kind in the

Exhibition, and a cabinet version of the "Gnome." Prices have been reduced considerably; the new "Gnome" now costs 14 guineas, and the superheterodyne 19 guineas.

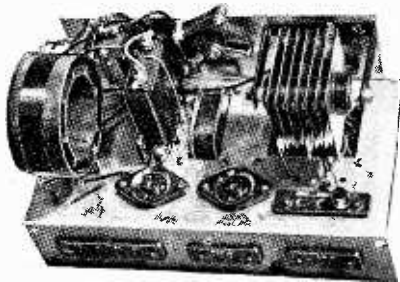
*Rees Mace Mfg. Co., Ltd., 39a, Welbeck Street, W.1.*



Rees Mace Transportable Four self-contained A.C. receiver.

**REGENTONE. (22)**

Surely one of the most compact receivers at the Exhibition is the new two-valve all-mains set measuring only 9½ in. x 7½ in. x 5½ in.? Built in accordance with the latest accepted practice, it consists essentially of a pressed-steel stamping, on which are housed the receiver components and all-mains equipment. At the attractive price of £6 15s. complete in bakelite cabinet, it represents good value for money, and should not be missed when a visit is made to Olympia. There are special mouldings for all terminals and valve holders, and, as there is no H.F.



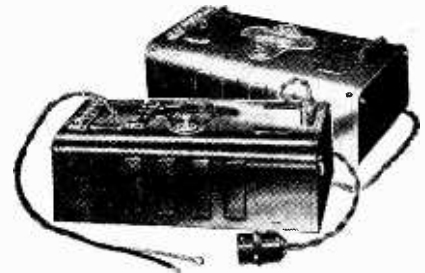
Regentone all-mains two-valve set.

stage, a 3 in. tuning coil which must contribute to the efficiency. The circuit consists of a regenerative leaky-grid detector transformer coupled to a 104v. valve capable of an undistorted A.C. output of some 600 milliwatts. It can fairly be said that this set has been designed to a pre-conceived plan, and is not a heterogeneous assembly of standard parts.

There are mains units to suit every

purpose and purse, from type W.I.F. for the popular combination of S.G.-Det.-L.F. set selling at £2 7s. 6d., to an ambitious combined model suitable for a multi-valve set and providing 4 amps. at 4 volts for heater current, selling at £10. All eliminators have series-feed resistances and not potentiometers except for screen-grid voltages, where they are essential for proper regulation.

In view of the critical nature of screening-grid voltage, it is interesting to note that there are provided in this firm's units two screen-grid tappings to ensure optimum working conditions. An ingenious fool-proof three-socket mains connector is standardised on all models, and an attractive lacquer finish is now given to the metal containers. Improved smoothing is obtained in a number of the eliminators by the use of 4 and 8 mfd. electrolytic condensers, which are now



Regentone eliminators, types W5A and W5B.

made for high voltages. For those possessing the Pye "Q" portable, the Regentone Co. have available a combined H.T. and G.B. eliminator with L.T. charger, which fits into the H.T. battery compartment. The name of this unit is the W5Q, and the price, £4 12s. 6d.

*Regentone, Ltd., 21, Bartlett's Buildings, E.C.4.*

**ROLLS CAYDON. (56)**

Evidence of the modern trend of receiver design is revealed in this season's Rolls Caydon products. While suit-case portables of proved performance are still shown, a new type "All Mains Three" is of principal interest. One dial control is adopted with concentric trimmer, and the all-important band-pass aerial tuning is incorporated, as is evidenced by a three-section tuning condenser in a single H.F. stage set. It is a chassis-built receiver in an attractive cabinet of burr walnut, carrying the simple controls of wave range, tuning and volume. The design includes a moving-coil loud speaker, and the price is 20 guineas.

Also of similar external design, is a superheterodyne arranged for one-dial tuning, but fitted with an auxiliary trimmer knob concentric with the main control. Being battery operated, this receiver has an entirely silent background, and batteries and moving-coil loud speaker being included in the cabinet, the set is entirely self-contained.

*Rolls Caydon, Ltd., 77, Rochester Row, S.W.1.*



**Stand-to-Stand Report.—**

**ROLLS RADIO. (256)**

Three exceedingly handsome radio-gramophones arrest the attention at this stand. These embody a loud speaker of an entirely new design, but at the time our representative visited the stand there were no technical details concerning the principle of operation available.

Quality of reproduction is the main claim made for these various models, although that fitted with an orthodox three-valve set having one H.F. stage can be relied upon for reception of most of the high-power Continental broadcast stations.

*Rolls Radio, Ltd., 138, St. John Street, Clerkenwell, E.C.1.*

**SELECTORS. (83)**

The *pièce de résistance* on this stand is the new superheterodyne receiver, which is offered as a battery model complete with balanced-armature speaker and self-contained frame aerial, at 22 guineas plus royalties.

A four-valve portable set is made up in a number of different forms, including one for A.C. mains, while two-valve and three-valve sets are also to be had.

*Selectors (1931), Ltd., Servis Works, Albion Street, N.16.*



The Selectors battery model superheterodyne receiver.

**SEL-EZI. (190)**

Although the activities of this firm are devoted to factoring, and there is in consequence a wide range of receivers on show, the principal exhibit is undoubtedly Lotus receivers and components.

*Sel-Ezi Wireless Supply Co., Ltd., 1, Soho Square, W.1.*

**SELFRIDGE. (234)**

A wide selection of the products of the leading radio manufacturers constitute the principal exhibits on this stand. In addition a feature is made of a range of "Key" H.T. batteries shown in 99- and 108-volt sizes, the prices being 7s. 11d. and 8s. 9d. respectively.

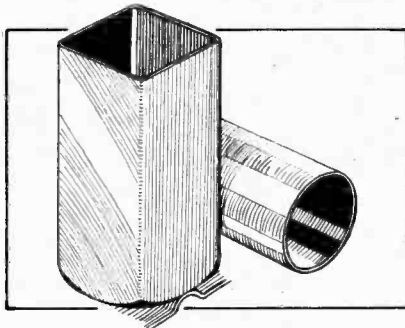
D 55

Demonstrations are given showing the ease with which the "Zonophone" constructor kit can be assembled. Complete with loud speaker and valves it costs £6 6s.

*Selfridge and Co., Ltd., Oxford Street, W.1.*

**SIEMENS. (74)**

A particular feature of this exhibit is the one-piece zinc container used in the construction of "Full-o-Power" batteries. This departure, which is probably exclusive to Siemens's batteries, avoids the severe contamination of the zinc which occurs by the use of soldered containers. Batteries in various stages of construction are shown, revealing the use of rectangular seamless containers in the large-capacity types. Large power-type bat-



A feature that is probably exclusive to Siemens dry batteries, is the use of seamless zinc containers, thus avoiding the contamination arising from soldering.

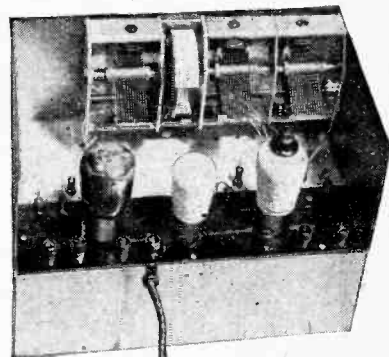
teries of special interest to the battery set user requiring quality reception are shown, of which an example is the type V.8. This is a 120-volt battery measuring 11in. x 6½in. x 7½in., weighing 22lb., and selling at 24s.

*Siemens Electric Lamps and Supplies, Ltd., Caxton House, S.W.1.*

**SIX-SIXTY. (20)**

The elimination of uncertainty is the keynote of the "Chassikit" home constructor's equipment, which consists of three basic parts—a triple-gang tuning condenser unit, a screened-coil unit, and a valve unit. The constructor is relieved of the trouble of wiring, as each unit is already wired up and provided with plugs and sockets, so for complete assembly it is only necessary to screw the three units to a metal chassis and insert a number of plugs in appropriately marked sockets. The three-valve circuit of the "Chassikit" conforms to the latest practice and consists of a two-member band-pass pre-selector (coupled by mutual inductance) ganged to a choke-fed tuned-grid circuit, which is followed by a leaky-grid detector linked to a pentode by L.F. transformer coupling. There are three controls—one-dial tuning, volume and reaction, and means for switching-in a gramophone pick-up. A large number of extremely well-finished cabinets are being shown for the housing of the "Chassikit," many

of them having sufficient space for a gramophone motor, turntable, and built-in loud speaker. These cabinets strike a



Six-sixty Chassikit assembled

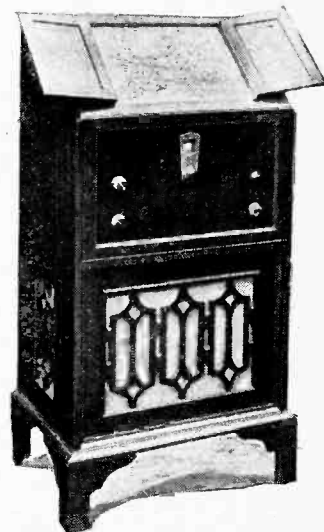
new note in modern artistic finish, and notable among the designs is the "Pylon" type.

The range of Six-Sixty valves has been considerably augmented this season. There is the 220 S.P.—a highly efficient two-volt battery valve for the output position, and the 4DXAC, an indirectly heated detector with a very high slope suitable for power-grid rectification. Among the directly heated output valves mention should be made of the HV.4/1 and the HV.4/2, both capable of undistorted outputs of nearly one watt.

*Six-Sixty Radio Co., Ltd., 17-18, Rathbone Place, W.1.*

**SMURTHWAITE. (107)**

Two models of the Stenode receiver, one of which is illustrated, are shown here.



The Macgregor station indicator fitted to a Stenode receiver (Smurthwaite).

Both are of the "broadcast" type, using one sharply tuned intermediate stage, but not employing the crystal gate.

**Stand-to-Stand Report.—**

One set is fitted with the Macgregor station indicator, consisting of a map with coloured lights marking the position of the main European stations. Tuning is effected by turning the single-control dial until the lamp corresponding to the station required is seen to light. The volume control is then turned up until the station is received as loudly as desired.

Sets for special purposes, such as hospital installations, are also on view.

F. W. Smurthwaite, 15a, Onslow Gardens, Wallington, Surrey.

**SOVEREIGN. (64)**

One of the lowest-priced sets available and yet contained in a good grey polished oak cabinet is the Sovereign Transportable Three. Its price is £3 10s. without valves or batteries, yet it includes an H.F. amplifying stage not usually found in inexpensive three-valve sets. It has a built-in aerial and a cone loud speaker, and is arranged to be economical in current consumption. Components form a large part of the exhibit. A dual-range, general-purpose tuning coil with plunger-type wave-change switch is priced at 6s. 6d. Small fixed condensers in moulded cases accurate to within 5 per cent. are priced at 10d. each. There is, in addition, a Sovereign pre-set condenser. New lines for the amateur include Mansbridge-type condensers in moulded bakelite cases and fitted with terminals, among which the 750-volt D.C. test type of 1 mfd. sells for 2s. 3d. There is a convenient midge-type wire-wound resistance for baseboard mounting and housed in a bakelite case

For tracking purposes it is possible to use the outer grooves on a discarded 12in. record, but where one is not avail-

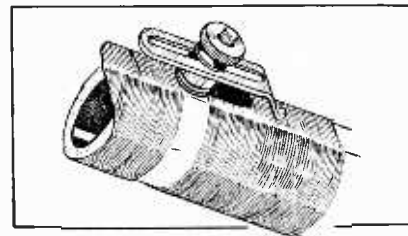
For the gramophone enthusiast a synchronous motor, running at exactly 78 r.p.m., together with an automatic stop and a pick-up, make a complete outfit.



Speakeasie de luxe model home recorder.

able the special tracking discs shown can be used. The aluminium discs employed for recording purposes are 6in. in diameter. A special feature of these outfits is that a diamond cutter is incorporated in all recording sound boxes, even in that supplied with the cheapest model.

Speakeasie Home Recorders, Ltd., 63, New Broad Street, E.C.2.



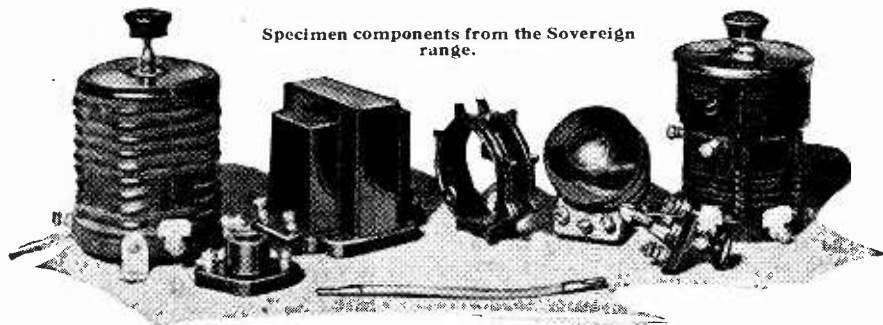
Portion of Standard Battery Company's potential divider. The clip does not cut the wire.

Among the components shown, a 50-watt potential divider, with an ingenious method of varying the tapping points, takes a prominent place.

Standard Battery Co., 184, Shaftesbury Avenue, W.C.2.

**SYNCHROPHONE. (223)**

The basis of all Synchrophone products is a home-talkie apparatus which in some models has combined with it a radio-gramophone, thus forming what is probably the most versatile piece of apparatus seen so far at any wireless exhibition. The Model "A" incorporates a three-valve receiver having one H.F. stage, a 16 mm. film projector, and a gramophone turntable with pick-up. A high-grade reed-type loud speaker is incorporated. This instrument can be used as (a) a home talkie with synchronised



Specimen components from the Sovereign range.

selling as low as 1s. 3d., while spaghetti resistances are a few pence each in the lower ranges. Wire-wound volume controls at competitive prices are available in sizes up to 50,000 ohms. L.F. chokes, interval transformers, "on" and "off" switches, H.F. chokes, and terminal mounts are all described in a booklet obtainable at the stand.

Sovereign Products, Ltd., 52, Rosebery Avenue, E.C.1.

**SPEAKEASIE HOME RECORDERS. (236)**

Here are shown various models of home-recording apparatus for use in conjunction with an ordinary gramophone. The simplest model costs £1, while £2 2s. will purchase the de luxe outfit.

**STANDARD BATTERY. (94)**

Besides the wet H.T. battery from which the firm derives its name, the "Star" loud speaker unit, with its associated double-cone chassis, are well-known products of this company. A comparatively new addition is the Wates rotary converter, for driving A.C. sets from D.C. mains of all voltages; complete silence, both electrical and mechanical, is claimed for this. The output available runs up to 160 watts.

A wet cell for filament heating has been introduced for the benefit of those who cannot easily have their accumulators charged. The capacity of this is about 500 ampere hours without replacement of the zinc element; this is equivalent to a year's consumption of filament current at 0.5 ampere for three hours daily.



Model "A" Synchrophone incorporating a three-valve receiver.

sound discs, (b) a projector for silent films, (c) a radio-gramophone, and (d) a broadcast receiver. It is electrically operated.

**Stand-to-Stand Report.—**

The cabinet contains special drawers for the film spools, and a numbered rack for the sound discs and spare gramophone records. This model is contained in a burr walnut cabinet, and complete costs 125 guineas.

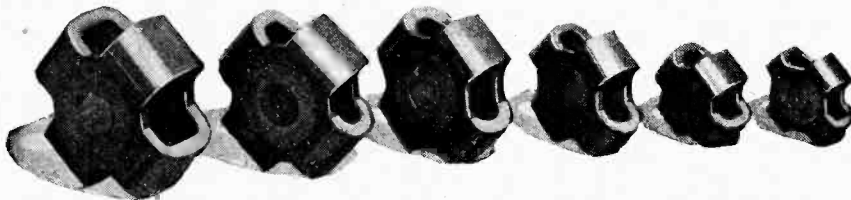
Model "B" is the same as Model "A," but is housed in a less expensive cabinet; this costs 100 guineas. Other models shown include one fitted with a two-valve receiver, and three in which there is no provision for broadcast reception.

Special picture screens with loud speakers mounted behind are shown in various forms.

*Synchrophone, Ltd., 24, Berners Street, W.1.*

**SWIFT LEVICK. (52)**

It is due to the energies of this company that the use of permanent magnets for moving-coil loud speakers has in the past two years become standard practice. A range of sizes has been developed to suit all requirements, and a pamphlet is available giving full dimensional and flux density data. Price reductions have taken place, and greater efficiencies are



A selection from the range of Swift Levick permanent magnets, which are now available in a variety of sizes to suit all requirements.

now claimed. All magnets are now coppered to prevent rusting. A complete permanent-magnet moving-coil loud speaker is shown at the stand, being a product of one of the many loud speaker manufacturers making use of Swift-Levick magnets.

*Swift Levick and Sons, Ltd., Clurence Steel Works, Sheffield.*

**SUNCO. (203)**

The activities of this firm being devoted mainly to the distribution to the trade, the exhibits on this stand take the form of a representative display of receivers and apparatus made by the leading radio manufacturers.

*Sun Electrical Co., Ltd., 118, Charing Cross Road, W.C.2.*

**SWAIN. (254)**

The "Marquis" self-contained portable and transportable receivers are the main feature of this exhibit. There are models ranging from an inexpensive two-valve receiver to a five-valve suit-case model. The diminutive "Straight Three" for battery operation and for use with an outside aerial is an interesting set, more especially as the price complete is 52s. 6d. only.

*Charles Swain, Ltd., 32, Queensway, Ponders End, Middlesex.*

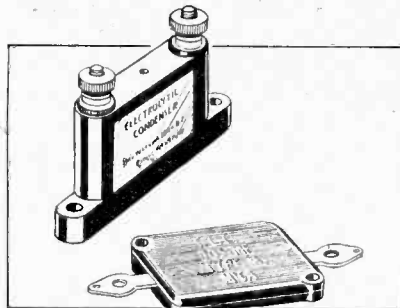
D 57

**T.C.C. (14)**

Miniature fixed condensers of the so-called "postage-stamp" type, in capacities between 0.00005 mfd. and 0.01 mfd., which were originally supplied only to manufacturers, are now available generally. Although intended primarily to be supported by their connecting leads, these components are also provided with screw-holes for fixing to a baseboard or in any other convenient position, and are entirely sealed in a moulded bakelite case. Extreme compactness and low cost are the main features.

High-capacity, high-voltage, liquid electrolytic condensers to operate on working voltages up to 450 D.C., are now manufactured; a condenser to withstand that pressure, and with a capacity of 8 mfd., costs 12s.

A range of "dry" electrolytic condensers for relatively low-voltage work (up to 100 volts) is exhibited; these condensers are particularly suitable for smoothing and decoupling in grid circuits. As an example of the compactness of dry electrolytic condensers, it may be mentioned that a unit of 2 mfd., working at 100 volts, is contained in the same



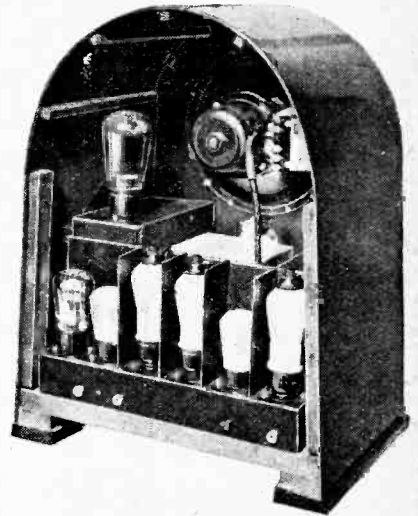
New T.C.C. condensers: a 2 mfd. dry electrolytic and a moulded type.

nical information is available on the stand. Particular emphasis is laid on the fact that all T.C.C. paper condensers up to 2 mfd. capacity are non-inductive, whatever their voltage rating or cost, and so they may safely be used for H.F. work, even when ultra-short wavelengths are being dealt with.

*Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, W.3.*

**TANNOY. (63)**

This stand bears the mark of up-to-dateness by the exhibiting of a modern superheterodyne. The Tannoy "Mid-



Interior view of the new Tannoy all-mains superheterodyne.

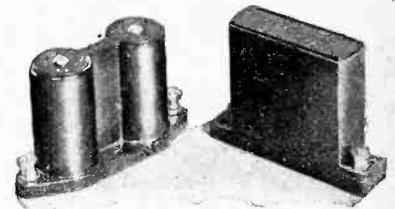
get," while of compact design, is a mains-operated superheterodyne incorporating variable- $\mu$  valves, band-pass tuning, power grid detection, with a pair of intermediate amplifying valves and a pre-first detector H.F. stage giving in all nine tuned circuits with six valves and a valve rectifier. The price is only 23 guineas in a walnut and figured veneer domed cabinet. This same chassis is available housed either with radio-gramophone equipment or in a console cabinet.

Tannoy mains units are now well known, and, by way of price indication, reference might be made to the model P.1, which, fitted with Westinghouse rectifier and provided with three voltage tapplings giving 150 volts at 15 mA., sells at £2 19s. 6d. Another model, type G.B.1, to which is added three grid-biasing potentials and a low-tension trickle-charger, is priced at £4 15s.

*Tannoy Products, 1-7, Dalton Street, West Norwood, S.E.27.*

**TELSEN. (19 & 213)**

When visiting a large number of stands at the Exhibition, one cannot fail to notice the varying prices of similar components. Extremely good value for money is to be found in the components

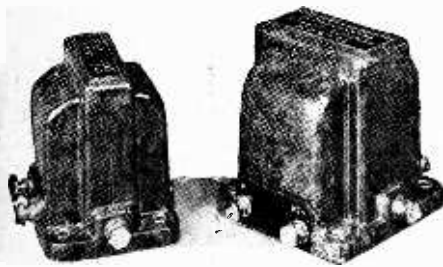


Telsen Binocular H.F. choke and Mansbridge condenser.

**Stand-to-Stand Report.—**

displayed by this company. As the result of careful investigation into the properties of Mansbridge condensers, a new series of these components has been developed, with a maximum error of capacity not exceeding plus or minus five per cent. Each condenser is tested for insulation resistance to a specification of 1,000 megohms per microfarad, and the winding of the foil is non-inductive. Housed in hermetically sealed bakelite covers, the 2-mfd. type sells at 3s. for 500-volt test, and 5s. for 1,000-volt test.

Another component of special merit is the fieldless-binocular H.F. choke of 170 millihenrys inductance, moulded in bakelite, and selling at 5s. There is available a full range of spaghetti resistances at prices from 6d. each. A well-known disability of this component is the tendency to change in value when subjected to bending; the product of this firm is heavily impregnated and baked before final assembly, with the result that adjacent turns do not tend to touch, and the resistance value remains constant. For trimming purposes and for series aerial capacity connection, the pre-set condensers should commend themselves, as the minimum capacities are remarkably low; the 0.0001-mfd. model, for instance, having a minimum capacity of 1 mufd.



(Left) Telsen 100-henry choke. (Right) 90-henry Pentode transformer.

An interesting interval low-frequency choke called the power-grid choke, of 40 henrys inductance, sells at 8s., and should be used after power-grid detection, being coupled to the succeeding valve by a 0.002 mfd. condenser.

A very complete range of low-frequency and output transformers is being exhibited, and it is noteworthy that in all cases the inductance is quoted under varying D.C. conditions with 1 mA. ripple current.

*Telsen Electric Co., Ltd., Thomas Street, Aston, Birmingham.*

**THOMPSON, DIAMOND, & BUTCHER.**  
(210)

In addition to a large selection of proprietary receivers, loud speakers and components, this firm are featuring a range of radio-gramophones of their own manufacture, and described as the "National Band" series. The cheapest is a two-valve model with reed-driven cone loud speaker, priced at 18 guineas, while the most attractive one shown has a four-valve receiver, is A.C.-operated using a

valve rectifier, and costs thirty-two and a half guineas. There is a range of loud speakers, those fitted with reed-operated cones varying in price from 15s. 6d. to 32s. 6d., while a permanent-magnet moving-coil model is shown at £3 15s.

*Thompson, Diamond and Butcher, 34, Farringdon Road, E.C.1.*

**TONEX. (231)**

Besides a range of components, a two-valve all-mains set, with band-pass tuning and pentode output to a moving-coil



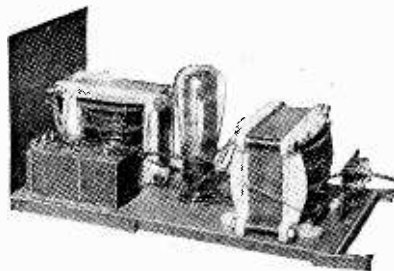
Tonex two-valve all-mains set, which has band-pass tuning.

speaker, is shown. This set, of which a photograph is given, is to be priced at about ten guineas complete.

*Tonex Co., Walker Street, Blackpool.*

**TUNEWELL. (82)**

The exhibit here consists largely of components of different kinds, prominent among which are tuning coils covering a wide range of requirements. These have recently been reduced in price. In addition to these, mains units of various kinds, together with transformers and chokes from which the constructor may select the basis of his own eliminator, are on



A unit to feed a complete D.C. set from A.C. mains. Output 300 mA. at 230 volts. (Tunewell).

view. This firm gives full details of its products; curves showing the variation of effective inductance of the smoothing and output chokes with direct-current load are available. Among these, an output choke intended to follow a pentode,

and maintaining the high inductance of 60 henrys at over 30 milliamps., is especially interesting at 15s. 6d.

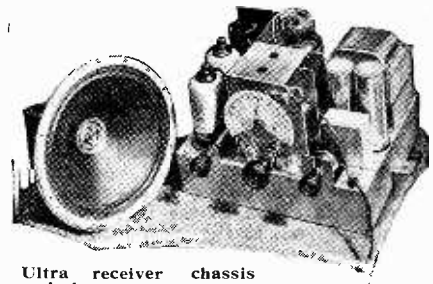
A combined H.T. and L.T. charger, with barreter to hold the charging current steady under varying loads, is a prominent new line.

*Turner and Co., 54, Station Road, New Southgate, N.11.*

**ULTRA. (10)**

The Ultra "Tiger" is a good example of the popular A.C. three-valve self-contained cabinet receiver with a built-in moving-coil loud speaker, of which the field in this case is energised from the source of H.T. supply. The tuning system is fully ganged (without an external trimmer), and the controls have been simplified as much as possible; calibration is directly in wavelengths. This is one of the few sets to include a screen-grid detector valve, which is coupled to an output pentode by the resistance-capacity method. There is no reaction in the ordinary sense, as the H.F. circuits are so arranged that the valve, with optimum bias, is on the verge of self-oscillation; it is de-sensitised, for purposes of volume control, by over-biasing the grid.

The "Panther" receiver chassis is similar in every way, except that it has another H.F. stage. The layout of both these sets is exceptionally neat and compact.



Ultra receiver chassis and the new permanent-magnet moving-coil loud speaker.

The new "Ultra" moving-coil loud speaker is of the permanent-magnet type, with a pressed core, of which the centre is "doped" in order to accentuate the upper register. This instrument, in chassis form, costs only 55s., while a cabinet model is sold at £4.

*Ultra Electric, Ltd., Erskine Road, N.W.3.*

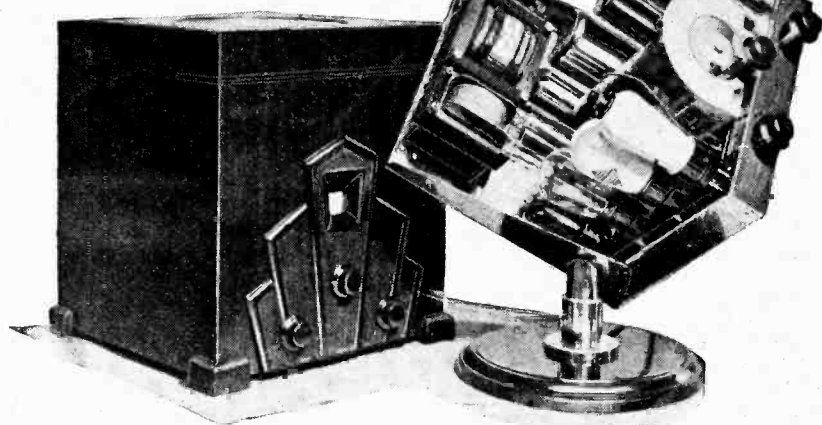
**UMELLO. (73)**

A set is here exhibited which should not escape the notice of the technically interested listener, as close examination of the chassis will reveal the adoption of all modern principles. This set, a three-valve arrangement, incorporates a band-pass input filter preceding the first screen-grid valve. A power-grid detector gives a high amplification, and is followed by a generous compensated pentode output. Direct calibration in wavelength is provided, and the controls include a useful tone-regulating switch. It is

**Stand-to-Stand Report.**—

interesting to note that the moving-coil loud speaker faces upwards, which is, possibly, an advantage when so much sound reflection takes place in the average room. Not only is this chassis beautifully constructed to appeal to the

Of distinctive and original design the new Umello set incorporates a well-built chassis.

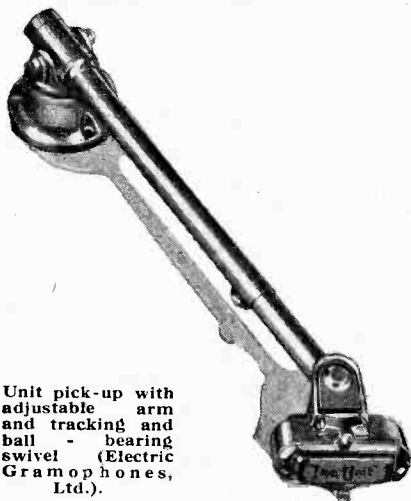


technician, but an artistic cabinet is adopted of quite compact dimensions.

*Umello, Ltd., 55, Great Marlborough Street, W.1.*

**UNIT (ELECTRIC GRAMOPHONES). (89)**

A somewhat revolutionary type of gramophone motor for use with A.C. supply, and selling at the popular price of 48s., is a new product of this firm of gramophone motor manufacturers. Unlike other inexpensive A.C. motors, it is self-starting, and the speed of rotation is not in synchrony with the A.C. supply.



Unit pick-up with adjustable arm and tracking and ball-bearing swivel (Electric Gramophones, Ltd.).

Ventilation of the windings is deliberately avoided so that the motor and governor are entirely enclosed and dustproof. Mounted on a square-top plate, it is only necessary to cut a rectangular hole when

mounting, and quite small space is taken by the interior depth. One model suffices for running on supplies of 100-125 and 200-240 volts, and the current consumed is about 120 mA.

Another new product is the Unit pick-up, which is fitted with adjustable track-

ing by variable length arm and swing-about action at the attachment between arm and pick-up. It is of pleasing external design, and examination of the interior shows an attractive form of construction. It can be surmised that record wear is particularly light. The head swivels through 180° to facilitate inserting new needles, and a ball-bearing swivel on the arm provides perfect freedom of movement, while end stops prevent the pick-up from swinging about in the cabinet. This pick-up does not follow any of the previously existing shapes, and is a small and particularly neat instrument.

*Electric Gramophones, Ltd., The Quadrant, Winchmore Hill, N.21.*

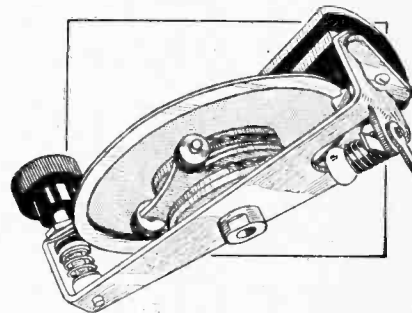
**UTILITY. (90)**

Screened gang condensers of particular interest to the manufacturer and set constructor are an entirely new addition to the Utility range. The bent metal box form of construction is adopted, giving absolute rigidity. Greater accuracy in the setting up of the stators than would result by merely screwing to the barrier plates between the sections is provided by ingenious eccentric screw adjustments. In addition, the individual condenser sections are accurately matched to capacity across the scale by the use of slotted end vanes and an accuracy of adjustment to within 1 per cent. is obtained. Spindles run on ball bearings and star-wheel control of the trimmers is supplied in place of the usual screw heads.

Two types of ganged condensers are shown, being of the fully screened and semi-screened types. The former is completely covered, while a specimen of the latter, which is suitable for practically all purposes and costs less, is shown

in an accompanying illustration. Competitive prices have been maintained.

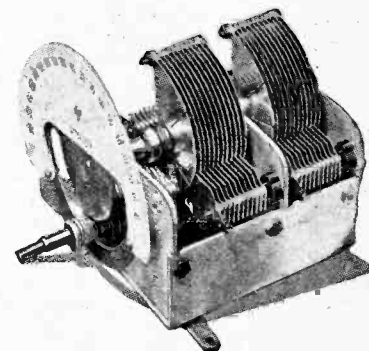
For a central drive between a pair of ganged sections a new-type drum dial has been produced. It is larger than usual, being 4 3/4 in. in diameter, smooth in



The Utility reduction drive using a unique method of chain and pulleys, entirely avoids backlash and provides a powerful movement.

action, and is provided with an escutcheon. Among other new Utility products is to be found a compact form of baseboard or panel-mounting switch. It is arranged so that it can be gang-operated if required, and is particularly suitable for use in H.F. circuits.

*Wilkins and Wright, Ltd., Utility Works, Holyhead Road, Birmingham.*



Double ganged Utility condenser with externally controlled trimming on the front section, a new Wilkins & Wright product.

**VALUNDA. (224)**

Two items of interest are featured on this stand. One is the Valunda switch, which combines the function of a change-over switch with that of an on-off switch, and sells at 3s., while the other is an ingenious carrying strap which can be clamped under the L.T. accumulator terminals. The price of this device is 6d.

*F. Francke, 28, Blomfield Road, Maida Vale, W.*

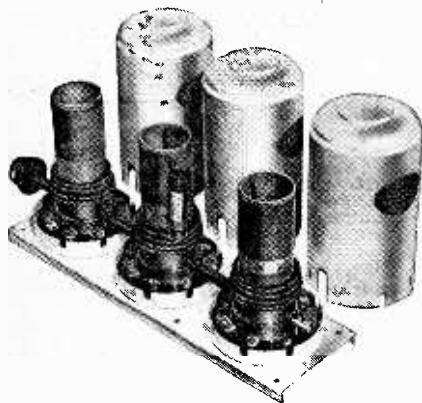
**VARLEY. (58)**

Components for the construction of high-grade receiving apparatus of the more ambitious kind are the principal exhibits of the Varley firm.

As an addition to the original "Square Peak" filter coil assembly, there is a new range of matched coils, sold under the same trade name, and primarily intended

**Stand-to-Stand Report.**—

to be used in filters coupled by a combination of common capacity and negative inductance, which gives sensibly uniform band width. These coils are matched as to their inductance values—we are informed that a bridge method of testing is employed—and would appear to have a wide field of usefulness; terminal connections are brought out in such positions that the user is not entirely restricted to any one circuit arrangement.



Varley Square Peak coils.

Mechanically, construction is beyond criticism, and the built-in wave-range switches, which, incidentally, may be ganged, seem to function exceptionally well; this is often a weak point, and it is more than annoying to have to remove all the connections to a coil in order to clear a fault of this nature.

Individual elements of the filter circuit, as well as the associated H.F. coupling coil, are screened under cylindrical covers of drawn aluminium. Two types of interval coupling are available, one of which is fitted with a reaction winding.



Varley high-resistance potentiometers, with ganging link.

The "square peak" principle of tuning is embodied in several new Varley receivers; as an illustration of what is being done in this direction, we may take the console radio-gramophone, with a "mixed" band-pass input filter and two

H.F. stages. The tuning system is fully ganged, and there is a triple volume control, operated by means of a single knob, which controls aerial input, screening grid voltage, and pick-up output. Direct-station calibration is only one of the many up-to-date features included in this ambitious piece of apparatus.

Returning to components, mention should be made of the new ganged resistances or potentiometers, any number of which (within reason) can be linked together mechanically. There is great scope for ingenuity in the use of these devices, and the opinion can confidently be expressed that the ganging of subsidiary controls will receive a great deal of attention in the future.

Special apparatus for use with the G.U.1 rectifier valve has been produced, including a suitable power transformer and a delay-action switch. Among other "out-of-the-rat" components are push-pull output chokes for pentodes, and an impedance matching transformer, by means of which any loud speaker, provided its impedance is known, may be matched to any valve. A 3-henry choke, in which a minimum of iron is used in the core, should be useful for tone control and in tuned L.F. circuits. Finally, it should be stated that technical pamphlets dealing with the uses of these products are available.

Varley (Oliver Pell Control), Ltd., 103, Kingsway, W.C.2.

**VOLTRON. (227)**

This year a special feature is made of kit-sets, the two principal being the "S.G.4" and the "Hornet." The "S.G.4" consists of two separate units, one carrying the H.F. valves and associated components, while the other is a three-gang screened condenser. All the constructor is required to do is to connect together these two main units and wire in circuit a L.F. transformer. The price, complete with valves and cabinet, is £10 6s. The "Hornet" is a simple two-valve kit listed at 29s. 6d., complete with metal cabinet.

In addition, there is a range of mains receivers, table-type sets and sundry Voltron components.

Voltron Electric, Ltd., Queensway Works, Ponders End.

**W.B. (46)**

Permanent-magnet moving-coil loud speakers and valve holders are the two chief products of this firm. The latter are subject to an all-round reduction in price, and a new loud speaker, the P.M.3, takes its place with its predecessors, the well-known P.M.1 and P.M.2.

The new P.M.3 has a built-up field magnet, consisting of four flat bar magnets assembled between laminated end-plates. It is supported on a cast aluminium base, which is designed to hold an output transformer. In chassis form the price of the P.M.3 is 45s., and the output transformer costs 7s. 6d. A new distinctive cabinet has been produced for

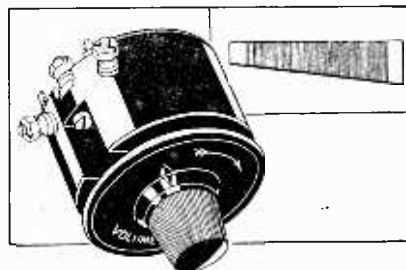
this model and may be purchased separately for 30s., or the complete loud speaker, including transformer, may be bought for £4 2s. 6d.

Whiteley Electrical Radio Co., Ltd., Nottingham Road, Mansfield, Notts.

**WATMEL. (100)**

The most important series of components shown here are without doubt the screened coils, of which there is a good variety. There are, of course, the coils specified for *The Wireless World* Superselective series, sold together as a single matched set, with wave-change switch, and in addition a series of screened coils adapted for ordinary H.F. amplifying circuits. These are available either with or without a reaction winding.

A new component is a pair of coils designed as a band-pass filter for connection in the aerial circuit of a modern high-power set; in this the aerial is coupled from a slab coil through a condenser to a tap on the first coil, and the coupling between the two coils is inductive. This is also made up with the addition of one or more single coils for coupling the high-frequency stages.



Watmel "log-law" volume control. The tapered resistance element is shown separately.

Wire-wound potentiometers, both of the ordinary type and of the type using a tapered resistance element, as illustrated, for volume control, are offered in a whole range of resistance-values up to 50,000 ohms.

All models of the "Superselective" series of sets can be seen, the builder of these, Mr. Arthur Smith, being in attendance to give any technical information visitors may require.

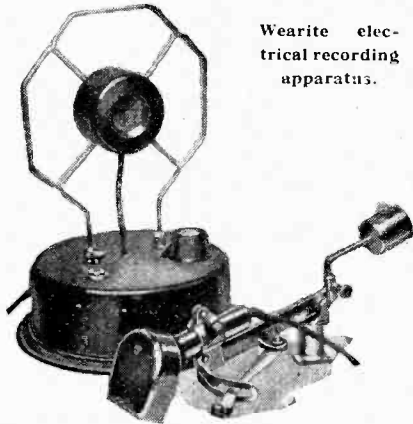
Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware.

**WEARITE. (152)**

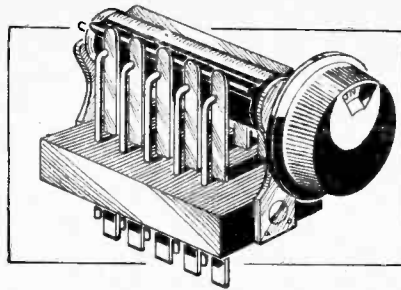
One of the most interesting exhibits on this stand is the Kingston-Wearite Home Recorder; the record blank has a diameter of only 6in., but it is stated that it takes nearly as long to play as a normal 10in. record. The outfit, which is priced at 67s. 6d., contains all the apparatus necessary, including cutters, record blanks, and cutting needles. When playing a home made record, steel needles cannot be used, and only Burmese Coloured Needles can be employed.

Among the wide range of components shown are a number of graphite-type volume-control potentiometers with re-

**Stand-to-Stand Report.**— Distances ranging from 10,000 ohms to over 1 megohm, at a price of 4s. A wire-wound potentiometer of 50,000 ohms and rated to carry 4 mA. is also available. Switches of various types are prominent,

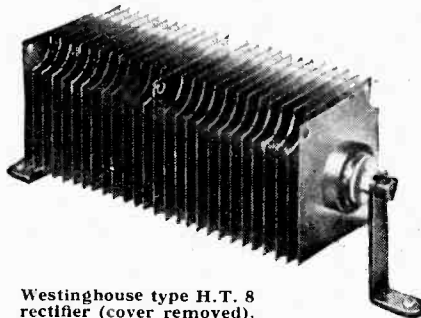


Wearite electrical recording apparatus.



Wearite switch with indicating dial.

the wireless constructor is concerned. Already many firms are making special mains transformers for this unit, which is of the voltage-doubler type, and gives a rectified output of 60 mA. at 250 volts from a 200-120-volt A.C. input. It is screened, and the overall dimensions are  $7\frac{3}{8} \times 3\frac{1}{2} \times 3\frac{1}{2}$  in. The price is 21s. Types H.T.5, 6 and 7 are continued at their reduced prices of 12s. 6d., 15s., and 17s. 6d. respectively.



Westinghouse type H.T. 8 rectifier (cover removed).

Special bridge-type rectifiers for instrument work are shown, and one of these is working in conjunction with a recording milliammeter from the demonstration music relayed to each stand by the B.B.C.

Westinghouse Brake and Saxby Signal Co., Ltd., 82, York Road, King's Cross, N.1.

and it is interesting to see that these can be obtained fitted with an engraved scale; a portion of the knob is cut away to form a window through which the scale markings are visible.

A number of mains transformers are shown, and one of these is designed for the Westinghouse H.T.8 rectifier; it has windings giving 4 volts at 4 amps. for L.T., and 250 volts at 60 mA. for H.T. Another transformer, the T.2, is intended for the U.5 rectifier, and has windings giving 4 volts at 4 amps., 5 volts centre-tapped and 250-0-250 volts at 80 mA. It is interesting to note that in order to secure good regulation, the 4-volts winding is wound with copper strip, instead of wire.

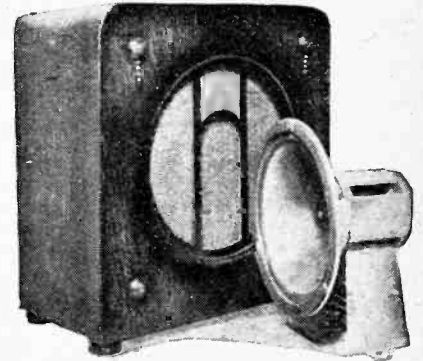
Wright and Weaire, Ltd., 740, High Road, Tottenham, N.17.

**WESTINGHOUSE. (44)**

The new H.T.8 rectifier is the most important exhibit on this stand as far as

**WHITELEY. (158)**

In addition to a representative range of apparatus by the leading radio manufacturers, this firm is showing an A.C. combined battery eliminator and trickle-charger giving a maximum of 20 mA. at 120 volts output. Two fixed and one variable H.T. tapping are provided, and



Whiteley electrical type PM3 loud speaker and chassis.

a Westinghouse rectifier is fitted. The price is £3 19s. 6d. A 108-volt standard size dry cell H.T. battery is offered at 8s. 9d.

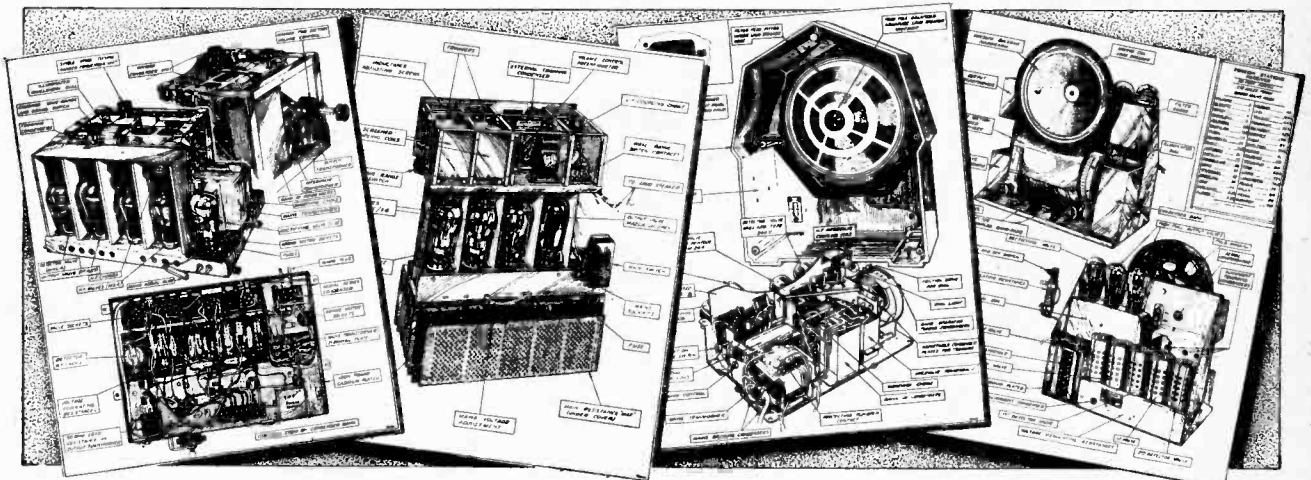
William Whiteley, Ltd., Westbourne Grove, W.2.

**YAGERPHONE. (222)**

Although radio-gramophones form the principal exhibits on this stand there are in addition some portable and transportable sets, also a range of inexpensive loud speakers. The most imposing model in the range is the Y.300 selling at 45 guineas. It is entirely electrically operated, and is a very handsome piece of furniture.

The loud speakers are of the reed-driven cone type; No. 1 has a balanced-armature unit and costs two guineas, while No. 2 is priced at £1 7s. 6d.

Yagerphone, Ltd., Charlotte Cabinet Works, Ponders End, Middlesex.



"THE WIRELESS WORLD" TEST REPORTS, giving detailed descriptions of construction and performance of the latest sets, are a weekly feature. In addition to explaining the merits of the circuit used, a specially prepared drawing gives the essential features of the design and equipment.

## CURRENT TOPICS

## Events of the Week in Brief Review.

**RECORD-SMASHING AT OLYMPIA.**

The success of the Olympia Show was assured on the first day, when orders amounting to almost £100,000 were taken. We hear that one firm sold 1,000 sets during the period required to dispose of 257 sets last year. Taken as a whole, business on the first day was twenty per cent. in excess of that of opening day in 1930. Orders came from as far afield as South America.

**AMONG THOSE PRESENT.**

All previous attendance records were beaten within a few hours of the opening of the Olympia doors on Friday last. Among the distinguished visitors were three Indian princes who toured the Exhibition and purchased a number of sets.

**A MIDGET OLYMPIA.**

To-morrow (Thursday), the Radio and Television Society will hold what may be termed a special "show" meeting at 195, Hammersmith Road, where an interesting exhibition of ancient and modern receiving and transmitting apparatus belonging to members will be on view. A number of ten-minute demonstrations will be given during the evening. The exhibition will be open from 7 to 11 p.m.

**AMATEUR TRANSMITTERS' RALLY.**

Visits to amateur transmitting stations in the London area, and a dinner at Pinoli's restaurant, are included in the programme of the Sixth Annual Convention of the Radio Society of Great

Britain, which will be held on Friday and Saturday next (September 25th and 26th) at the Institution of Electrical Engineers, Savoy Place, W.C.2.

Among the matters to be discussed will be the attitude of British amateurs to the Madrid Radio Conference in 1932, the progress of the British Empire Radio Union, and schemes for a series of tests between amateurs within the Empire.

**BROADCASTING HOUSE.**

We understand that Mr. Noel Ashbridge, chief engineer of the B.B.C., together with his staff, will move into Broadcasting House on Saturday next, September 26th.

Most of the engineers will occupy offices at the top of the new building, where the control room is situated.

The engineers are thus the first to leave Savoy Hill, but we understand that they will soon be followed by other departments, and that the move will probably be completed by the end of November.

**SO HELPFUL.**

"Answer to Correspondent" in a London newspaper:—"You say that your set, which is ten years old, is not entirely satisfactory," and ask my advice. I advise you to get a new one."

**RADIO COURSES IN MANCHESTER.**

Service agents and others interested in broadcast reception in the Manchester district are to be catered for in a special evening course in "The Performance and

Servicing of Broadcast Receiving Sets," which has been arranged by the Manchester Municipal College of Technology. The lectures will be given on Wednesday evenings, beginning on October 7th, and will last, with laboratory work, from 6.30 to 9 p.m. The fee for the course is 15s., and enrolments begin on September 30th from 6.30 p.m.

**NO TELEVISION BROADCASTS FOR ITALY.**

No false fancies about the possibilities of television are entertained by the Italian broadcasting authorities. We hear that, in an official letter sent to a number of Italian listeners who were clamouring for the establishment of a "Television Theatre," it is declared that, having regard to the present state of television, such a theatre would only bring discredit to the art and serve no useful purpose.

The authorities give the assurance, however, that television developments are being closely watched, and that an experimental television station may soon be erected in Turin.

**RADIO CITY'S ROOF GARDENS.**

New York's new Radio City, on which excavation work for the foundations has recently started, is to be beautified by landscape gardening to the tune of £3,600,000. Land costing £3,500,000 will be left open for gardens, while £100,000 will be spent on landscaping. Even the roofs of the ten structures will be transformed into modern Hanging Gardens of Babylon.

The present plans call for seven acres of landscaping with waterfalls, fountains, pools, trees, formal flower beds and statuary. Even the outer walls of the buildings, according to our New York correspondent, will be covered with a lacework of living ivy.

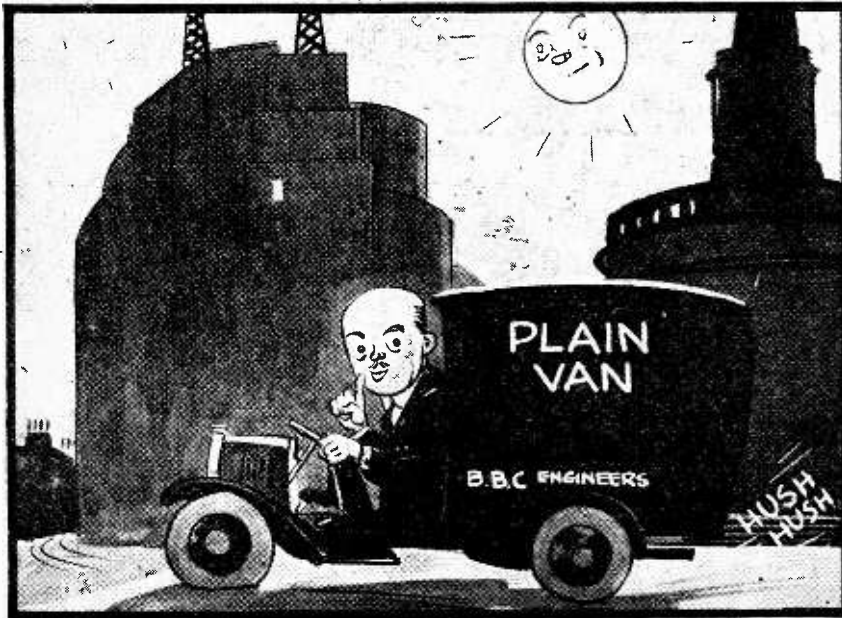
Forty feet above the roof of the sixteen-story wing of the centre building there will be a curved waterfall with a fifty-foot spillway and cascades ending in a reflecting pool on the roof.

**WHERE SUNDAY PROGRAMMES SPARKLE.**

Czechoslovakia has set a new fashion by dedicating a Sunday to the popularisation of broadcasting. The affair took place on Sunday last, September 20th, when special programmes were broadcast and public demonstrations were held at the Pardubice Exhibition of Physical Culture.

The celebrations actually began on the previous evening, which was marked by "a model radio programme" in which the best artists and the most notable speakers took their share in spreading the gospel of radio.

On the Sunday afternoon a radio-equipped aeroplane flew over Prague and maintained a spirited conversation, which was broadcast, with ground stations.



**NO OPENING CEREMONY.** Broadcasting House is, we understand, to be occupied by stealth. The first move in, by the engineers, is fixed for next Saturday, but Mr. Noel Ashbridge must have overlooked that there's a full moon that night—someone will see them!



The postal authorities co-operated by giving letters a special postmark on "Radio Sunday."

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**KING PRAJADHIPOK'S TELEVISION SET.**

The King of Siam, who is known to be one of the world's most radio-minded monarchs, has just purchased a television receiver from the Jenkins Television Corporation of New Jersey. During his recent stay in America King Prajadhipok visited several broadcasting stations, radio traffic offices, and radio factories, besides

purchasing a collection of short-wave sets with which to keep in touch with the world at large on his return to Siam.

o o o o

**DAY-TIME WIRELESS COURSE.**

Part-time courses in radio during the daytime are rather rare, but the City of Cardiff Education Committee has decided to offer such facilities to young men in the radio and allied trades. Beginning on October 6th and continuing every Tuesday morning from 9.30-12.30 until March 30th, 1932, a course in Radio Technology will be given at the Cardiff Techni-

cal College, and it is believed that the instruction will cover all that is required for a thorough knowledge of the operation and maintenance of radio and sound-diffusion apparatus. Full details of the course, the fee for which is £2, can be obtained from the Principal of the College.

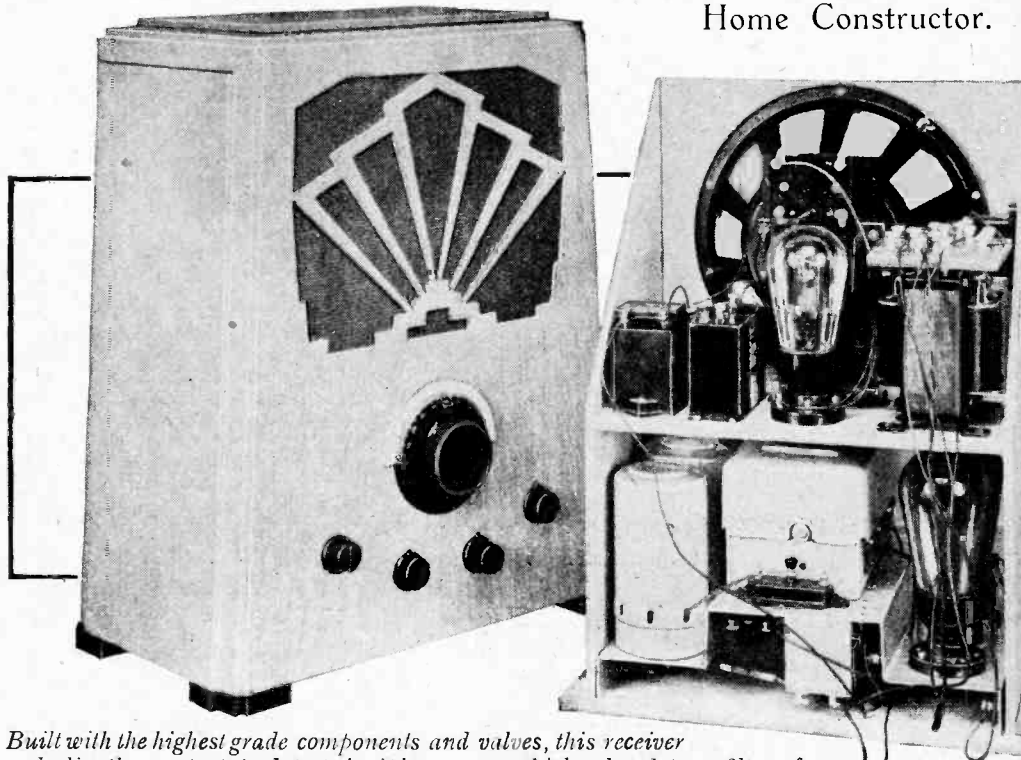
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**RADIOCABINETS, LTD.**

We learn that Mr. H. J. Macnamara, late of Macnamara's, the Birmingham radio manufacturers, is now a director of Radiocabinets, Ltd., of Stafford Street, Walsall.

**FULLY DESCRIBED IN NEXT WEEK'S ISSUE.**

Self-contained Mains Set, with Band-pass Tuning, for the Home Constructor.



THE **7** Wireless World **THREE**  
A.C. MODEL

*Tuning is effected by a single dial and the set is station calibrated.*

*Built with the highest grade components and valves, this receiver embodies the most up-to-date principles among which a band-pass filter of new design combining capacity and negative inductance coupling gives high and constant selectivity across the tuning range.*

*An easily constructed and inexpensive all-mains receiver giving long range quality reception, with entire freedom from back-ground or mains noise.*

**LIST OF PARTS REQUIRED.**

- 1 Aluminium chassis (Colvern type WW3/AC)
- 9 Condensers, 1 mfd. (T.C.C. Type 65)
- 1 Condenser, 2 mfd. (T.C.C. Type 65)
- 1 Condenser, 4 mfd. (Formo, working voltage, 400 D.C.)
- 2 Condensers, 0.0005 mfd. (T.C.C. Type, 34 Upright)
- 3 Condensers, 0.01 mfd. (T.C.C., Type 34, Upright)
- 2 Condensers, 0.0001 mfd. (T.C.C., "M" Type)
- 1 Condenser, 0.05 mfd. (T.C.C., Type 40)
- 1 Three-gang condenser with fixing screws (British Radiophone, Ltd.)
- 4 5-pin valve-holders (W.B., with large type base)
- 1 L.F. intervalve transformer (R.I. Parafeed)
- 1 Set of three coils incorporating band-pass filter, and H.F. intervalve coupling with screening (Colvern)
- 1 Differential reaction condenser, 0.0002 mfd., slow-motion drive and fitted with insulating bush (Ormond, Type R190)

- Resistances as follows: 3,000 ohms centre tapped, 30,000 ohms, 15,000 ohms, 300 ohms, 10,000 ohms, 5,000 ohms (Colvern Strip Type)
- 1 Resistance, 5,000 ohms for bridging the 0.05 mfd. condenser terminals (Colvern Strip Type)
- Resistances, grid leak type, 50,000 ohms, 100,000 ohms, 25,000 ohms and 0.25 megohm (Loewe)
- 1 H.F. choke (McMichael, Junior Type)
  - 1 Pre-set condenser, 0.0005 mfd. (Polar)
  - 1 On-and-off switch, for gramophone pick-up (B.A.T., Type 161, Claude Lyons, Ltd.)
  - 1 On-and-off switch (Q.M.B., Type No. 728)
  - 1 L.T. long throat mains switch, Claude Lyons, Ltd.)
  - 1 Volume control resistance, 50,000 ohms (Colvern Potentiometer)

- 1 Valve-screen (Colvern)
- 1 Mains transformer, with outputs of 350+350 volts, 80 mA., 4 volts 3 amps., 4 volts 2.5 amps. (W. Andrew Bryce, 54, Dawson St., Bury, Lancs., Type AB.35)
- 1 Smoothing choke, 20/14 henrys, 450 ohms (Varley Nichoke II)
- 1 Loud speaker with pentode output transformer, resistance of field, 2,500 ohms (Amplion, Type E.M. 644)
- 1 Cabinet with interior chassis (Clarion Radio Furniture, 28/33, Mansford Street, Hackney, E.2. Type S.C.3)
- 1 Dial, geared type (Burndopt Ethoverner, with station-indicating scale—Henry E. Taylor, 61/53, Church Street, Greenwich, S.E.10)
- 5 Lengths 4 mm., silk sleeving.
- Small quantity No. 24 tinned copper wire and a few yards of good-quality flex with thin rubber covering.
- Valves—Mazla AC/HL, Mazla AC/SG, Marconi or Osram P14 and rectifier U.12.



# READERS' PROBLEMS

Replies to Readers' Questions of  
General Interest.

Technical enquiries addressed to our Information Department are used as the basis of the replies which we publish in these pages, a selection being made from amongst those questions which are of general interest.

## Mains Aerials and Indoor Aerials Compared.

Can you tell me how a "mains aerial" connection arranged in the conventional way would compare with an indoor aerial about thirty feet long?

The effectiveness of both these forms of aerial is always uncertain, and so it is impossible to give a definite answer to your query. But it may be taken that, under average conditions, there is likely to be little difference between the pick-up of either.

o o o o

## Parallel Output Valves.

Is there any reason why two output valves of different types should not be connected in parallel? My problem is to arrange to feed a moving-coil and a moving-iron loud speaker simultaneously from the same receiver, and I have found by experience that it is impracticable to connect them both in the output circuit of the same valve without impairing the quality of both—particularly of the moving-coil instrument.

When valves are connected in parallel it is, unless very special arrangements are made, quite essential that they should have similar characteristics with regard to the grid voltage amplitude with which they can deal.

We take it that you probably wish to use a low-power valve for feeding the moving-iron loud speaker because your eliminator output is insufficient to supply two high-power valves of the type at present in use. If this is so, you might care to send us a circuit diagram of the set, in order that we may try to suggest something.

o o o o

## Decline of the 1-v-2 Circuit

Can you refer me to a book number in which you have described an up-to-date receiver with one H.F. amplifier, a detector, and two L.F. stages? I ask this because I am thinking of modernising my own set, which includes this circuit arrangement.

For reasons that can hardly be entered into in the course of a letter, this circuit arrangement has rather fallen into disuse, except for self-contained receivers, and in consequence we have not recently described a set in which it is included.

This reply must not be taken as meaning that the 1-v-2 set with an open aerial has no field of usefulness other than that mentioned above: the point is that, due to improved valves, and, to a lesser extent, improved intervalve couplings, as much L.F. magnification as can ordinarily be handled is obtainable from a single stage.

o o o o

## D.C. Valve Connections Simplified.

I am thinking of modifying my 1-v-1 battery set in order to use the new D.C. valves, but am afraid that I do not understand exactly how the interconnections between the series-connected heaters and the cathodes should be made. I have examined the diagrams of sets using these valves, but the issue is generally complicated by the fact that a number of other details are shown; perhaps you would be good enough to let me have a simplified diagram.

Matters are usually so arranged that the anode current of these valves does not pass through the heaters, so these are usually joined in series, while the cathodes are all in parallel. An interconnection between heaters and cathodes is made at the most negative end of the chain. This is shown in Fig. 1.

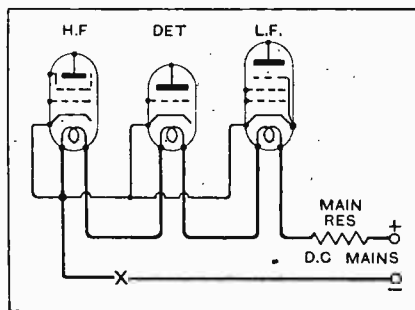


Fig. 1.—Heater-cathode connections for D.C. valves of the 6-8-volt types.

In designing a set such as that with which you are concerned, it is usual to obtain grid bias by connecting an appropriate resistance at the point marked X, across which the necessary potentials are developed.

## Oscillator Coil Connections.

Although I built my "Super-Selective Six" exactly to specification, and am satisfied that the wiring was correct, I could get no results whatever until I reversed the connections to the oscillator grid coil. The set now works well, and I am very satisfied with it. Can you tell me why it was necessary to reverse the coil connections?

The superheterodyne will not work at all unless the oscillator valve is functioning, and it cannot do this unless the associated coil connections are correct.

Unfortunately, some confusion has arisen with regard to the correct connections, owing to changes in the terminal markings since the publication of the article on the "Super-Selective Six." The correct connections for the latest coils of the specified type are:—

Terminal No. 1 to oscillator anode.

Terminal No. 2 to oscillator positive H.T.

Terminal No. 3 to oscillator grid.

Terminal No. 4 to negative H.T.

Certain other coils which are available have slightly different terminal markings, as follows:—

Terminal No. 1 to oscillator anode.

Terminal No. 2 to oscillator positive H.T.

Terminal No. 3 to negative H.T.

Terminal No. 4 to oscillator grid.

In any case where the receiver does not function, the first thing to do is to try the effect of reversing the connections to terminals Nos. 3 and 4.

o o o o

## No Basic Difference.

As a new reader, I am rather puzzled as to the difference between a radio-gramophone and an ordinary broadcast receiver. Could you give me a word of explanation?

Broadly speaking, there is no basic difference. A radio-gramophone is merely a wireless receiver fitted with a turntable and motor, a pick-up, a change-over switch, and—if it is not already included—an L.F. volume control. It may be said that any receiver circuit capable of giving a reasonable power output could be included in a radio-gramophone.

# The Wireless World

AND  
RADIO REVIEW  
(19<sup>th</sup> Year of Publication)

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

## Our Show Numbers.

### Some Facts and a Rebuke.

EVERY year *The Wireless World* regards the occasion of the Radio Exhibition as a subject of outstanding importance and interest, and, accordingly, deals with it generously in three special Show Numbers of the paper.

The first of these Show Numbers, which we style a "Forecast," gives in advance a general impression of what, from early information we are then able to obtain, we consider will be important items at the Show. Our next number, which we describe as a "Stand-to-Stand Report," is an outstanding example of modern technical journalism. Although, as for example in our Show Number of last week, over forty-three pages fully illustrated were devoted to the Show, the entire report was prepared by the technical staff of *The Wireless World*, at Olympia, from first-hand information obtained from stand-to-stand visits. The photographs illustrating this report were also taken by our staff photographers inside Olympia. No other public wireless journal makes any attempt to deal with the Olympia Radio Show on these lines. The bulk of the reports in our contemporaries are prepared solely from early information, and are in print in issues on sale to the public before Olympia has opened.

The effort which the entire staff of *The Wireless World* is required to make in order to meet this programme is a strenuous one, and we know that the fulfilment of the

task which we set ourselves is appreciated both by our readers and by the wireless industry. Our Show Numbers supply information of value to everyone connected with wireless. We prefer not to adopt a boastful attitude in connection with the pre-eminence of *The Wireless World* Show Numbers in relation to those of our contemporaries, but a statement having appeared in the current issue of a contemporary describing *their* Show Number of the previous week as "The World's Record Issue of a Wireless Weekly," and again, "It easily beat all Competitors," then we think that, in fairness to ourselves and to the staff responsible for the production of our Show Numbers, the real facts should be stated. The facts are that since the policy of special Show Numbers of *The Wireless World* was introduced, no rival paper has approached our Big Show Number,

either in size or in the space devoted to the report of the Show. For the past four years the principal Show Number of *The Wireless World* has always exceeded 140 pages; this year's Show Number was 156 pages, of which 43 were devoted to the illustrated stand-to-stand report of the Show. The Show Number of which our contemporary boasts as constituting such a record, contained in all 116 pages, some 14 of which only dealt with the Olympia Show.

It is a matter of sincere regret to us that the necessity for this rebuke should have arisen.

#### In This Issue

THE WIRELESS WORLD THREE  
A.C. MODEL.

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NEW RECEIVER DESIGNS.

DEVELOPMENT IN LOUD SPEAKERS  
AND GRAMOPHONE EQUIPMENT.

THE SEASON'S VALVES.

COMPONENTS FOR THE SET CON-  
STRUCTOR AND NEW ACCESSORIES.

THE MODERN SCREENED COIL.

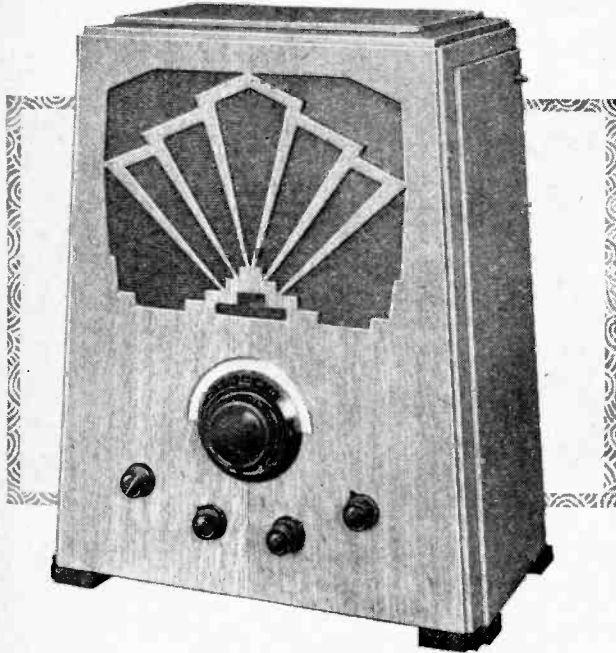
CURRENT TOPICS.

LETTERS TO THE EDITOR.

BROADCAST BREVITIES.

READERS' PROBLEMS.

# Self-contained Mains Set



THE  
**Wireless  
World  
THREE**

**A.C. MODEL**

By F. H. HAYNES.

IT would be more correct to say that the three-valve set recently described was developed first of all for A.C. working, the battery model being a modification. Consequently, the dimensions given for the bent aluminium chassis were based upon the requirements for accommodating the A.C. mains equipment. Space will not be taken in repeating a description of the circuit arrangement, reference only being made to the modifications to the design of the battery set.

Following through the aerial band pass, with its mixed filter coupling, giving constant selectivity across the tuning range, we come to an alteration to the general method of volume control. Here, a 50,000-ohm resistance is not only a potential divider of the signal applied to the grid of the S.G. valve, but this single component regulates the value of grid bias so as to produce a steady increase as the volume control is turned down for the reception of a strong local station. A new principle is here applied by which a steady increase in negative voltage is developed across the volume control potentiometer as its earth end is approached. Reference to the circuit diagram shows that the full negative biasing potential,

as required by the output pentode, is developed across the resistance  $R_{12}$  and has a value of about 18 volts. Across this resistance are connected in series  $R_1$ ,  $R_2$ , and  $R_7$ . Taking the voltage at the lower end of  $R_1$  as being zero, it will be seen that the potential at the junction of  $R_1$  and  $R_2$ , through tuning coil  $L_2$ , will be  $\frac{5,000 \times 18}{155,000}$ , or about 0.6 volt negative. This is the starting-off biasing potential on the S.G. valve, increasing as the volume control is turned

down to  $\frac{55,000 \times 18}{155,000}$ , or some 6 volts negative. By this arrangement the use of a pair of gang-operated potentiometers is avoided. Omission of superfluous equipment has again been the aim, as was the case with the battery operated set, and in considering the voltage feeding circuits not one of the condensers specified can be dispensed with, neither is the capacity of higher value than necessary. The number and value of the feed resistances have

been brought down to a minimum.

Taking, next, the H.T. supply circuits, it will be noted that the first smoothing choke is the loud speaker field.<sup>1</sup>

<sup>1</sup> "Free Field Current," July 15th, 1931.

*APART from the fascination of building one's own radio set, there are certain requirements which must be fulfilled by any design put forward for home assembly. No set is worth the making that does not serve as a practical example of the most up-to-date theoretical principles, at the same time effecting some appreciable saving in cost. In addition, construction must consist of no more than a straightforward assembly of components, and the standard of finish which results must not bear the evidence of restricted working facilities. It is not out of place to say that the design fails if the set has not a first-class appearance, and while the maintenance of radio sets is not without its difficulties, a home-constructed set can always be adjusted and repaired to give the best possible performance and, to some extent, modernised by modification as time goes on. These needs have been appreciated in pulling forward the "Wireless World Three" described in the two preceding issues. The set was arranged for battery working, and the present receiver is of similar specification, but arranged for use with A.C. supply.*



**The Wireless World Three—A.C. Model.—**

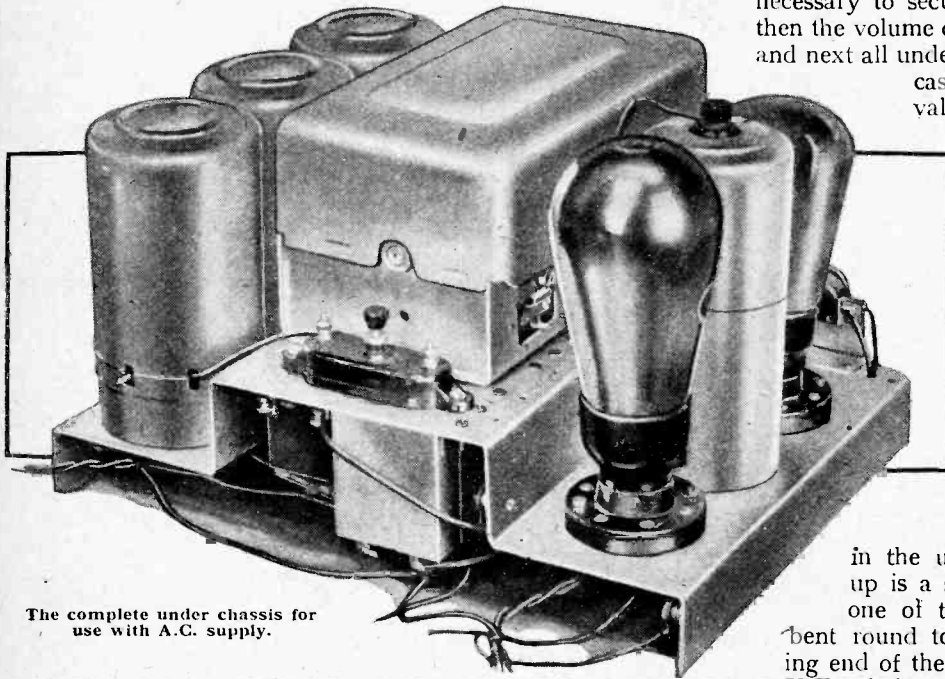
Tone correction of the pentode is provided by an 0.01 mfd. condenser,  $C_{20}$ , in series with a 10,000-ohm resistance,  $R_{11}$ , resulting in a fairly uniform output over the range from 50 to 5,000 cycles. By way of complete hum elimination a pair of condensers,  $C_{23}$  and  $C_{24}$ , of 0.01 mfd., are connected across the supply and their junction earth-connected. As an alternative to earthing the mid-point of the transformer heater winding, should a very slight hum be experienced, a 20-ohm resistance<sup>2</sup>

densers. Seven wire-wound resistances are shown in the circuit, and these are made to take up but little space by using a flat strip type assembled one above another, one of which serves as two resistances by using a centre tap. Positions are chosen for these resistances so as to shorten the wiring.

Holes for all components are provided in the chassis, so that setting out and drilling are avoided, and assembly is a simple process, using the underside view as a guide to the identity of the components. It is, of course, necessary to secure the tuning condenser first, then the volume control and reaction condenser, and next all underside components. As was the

case with the battery model, all valve terminals are reversed, excepting the grid of the H.F. valve. As a precaution, it is advisable to test all the 1 mfd. condensers by applying a charge to them through an H.T. battery and noting that a small spark can be obtained on discharge, and checking every resistance, including the volume control, for continuity, verifying also that none of the resistances make contact to earth when assembled.

To anyone experienced in the use of a soldering iron, wiring up is a simple job. First, the tags of one of the small condensers ( $C_{12}$ ) are bent round to engage between the projecting end of the condenser ( $C_9$ ) carried by the H.F. choke, and the grid terminal of the detector valve. Care is necessary to avoid the possibility of a bead of solder falling in under a valve holder. After soldering to the valve-holder stems, retighten the terminal screws from the top. It is preferable, as a preliminary to assembling, although a little more trouble, to actually solder in the under nuts on to the screws and the socket pieces, taking care that no fluxite spreads on to the face of the bakelite. Connecting-up wires are run by the shortest paths from point to point, using No. 24-gauge tinned copper wire



The complete under chassis for use with A.C. supply.

may bridge the 4-volt terminals, its slider connecting to earth in place of the mid-point tap. In planning the dimensions for the bent middle chassis, allowance was made for the condensers to stand upright. Nine 1 mfd. condensers stand in a row, so that, excepting in one instance, a straight wire, run along one set of terminals, provides all the earth connections. To facilitate screening, the H.F. feed choke is assembled among the con-

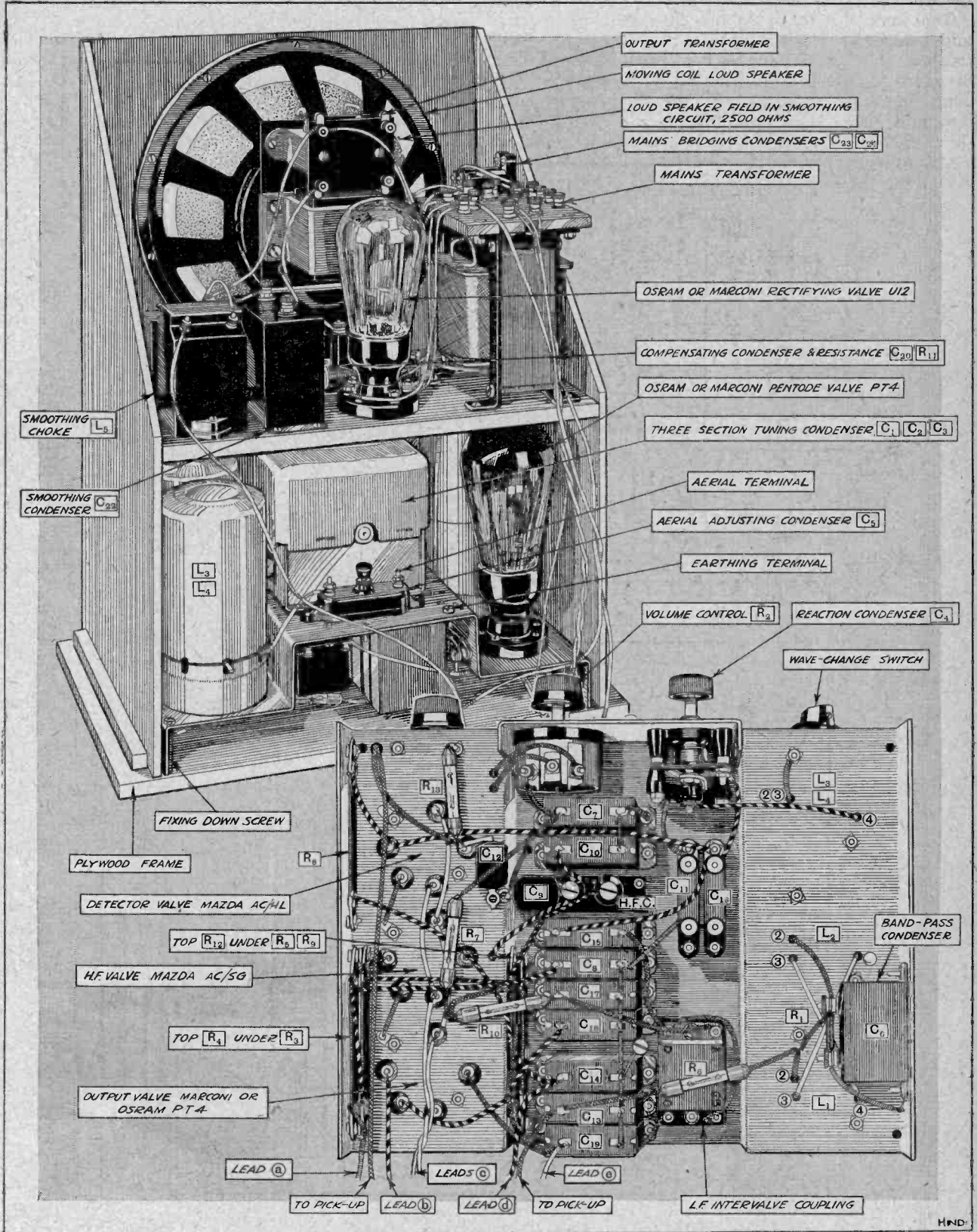
<sup>2</sup> Clarostat "Hum-dinger." (Claude Lyon, Ltd.)

- 1 Aluminium chassis . . . (Colvern type WW3/AC)
- 9 Condensers, 1 mfd. . . . . (T.C.C. Type 65)
- 1 Condenser, 2 mfd. . . . . (T.C.C. Type 65)
- 1 Condenser, 4 mfd. . . . . (Formo, working voltage, 400 D.C.)
- 2 Condensers, 0.0005 mfd. . . . . (T.C.C. Type, 34 Upright)
- 3 Condensers, 0.01 mfd. . . . . (T.C.C., Type 34, Upright)
- 2 Condensers, 0.0001 mfd. . . . . (T.C.C., "M" Type)
- 1 Condenser, 0.05 mfd. . . . . (T.C.C., Type 40)
- 1 Three-gang condenser with fixing screws . . . . . (British Radiophone, Ltd.)
- 4 5-pin valve-holders (W.B., with large type base)
- 1 L.F. intervalve transformer (R.I. Parafed)
- 1 Set of three coils incorporating band-pass filter, and H.F. intervalve coupling with screening . . . . . (Colvern)
- 1 Differential reaction condenser, 0.0002 mfd., slow-motion drive and fitted with insulating bush . . . (Ormond, Type R190)

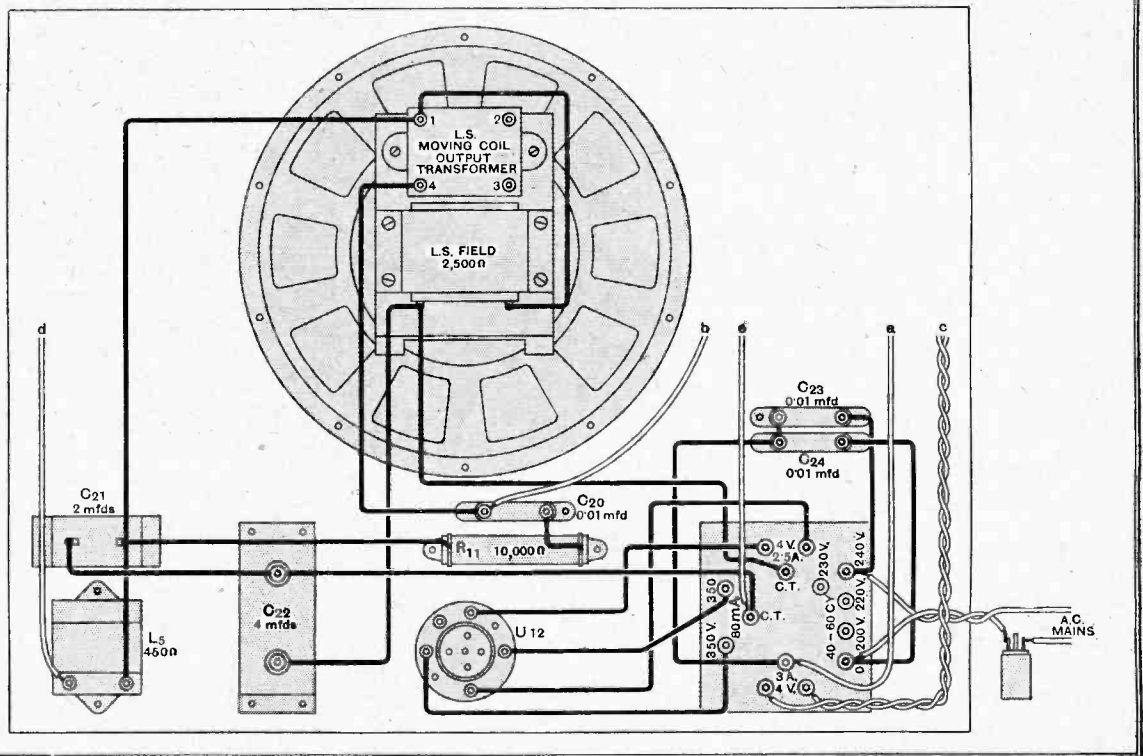
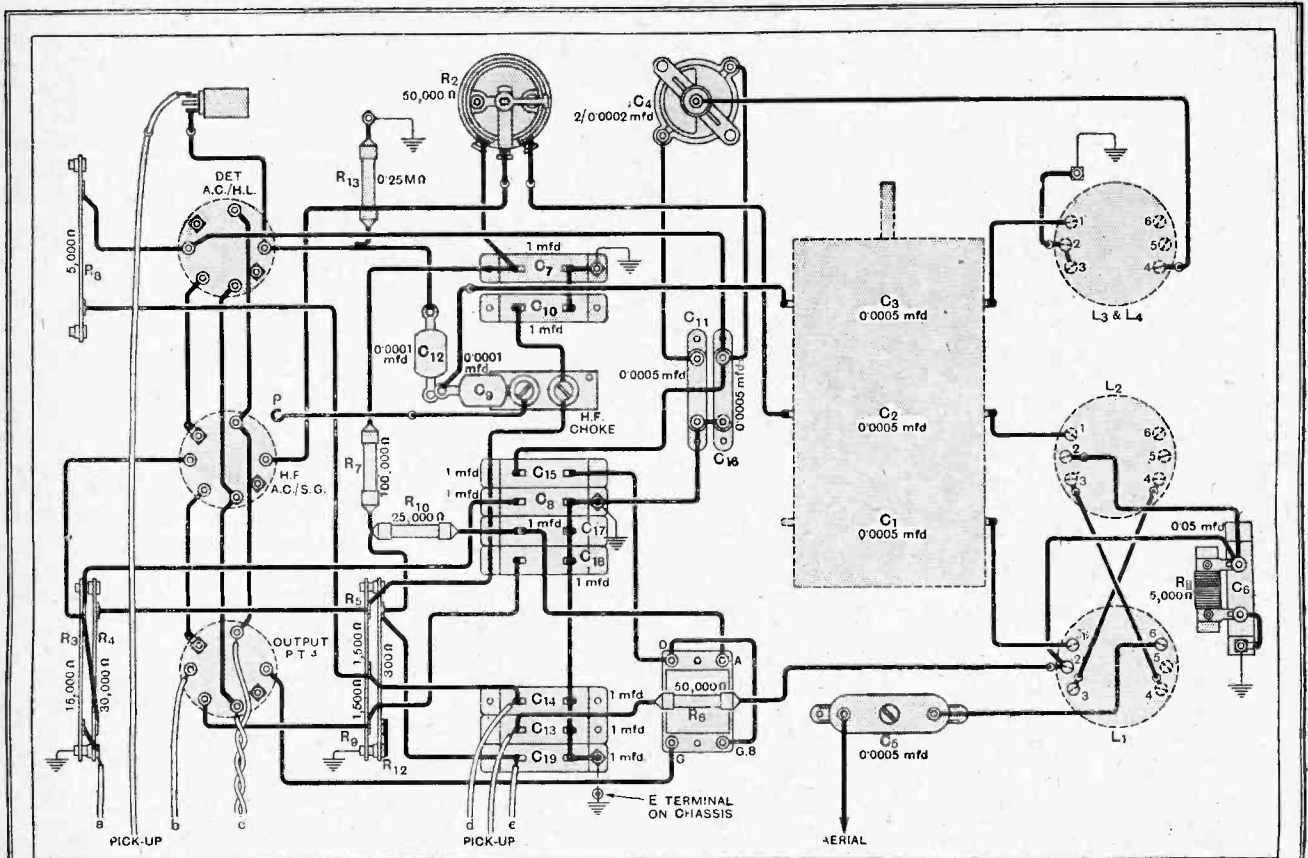
**LIST OF PARTS REQUIRED.**

- Resistances as follows: 3,000 ohms centre tapped, 30,000 ohms, 15,000 ohms, 300 ohms, 10,000 ohms, 5,000 ohms . . . . . (Colvern Strip Type)
- 1 Resistance, 5,000 ohms for bridging the 0.05 mfd. condenser terminals . . . . . (Colvern Strip Type)
- Resistances, grid leak type, 50,000 ohms, 100,000 ohms, 25,000 ohms and 0.25 megohm . . . . . (Loewe)
- 1 H.F. choke . . . . . (McMichael, Junior Type)
- 1 Pre-set condenser, 0.0005 mfd. . . . . (Polar)
- 1 Valve-screen . . . . . (Colvern)
- 1 On-and-off switch, for gramophone pick-up (B.A.T., Type 161, Claude Lyons, Ltd.)
- 1 On-and-off switch (Q.M.B., Type No. 728—L.T. long throat mains switch, Claude Lyons, Ltd.)
- 1 Volume control resistance, 50,000 ohms . . . . . (Colvern Potentiometer)

- 1 Mains transformer, with outputs of 350+350 volts, 80 mA., 4 volts 3 amps., 4 volts 2.5 amps. . . (W. Andrew Bryce, 54, Dawson St., Bury, Lancs., Type AB.35)
- 1 Smoothing choke, 20/14 henrys, 450 ohms . . . . . (Varley Nicheke 11)
- 1 Loud speaker with pentode output transformer, resistance of field, 2,500 ohms . . . . . (Amplion, Type E.M. 644)
- 1 Cabinet with interior chassis (Clarion Radio Furniture, 28/38, Mansford Street, Hackney, E.2. Type S.C.3)
- 1 Dial, geared type (Burndepf Ethovernier, with station-indicating scale—Henry E. Taylor, 51/53, Church Street, Greenwich, S.E.10)
- 6 Lengths ½ mm. silk sleeving. Spicers Ltd., 19, New Bridge Street, E.C.4.
- Small quantity No. 24 tinned copper wire and a few yards of good-quality flex with thin rubber covering.
- Valves: Mazda AC/HL, Mazda AC/SG, Marconi or Osram P11 and rectifier U.12.



These views serve as a guide in assembly, showing in particular the location of the components on the underside of the bent aluminium frame.

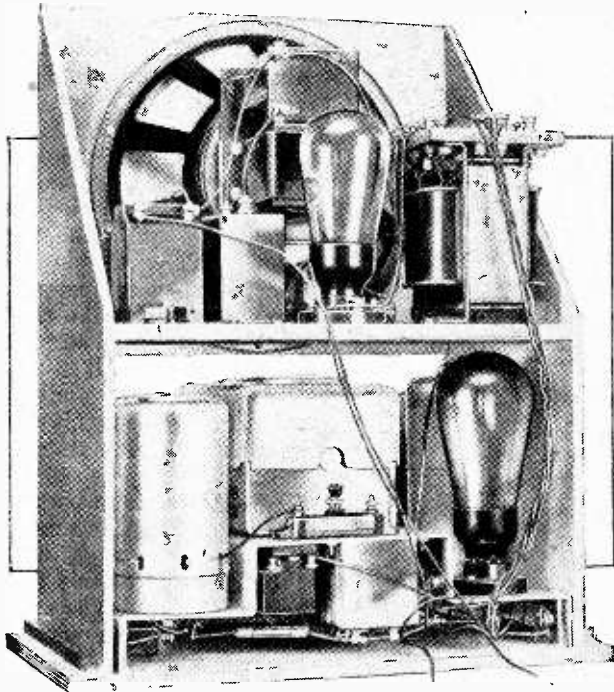


Practical wiring diagram. Connections are soldered and run from point to point by the shortest route, using No. 24 tinned wire in fine sleeving of  $\frac{1}{16}$  mm. bore. The reference letters on the flexible leads reveal their identity by reference to the layout and theoretical circuit diagrams.



**The Wireless World Three—A.C. Model.—**

and small-gauge silk sleeving, the best appearance resulting from the use of a special small size of silk sleeving having a bore of only  $\frac{1}{2}$  mm., but this is not always conveniently obtainable. There is no difficulty in soldering the grid leaks into position on the wiring, and it is helpful to first blob the ends with solder, taking



The complete chassis assembled ready for securing into the cabinet.

care to avoid overheating. A gap is allowed between condensers  $C_7$  and  $C_{10}$  so that a direct lead may run from the anode of the detector across to the reaction circuit.

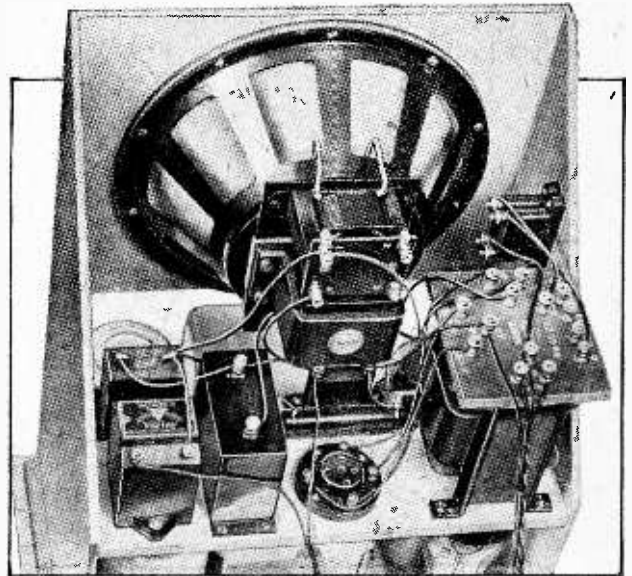
**Eliminator to Under Chassis Connections.**

The rectifier equipment is assembled in the manner shown on the strengthening shelf that bridges the wooden frame. Leads between the transformer and the rectifying valve may be bunched together and run straight down the side of the transformer. When the wiring of the rectifier and loud speaker equipment is completed six flexible leads are required to run across to the under chassis. These are the H.T.— wire (*e*), best taken direct from the C.T. tap of the high voltage winding of the transformer, the two heater leads (*c*) and their centre tap (*a*), thus making four wires which may be conveniently bound together as a cable, a lead from the pentode anode (*b*) to terminal No. 4 on the loud speaker, which may join in at the terminal  $C_{20}$ , and the H.T. + lead (*d*) from the smoothing choke  $L_5$ . A lead from the centre point of the two bridging condensers  $C_{23}$  and  $C_{24}$  picks up earth down the lead from the centre-tap terminal of the 4-volt 3-amp. winding. Connections to this terminal will, however, be abandoned if a 30-ohm "hum-dimming" potentiometer is connected across the heater winding, and the earth lead

will be connected to the slider. Mention might be made of the fact that the resistance of the "hum-dimmer" should not exceed the value just mentioned or the output valve will be overbiased. The length of the flexible leads should be just sufficient to allow the easy withdrawal of the under chassis, by swinging it round so that it stands vertical with its underside apparatus facing outwards. In this position the set can be operated and the wiring examined. See that the lead to the anode of the screen-grid valve is well insulated right up to the terminal as an earth on to the valve screen would destroy the H.F. choke and might impair the rectifier valve.

**Operating Hints.**

The set, being comparatively simple, should work at once on signals from the local station. Hum from the loud speaker indicates a fault even if signals are received, and the best method of fault-finding is that of a very careful inspection of the wiring, using both the theoretical and practical diagrams for guidance. Adjustment of the trimming condensers is effected with a long screwdriver through the holes provided in the sides of the frame, following the instructions given in the former article on the battery set. Station calibration is as previously shown, and a station identity scale is available on request. When switched over to long



View showing the layout of the components on the rectifier panel.

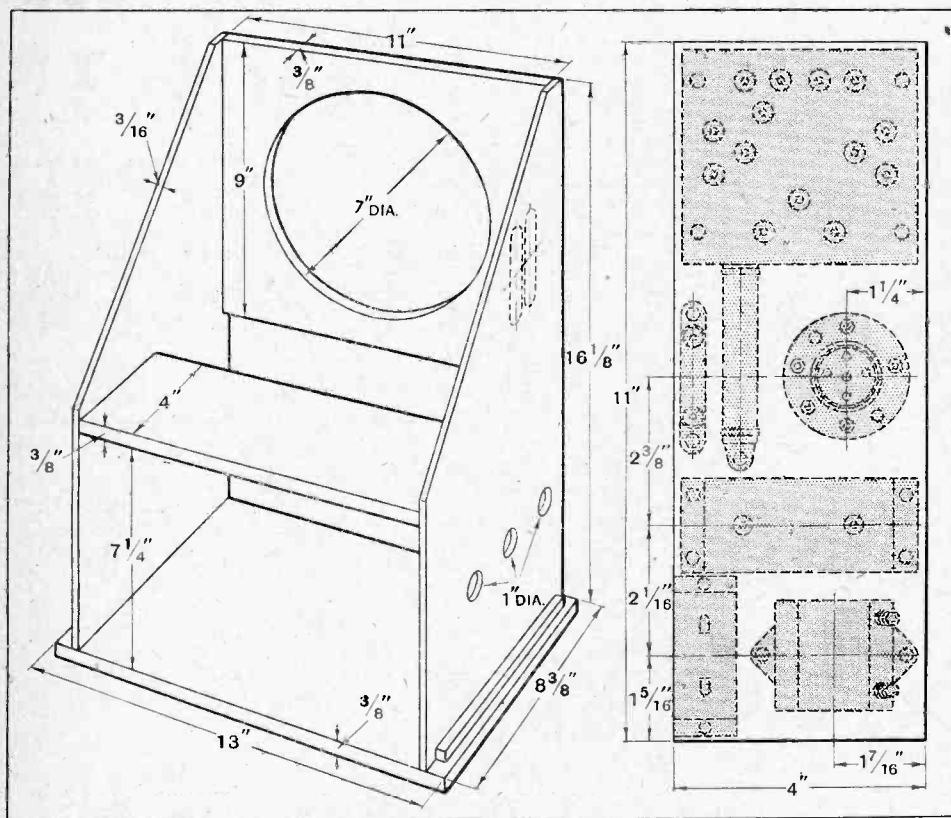
waves the tuning range is 880 to 2,200 metres, and the calibration is as follows:—

	900 metres	2 divisions.
1,200	"	16.5 "
1,500	"	38.5 "
1,800	"	63 "
2,100	"	91.5 "

Ganging is satisfactory right across the scale on both wave-ranges. A gramophone pick-up giving an average output of about 0.7 volt will fully load the pentode. Radio reception may be removed, of course, when on

**The Wireless World Three—A.C. Model.—**  
gramophone by turning down the volume control. Connections to the pick-up may be taken out by a pair of flexible leads, or one might consider the fitting of a small ebonite panel at the back of the lower aluminium

prove to be smooth, appreciably augmenting the loudness of a weak, distant station and functioning with equal effectiveness on both wave ranges. With reaction turned to zero the receiver will not oscillate on any dial setting unless one of the 1-mfd. bridging condensers is at fault.



Dimensions of the ply wooden frame. The holes in the side give access to the trimming condenser. Positions are shown for securing the components to the rectifier panel.

chassis arranged to carry two sockets and to which access is gained through holes in the plywood back of the cabinet. The practice of earthing one side of the pick-up to avoid hum due to the proximity to the A.C.-connected gramophone motor should only be applied through a 1-mfd. condenser or otherwise the grid bias may be short-circuited. Reaction control should

with in mains sets, is not likely to be encountered. In this connection it may be mentioned that a "crackling noise" of which a reader recently complained in a *Wireless World* A.C.-mains set was, after sending the set for test on three occasions, finally found to be due to a bad contact on a lighting switch quite unconnected with the set.

When securing the under chassis in position on the wooden frame, allow a projection at the front of about  $\frac{1}{32}$  in. proud of the woodwork, so that all spindles may be suitably engaged through the front of the cabinet. Accuracy is required when fitting the condenser dial, and one should follow the instructions which accompany the component and make use of the template supplied. The rod through the coil switches is a push-in fit, and can therefore be suitably adjusted. Wooden stops on the inside of the cabinet secure the frame in position, and, in addition, two screws may be put through at the back corners. Should there be insufficient space between the back of the cabinet and the eliminator shelf, slots may be cut to allow the flexible wires to pass down.

This set will be found to be free from trouble to get going and maintain. Hum, the principal trouble met

## DON'T FORGET TO VOTE

WITH the appearance of this issue readers still have time to enter for *The Wireless World* Olympia Show Competition, a form for which appears amongst the advertisement pages. Entries must reach *The Wireless World* offices not later than Wednesday, October 7th, and should be addressed to the Competition Editor, *The Wireless World*, Dorset House, Tudor Street, E.C.4.

We anticipate that it will be two or three weeks after that date before we are able to announce the results of the Competition, owing to the time required to sort out the votes and ascertain the winners in each class.

We hope that every reader will

take an interest in the Competition and send in his completed ballot form in time, as we are particularly anxious that the voting should be as representative as possible. This year the variety and excellence of the apparatus at Olympia makes the Competition of exceptional interest, and comments were freely circulating at Olympia on the probable results of the voting.



New Developments Reviewed.

IT is hardly to be expected, after nine years of broadcasting, that the changes in the design of sets and components would indicate marked progress, but would rather take the form of steadily changing fashion. On the contrary, this season's Radio Show, which has just finished at Olympia, marks the introduction of more modifications than any show hitherto. By way of qualifying this statement, it will be realised that the superheterodyne, in a completely revised form, has come right to the front. Single dial control has become the essential aim of all set designers, and total screening of components in the H.F. stages is standard practice. The bent-up and punched-out metal chassis has now entirely superseded the wooden base-board, a change which is evidenced also in home constructors' sets, where the advantages of easy and speedy assembly on to a drilled bent metal frame are readily appreciated. Home construction is by no means on the wane, and in spite of an enormous increase in the variety of complete sets available, the home building of sets has been simplified, while the finished results are as attractive as the factory-built set. Compo-

nents are far more extensive, while it costs less to build a set to-day than ever before, using components embodying the most up-to-date principles.

In the following pages an analysis has been made of those changes representative of important progress, revealed by a careful examination of the apparatus shown at the stands. Most outstanding is the universal adoption of band-pass tuning in

waveband switching. Anode bend detection has practically passed out, the power-grid arrangement being universally adopted. Tone correction of pentodes is standard practice, and the correct matching of output stages now goes without question. In spite of the excellence of moving armature loud speakers, it must be admitted that these are being rapidly superseded by low-priced moving-coil types, permanent magnet models being used for battery sets and small electromagnetic types for mains sets.

The most noteworthy advance is to be found in valve technique, and it cannot be denied that British valves are to-day the best in the world. Twenty new valves are illustrated in the pages that follow, bearing, in most cases, entirely new names, and the few that retain their old titles have vastly improved characteristics. The number of new valves, however, counting only those used entirely for reception purposes, totals nearly one hundred, and in describing these the reader is given concise explanations of how receiving sets are benefited by the valve improvements, at the same time throwing light on some of the difficulties which we have met with in the past.

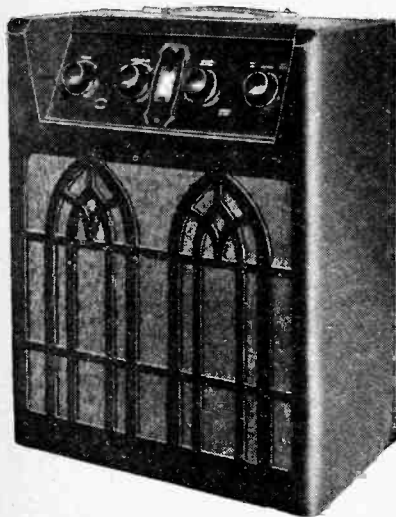
*COMPILED by the technical staff of this journal after a careful study of the sets and components exhibited at the Olympia Show, the following pages form a valuable summary of the changes that have taken place in radio practice. Many of the developments are of first importance, and these are presented here in concise form to assist the reader in keeping up to date and well informed on the new designs, care having been taken to sort out the new from the old and the outstanding from the ordinary.*

all types of sets, and the large number of band-pass tuning coils and associated components, though many of these have yet to reach maturity. All multi-stage screen-grid H.F. amplifiers are single-dial controlled, all have screened coils in cylindrical containers, with ganged

# New Receiver Designs



THE revival of the supersonic heterodyne receiver is due to the greatly increased need for high selectivity. Last year's Show came at a time when the need for this selectivity was first begin-



The Halcyon portable with "bi-grille" frequency changer.

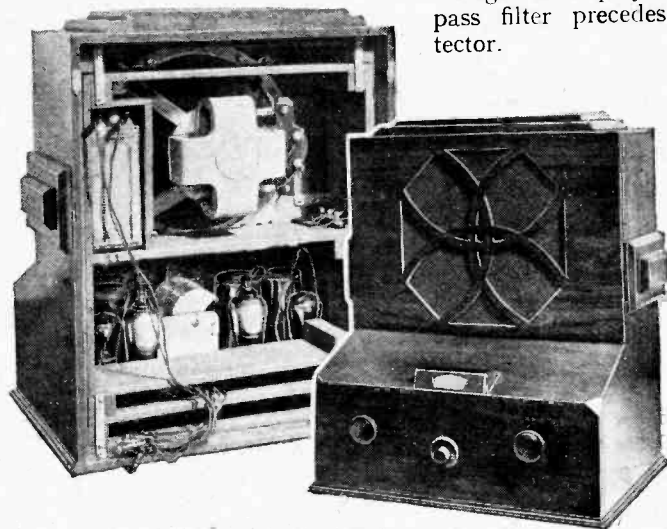
ning to be felt, and many firms have spent the intervening time in developing more selective circuit arrangements, with the result that there are now many superheterodynes on show for the first time in many years.

The possibilities of individual circuit design are greater in the superheterodyne than with tuned H.F. circuits, and so it is not surprising to find that many widely different circuits are employed. In general, however, it appears that in the larger receivers it is becoming the standard practice to employ a band-pass filter before the first valve, in order to keep second channel interference at a minimum. In many cases, also, the oscillator condenser is ganged to the others, thus giving a true single control to the receiver.

In smaller receivers of the portable and transportable class a frame aerial is commonly employed, and then no band-pass input circuit is

used. As only two tuning condensers are needed their ganging becomes simpler, and we find that in most of the sets on show the frame aerial and the oscillator are tuned by a two-gang condenser, and that no special precautions are taken to ensure that they run perfectly together. A trimmer is fitted to the aerial circuit, however, so that it may always be brought into exact tune. These receivers are of the semi-ganged type, and are represented by the Halcyon and Rolls-Caydon. The latter of these sets is interesting, in that it is battery-driven with two screen-grid intermediate-frequency stages and a two-valve frequency changer. The new Mazda low-consumption pentode is used for the output stage, and the H.T. supply is only 12 mA. at 108 volts. A frame aerial is used, and a permanent-magnet moving-coil speaker is fitted.

The Halcyon portable employs a similar circuit arrangement,



The Edison-Bell battery superheterodyne, which is fitted with a permanent-magnet moving-coil loud speaker, has an H.T. current consumption of only 9 mA.

but uses the Mullard P.M.1 D.G. four-electrode valve in a single-valve frequency changer. In this case the H.T. current consumption is 11 mA. at 99 volts. In battery-driven re-

ceivers the H.T. current is of considerable importance, since it exercises the chief influence on the running costs. In this respect, the

## SUPERHETERODYNES.

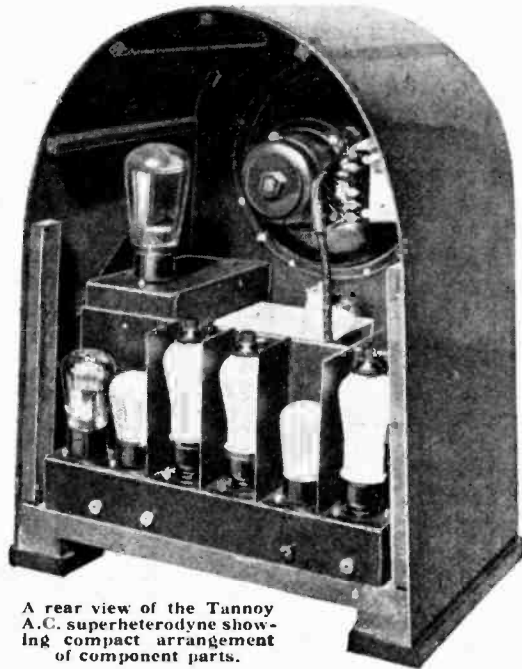
Edison-Bell receiver is of interest, since the current at 108 volts is only 9 mA. It is a five-valve set, with the Mazda Pen. 220 output valve, and the Mullard P.M.1 D.G. single-valve frequency changer. Again, a permanent-magnet moving coil speaker is fitted, and the two-gang condenser is provided with a trimmer.

Coming now to receivers of a slightly larger type, we find the Tannoy transportable illustrative of a modern self-contained A.C. superheterodyne. It is a seven-valve set, with valve rectification for the H.T. supply, and is built on a metal chassis with ample screening. It can be supplied with either a P.X.4 or a 104v. output valve, and this stage is preceded by a power grid second detector. Two stages of band-pass intermediate-frequency amplification are used. A two-valve frequency changer is employed, and a band-pass filter precedes the first detector.

The tuning controls are ganged, the oscillator circuit being arranged to run out of step with the band-pass circuits by the requisite amount.

**New Receiver Designs.—**

The arrangements for this are rather interesting, and are employed in the other completely ganged receivers exhibited. Trimming condensers are



A rear view of the Tannoy A.C. superheterodyne showing compact arrangement of component parts.

placed in series with the oscillator tuning condenser, and others are placed in parallel; by choosing coils of suitable inductance a judicious balance between the capacities of the various trimmers keeps the oscillator circuit very close to its correct frequency at all settings of the tuning dial. Owing to the use of Mullard variable- $\mu$  tetrodes for the I.F. stages, an ordinary screen-grid valve is used for the first detector, the volume control acts by varying the grid bias, and should prove both effective and distortionless.

Among the larger receivers the R.G.D. radio-gramophone is one of the most interesting. Again, an input band-pass filter is employed. A two-valve frequency changer is used, and the oscillator tuning is ganged to the input filter. Although there are only three circuits which require tuning, a four-gang condenser is fitted, in order to simplify the oscillator ganging. Two sections of the gang condenser are devoted to the oscillator—one for the long waveband, and the other for the medium; in this way complex switching of

the padding trimming condensers is avoided.

Two stages of I.F. amplification, with band-pass filters tuned to 110 k.c., are used, and volume control is obtained by varying the screen-grid voltage. A power grid second detector is coupled to a low gain L.F. stage, which feeds the push-pull output stage. This output stage can be supplied fitted with either P.X.4 valves or P.P.5/400 valves, giving outputs of either 5 watts or 10 watts, as desired.

The set is completely screened and built on a metal chassis, with built-in mains apparatus. Before reaching the second detector, the signal has to pass through eight tuned circuits, arranged as four band-pass filters, and so one would expect both high selectivity and high quality.

The wavelength range is from 200 to 2,000 metres; with a highly sensitive receiver of this nature, however, it is often desired to receive on the ultra-short waveband. A converter is available, therefore, and this consists of a two-valve frequency changer. A screen-grid detector has a triode oscillator coupled to it, and changes the frequency of the incoming ultra-short wave signals to the frequency of the input tuned circuits of the superheterodyne. The whole apparatus thus becomes a double superheterodyne, for the signal frequency is changed twice. Ganging is not resorted to in the unit, but it is virtually a single-control converter, for the aerial-tuning condenser is very flat; the main tuning is carried out on the oscillator condenser alone. The wavelength range of 15-60 metres is divided into two sections, and switching is provided

for changing from one to the other. The converter is run from A.C. mains, and switching it off automatically changes the aerial connection from the converter to the main set. It is stated that it can be used with any receiver employing H.F. amplification.

The Marconiphone superheterodyne falls into the same luxury class, although the circuit arrangement is quite different. In this case a preliminary H.F. stage is used, and there are three signal frequency tuning circuits; the oscillator is ganged by the usual padding condensers. A single screen-grid intermediate-frequency amplifier is coupled by band-pass filters, and a leaky grid second detector feeds a P.X.4 output valve. Volume control is again by variation of the screen-grid voltage; although a twin control is fitted, one section of this is solely for gramophone work. It is interesting to note the employment of electrolytic condensers in the H.T. smoothing circuit. As might be expected, the mechanical construction is of a very high order indeed; as usual, a metal chassis is employed, but efforts have been made to simplify the controls. A single control switches on and off, changes from radio to gramophone, and from the long waveband to the medium.

One of the few receivers shown arranged for reception on the ultra-short wavelengths, as well as the two



The Kolster-Brandes superheterodyne.

higher bands, is the six-valve Kolster-Brandes. In this set a preliminary H.F. stage is employed with a two-valve frequency changer; a single I.F. stage is followed by the

**New Receiver Designs.—**

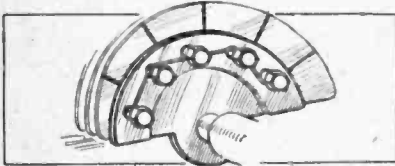
second detector and a pentode output valve. The I.F. is 110 kc., and the volume control is particularly interesting, since it does not vary the valve voltages. It is a twin control, one section acting on the aerial input, and the other consisting of a potentiometer shunted across the second I.F. coupling, and thus varying the input to the second detector.

The vast majority of superheterodynes employ band-pass coupling in the intermediate circuits; it is interesting, therefore, to find two receivers which employ other methods of obtaining selectivity. The first of these is the R.I. stenode, a band-pass filter is used before the first detector, but sharply tuned circuits are employed in the I.F. amplifier, and the high note loss corrected in

the L.F. circuits. Ganged tuning controls are fitted, and two sections of the four-gang condenser are devoted to oscillator tuning. The Smurthwaite stenode, on the other hand, uses only a single section of the ganged condenser for the oscillator; no input band-pass filter is fitted to this set, but there are still two signal-frequency circuits, as a preliminary H.F. stage is employed.

**STRAIGHT SETS AND CONSTRUCTORS' KITS.**

SO far as "straight" receivers are concerned, there can be no doubt as to the present trend of design; the outstanding point about the new sets shown at the



Screw adjustment for condenser end-vane segments (H.M.V. radio-gramophones).

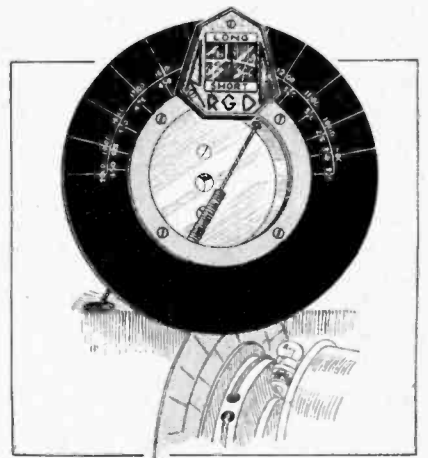
recent Olympia Exhibition is the inclusion of technical features that until now were only to be found in apparatus constructed by enthusiasts. Way and means have been devised for applying commercially the work of the research laboratory, and unquestionably the most widely adopted of these innovations is band-pass tuning or pre-selection, which is included in probably the majority of sets of the more ambitious type—from H.F.-det.-L.F. combinations upwards. By its use, selectivity has been greatly improved without increasing the number of valves.

As a natural corollary, ganged tuning has become almost universal. As to the actual methods of band-pass coupling, it seems that comparatively few makers have attempted to embody constant-width filters; capacity coupling is generally favoured, as with this system divergence in band width over the tuning scale tends to be corrected fairly satisfactorily by suc-

ceeding single-tuned circuits. But a few makers have included filter systems which give in themselves sensibly constant broadness of tuning; among these is the Varley firm, whose "Square Peak" sets embody filters coupled by a combination of capacity and negative inductance. The Columbia and Edison Bell sets also include mixed filters. Due to the increasing need for selectivity, there is a natural tendency to restrict the band width, and the last-mentioned firm, it is understood, aim at a peak separation of 7 kc. only.

Ganged tuning problems have been tackled on fairly conventional lines; in almost every case the tuning coils are individually screened, and in many instances the tuning condensers have segmented end vanes, thus allowing minor divergences in condenser capacity to be corrected at various rotor settings by bending the segments. This method may, at

first sight, appear to be somewhat crude, but there is ample evidence to show that it works satisfactorily in practice, but in one case at least provision was made for adjusting the

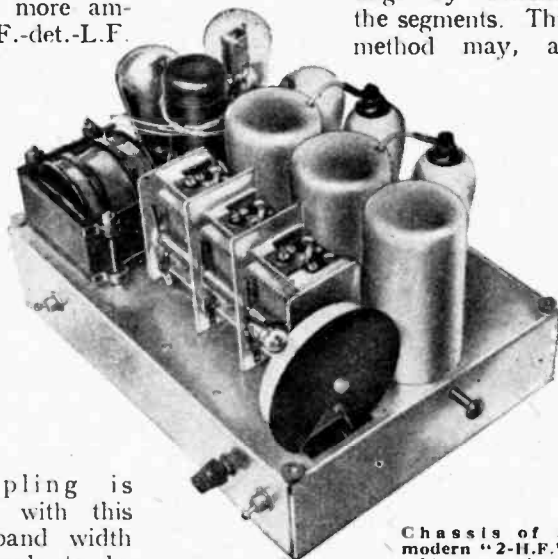


Beam lighting of R.G.D. wavelength indicator: spotlight shown in inset.

various segments by means of a screw adjustment.

Simplification of controls has clearly been regarded as being of the utmost importance, and designers are to be congratulated on the fact that they have achieved a large measure of success in this direction without loss of efficiency. In practically all except the cheapest sets there is to be found a combination switch with several positions—"off," "medium waves," "long waves," and "gramophone," for example. In certain of the Marconi-phonograph and H.M.V. models a switch operating on this plan is mechanically linked with an indicator, on which appropriate changes are made by rotation of the knob.

Still with a view to avoiding complications, the ganged control principle, originally adopted for tuning



Chassis of a modern "2-H.F." cabinet receiver, self-contained with moving-coil loud speaker: the Cossor Type 244.

**Straight Sets and Constructors' Kits.**— purposes, has been extended to other spheres; for instance, the principle of operating "radio" and "gramophone" volume controls by one knob, which was last year a feature of Marconiphone sets, has now been extended in other directions. Some sets have an arrangement whereby the H.F. valve (or valves) is desensitized by reduction of screen-grid voltage, at the same time as reaction coupling is reduced. In one of the Varley receivers there is a triple control, consisting of an H.F. aerial input potentiometer, a screening grid voltage control, and a pick-up output regulator, all on one spindle.

To make station - identification easier, most sets are directly calibrated in wavelengths, while others have gone a step further and provide direct station calibration. Of these latter it will generally be agreed that the Ekco plan is the most practical; by fitting a large-diameter scale, mounted round the loud speaker cone aperture it has been possible to fit a clearly printed indicator that can be read without any difficulty. Incidentally, it should be mentioned that this station identification device is combined with automatic wave-range changing and radio-gramophone switching.

It would appear that comparatively few difficulties have been encountered in providing either wavelength or direct-station calibration, but from the fact that many of the scales have indicators so arranged that a critical reading is not possible, it may safely be assumed that in some cases the calibration is only approximate, but probably quite close enough for most practical purposes.

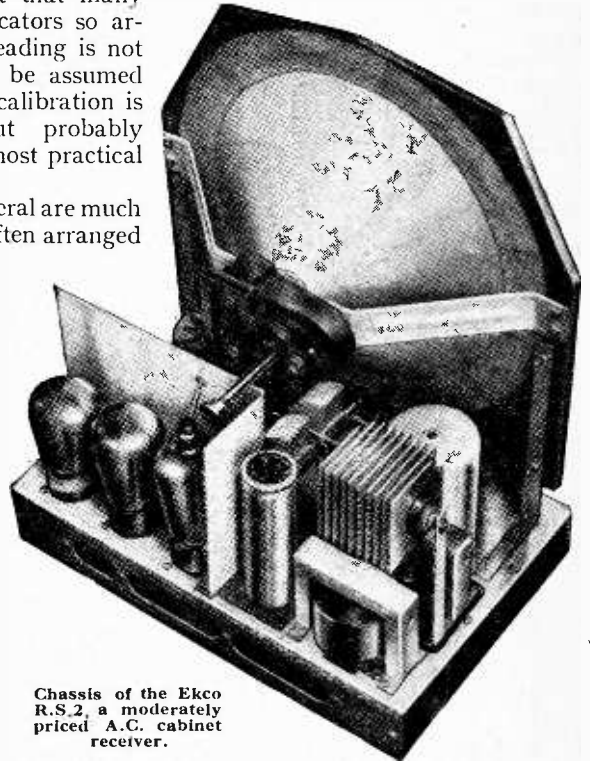
Indicator scales in general are much easier to read, and are often arranged horizontally; an example of this is to be seen in the McMichael sets, where the original arrangement is now fitted even to a portable model. Another unusual plan is that of the R.G.D. "Popular" radio-gramophone, where, by means of a spot light, a part of a printed celluloid scale is projected on a screen, which, in consequence, need not be recessed, and so is clearer than usual.

Another useful feature, common to quite a number of sets, is a local-distance switch, which in several cases operates by introducing a partial short-circuit across the H.F. input.

As regards the actual arrangement of circuit details, and starting at the input end, a pre-selector is, as already stated, the outstanding new feature. With regard to inter-valve coupling, the choke-fed tuned grid system is still the most popular; although there is some increase in the use of double-wound transformers. As there are so many mains-operated sets it is not surprising that power grid detection, which is now the rule rather than the exception, has gained ground, especially as the average receiver now has but a single L.F. stage. Smoothing is more thorough, and high-voltage

electrolytic condensers are widely used.

In discussing the various receivers,

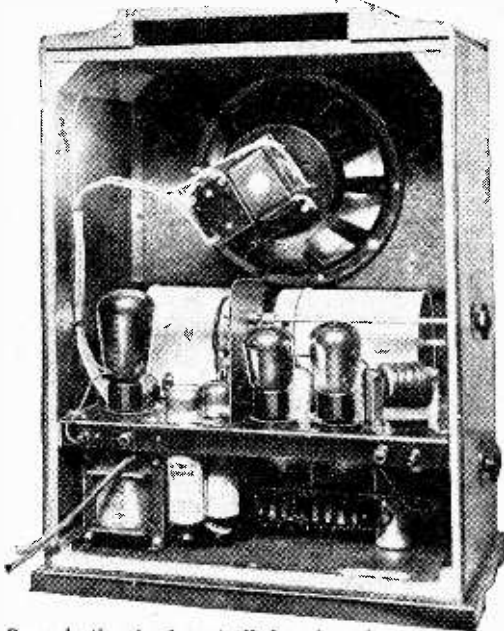


Chassis of the Ekco R.S.2, a moderately priced A.C. cabinet receiver.

it will be convenient to consider the expressions "receiver" and "radio-gramophone" as synonymous; indeed, to do otherwise would tend to complicate makers, because a large number of the chassis that were shown at Olympia are available either as cabinet or table receivers, or as radio-gramophones.

Another problem with regard to classification should be touched upon here. For the purpose of this discussion, a power rectifier, of whatever type, is *not* a valve; there is a tendency in some quarters to include the power rectifier among the number of receiving valves, thus causing a good deal of confusion; this point should be settled definitely, one way or another.

Coming to specific receiver designs, the outstanding feature of the new season is the miniature cabinet set, mains-operated, and almost invariably fitted with a moving-coil loud speaker. These receivers, most of which are sold at prices varying between roughly £15 and £25, are self-contained except for an external



Pre-selective gang-controlled tuning, the new variable- $\mu$  valves, and several other interesting features are included in the Amplion Six.

**Straight Sets and Constructors' Kits.**—aerial, although the new Pye "MM" set is an exception, as it has a built-in frame, which, however, may be supplemented by an outside aerial. For the great

been redesigned, and now embodies a pre-selector.

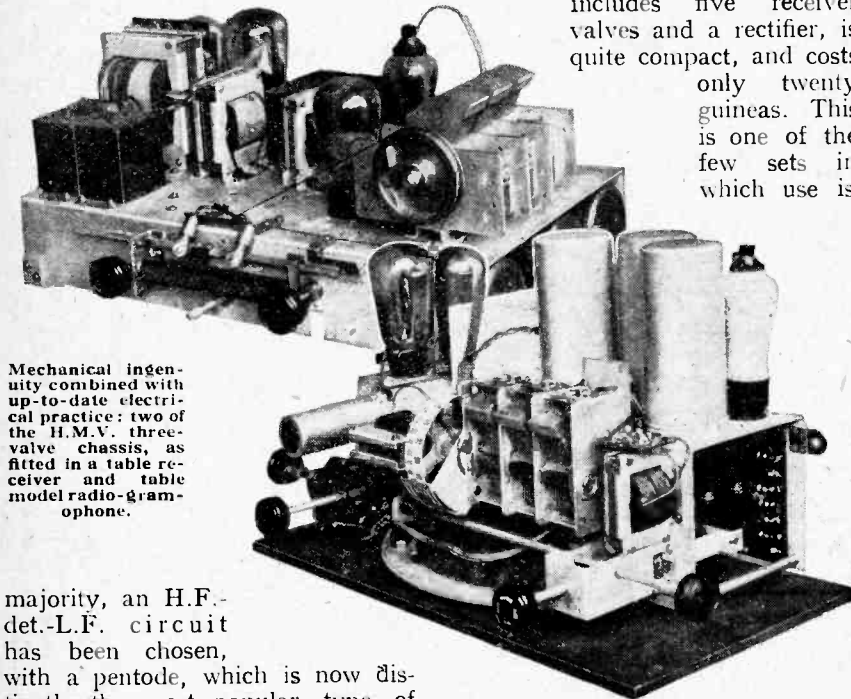
Several "2-H.F." sets are to be found in the miniature cabinet class. One of the most ambitious of these is the Amplion Six, which, in spite of the fact that it includes five receiver valves and a rectifier, is quite compact, and costs only twenty guineas. This is one of the few sets in which use is

constant-width type, with mixed coupling, and a single H.F. stage followed by a screen-grid valve acting as a grid detector. This valve is coupled by the choke-capacity method to an output pentode.

Mention should be made here of the fact that, through confusion between the three- and four-valve models, an error crept into our description of the new Columbia sets last week; it should be made clear that the four-valve model does not include band-pass input, and that the detector in this set is a triode.

Thanks largely to the introduction of indirectly-heated valves for D.C. mains, those with this form of electrical supply can no longer complain that they are neglected by manufacturers; indeed, it is not far short of the mark to say that they are practically as well catered for as those having access to A.C. mains. As a rule the new valves are used throughout, but in a few cases directly-heated valves are employed in the output position.

Unfortunately, the battery user has not the same grounds for satisfaction, as sets which derive their energy from other sources than the mains are very much in the background, except as regards portables; indeed, it is possible that he might find it wise to consider a portable even if portability as such was not required. Some of the new sets of this type have special provision for connecting an aerial; matters are so arranged that by doing so no



Mechanical ingenuity combined with up-to-date electrical practice: two of the H.M.V. three-valve chassis, as fitted in a table receiver and table model radio-gramophone.

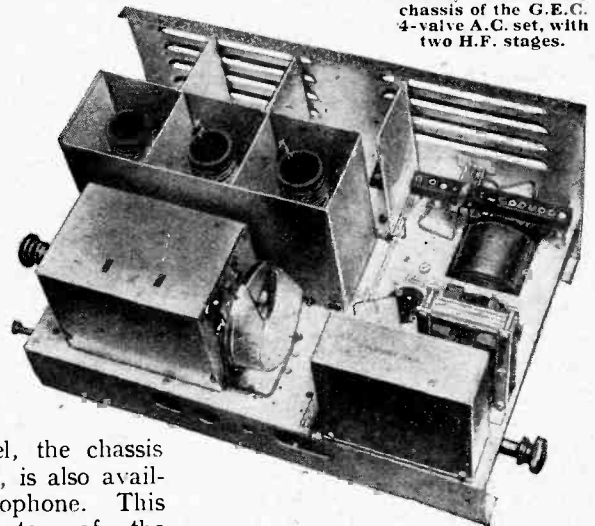
majority, an H.F.-det.-L.F. circuit has been chosen, with a pentode, which is now distinctly the most popular type of output valve.

When there are so many interesting sets in this category, it would be invidious to pick out any for special mention or description, but the Murphy, Marconiphone, and H.M.V. models are particularly attractive in that they embody nearly all the features that illustrate the present tendency in design. For example, the new H.M.V. "straight" broadcast receiver, the first instrument of this type produced by the Gramophone Company, is self-contained, with a built-in moving-coil loud speaker; it embodies a capacity-coupled band-pass input filter, ganged tuning, and a double-acting volume-control system, together with the special type of switching already described, in which the appropriate scale of a four-sided horizontal indicator is turned to face a horizontal aperture by the action of the switch. What must surely be the precursor of all these sets (so it is not in quite the same external form) is the R.I. "Madrigal," which internally has

made of the new variable-mu H.F. valves, which are employed in both H.F. stages. Next comes a power rectifier, and then a pair of output valves, connected in a push-pull circuit. Tuning is fully ganged, although there is a trimmer for balancing the input circuit so that the utmost efficiency may be obtained with various aeri-als. For long-range reception an external aerial may be used, but there is a built-in capacity collector for medium- and short-distance work. Band-pass tuning is employed.

Another interesting set is the Columbia table model, the chassis of which, incidentally, is also available as a radio-gramophone. This set has a pre-selector of the

Solidly constructed chassis of the G.E.C. 4-valve A.C. set, with two H.F. stages.



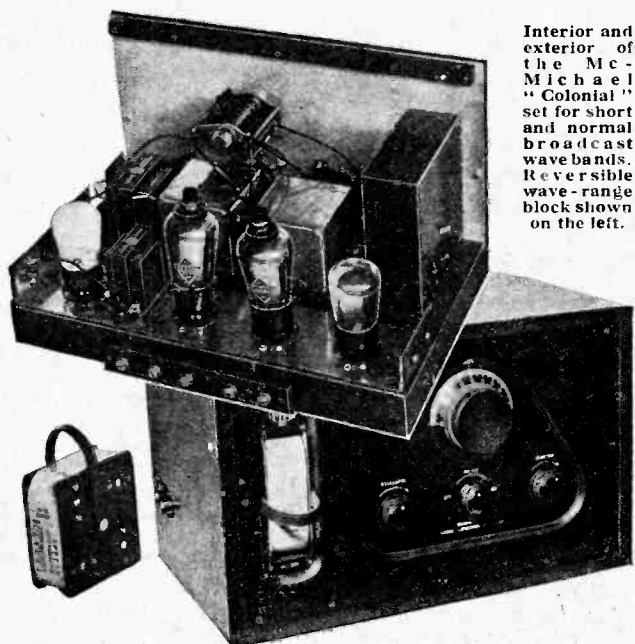


**Straight Sets and Constructors' Kits.**—noticeable disturbance of the wavelength calibration is introduced.

It is a fact that comparatively few of the more recent developments are contained in ordinary battery-fed

found in quite a number of other sets.

The simple two-valve set is at last being taken much more seriously, and is no longer regarded as the Cinderella among wireless receivers; except as regards range and selectivity, its performance can be practically as good as that of anything else. But no one seems to dare to offer these sets as being specifically for short-range work; indeed, some manufacturers tell us that to do so would be equivalent to commercial suicide. Purchasers of the simplest equipment still want at least a good chance of receiving distant stations.



Interior and exterior of the McMichael "Colonial" set for short and normal broadcast wave bands. Reversible wave-range block shown on the left.

sets for operation with an external aerial, but there are one or two notable exceptions. For example, S. G. Brown was showing a three-valve cabinet set for battery feed with an up-to-date specification, including band-pass input and ganged tuning.

Automatic grid bias is now included in the McMichael and Kolster-Brandes battery sets, and will be approved generally; it means that, as H.T. battery voltage falls, a corresponding appropriate reduction of negative grid bias will come about automatically. The new high-efficiency pentodes look like being the salvation of battery-set users.

Variable-mu H.F. valves have hardly been introduced long enough for them to have found their way into many commercial receivers, but they are already fitted in the Amplion and Edison Bell sets.

If we remember aright, the use of screen-grid detector valves was last year confined to the Ultra sets, where they are retained, being linked to the output pentode by means of resistance-capacity coupling. In addition they are, this season, to be

The new Cossor "Two-valve All-electric" set is illustrative of modern tendencies, as it embodies a genuine power grid detector, which is coupled by a resistance-fed transformer to a power valve giving an output of about 1½ watts. The total anode-current consumption amounts to something in the neighbourhood of 60 mA., which a year ago would have been considered on the generous side for a four-valve A.C. receiver. A moving-coil loud speaker is included in this set, which is of the self-contained cabinet type, and is sold for £10 15s.

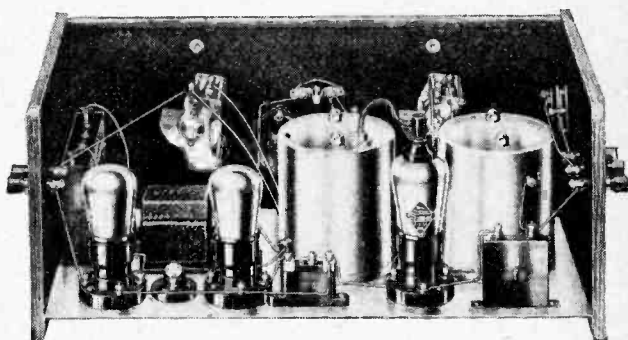
The principle of "switch tuning" whereby the usual tuning system is replaced by a multi-position switch by which suitable circuit adjustments

can be made, does not seem to have made any headway, although at least one firm—Mains Radio Gramophones, Ltd.—were showing a range of sets and radio-gramophones in which this plan is employed.

It will be no news to the majority of readers that most of the new sets, even those of the more ambitious type which we have dealt with up to the present, are offered at extraordinarily low prices. There are also a number of simpler receivers which, in spite of their extreme cheapness, would appear to have quite an adequate performance; amongst those designed for battery feed special mention should be made of the Columbia cabinet battery set, a self-contained detector-L.F. combination, complete with loud speaker, which is sold for £5. Other sets in this category are produced by the Burton, Kolster-Brandes, and Brownie firms.

Similarly, there are many mains-operated receivers of the same type, which must be considered as equally cheap if it is remembered that upkeep cost should be very much lower. The Regentone detector-L.F. set, complete with a Westinghouse metal rectifier, and contained in a neat moulded case, costs only £6 15s.

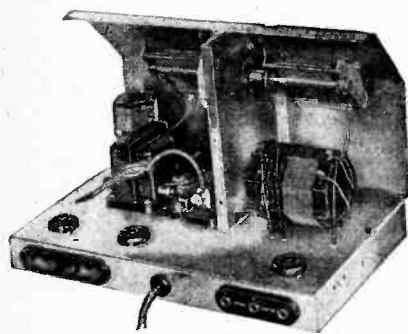
It is safe to say that portable sets will never disappear from the market, because there are always a number of potential listeners who stand in need of real portability, but the number of these sets is distinctly less than formerly. Without doubt



One of the few mains-operated "kits": the Cossor A.C. receiver, with an H.F.-det.-L.F. circuit. A battery-fed counterpart is available.

the H.F.-det.-2L.F. circuit has swept the board, so far as portables are concerned, and one of the most interesting examples of modern de-

**Straight Sets and Constructors' Kits.**— sign in this category is the new Marcomiphone Super-tuned Portable Four. With ganged tuning, a combination indicator switch, and one of the new high-efficiency pentode output valves, this set embodies practically all the latest features for a receiver of its type, and in addition has a special large-sized cone loud speaker with a balanced-armature unit specially wound to match the new pentode. Total anode current consumption is given as 7 milliamps., and so upkeep cost should be reasonably low. A number of interesting points were noticed in the design of this receiver; for instance, there is a proper support for the battery in place of the extemporised arrangement that is so often found, and the whole receiver chassis, complete with frame aerial and loud speaker, can be removed



Burton kit set, with screens partly dismantled. Some of the more important components are assembled by the makers.

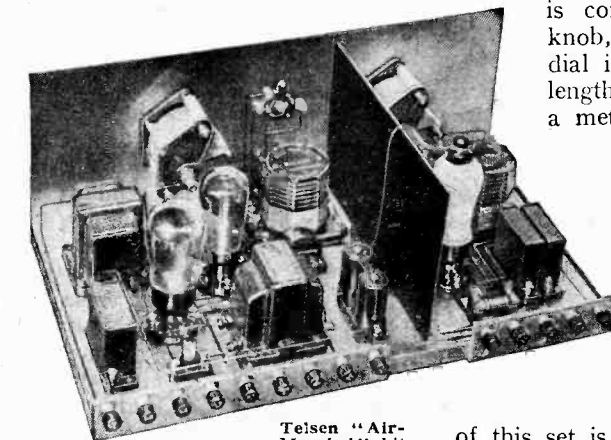
for purposes of testing or repair by taking out four screws. The set is directly calibrated in wavelengths, and there is provision for using a gramophone pick-up and an external loud speaker, as well as an external aerial-earth system.

Another interesting new battery portable is the Pye "Q," again with the popular 1-v-2 circuit, and one of the new Mazda high-efficiency pentodes.

There is clearly an increasing interest in short-wave work, if only to judge from the Eddystone exhibit, which was considerably wider in its scope than during previous years. Although primarily intended for use overseas, the new McMichael "Colonial" superheterodyne will doubtless appeal to the short-wave listener in this country; by the use

of an extremely ingenious coil assembly, which is fitted into a rectangular block, the difficulties asso-

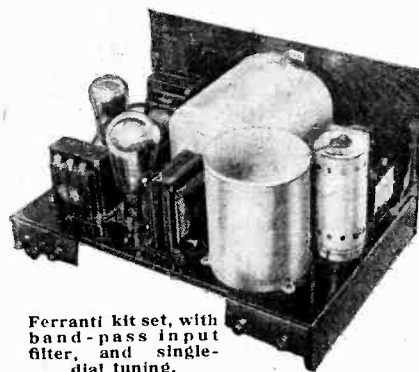
ciated with coil changing, which is usually a clumsy process, have been entirely overcome. This coil assembly fits into an aperture in the front panel, and contact is automatically picked up with the appropriate windings for the wave-range indicated on the front of the block, which also carries a conversion scale giving wavelengths corresponding to various condenser settings.



Telsen "Air-Marshall" kit set. The circuit arrangement comprises one H.F. and two L.F. stages.

At Olympia there were certainly more "kit" sets for home assembly than ever before, including complete sets of parts, boxed together and sold complete, and also a number of receiver circuits sponsored by the manufacturer producing the majority of components used in them.

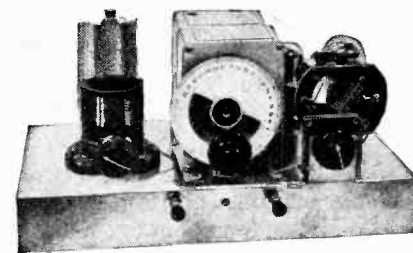
Being the most ambitious in the first-mentioned category, the "Osram Four," already familiar to most of our readers, should be mentioned first. Available either as for battery or A.C. mains feed, this



Ferranti kit set, with band-pass input filter, and single-dial tuning.

cleverly designed and highly effective set embodies two H.F. stages, grid detector, and a transformer-coupled triode output valve. Tuning is controlled by a single knob, and the condenser dial is calibrated in wavelengths. Construction is on a metal chassis.

Most of these up-to-date features are also to be found in the new "Radio for the Million" kit, sold by United Radio Manufacturers, Ltd., which has an H.F.-det.-L.F. three-valve circuit. The chassis



The "R. for M.3" kit set; a compact all-metal chassis.

of this set is particularly neat and compact, and matters are so arranged that even a beginner should be able to set up the ganged tuning circuits quite easily. The selectivity of this set is controlled by variable magnetic

aerial coupling. Another kit set with an equally attractive and very similar specification is the new "Mullard Three."

One of the most up to date of the kits for which essential components rather than a complete set of parts are sold is the new Ferranti Band-Pass receiver, another H.F.-det.-L.F. combination. Mixed inductive and capacitive coupling is used in the filter, and the detector valve is screened in the same compartment as the H.F. intervalve coil.

The makers of Telsen components have prepared designs for a complete range of home-constructed receivers in which their products are employed. These range from a detector-L.F. set, for which all the parts (except panel, baseboard and terminals) cost only 24s., to a 1-v-2 receiver at 84s. 3d. Two three-valve sets are also produced.

# Developments in Loud Speakers and Gramophone Equipment

AS far as loud speakers are concerned this is undoubtedly a "moving-coil" year. Of the numerous methods of converting electrical into sound energy which have been adopted in the construction of loud speakers, the moving-coil principle has so far yielded the most satisfactory results. Its claim to superiority has been established now for some years, but hitherto its general adoption has been delayed on account of cost. Further, the earlier designs were of comparatively large size, and required a power amplifying equipment beyond the means of the majority of wireless enthusiasts. The current crop of "midget" moving coils are not only reasonable in price but will also work well at a much lower level of volume. In actual fact, the "threshold" level, below which the reproduction loses the lower register and sounds thin and harsh, has been lowered by careful design from 1 watt

into the region of 300-500 milliwatts. The compact, self-contained, all-mains receiver is primarily responsible for the demand which has hastened the development of the midget moving-coil loud speaker. Consequently, we find that a considerable proportion of these instruments are fitted with mains-energised field magnets. They may be energised directly from D.C. mains, through a rectifier from A.C. mains, or they may be connected in series with the H.T. supply to the set, when they also serve as a smoothing choke. In many cases low-resistance windings are available for excitation from the L.T. accumulator.

The permanent magnet moving coil has quite definitely strengthened its position during the year, and the majority of makers have succeeded in improving sensitivity as well as in reducing price. The popular low-priced permanent magnet moving coil can hardly be classified as a miniature loud speaker, since the majority employ comparatively large diaphragms, with the object of increasing sensitivity. The Ferranti type M3, for instance, has a 9in. diaphragm, and 7in. is quite a common diameter for loud speakers in this class.

The problem of increasing the sensitivity of a small permanent magnet moving coil, without at the same

time adding unduly to the cost of production, is not too easy of solution. Apart from the question of diaphragm size, already mentioned, the sensitivity will depend chiefly upon the total magnetic energy in the gap. This is not determined solely by the flux density, or by the total magnetic flux, but is proportional to the square of the flux density and the volume of the gap. In designing the magnet it is customary to start from the air gap and to determine the cross-section of magnet steel required to provide the stipulated flux density, and also the length of magnetic circuit which will provide the necessary magneto-motive force to drive the flux across the gap. The cost of the magnet will be determined principally by the weight of the comparatively expensive cobalt steel alloy required, and in general the most effective way of keeping the weight of the magnet down is to employ the narrowest

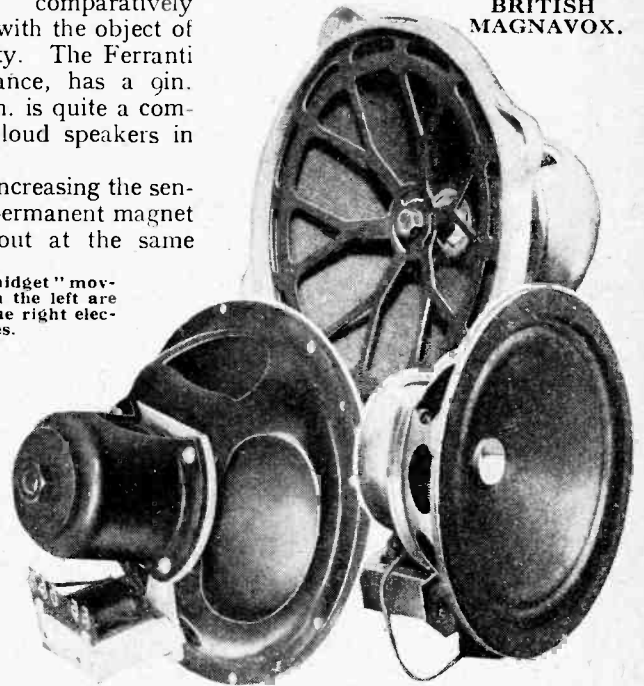
BRITISH BLUE SPOT.



AMPLION.

FERRANTI.

BRITISH MAGNAVOX.

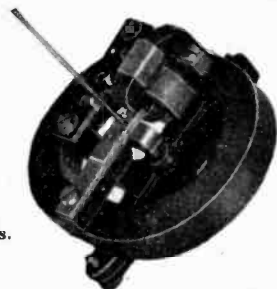


BRITISH ROLA.

EPOCH.

A representative group of "midget" moving-coil speakers. Those on the left are permanent magnet, and on the right electro-magnetic types.

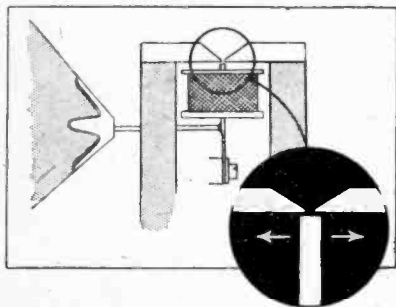
**Loud Speakers and Gramophone Equip.**—possible air gap, and the smallest diameter and depth of gap, consistent with acoustic efficiency. A limit is set to the width of the gap by con-



Celestion M12 chassis.

siderations of accuracy in machining and assembly, but the situation is relieved by the use of low-resistance speech coils with the minimum number of turns. Thus, in the B.T.H. "Minor" R.K., the speech coil has a D.C. resistance of 4 ohms, and in the Rola type "F" unit the resistance is only 2 ohms. The advances that have been made in the technique of jig assembly in small air gaps are well exemplified in the R. & A. type 100 permanent magnet moving coil, which was shown on several of the factors' stands at Olympia. This unit has an 8-ohm speech coil, working in a gap of only 35 mils.

Readers will have noticed that a new type of totally enclosed magnet, not unlike a curling stone in shape, is gaining in popularity, and will naturally want to know what advantages, if any, are to be gained by

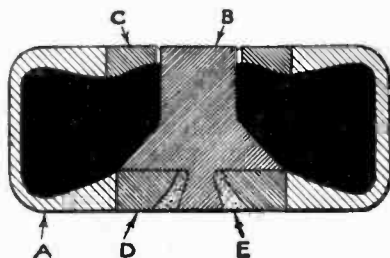


British Blue Spot 100U movement shown diagrammatically.

this form of construction. It would appear that the chief reasons for its adoption are on the score of novelty, and the fact that dust is excluded from the back of the air gap. The last advantage, however, is not exclusive to this type of magnet, for

many of the open four-claw types have been fitted for some time with a diecast ring forced on to the centre pole piece, and fitting into a recess machined on the under-side of the annular pole piece. Not only does this exclude dust, but also serves to keep the air gap concentric. On the score of cost, and from the point of view of magnetic efficiency, there is little, if anything, to choose between the two types.

One of the new types of magnet made by Messrs. Darwins, Ltd., is shown in section on this page. The continuous shell of cobalt magnet steel (A) is designed to give the correct length of magnetic circuit required by the dimensions of air gap, and uniform cross-sectional area is maintained by thickening the walls as they approach the soft iron pole

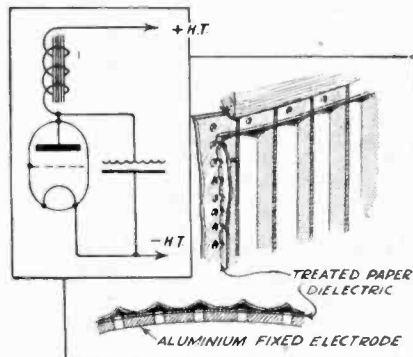


Section through one of the new type permanent magnets by Darwins. The lettering is explained in the accompanying text.

pieces, and the mean diameter becomes less. It will be noticed that the under-side of the annular pole piece (C) is recessed to reduce leakage flux. The centre pole piece (B) is centred in the air gap by a special jig, and finally sealed in position by white metal (E). An important feature of the design is the soft iron ring (D), which is a driving fit in the magnet shell. It will be appreciated that the internal solenoid method of magnetising the claw-type magnet cannot be applied to the enclosed type, and an external solenoid, or yoke, must be used. With either of these methods it was found that a small volume of steel at the base of the centre pole was magnetised in a reverse direction to the main field. Not only did this reduce the effective flux in the gap, but the expensive magnet steel in this region was wasted. Hence the soft iron ring (D).

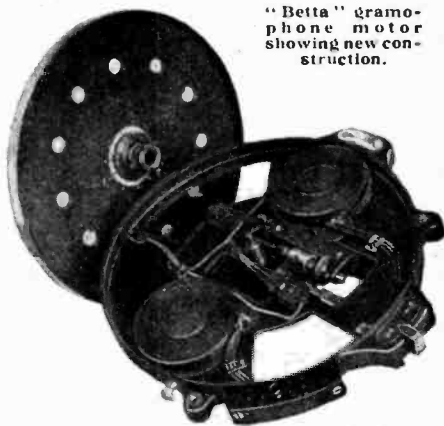
There can be little doubt that the magnet makers have done their fair

share towards the advance of the permanent magnet moving coil, and there is no reason why any manufacturer worth his salt should not be



Sketch showing the principle of operation of the electrostatic loud speaker shown by the Primus Manufacturing Co.

able to turn out a unit with a satisfactory degree of sensitivity and range of frequency response. On the other hand, a loud speaker, just because it is a moving coil, is not necessarily superior to a good specimen of the moving iron type, and there is still plenty of scope for high-grade units in the latter class. The new type M movement, used in the Celestion M12 chassis, with its unusually massive ring-type magnet and rigidly mounted pole pieces and armature, is evidence that design in this field is not stagnating, and we



"Beta" gramophone motor showing new construction.

welcome two additions to the inductor class—the Ferranti and the new Blue Spot 100U movement.

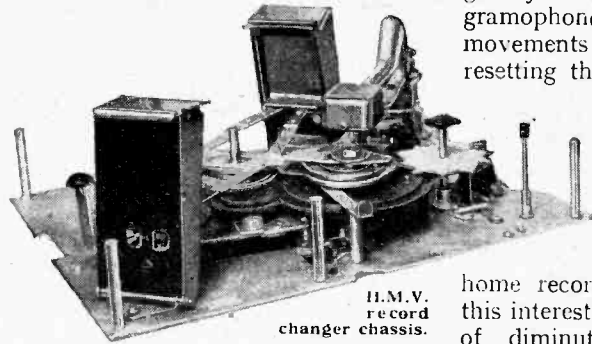
The electrostatic loud speaker, the principle of which is already well known to readers, has enjoyed a considerable vogue in Germany, and is used there in many sound picture theatre equipments. A British-made

**Loud Speakers and Gramophone Equip.**— example of this principle was shown by the Primus Manufacturing Co., Ltd. The foil diaphragm is fluted, and by careful design adequate sensitivity has been attained with a polarising voltage of 100-120 volts. Thus it will function without extra polarising batteries if connected between anode and earth of the average output valve, with, of course, a choke connected in the anode circuit. It is made in two sizes— 1 watt (100-120 volts) and 6 watts (200-300 volts).

A survey of the gramophone pickups exhibited this year reveals a general reduction in the price of instruments of the better class, and a number of arresting tone-arm designs. The general tendency in

ing a considerable vogue at the present time. A good example of this form of construction is to be found in the "Macom" series of

phone Company of an automatic record changer as a separate unit for attachment to existing sets will greatly enhance the enjoyment of gramophone reproduction. All the movements of releasing records and resetting the tone arm are achieved by cams operated by a single clutch from the motor spindle.



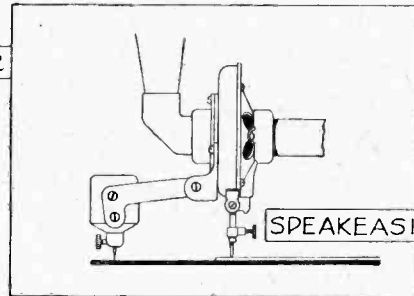
H.M.V. record changer chassis.

motors made by Betta Electric Motors, Ltd. Within the overall depth of 1½ in. is housed a universal commutator motor, complete with

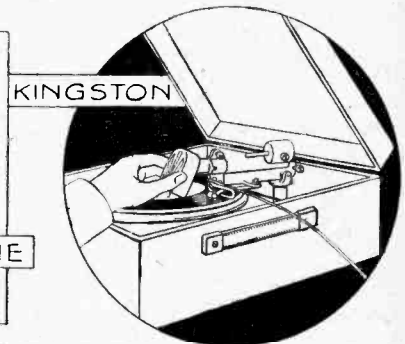
If one may judge by the number of visitors surrounding the stands exhibiting home recorders, the fascination of this interesting hobby shows no sign of diminution. Considerable ingenuity is displayed in the mechanism for tracking and cutting the record groove, and some idea of the diversity of the methods adopted



CAIRMOR



SPEAKEASIE



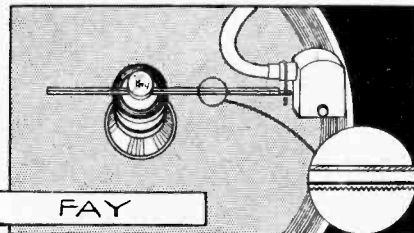
KINGSTON

this direction seems to be towards a shallow build, taking up the minimum depth under the gramophone lid. The B.T.H. "Minor" tone arm is a good example of this trend.

It would appear that the half-rocker type of movement is now generally acknowledged to be the one best suited to production requirements. In support of this it is only necessary to state that the Gramophone Company have now reverted to this type, with which they are now able to get the same excellent results that were obtained with last year's three-pole movement.

The revival of the microphone type of amplifier in the Brown "Micro-box" pick-up and tone arm is a development which will be watched with close interest.

The induction type of A.C. gramophone motor continues to make headway, and the new Garrard type 202 motor is a fine example of this class. Shallow-type motors built into the under-side of the turntable are enjoy-



FAY

Diagrams showing various methods of tracking employed with home recording outfits.

governor and speed regulator. The turntable itself forms the armature, and a series of flat coils are riveted on the under-side and connected to the radial commutator surrounding the centre bearing. These coils react with two field magnets fixed on diametrically opposite sides of the motor base. The Simpson turntable motor is of the synchronous type, and is designed to run at 78 r.p.m. on a 50-cycle supply. We understand that a commutator adaptor is being developed for this motor for use on D.C. supplies.

The introduction by the Gramo-

may be gathered from the sketches on this page.

To conclude, we may draw attention to the Synchronophone instrument. In addition to a wireless receiving set and electric gramophone, this cabinet incorporates a



The Simpson synchronous turntable.

16 mm. film projector which may be synchronised with the gramophone motor, and provides home-talkie entertainment.

ooooooooooooo *This Season's* ooooooooooooooo  
*Valves*

ONE hundred new valves have made their debut at Olympia, and in all the different classes there are important additions, some of which are new in principle and some representing an improvement in characteristic of a past type.

With the increasing congestion of the European ether it has lately become abundantly clear that the ordinary screen-grid valve falls short in the matter of selectivity. Competition between manufacturers to produce a valve giving the greatest H.F. magnification led to a design of high impedance favourable to poor selectivity resulting from rectification. It is to this disability that serious attention has been paid in the last few months, and two new designs have emerged. The first, represented by the Cossor MS.PenA, makes use of the more generous grid swing of the pentode, and at the same time combines the internal screening arrangements of the screen-grid valve. We thus obtain a valve capable of high stage-gain and linear amplification without the attendant secondary effects known as cross-modulation and modulation distortion.

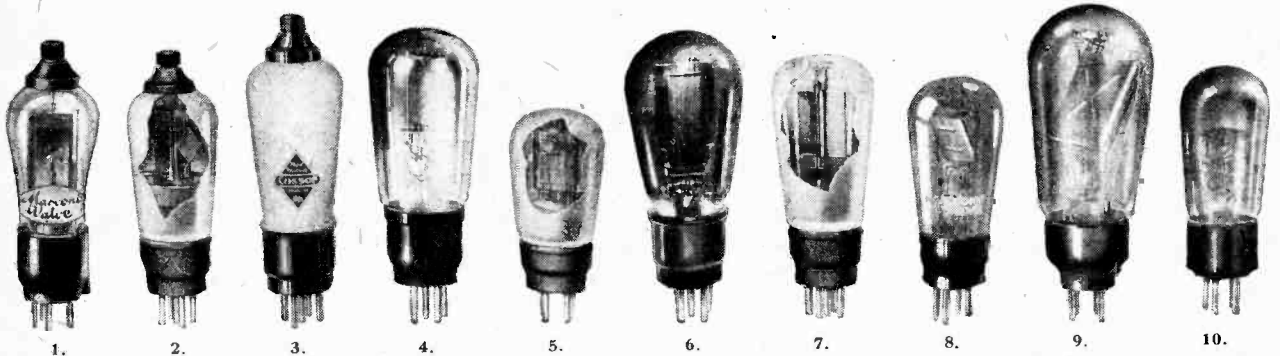
The second design is known as the variable-mu valve and consists of an ordinary screen-grid valve in which the distance apart of the turns of wire in the grid is not the same throughout. This has the effect of altering considerably the grid's control of the electron flow at different

values of grid bias. There are two variable-mu valves at present available, the Marconi and Osram VMS4 and the Mullard MM4V, and in each case the mutual conductance varies between very wide limits when the grid bias is changed from minimum to maximum. The grid volts-anode current curve of the ordinary S.G. valve ends rather abruptly at, say, 7 or 8 volts grid negative, whereas that of the variable-mu "tails" off very gradually, there being measurable anode current at 40 volts bias. The long, straight characteristic at the higher negative grid potentials allows the valve to accept powerful signals from the local station without rectification, and the troubles already enumerated are reduced to negligible proportions. Furthermore, there is provided a new and highly satisfactory form of volume control by the simple expedient of using a variable self-bias resistance. A control such as this does not affect ganging, and is, therefore, superior to an aerial or grid potentiometer. It can confidently be predicted that the new valve will find considerable application in the near future.

Another development in H.F. valves is the metallisation of the outside of the bulb. We are given gratis a thick, sprayed zinc coating, which is connected internally to the cathode pin in A.C. valves and to one of the filament pins, which is suitably marked, in the case of battery valves.

There is thus formed an earthed shield which avoids the necessity of using a separate cylindrical valve screen, and hum as well as stray coupling is minimised. The coating continues externally, the internal screen between anode and grid, and thus has the effect of reducing the interelectrode capacity. When designing a set with these valves a word of warning is necessary: should the metal covering touch any earthed screening compartments the grid bias resistance or the L.T. accumulator may be short-circuited in the case of A.C. and battery valves respectively. The metallised bulb adds to the capacity between anode and cathode; it is, therefore, essential to see that the cathode is properly earthed to H.F., and should a cathode bias resistor be used, this must be shunted with a *non-inductive* condenser.

In general, H.F. valves have undergone great improvement in efficiency; mutual conductance soars higher and higher, and in the case of the new Mazda AC/S2 reaches the remarkable figure of 5.0 mA./volt. With this valve the enormous stage amplification of 400 should be possible even with quite modest coils. A new Cossor H.F. valve has just been introduced, styled the MSG/LA, with an impedance of 200,000 ohms *under working conditions*, and other new-comers are the Marconi and Osram MS4B, S.21, and S.22, with the comparatively low impedances of 350,000, 200,000, and 200,000 ohms,



A selection of new valves. (1) Marconi S.22, a battery S.G. valve. (2) Mazda AC/S2 with an amplification factor of 3,000. (3) Cossor MSG/LA of low impedance. (4) Osram DH, a D.C. mains power-grid detector. (5) Mazda HL2, a battery-type detector. (6) Cossor 41MHL for detection. (7) Mazda DC3/HL for D.C. mains with 30-volt heater. (8) Marconi P.2 output valve. (9) Osram PX4 with a slope of 6.0. (10) Mullard PM202 output valve with a slope of 3.5.

**This Season's Valves.—**

all of which lend support to the statement that efforts are being directed to give H.F. valves more linear characteristics. With regard to H.F. circuit practice, it was quite evident at Olympia that band-pass input filters—first introduced in this country by *The Wireless World*—were becoming almost universally used in ambitious receivers. Appreciation is also being given to the prevention of valve noise by avoiding high resistances between grid and vathode.

Small coils of 1in. or 1½in. diameter of an average dynamic resistance of 100,000 ohms are finding favour, which means that the threshold of instability, due to feed-back within the valve, is never reached now that inter-electrode capacities have been reduced to the extremely low figure of 0.001 and 0.002 μμF.

Neither are improvements restricted to S.G. valves. Taking detectors next, we find a large increase in the number of valves suitable for power grid-rectification now so widely used. It is becoming generally realised that square law rectification, as represented by leaky-grid detection with conventional valves, introduces an objectionable percentage of harmonics, and that the anode bend method is highly insensitive to weak signals, non-linear to deep modulation, and difficult to couple to the L.F. amplifier. For local transmissions straight-line detection, as given by the power-grid circuit, is very desirable, for not only are unwanted harmonics absent, but also modulation percentages up to 90 can be faithfully reproduced. There is another advantage which is

not perhaps so well known, but is, nevertheless, important; it has been explained by F. M. Colebrook in *The Wireless World*.<sup>1</sup> It is possible, provided that the detector is linear, to obtain an increase of selectivity when two stations not differing greatly in wavelength are received together as de-modulation of the weaker by the carrier wave of the stronger station takes place. The carrier waves heterodyne and the modulation of the weaker station is lost at a frequency above audibility.

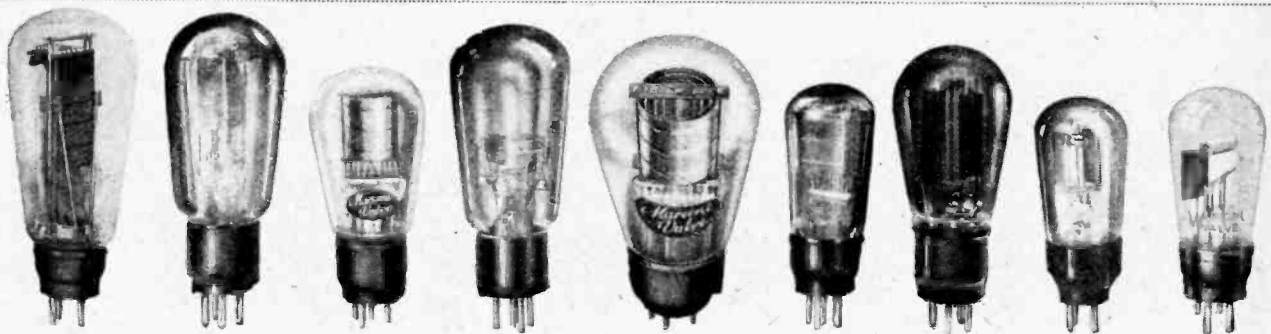
For linear grid rectification a large input grid swing and a high anode voltage are required, but the valve must be able to stand the anode watts dissipation when the grid is returned to cathode. The Mullard 904.V is a new detector which satisfies these conditions, and has a slope of 5 and an amplification factor of 85. In the Mazda series there is the AC2/HL, with a slope of 6.5 and an impedance of only 11,000 ohms, whilst the Marconi and Osram counterpart—the MH4—although of lower slope, handles large inputs.

A great deal of progress has been made in the design of output valves. As an instance let us take the Mazda PP5/400, which will give an undistorted output of 5,000 milliwatts for a grid swing of 32 volts. A year ago a valve giving this output would have required an input from two or three times as great. Other examples are the new Marconi and Osram PX4, the Mullard 054V, and the Cossor 41MP and 41MXP, the slopes of which are between 4 and 7.5. Perhaps the most important advance in

valve technique is represented by the pentode series, of which there are to-day some 25 models available. All the well-known valve makers now have an indirectly heated A.C. pentode as well as many directly heated types, and from the number of receivers equipped with these valves it is clear that the prejudice that once existed has now passed. If the output load is limited by a compensating circuit, as put forward from time to time in this journal, the reproduction with a pentode can be beyond reproach.

There is a new pentode deserving of special mention—the Mazda Pen. 220—designed for the needs of those who perforce must use H.T. batteries. With only 5 mA. at 150 volts—that is, a dissipation of 750 milliwatts—an undistorted A.C. output of 370 milliwatts is possible. This ratio of A.C. to D.C. watts of 49 per cent. is the highest yet attained by a long stretch, and makes it clear that the publication by valve makers of D.C. watts dissipation is only of secondary importance. It is believed that the general issue of data for A.C. output and optimum load cannot be much longer delayed. Finally, any notes on valve development would be incomplete without reference to the standardised range of mains rectifiers and to the new indirectly heated D.C. valves. The latter are being manufactured by the Marconi, Osram and Mazda companies, and have heaters rated respectively at 16.0 volt 0.25 amp. and 40 volt 0.1 amp. This makes it possible to design a set for D.C. mains with a consumption less than that of a small electric lamp.

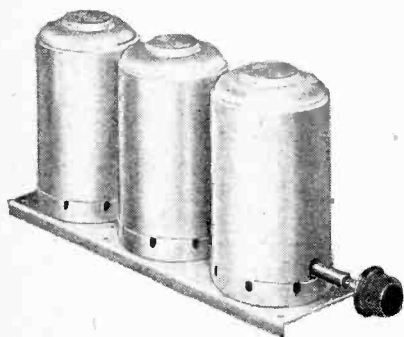
<sup>1</sup> See "A Little-known Fact About Interference," May 27th, 1931.



—(11) Mazda PP5/400 power valve with working slope of 7. (12) Osram PT4, a directly heated pentode, a pentode for D.C. mains. (13) Mullard PM24C, a pentode with an output of 3,500 milliwatts. (14) Marconi MPT4 indirectly heated pentode. (15) Mazda Pen.220 giving 370 milliwatts output with 5 mA. anode current. (16), (17), (18) New standardised mains rectifiers, Cossor 442BU and Osram U.10. (19) Marconi GUI hot-cathode mercury-vapour rectifier for large amplifiers.

# Components for the Set Constructor and New Accessories

THE past twelve months have seen some important changes in the design of coils, the band-pass filter now being definitely established, and it is interesting to note that quite a large number of the input filter units are coupled by a negative inductance and a large capacity. The "mixed filter," as it is sometimes termed, assures a constant peak separation over the whole waveband covered, and as a consequence the selectivity is sensibly the same at all wavelengths. Coils have been reduced in size, and in general do not exceed 1½ in. in diameter, so that it has been found possible to limit the diameter of screening cases to about 2½ in., with the consequent

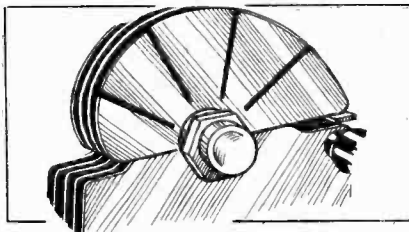


Varley Square Peak canned coils mounted on an aluminium base and fitted with ganged switches.

saving in baseboard space. Careful investigation into the effects of screening has enabled a satisfactory compromise to be reached between coil diameter and size of screen, so that the new coils do not show any appreciable reduction in efficiency over last year's models. Wave-change switches form part of the coil assembly, these being arranged so that they can be linked together and operated by a single control. Notable examples are the Colvern "Link" coil and the Varley "Square Peak" canned coils.

All makers include in their range a companion H.F. coil, usually of the tuned-grid type, but in some cases an alternative is available, taking the form of an intervalve H.F. transformer. As a rule the

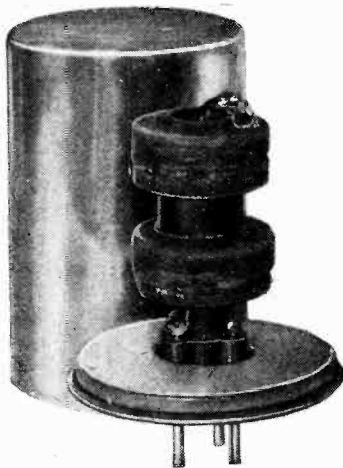
three coils are mounted on an aluminium base, with the switches linked together, thus forming a very compact unit.



Segmented end vanes used in some makes of ganged condensers to enable accurate matching of the capacities.

Rapid strides have been made, also, in the design of ganged condensers, since to achieve satisfactory tuning the condensers must be matched as accurately as the coils. Some new ideas have been embodied, the most noteworthy to date being the fitting of segmented end-vanes to each set of rotors. During the testing process these segments are adjusted to compensate for any discrepancy in the capacities of the condensers in the unit. By this means it is possible to assure exceedingly accurate matching, the usual tolerance being of the order of one per cent.

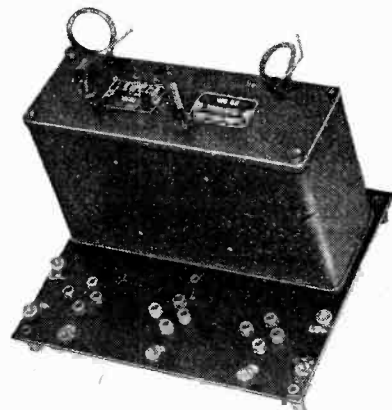
Examples of totally enclosed ganged condensers including these features are to be found in the



Wearite band-pass supersonic I.F. transformer shown removed from its screening can.

Utility models, the Polar "Uni-knob," and in the British Radiophone range. The last mentioned actually guarantee that the differences in capacity do not exceed one-half of one per cent, over the whole scale.

The superheterodyne receiver is once again coming into favour, as most of the disadvantages concomitant with this system have been overcome. Intermediate frequency coil units now universally include band-pass tuning. A notable example of modern practice is the Wearite 126 kc. three-stage unit, consisting of three I.F. transformers, individu-



Complete I.F. Unit made by Lewcos. It has three tuned band-pass transformers adjusted to 126 kc.

ally screened, and mounted on a base carrying three valve holders. It is completely wired, and forms a self-contained unit. Each I.F. unit is carefully matched; the difference is stated to be no greater than one-third of one per cent.

The Lewcos unit is another example of a complete I.F. assembly, while the Igranic outfit consists of separate coils mounted on plug-in bases. The R.I. range takes the same form.

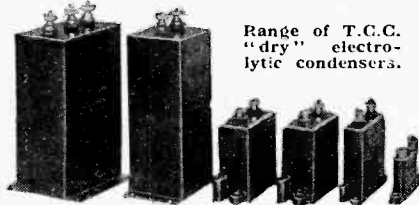
Intervalve transformers wound on a bi-metal core have now practically replaced all the earlier types, but the most recent development in this direction is the introduction of special transformers for use with the parallel feed circuits. Since it is quite unnecessary to make provision for the



**Components and New Accessories.**— primary winding to carry a steady D.C. current, the use of high permeability alloys is possible, and, furthermore, the size of the core can be restricted to that necessary to give the required inductance value only. Special transformers of this type are the R.I. "Parafeed" and the Igranic "Parvo." The "Parafeed" measures 2in. x 1 $\frac{3}{8}$ in. x 1 $\frac{5}{8}$ in., and has a primary inductance of just over 100 henrys, and a nominal ratio of 1:3. The "Parvo" is approximately the same size, and shows a primary inductance of 65 henrys.

No opportunity has been missed to cheapen production costs of standard pattern L.F. transformers, and many fine examples of competitively priced components are well in evidence, notable examples being the Telsen range and the R.I. "Dux." Fixed condensers have received attention also, and in addition to the introduction of many new styles, such as the T.C.C. type "M" and the Dubilier types 665 and 670, quite substantial reductions in prices have been effected, and it is now no longer necessary to look to the foreigner for cheap condensers. The best quality material is used and the standard is of a high order.

A new feature is the extension of the range of electrolytic condensers made by the Telegraph Condenser Co. Capacities up to many thousands of microfarads can be obtained in exceedingly compact form, but these very high capacities cannot be used when the potential developed across them exceeds some 12 volts. The higher voltage types, such as

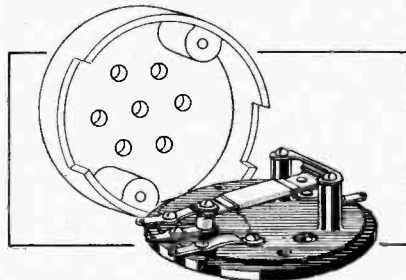


Range of T.C.C. "dry" electrolytic condensers.

those rated to work at 40 volts and 100 volts, will be particularly useful in grid-bias circuits where the various potentials are derived from a mains unit. A 2-mfd. size in the 100-volt working type is contained in the same size case as that housing an ordinary 0.0003 mfd. fixed condenser, while 80 mfd. are condensed into the dimensions of a normal

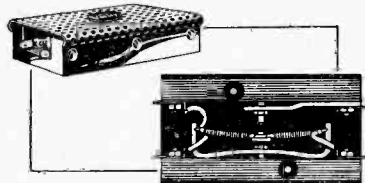
4 - mfd. size of higher working voltage.

There are some cylindrically shaped aqueous type condensers in capacities of 8 mfd., rated to oper-



Bulgin thermal delayed action switch with 30 seconds time lag.

ate at 460 volts D.C. They occupy considerably less space than a corresponding size in the paper range of the same test voltage. They are styled the aqueous type as the electrolyte is a free liquid, but the case is perfectly sealed, and there is no likelihood of leakage. When using these condensers it is essential to bear in mind the fact that they are



Thermal delay switch made by Varley for the Osram G.U.I. rectifier.

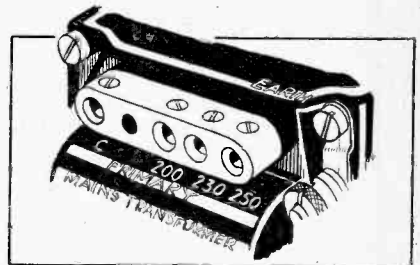
suitable for D.C. circuits only, and furthermore, that the positive lead must be connected to the correct terminal on the condenser.

Where A.C. is available, it is a comparatively easy matter to obtain high D.C. voltages by using a suitable transformer and a rectifier, and while such components as smoothing condensers will be well capable of withstanding the normal working potential if chosen with due care, they are often subjected to serious strain while the heaters of the A.C. valves are warming up, and before the cathodes reach full emission state. As a safeguard in such cases it is advisable to delay switching on the H.T. for at least 30 seconds, but human nature is such that occasionally the correct sequence will be departed from, with the possibility that damage may occur to some of the principal components. With a view

to obviating the need for more than one control, there has been devised a delay-action switch, operating on the thermal principle. This is connected across the 4-volt winding on the transformer and allows sufficient time to elapse for the cathodes to attain full emission state before the H.T. contacts close.

One example of this is the Bulgin "Thermal Delayed Action Switch," which allows thirty seconds to pass before its H.T. contacts make. It contains a heater element made up of two strips of metal having dissimilar coefficients of expansion, and arranged so that when the H.T. contacts close they do so with a snap action. When the main switch is put to the "off" position about twenty seconds elapse before the contacts open, and during this time the pressure is constant. When finally the contacts open they come apart quickly. This delay after switching off allows ample time for all condensers to discharge.

A somewhat similar device is the Varley "Thermal Delay Switch," intended specifically for use with the Osram G.U.I. mercury vapour rectifier, which handles very high voltages. The basic principles of the device are the same, but in this case the delay is of the order of one minute, while some thirty seconds elapse after switching off before the contacts open. The consumption of this style of switch is about 4 watts at 4 volts, and it is essential that the L.T. transformer winding should be sufficiently well regulated to withstand the extra load of one ampere.

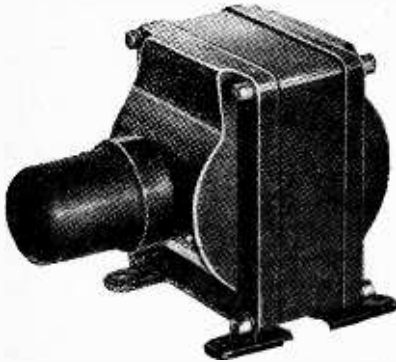


Completely insulated input sockets fitted to some Ferranti mains transformers.

Certain safety measures have been adopted in the design of mains transformers by most makers. The R.I. models have for some time past been fitted with insulated terminals at all the high voltage points, while in some of the Ferranti

**Components and New Accessories.—**

models the mains terminals have been replaced by an ebonite batten carrying enclosed connectors. All metal parts are sunk below the face of the ebonite block, and it is impossible to cause a short-circuit accidentally. One model, the P.11, is particularly well protected in this respect. It is intended for use where the A.C. supply is of the order of 100 to 130 volts, and steps up the voltage to about double this value, thereby enabling receivers designed for standard supplies of between 200 and 250 volts to be used. There are no terminals whatsoever, a well-insulated cable being fitted to the input side, while the output leads are taken to a lamp holder mounted on the side of the transformer and

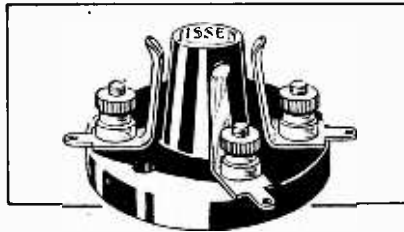


Another safety device; the secondary connections on the Ferranti P.11. mains transformer are protected by an ebonite cap.

completely enclosed in an ebonite cap. The transformer is fully protected, being housed in the familiar Ferranti case, and it may be placed on the floor in juxtaposition to the wall socket without fear that anyone will receive a shock accidentally by coming in contact with it.

Another innovation adopted by Ferranti is the omission of terminals from some of their mains transformers. The ends of the various windings are brought out and sufficient length is allowed to enable each lead to be taken direct to its respective point on the circuit. Manufacturing costs are lowered, and the selling prices can be adjusted accordingly. An additional advantage is that fewer connections are required, and time is saved in building a set. Price considerations have had some influence on the design of the new range of power transformers introduced by Varley, and although

terminals are retained, all connections are brought out to a terminal board on one side of the component. These transformers are of the uncased type.

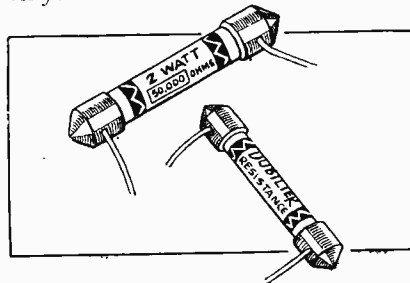


Simple but effective design of the Lissen 4-pin valve holder.

Resistances which have come to be known as the "Spaghetti" type seem to be very popular this year, for practically every component manufacturer has a range.

They are undoubtedly convenient in that special bases are unnecessary, and the resistance may be connected direct between any two components. They have the additional advantage that price is in their favour, as they are extraordinarily cheap for a wire-wound component.

The new range of metallised resistances introduced by Dubilier are of more than passing interest. Three types are available, rated to dissipate 1, 2, and 3 watts respectively. The lowest rating is about the same size as an ordinary grid leak, while the others are proportionately larger. Quite massive end caps are fitted, to which is attached a short length of tinned copper wire for connecting purposes. The resistance is claimed to be unaffected by temperature, but their rating is on the conservative side, and normally the rise in temperature will be slight only.

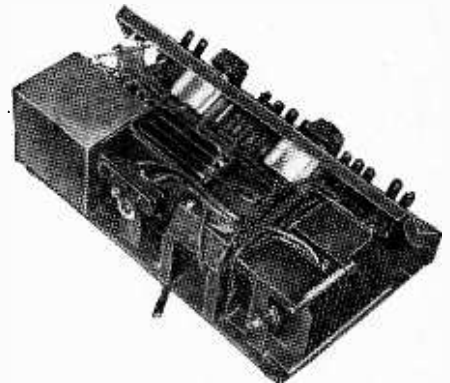


Dubilier one- and two-watt metallised resistances.

The new Lissen 4-pin rigid-type valve holder justifies a mention, not only on the grounds of its uniquely simple design, but on the score of price. It costs but 4½d., and at this

figure is without doubt the cheapest of its kind in the Exhibition. Other makes run it exceedingly close, however, the 4-pin model of Graham Farish and Telsen costing very little more.

An interesting L.T. accumulator is the Pertrix model P.Z.2. This is approximately the same height as an ordinary dry-cell H.T. battery, being but 4½in. high, but considerably deeper from back to front. It is a 2-volt cell in a glass container, and it has been designed to fit adjacent to the H.T. battery, thus simplifying the construction of battery compartments in self-contained sets. The

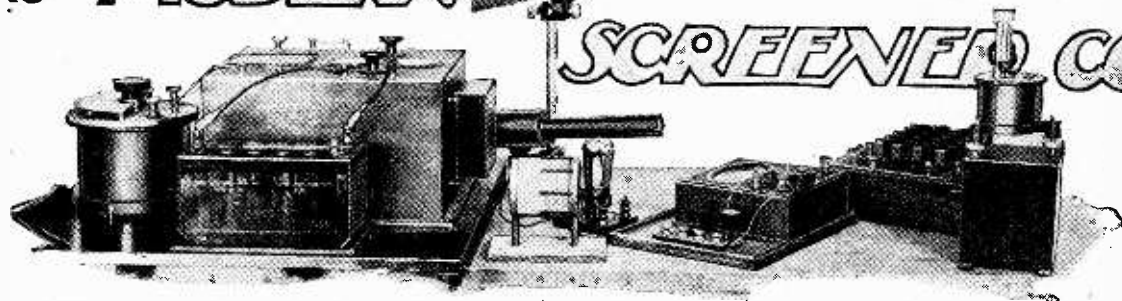


Compact construction of the Clarke's Atlas model A.C.290. complete battery eliminator. It is fitted with L.T. trickle charger.

capacity is generous, being 35 ampere-hours.

Battery eliminators are not so numerous as in the past, the preponderance of all-mains sets no doubt being responsible for this. However, the firms who specialise in this type of accessory have not been idle, as is evidenced by the new Clarke's "Atlas" model A.C.290. It provides four separate H.T. voltages and supplies four values of grid bias, the maximum being 16 volts. The grid-bias voltages are not affected by the H.T. load as a separate rectifier is employed. Electrolytic condensers are used for smoothing in this portion of the circuit. In addition, it contains a trickle charger for 2, 4, or 6-volt accumulators, the charging rate being about 0.5 amps. The feature of interest regarding this is that when the L.T. battery is on charge it is entirely isolated from the receiver. The unit is exceedingly compact, and the price is very reasonable. Westinghouse rectifiers are fitted.

# The MODERN SCREENED COIL



## Part II.—The H.F. Resistance of Screened Coils.

By A. L. M. SOWERBY, M.Sc.

THE effect of putting a metal screening-box round a coil is not by any means limited to the decrease in inductance discussed in a preceding article.

Although a theoretically perfect, or ideal, coil would have no electrical properties at all other than pure inductance, for which characteristic we primarily require it, every coil that is capable of practical realisation possesses, in some measure at least, each of the two remaining properties by virtue of which it can react upon an alternating or high-frequency current. These two remaining properties are capacity and resistance.

With the first of these we shall have but little to do, for we are discussing coils that are intended for use in a receiver as tuning coils. To tune a coil, a capacity—the tuning condenser—is deliberately connected in parallel with it, so that the sole effect of the distributed capacity of the coil itself is to make it necessary to use a little less intentional tuning capacity to reach a given wavelength. In practical terms, the only result of removing the distributed capacity of the coils in a receiver would be that all the stations in that receiver's repertoire would be found at a tuning-point a degree or so higher on the dial.

### Principles of the Tuned Circuit.

It is true, of course, that any increase in the capacity of a coil brings with it an increase of resistance, because the stray capacity of a coil always involves dielectric materials of poor quality, but, while not ignoring this extra resistance, it is proposed to neglect its connection with capacity effects, and to treat all change in coil resistance due to screening under one head.

The second unwanted property possessed by the coil, its resistance, is the subject of this article. In the interests of good amplification, and of obtaining a "lively" set, it is desirable to keep the resistance of all the tuning coils as low as is conveniently possible; it is not too much to say that in very many cases the difference between a highly sensitive receiver and

another which feels "dead" in handling and puts up a poor performance is entirely due to the design of the coils used in the two cases. It was for this reason that it was deemed desirable to make some measurements on the resistance of screened coils, on which point but meagre information is available.

Before detailing the results of the measurements which have been made it will be necessary to discuss, for the sake of those to whom quantitative figures for coil resistance are not part of the ordinary small change of wireless discussions, the two forms in which such resistance is usually expressed. There is the more need for this, as we shall meet two physical sources of resistance whose practical effects correspond exactly to these two alternative modes of expressing resistance.

Let us consider the simple case of a tuned circuit coupled to an aerial, as suggested in Fig. 1, and let us first make the quite unwarrantable assumption that neither the

coil nor the condenser absorbs any power whatever from any currents that may circulate through them. Suppose, now, that the local station starts to broadcast, and that the variable condenser C is adjusted until the tuned circuit consisting of C and the coil L is in resonance with the received signal.

The power sent out by the broadcasting station and picked up by the aerial will induce a current in the coil. This current must be regarded as circulating round the tuned circuit, flowing first one way and then the other, so that the upper side of the condenser is charged first positively and then negatively. On the supposition that neither L nor C absorb any power, this current, once started on its to-and-fro path, would persist for ever, without any further assistance from the transmitter. But the transmitter does not cease supplying power, so that the current, instead of staying constant in amount, will grow continuously, and without limit, to larger and larger values. Simultaneously, the voltage across the condenser—which is the signal operating the first valve—will grow to enormous values.

*In Part I of this series the effect of screening on the inductance of tuning coils was dealt with quantitatively.*

*Before discussing the results of measurements of H.F. resistance, it is necessary to form a clear mental picture of the interdependent factors contributing to the total effective resistance of a tuned circuit. Otherwise it is very easy to draw misleading conclusions from the results of H.F. resistance measurements.*

**The Modern Screened Coil.—**

In practice, of course, this does not happen, for both the coil and the condenser absorb power as soon as a current begins to flow. So long as the current is quite small, the power lost in the tuned circuit during each instant will be less than the power supplied from the aerial, so that the current will continue to grow. The greater it becomes, the more power is lost; the current will therefore rise until the power lost in the tuned circuit is equal to that supplied from the aerial, after which point growth will stop and the current will remain at a steady value so long as the transmitter which is the source of the power continues to operate.

It becomes necessary, in view of these facts, to modify the simple

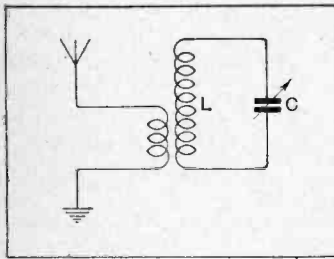


Fig. 1.—The ideal tuned circuit, the coil L and condenser C being both assumed free from all losses.

diagram of Fig. 1, which takes no account of the loss of power, by some addition which will symbolise it. Since resistance is distinguished by the ability to convert electrical energy into heat, during which process the electrical energy naturally ceases to exist as such, it is to resistance that we must turn to express the losses in the tuned circuit.

**Series and Parallel Losses.**

The resistance required to express the observed behaviour of a realisable tuned circuit can be added to Fig. 1 in either of two ways. If we fix our attention on the current that flows, and put in a resistance to take toll from it as it circulates round the tuned circuit, we arrive at the arrangement of Fig. 2. In this diagram the coil and condenser are supposed, as before, to be devoid of losses, all sources of loss being considered concentrated in the resistance  $r$ .

Alternatively, we can fix our attention on the voltage developed across the condenser, and put in a resistance which, though not in the direct line of the flow of current, will, nevertheless, take current, and so absorb power, as soon as any voltage appears on the condenser. This other way of representing the observed losses is symbolised in the circuit of Fig. 3; in which, once again, R is supposed to be the sole source of loss.

At first sight Fig. 2 would appear to be the alternative that approaches most nearly the actual physical process that is occurring in the tuned circuit. It is self-evident that the wire of a coil, the leads joining coil to condenser, and the plates of the condenser itself, must all offer some resistance to the flow of current.

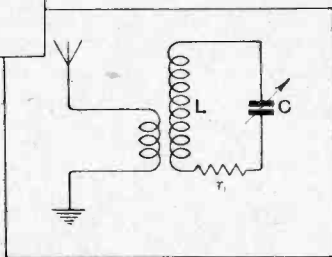


Fig. 2.—Series method of presenting losses in a practical circuit. Coil and condenser are still assumed to be free from losses, the sole source of which is the series resistance  $r$ .

So far as these more obvious sources of loss are concerned, this conclusion is perfectly true; the series resistance  $r$  is their correct representation.

One might even think that the parallel resistance R was a far-fetched and highly theoretical way of representing the losses in the circuit, because there is normally perfect insulation—or as near as makes no matter—between one set of condenser-plates and the other. True enough, so far as direct-current insulation is concerned, but grossly untrue in its application to high-frequency currents. In high-frequency circuits, the condenser has to behave not as a barrier to electrons, but as a reservoir for them. If there is to be no power lost in a condenser, the energy required to charge it must all be yielded up when the condenser discharges again—in terms of a rather crude picture, the electrons must bounce out again as energetically as they were crammed in, and must on no account dribble out half-heartedly. Carrying on the picture, we may say that, just as there is no spring which will not warm up noticeably if compressed and decompressed vigorously enough, there is no insulating material which will accept and redeliver electrons without some minute conversion of their energy into heat.

It is this loss, known as dielectric loss, that finds its diagrammatic representation in the resistance R of Fig. 3.

**Methods of Measuring Losses.**

From this discussion, we conclude that none of the diagrams so far mentioned really show what is going on in a tuned circuit; we require that both  $r$  and R shall be present, the one to indicate losses depending upon the current circulating, the other to indicate losses due to the voltage developed.

Fig. 4 shows the full diagram (now shorn of the purely illustrative aerial) which completely expresses the behaviour

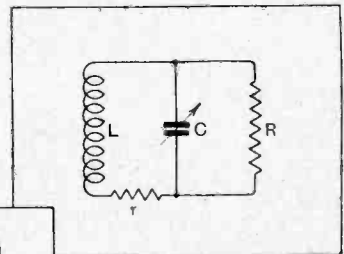


Fig. 4.—A more nearly true representation of a practical tuned circuit, in which both series and parallel losses are included.

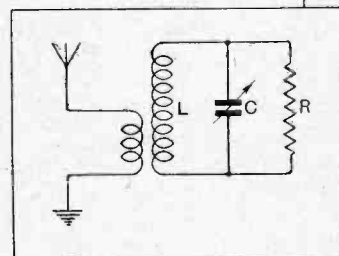


Fig. 3.—Another method of presenting a practical circuit in which the losses are supposed concentrated in the parallel resistance R.

of the tuned circuit as it really is.

The difficulty about Fig. 4, when we come to make measurements, is that all we can measure is the sum total of losses in the circuit. How much of the total must be ascribed to dielectric losses, and how much to the losses in metallic conductors, is always unknown. The fact that we cannot tell, from a measurement, how much of the total loss is due to each source separately shows that the behaviour of the tuned circuit can fairly be represented by consider-

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ing all the losses centralised in either one form or the other.

That this is so can perhaps be best seen from the methods used for the measurement of the resistance; these are outlined in Figs. 5 and 6. In either case, there is a fixed coupling between the oscillator coil and the coil L belonging to the tuned circuit whose losses it is desired to measure. Provided the output from the oscillator is constant, a constant voltage is induced in L, so that the current round the circuit and the voltage developed across C are in inverse proportion to the resistance of the circuit.

If, therefore, we join the terminals T of Fig. 5 and observe the current flowing by reading the meter attached to the thermo-junction J, we have found the current produced by a certain (unknown) voltage

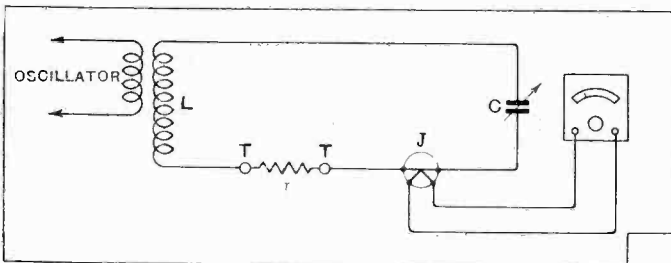


Fig. 5.—Circuit for determining the series resistance equivalent to the losses in a tuned circuit.

induced into the coil L by the oscillator. If now we put a resistance *r* into the tuned circuit by connecting it between the terminals T, and adjust *r* until the current is brought to exactly half its original value, we know that we have doubled the original losses of the tuned circuit. We may say, therefore, that the resistance of the tuned circuit (before the addition of the resistance, of course) is equal to the value we have had to take for *r*.

**Relation between Series and Dynamic Resistance.**

Although we have based our method of measurement entirely on the supposition that the losses are due to the resistance of the conductors obstructing the flow of current in the tuned circuit, ignoring dielectric losses altogether, yet the dielectric losses have been included in the measurement. What we have found is the value of resistance which, if placed in series, as at *r*, with a coil and condenser having no resistance, would give us a circuit identical with that measured. This value is accordingly called the "equivalent series resistance" of the circuit, and holds only for the wavelength at which the measurement was made.

Using the circuit of Fig. 6, we could go through exactly the same process, dealing now with the voltage instead of the current. This time we measure the voltage on C in the absence of the artificially added resistance R, and then put R into place and adjust it until that voltage is halved. The value of R so found is that which, when put in parallel with a coil and condenser of zero resistance, will produce a tuned circuit identical with that under measurement. This time we have based our measurement on dielectric

losses, which diminish the voltage across the condenser in just the same way as does the deliberately added resistance R, but the experimental result we attain gives us a measure of *all* losses, from whatever source, in the circuit. The artificiality of the result is acknowledged by calling R the "equivalent parallel resistance," or, more usually, the "dynamic resistance," of the tuned circuit.

The fact that the resistance of the tuned circuit may be measured in two independent ways, giving results which, while widely different in numerical value, both give us exact information as to the magnitude of the losses present, leads to the necessary conclusion that if we have measured *r* we ought to be able to calculate R, and vice versa. There can be no possible need (unless as a check upon the accuracy of the measurements) to determine the two independently.

It can be shown that there is such a relationship, and that it depends upon the inductance of the coil and upon the total tuning capacity. That is to say, if in one particular case we find that the series resistance *r* is 10 ohms, and the parallel resistance R is 100,000 ohms, we cannot conclude that R will always be 10,000 times greater than *r*. This particular ratio will hold so long as the

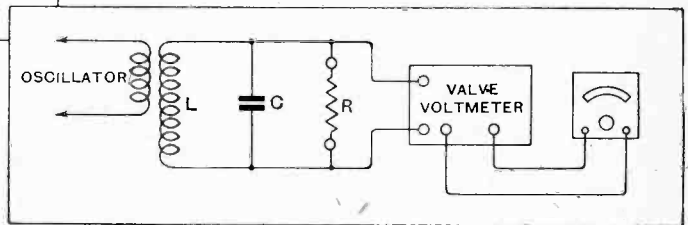


Fig. 6.—A voltage method is used to determine the equivalent parallel resistance of circuit losses.

number of microhenrys indicating the inductance of the coil is the same as the number of micro-microfarads capacity in parallel with it, but it will not be true in any other case. The conversion factor used for relating R and *r* will therefore have to take into consideration both L and C. Since, when these are known, the wavelength to which the circuit is tuned is determined, the connection between *r* and R can equally well be expressed in terms of this and either L or C. The formulae necessary for the conversion of *r* into R, or inversely, are these:—

$$R = \frac{L}{Cr} \text{ ohms; or } R = \frac{3.55L^2}{\lambda^2 r} \text{ megohms,}$$

where  $\lambda$  is the wavelength of resonance in metres, and L the inductance of the coil in microhenrys.

Similarly,

$$r = \frac{L}{CR} \text{ ohms, or } r = \frac{3.55L^2}{\lambda^2 R} \text{ if R is in megohms.}$$

The use of megohms as the unit for R in some of these formulae suggests that the values found for R may be very high. For the best tuned circuits used on the broadcast band *r* may be about 12 ohms at 300 metres, with a coil of 260 microhenrys, from which it may be calculated from any of the formulae that R

**The Modern Screened Coil.—**

will be about 220,000 ohms, or 0.22 megohm. This value is unlikely to be exceeded in modern practice. The smaller  $r$  is made the greater, in exact proportion, will be the value of  $R$ , as was implied, but not directly stated, in discussing the first three diagrams. A "low-loss" circuit, therefore, will have a low series resistance, but its dynamic resistance will be high.

**Resistance Due to Change of Inductance.**

Reverting to the formulae used for the relation of  $r$  to  $R$ , it will be seen that a given value of  $r$  will correspond to different values of  $R$  if the inductance of the coil or the wavelength of measurement is varied. But so long as we restrict ourselves to the consideration of a coil of definite inductance, and make our measurements at a single wavelength, it is a matter of indifference how we express our results. The fact that some of the sources of loss in the circuit are in reality conductor (series) losses, and some dielectric (parallel) losses, does not need to be considered until we vary either inductance or wavelength.

As we have already seen, the addition of a screening-box to a coil changes its inductance very appreciably,

and may, in an unfavourable case, decrease it very drastically indeed. If, therefore, we measure the equivalent series resistance of a coil before and after putting it into a screening-box, any difference we may find will partly be due to a real change in resistance, but will also owe its existence in part simply to the change in the inductance of the coil, which will give a new value, in terms of series resistance, to an unchanged dielectric (parallel) loss in, let us say, the tuning condenser. If we prefer to measure equivalent parallel resistance, the same thing applies; an unchanged series (conductor) loss will present itself as a different value of parallel resistance before and after screening, owing to the alteration in inductance.

It becomes clear, then, that although the measurements are reasonably easy to make, they are going to offer results which, unless carefully interpreted, may be extremely misleading. It is for this reason that so much space has been consumed in the discussion of high-frequency resistance and its mode of expression; unless the matters here treated are kept clearly in mind when examining the resistance measurements that will accompany the continuation of this article, the difficulties of interpreting those results will be considerable.

## THE AMERICAN "SPONSOR."

### A Peep Behind the Studios.

WHILE, in "Radio Writing,"\* Mr. Peter Dixon (himself a "radio writer") sets out to tell the yearning tyro how to achieve radio dramatic fame, he also turns a penetrating spotlight on modern American broadcasting methods.

The learner is told how a radio drama grows: how the first link in the creative

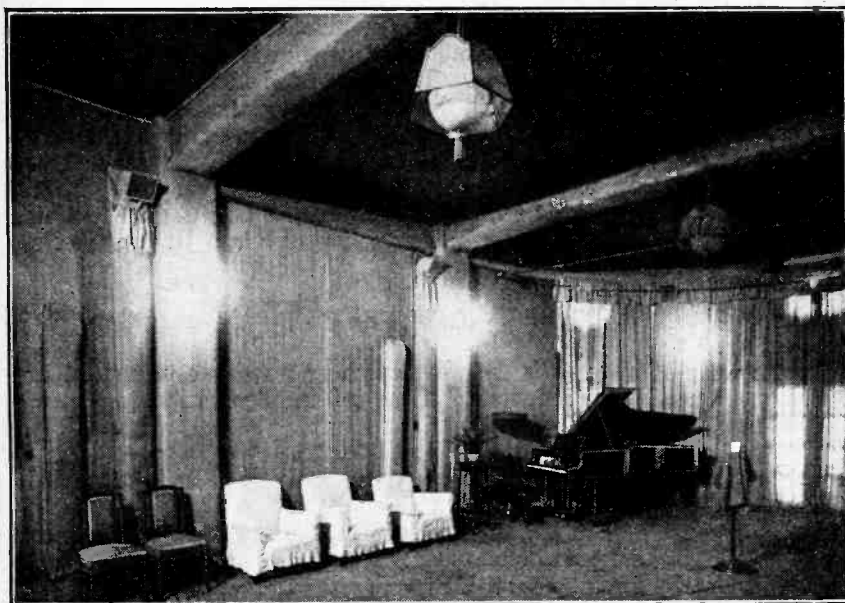
chain is forged when the advertising manager of, say, Silver Flakes Soap decides to arouse public interest by means of broadcasting; how fresh links are fashioned in a discussion with the radio officials, when a rough plan is prepared for a programme to be known as "Soap Bubbles"; how the radio writer then comes into his own, or thinks he does.

The writer evolves this fantasy: there shall be a mother whose child blows soap bubbles. In each bubble the child will see a picture which he will describe. . . . Somewhere, too, the writer will find room for the imperative love interest, while the whole affair must be pervaded by a "signature melody."

According to Mr. Dixon, the radio writer lives in constant fear of the sponsor, dreading most that this gentleman will insist on giving to an airy nothing a local habitation and a name. What can shatter a romance so quickly as a mention, perhaps by the heroine, of Somebody's baked beans or So-and-So's fat reducer? But the radio writer must bow to the powers that be, for "it is the sponsor who pays the bills and who makes it possible for the residents of Duncan, Oklahoma, to hear concerts by the Philadelphia Symphony Orchestra. . . . Business, and not art, has made broadcasting on its present mammoth scale possible."

Much advice in this interesting book would be valuable to radio dramatists all over the world. From it we can also glean some piquant facts. For instance, every word the American announcer utters so brightly and glibly is read from his "continuity," which is all written by another man. "Damn" must always be translated into "Damn." One mustn't get disheartened; only one type of programme would "draw" everybody, an example being a boxing-match between a movie star and President Hoover.

\* "Radio Writing," by Peter Dixon. New York: The Century Publishing Company, 353, Fourth Avenue. Pp. 324+8 photographic plates. Price \$2.50.



We hear very little in this country of broadcasting activity in Japan. The above photograph of the studio of the 10 kW. station JOAK, near Tokio, strikes a decidedly Western note. The construction and layout are quite modern.

# CURRENT TOPICS

Events of the Week in Brief Review.

## GERMAN POWER MENACE.

The doubling in power of Heilsberg, the 75 kW. broadcasting station near Königsberg, is contemplated in the near future.

We hear that negotiations are in progress for a new site for a super-power station at Hamburg. At Ochsenzoll, near Hamburg, a temporary transmitter is being used for field strength measurements.

Next year a new Bavarian station will be erected near Munich with a power exceeding 75 kW. The high-power stations at Frankfurt, Leipzig and Breslau will probably begin their first tests in February or March next.

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## SOLITUDE AT A RADIO SHOW.

When we consider the Olympia triumph we are touched to read in a report of the Paris Radio Salon given by our contemporary, "L'Homme Libre," that "not a living soul was to be met there." The report adds that "the unfortunate guardians of the stands" seemed to have been put there to defend imaginary goods in which no other human being took any interest.

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## NEW WAVELENGTH SHAKE-UP IN U.S.

A sweeping reallocation of American commercial and experimental wavelengths will take effect on February 3rd next by order of the Federal Radio Commission. In general (writes our Washington correspondent) the order puts into effect the new so-called "tolerances," or separations between channels, of one-tenth of one per cent., in lieu of the old standard of two-tenths of one per cent. In effect, it practically doubles the number of available frequencies, increasing the number of channels between 10 kilocycles and 28,000 kilocycles from 1,814 to 3,025. Broadcasting stations are not affected.

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## NEWSPAPER BROADCASTING IN NEW YORK.

American newspaper owners who fancy that broadcasting is competing too heavily with their own activities can buy up the stations. The latest reports, which are not contradicted, have it that New York City is to have its first newspaper-owned station, the purchaser being the famous news magnate, William Randolph Hearst.

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The station in question is WABS, and as its power is only 250 watts even the voice of Hearst will not travel far.

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## ANNOUNCER MARRIES ENGINEER.

The marriage is announced of Signorina Luiza Rizzi, the lady announcer at Milan, to Signore Giulio Marconi, engineer, who is a nephew of the famous inventor.

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weeks' broadcasting would be almost worth while if it could scotch this wireless-and-the-weather superstition.

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## KINGSFORD SMITH'S EMERGENCY WIRELESS.

Air-Commodore Kingsford Smith, who, according to telegraphic advices received from Australia at the time we go to press, was to have left Wyndham on September 22nd for England in an attempt to lower the record recently set up by Mr. Mollison, carries with him a wireless transmitter especially for use in the event of a forced landing. The transmitter, which weighs just under fifteen pounds, was designed and built especially for the flight by Amalgamated Wireless of Australia. It measures only 10x8½x8 inches, and is arranged to operate on 33 and 40 metres.

In the event of its being necessary to send out distress signals, Commodore Kingsford Smith will transmit on either of the wavelengths chosen, commencing at each hour Greenwich mean time, and will use the call sign VMZAX.

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## RADIO AT THE FARADAY EXHIBITION.

The Faraday Centenary Exhibition at the Royal Albert Hall, which will remain open until Saturday next, October 3rd, is full of interest for wireless amateurs. One of the most notable exhibits is the actual equipment to be used in the new Scottish Regional broadcasting station.

A number of items of Marconi apparatus have been withdrawn from the Science Museum, and are now on view at the Exhibition. These include replicas of Marchese Marconi's earliest apparatus and the gear used by him when demonstrating to Post Office officials on Salisbury Plain soon after his arrival in England.

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## WHITELEY ELECTRICAL CO., LTD.

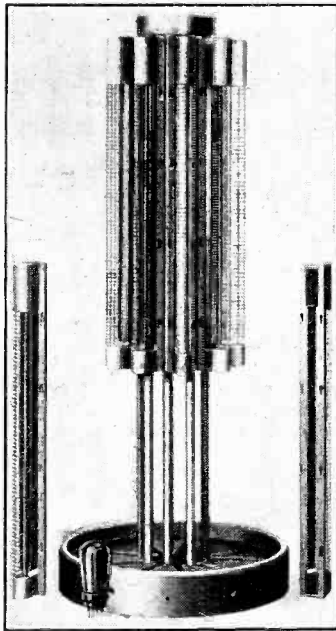
It is regretted that in our Show Report Number of last week the illustration of the Whiteley Electrical loud speaker cabinet and chassis Type PM3 was accidentally misplaced in the Stand-to-Stand Report, and appeared on page 369 instead of on page 368 with the report of the firm's other exhibits on Stand 46.

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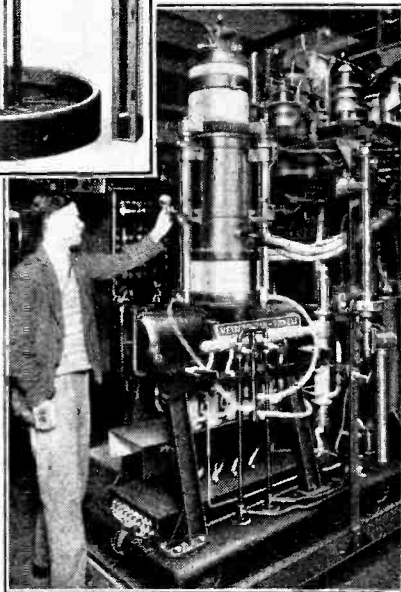
## THE ELEVENTH HOUR.

To-day is Pirate's Day in London. Until midnight the illicit listener can walk the streets with the assurance that he is safe. To-morrow conditions will be different, for October 1st is the date chosen by the Post Office for a big round-up in the London area.

In an interview last week a G.P.O. official said: "Between now and October 1st anyone with a guilty conscience about an unpaid wireless licence can get one from the Post Office without any questions being asked. After then there will be serious trouble."



**WORLD'S BIGGEST VALVE.** At the Faraday Show Metropolitan-Vickers are exhibiting this 500 kW. continuously evacuated valve, which has been built for the G.P.O. station at Rugby. No glass is used in its construction and it can be taken to pieces with a spanner. The upper picture shows the internal construction of the valve, while below it is seen compared in size with an ordinary receiving valve.



## RADIO AND RAIN.

The League of Nations has received a request for a general stoppage of all broadcasting during a period of five or six weeks in order to determine whether wireless is responsible for the prevailing wet weather. The signatory to this demand suggests that a "competent commission" would examine the climatic conditions during this temporary lull and publish a report which would either condemn or acquit the radio waves.

We believe that the sacrifice of six

## 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.

## SELECTIVITY.

Sir,—In these days, when the condition of the ether demands far sharper selectivity than was required only twelve months ago, in order to secure reasonably satisfactory separation of stations, and when the reasons by which this end may be attained are the subject continually of articles in the technical and other Press, it is interesting to observe that, notwithstanding the various advances made in the knowledge of methods by which selectivity may be secured, it is, in the writer's view, obtained in the large majority of commercial sets available at the present day, merely by the expedient of the use of a speaker that does not reproduce the upper register.

The sets may be fitted with all sorts of elaborate tuning arrangements, but one has only to observe the effect on their selectivity of the use of a good moving-coil speaker reproducing up to, say, 8,000 cycles, or over.

This seems to throw a rather interesting sidelight on the question of selectivity and quality, and will doubtless be of interest to your readers.

J. BAGGS.

Manchester.

## BAND PASS OR TONE CORRECTION.

Sir,—In his recently published article on Band Pass v. Tone Correction, Mr. Colebrook implies, if he does not actually state, that it is desirable to retain audio frequencies in an amplifier up to 10,000 cycles. Many others have taken almost as a *sine qua non* of good quality reproduction an upper frequency limit variously given as 7,000, 8,000 or 10,000 cycles. Mr. Colebrook is obviously dealing with the subject on the basis of things as they are and not as we would like them to be, and therefore I have the greater difficulty in understanding how he can regard with pleasure a characteristic substantially level up to 10,000 cycles. Broadcasting stations are spaced—apart from bargers-in—9,000 cycles, or 9 kc., apart. If, therefore, we have a receiver which accepts at practically full level up to 10 kc., and even if we grant that it cuts off like a guillotine right on that mark, we receive not only the station we want but two other stations at full strength, complete with rather more than one sideband each! Does Mr. Colebrook really enjoy that sort of reception?

Even if we cut down our response to 5,000 cycles, with a theoretically perfect cut-off at that point, we still get a 5,000 cycle modulation from the two neighbouring stations as strongly—or more strongly if there is any droop in the characteristic—as a similar modulation of the wanted station's carrier.

Apart from the selectivity question, I believe I am correct in stating that neither broadcast stations nor gramophone records give us any 10,000 cycle stuff to enjoy, so that all we gain is some more mush and scratch, if our loud speaker is capable of reproducing it (is it?).

With regard to the quality question, personally I confess without shame that an inequality of response level in the ratio of 2 to 1 fails to appal me. That is nothing to the tricks that the room plays on the response characteristic, and nobody the wiser. No, the reason I take care to avoid any such inequality is that the power the amplifier will handle without overloading, taken over the whole audio frequency band, is badly reduced by peaks of the 2 or more to 1 order. And the general public think that they are getting better quality, if a 10 per cent. peak is ironed out, so everybody is satisfied.

N. G. SCROGGIE.

Edinburgh.

Sir,—Mr. Colebrook's article on the subject of tone correction was read with great interest. With regard to his claims for the circuit described, there is one point on which I am not clear, and which perhaps has puzzled others of your readers.

A device producing similar characteristics has been in use on my set for the last few months as a tone control but not, however, with the idea of obtaining uniformity of response while still retaining good selectivity.

Presumably, the overall selectivity of a set tuned to a certain carrier frequency may be defined by the curve of sound output

from the loud speaker against frequency of interfering signal (the amplitudes of carrier and interfering signal being defined). In other words, the selectivity of a set depends not only on the characteristics of its radio-frequency portion but also on that of its audio-frequency portion.

It would appear, therefore, that any tone corrector which increases the high audio-frequency response relative to the middle and low frequency response must inevitably reduce the selectivity, contrary to Mr. Colebrook's claim.

Further, in the simple set considered in the article, would not a suitable increase of effective resistance of the tuned circuit produce precisely the same result as the insertion of the tone corrector (when adjusted to its critical value)?

London, S.W.12.

N. W. LEWIS.

Sir,—I have read with interest Mr. F. M. Colebrook's article on the subject of tone correction of a tuned circuit which cuts sidebands, and in this connection would draw your attention to British Patent No. 233417 of 1924 in which a device of precisely the same character is shown. It will be found on reference to this specification that the theory I gave is identical with that given by Mr. Colebrook in the appendix of his article.

In this connection it is possibly of interest to point out that the patent in question foreshadows the leading feature of Dr. Robinson's stenode device, though admittedly the case which was considered was only that in which reaction was employed.

The main argument in favour of tone correction of this kind appears to me to lie in the fact that the value of the interfering voltage at the grid of the detector valve is reduced to the utmost possible extent in comparison with that of the desired signal, the reduction of overall interference characteristic of such systems being thus a consequence of the different operation of the detector in the respective cases of strong and weak interfering signals.

P. W. WILLIAMS.

London, W.C.1.

## TALKS ON NATIONAL PROGRAMMES.

Sir,—The real case against talks in the twentieth century is that Caxton lived in the fifteenth. Popular education in 1931 is much better catered for in popular books (from sixpence a time) than the B.B.C. can ever hope to cater for it. Books have the advantage that they don't have to be printed in "The Listener"! The fact that the B.B.C. has found it necessary to print talks surely confesses the futility of talking them.

Southport.

R. N. WATSON.

## BROADCASTING HOUSE.

Sir,—I notice with regret that the B.B.C. do not intend to have an opening ceremony when they take over Broadcast House completely, but apparently intend to creep in to what will undoubtedly be one of the world's most wonderful buildings as if they were ashamed of it.

The opinion is often expressed that as a nation we are too modest about our achievements, and often lose trade as a result.

The B.B.C. will hardly be setting the rest of the country a good example by their modesty, and will merely help to keep this opinion of us alive.

It might be argued that national economy would not warrant the expense of an opening ceremony, but the cost would be small in comparison to the additional publicity given to broadcasting, all of which helps to make the public "radio-minded," and helps the B.B.C. and the trade generally.

I feel sure I am expressing the opinion of most listeners when I suggest that pressure should be brought to bear on the B.B.C. We may not always see eye to eye with them over the programmes, but few would deny the technical perfection of the transmissions, and we should like the world to know that we too have a new "Broadcast House."

H.R.H. The Duke of York is reputed to be a keen radio enthusiast. What could be more fitting than that he should perform the opening ceremony?

Kensington, W.14.

C. HADFIELD GALLOWAY.



# BROADCAST BREVITIES



*Radio-Barcelona claims to have the first lady control-room engineer in Europe.*

## An "Economy" Canard.

That was a good story about the B.B.C.'s wavelength economy scheme. It came just at the right moment, and must have convinced many old ladies that the Corporation was setting a worthy example to the country by showing overboard these costly wavelengths and keeping the good ship going on one.

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## What Mr. Ashbridge Said.

The truth is that Mr. Noel Ashbridge, on his return from a technical committee meeting at Brussels, let fall a few bland generalisations which the Press construed as an announcement of an impending repetition of the Newcastle synchronisation test on a grand scale, bringing the whole country into the sphere of operations. Mr. Ashbridge intended to convey no such impression.

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## Reshuffling the Wavelengths.

It is true that some such scheme has been discussed, but its execution depends entirely upon the attitude adopted by the other European countries at next month's meeting of the International Broadcasting Union in Rome. As already announced in *The Wireless World*, powers will be sought to revise the Prague Plan in a way which would widen the frequency separation between stations from 9 to 13 kilocycles. Such a step, which could only be taken by Governmental consent, would mean an extensive cut in the total number of wavelengths available and proportionate sacrifices by the countries concerned.

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## Countries That Need Dynamite.

The B.B.C., possessing nine exclusive wavelengths, is prepared to part with two if other countries will also play the game. Unfortunately, at least two of the most important broadcasting powers in Europe are squatting on their wavelengths like broody hens, and it will need dynamite to shift them. I doubt very much whether the necessary high explosive can be manufactured within the Union itself; it will have to come from the International Radio Conference at Madrid next year.

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## The Chief Engineer's Promise.

Meanwhile, Mr. Ashbridge gives the assurance that no further synchronisation experiments will be attempted in this country until after the Madrid Conference.

Which means that for this winter, at least, we are to be spared the era of "mush" reception which made Newcastle listeners froth at the mouth in August last.

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## 5SW's New Aerial.

Down at Chelmsford they are ready for winter storms. 5SW has discarded its old Franklin aerial and is now equipped with a second uniform-type antenna,

Harold French, who will appear in them with Isobel Elsom. The first will be comedy, but others will be on dramatic lines, as, for instance, historical *faux pas*, one of which is based on the French Revolution.

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## Could You Stand It?

The acid test of fortitude a few years ago was a night in the Chamber of Horrors at Madame Tussaud's. Now it is an hour alone with the Interval Signal.

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## Sunday Morning Broadcasts.

The B.B.C. is shrugging its shoulders at the suggestion that the air should be filled with music on Sunday mornings. Very few listeners, I believe, want broadcasts from the British stations before one o'clock on Sundays, but I think a good case could be made out for some light orchestral music to enliven the Sunday dinner.

It would help me to recover from the strain of listening all the morning to those forbidding Dutch sermons which my neighbour seems to like picking up from Hilversum.

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## Are the Announcers Overworked?

There are two or three announcers whom I find roaming Savoy Hill at all hours of the day, whether my visit is at ten in the morning or ten at night. Now nobody shows fatigue sooner than an announcer; he betrays himself at once, first by the tone of his voice, and secondly by slips of the tongue which no amount of apologising can cover up.

I suggest that whatever executive work an announcer is called upon to perform should be done *after* his studio work is finished. He should come fresh to the microphone.

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## Can Scotsmen Guess?

An original broadcast will take place in the Scottish region on October 17th, when an "Anonymous Symposium" will be given. In this symposium four unknown voices will discuss Present Discontents in Scotland. The voices belong to four Scotsmen, representing highly different points of view. There will be two main disputants and two interrogators, each interrogating from a different angle. All the speakers have broadcast on previous occasions, and listeners who think they recognise the voices are invited to send their guesses to Scottish Broadcasting House, 5, Queen Street, Edinburgh.

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## Send Your Old Set.

A radio bonfire is to be one of the features of Cardiff's Radio Week, from October 25th to 31st.

A competition is to be staged with prizes in the form of radio apparatus, and the "week" will culminate with an illuminated procession and a public bonfire of old wireless sets.

I must tell the man next door.

which can be brought into use by the throw of a switch. A correspondent, who is now probably suffering from eye-strain, tells me that this aerial has no fewer than 172 egg insulators.

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## A Crook Play.

Four crooks locked in a room should give us a thrill when a twenty-minutes' play, "Traitor," is broadcast on October 8th (National) and 10th (Regional). One of them is fearful of the consequences when the other three rogues discover, as they must discover, that he has betrayed them.

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## Famous Faux Pas.

On October 10th a new series, known as famous *faux pas*, will begin in the vaudeville programmes. They are written by

### FUTURE FEATURES.

**National (261, 301 and 1,554 metres).**  
OCTOBER 6TH.—"La Boheme," Acts 2 and 3, from Covent Garden.  
OCTOBER 7TH.—"The Little Ass," a Cornish comedy by Bernard Walke.  
OCTOBER 8TH.—"Traitor," a play.  
OCTOBER 9TH.—"The Ridgeway Parade—1 (new series), a song and dance show.

#### London Regional.

OCTOBER 4TH.—Religious service from Chester Cathedral.  
OCTOBER 5TH.—"La Tosca," Act 1, from Covent Garden.  
OCTOBER 7TH.—"The Ridgeway Parade."  
OCTOBER 8TH.—Vaudeville programme.  
OCTOBER 10TH.—"Traitor."

#### Midland Regional.

OCTOBER 9TH.—"All the Fun of the Fair," Cokernut Cameos by F. Morton Howard.  
OCTOBER 10TH.—City of Leicester Festival of Music.

#### North Regional.

OCTOBER 6TH.—Liverpool Philharmonic Society's Concert, from the Philharmonic Hall, Liverpool.  
OCTOBER 9TH.—"Drat the Girl," a play by Elizabeth Illingworth.

#### West Regional.

OCTOBER 5TH.—"The Immortal Hour," by Rutland Boughton.  
OCTOBER 7TH.—"Cindelectra," a tragedy of ancient Greece and modern civilisation, by Mary Diana Moigan and Sophocles.

#### Glasgow.

OCTOBER 10TH.—Mr. T. E. Maley: Eye-witness account of the Scottish League Association Football match, St. Mirren v. Aberdeen.

#### Belfast.

OCTOBER 4TH.—Service from St. Patrick's Protestant Cathedral, Armagh.

## READERS'

## PROBLEMS

Replies to Readers' Questions  
of  
General Interest.**Tone Control and Load Adjustment.**

A compensated output device, consisting of a suitably tapped choke shunted by a condenser and variable resistance, has often been recommended for use in conjunction with pentode valves. Can it be assumed that the matching of valve and loud speaker impedances is done entirely by the choke, and that the resistance-condenser device is purely for purposes of tone control?

No; not entirely. Matters are so arranged that the load is adjusted to a suitable value at a relatively low frequency by the action of the choke. The condenser does not come into action to any appreciable extent at these low frequencies, but becomes operative when higher frequencies are dealt with, and ensures that the load shall be maintained at a reasonably correct value.

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**Compensating for Sideband Loss.**

I should like to try the method of tone correction discussed in an article in your issue for September 2nd, but am unable to obtain an air-cored inductance of 240 millihenrys. My dealer says that he can supply me with two H.F. chokes, each with inductance values of 120 millihenrys, and with a D.C. resistance of 350 ohms; would these chokes be suitable if connected in series, and would the D.C. resistance be excessively high for the purpose?

If the chokes are made by a reputable manufacturer, and can therefore be depended upon to have the inductance value stated, they would be quite suitable for this purpose. Their D.C. resistance is of little account, as even with a total of 700 ohms it will be necessary to add a resistance in series.

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**An Inefficient Earth?**

I find that the performance of my receiver is entirely unaffected whether the earth lead is connected or not. As an earth terminal is not provided merely for show, I suppose that this indicates a fault, and would like to have your comments.

If your set is operated by the mains—particularly D.C. mains—it will be more or less effectively earthed in any case; and it is conceivable that an extra earth connection, even if fairly efficient, would make no appreciable difference. But if it is of the battery-operated variety, there is no natural earth connection, and so the effect you describe would suggest that your earth is highly inefficient. Perhaps the lead is entirely disconnected.

**D.C. to A.C.**

Our supply system is shortly to be changed over from direct to alternating current, and I should like to know if it would be possible to use the smoothing and voltage-regulating arrangements of my present D.C. high-tension battery eliminator by fitting a rectifier unit (preferably of the Westinghouse metal type).

If possible, I should like to avoid the need for altering any of the components.

Assuming that the smoothing arrangements included in your eliminator are capable of dealing with the output of a rectifier, it should be possible to convert your eliminator for A.C. operation, but a little care will be necessary in order to avoid the need for changing any of the component values; it will be essential that the rectifier output voltage should

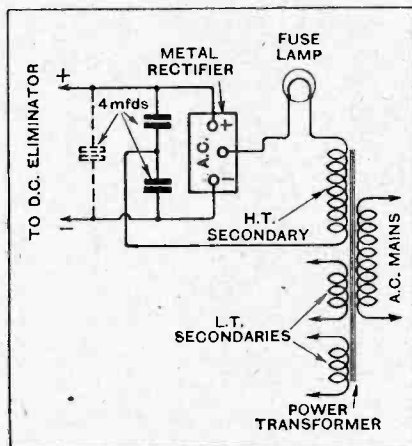


Fig. 1.—A rectifier unit for use in conjunction with existing smoothing and anode feed circuits.

be equal to that of the original D.C. supply. If it is not a series resistance may be inserted to absorb the surplus voltage.

In the accompanying diagram (Fig. 1) we show an appropriate form of connection, using either the Westinghouse H.T.7. or H.T.8 unit. Your choice will, of course, be governed by the requirements of the set in the way of anode current.

Technical enquiries addressed to our Information Department are used as the basis of the replies which we publish in these pages, a selection being made from amongst those questions which are of general interest.

As an alternative to the use of a series resistance (not shown in the diagram), you could, guided by information supplied by the makers of the rectifier, apply an A.C. voltage of suitable value to give approximately the rectified output voltage required.

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**How it Works.**

I cannot understand how the frequency changer of the Super-Selective Six works. The oscillator is apparently coupled to the input of the I.F. amplifier, but I always understood that the signal must be combined with the local oscillations before the first detector, not after. Can you tell me whether I am wrong, or whether there is some point in the circuit which I have missed?

You are quite right; the signal and the local oscillations must be combined before rectification, or there would be no beat note for the I.F. amplifier.

With anode bend detection the action is really that of a diode rectifier preceded by an H.F. amplifier. When the oscillator is coupled to the grid circuit, therefore, both the signal and the local oscillations are amplified, and appear in the anode circuit, where rectification takes place.

In the Super-Selective Six, however, the oscillator is coupled to the anode circuit of the detector; the signal only is applied to the grid of the valve, and is amplified to appear in the anode circuit. It is then combined with the local oscillations and rectified.

The action is at first sight complex, but you have been led astray by not realising that with anode bend detection rectification takes place in the anode circuit, and not in the grid circuit.

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**An Automatic Safeguard.**

During the last six months I have twice found it necessary to replace my indirectly heated output valve through failure of its emission. This valve is biased by means of a resistance in series with its cathode lead, and I am wondering whether the failures are in any way due to the fact that there was an intermittent disconnection in the resistance; this has only recently been discovered.

It is impossible that an open-circuited bias resistance could cause damage to the valve in this way. True, when the resistance becomes open-circuited, negative bias is no longer applied to the grid, but the anode circuit itself is simultaneously interrupted, and so current cannot flow in it.