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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.

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HIGH-FREQUENCY AMPLIFICATION.

Where We Stand To-day.

THE importance of high-frequency stages in broadcast receiving apparatus in this country will undoubtedly be emphasised as soon as the stations of the Regional Scheme begin to come into operation. Brookman's Park, the first of the regional stations, we now learn will commence an hour's transmission every night at the close of the normal 2LO programme as from September 16th, and it will not take long, we think, to convince those whose present receivers are unselective, or who lack a high-frequency stage capable of giving good selectivity, that a change of receiver or substantial alterations to their existing sets will be necessary. After four weeks of more or less experimental transmissions it is anticipated that Brookman's Park will be ready to take over from the Oxford Street transmitter 2LO, and the latter station will then close down. The alternative transmission from Brookman's Park, when two programmes will be radiated from the same transmitter, will probably come into operation at the end of the year.

Progress in H.F. Amplification.

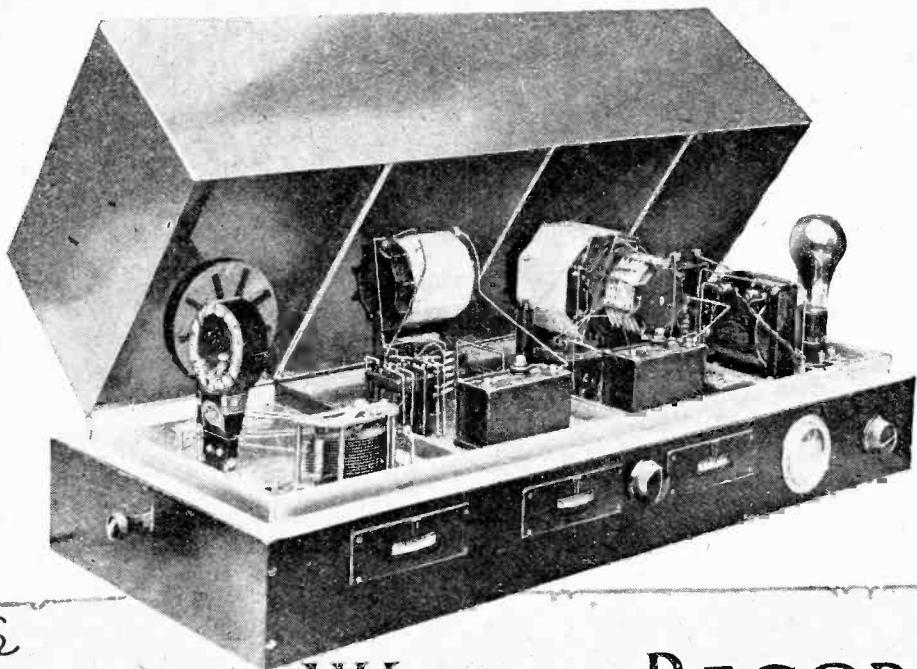
It is in the direction of increasing high-frequency amplification that the greatest progress has been made in connection with the design of receivers for broadcast reception during the past twelve months. The series of receiver designs now appearing in *The Wireless World* establish new records in sensitivity and selectivity. The valve manufacturers have devoted much attention to producing screened high-frequency valves for both mains or battery operation, some having, as we have seen from information published in *The Wireless World*, astonishing characteristics. It is by designing the H.F. stage around these valves that it has been possible to obtain the degree of amplification which reaches the high-water mark in *The Wireless World* "Record III" described in this issue.

The series of receivers now being described in this journal are indebted for performance to the incorporation of many of the technical points introduced to the wireless public through articles which have appeared in the pages of the journal during the past few months. Readers will recollect the care with which questions of complete screening, decoupling schemes, and the design of H.F. transformers have been discussed and explained by various contributors. We must admit that making the most of these points, so as to attain the utmost in efficiency, entails great care not only in design but also in the final execution by the constructor.

New Season's Sets and the Regional Scheme.

The changes which the introduction of the Regional Scheme will bring about in the conditions of reception in this country will, we believe, be reflected in the design of receivers which will be on show at the forthcoming Olympia Exhibition, and we would be inclined to prophesy that the price of sets suitable for use under the Regional Scheme will not show a reduction as compared with sets of last season.

To justify this statement we must explain a little more fully what is meant. The Regional Scheme demands that receivers should be far more selective than has been necessary in the past, and in order to achieve this increase in selectivity it becomes necessary to employ two H.F. stages, or, if one H.F. stage, then additional tuning equipment must be included. This in itself seems to indicate an increase in the number of valves over what has been necessary in the past, whilst we must also take into consideration that, from a manufacturing point of view, the production of sets embodying efficiently tuned H.F. stages entails a great deal of additional work, and these points we can hardly expect to be introduced without affecting the selling price of the receivers.



The WIRELESS WORLD RECORD III

The Highest H.F. Stage Gain Yet Attained.

By A. L. M. SOWERBY, M.Sc., and H. F. SMITH.

THE advances that have been made in valve design in the last year or two, together with an increasing appreciation of the best mode of making use of them in a receiver, have made it possible to produce a three-valve set that gives a performance quite equal to that of the very best four-valve receiver of a year or two ago. The single H.F. stage gain of 500, which is claimed, is unprecedented.

To attain this high efficiency, however, while at the same time keeping the quality of reproduction well up to the requirements of modern standards, it is absolutely essential to employ the most highly efficient valve obtainable, and to pay the very closest attention to the reduction of all sources of loss in the high-frequency circuits. Apart from these two points the design of a receiver may well follow established practice, so that its construction need offer no greater difficulties than are associated with the careful building of any other set.

It will not be news to any regular reader of *The Wireless World* that valves with indirectly heated cathodes are of higher efficiency than those of normal type, while it is also well known that the "short-path" type of construction, in which cathode, grid and plate

are all very close together, also adds considerably to the amplification attainable from a valve. For these two reasons the Cosmos A.C. type valves, which are intended to be heated, through a step-down transformer, from alternating current mains, and which employ the "short-path" construction, have been chosen for this receiver, which sets out to reach the high-water mark of attainable amplification. The receiver, of which photographs and diagrams accompany this article, has been designed to suit these particular valves, and though it is never fair to a set to use in it valves other than those for which it is designed, in the present case it would result in a complete failure to reach the expected standard of sensitivity.

The ideal receiver has long been known to be that in which the bulk of the amplification necessary for the reproduction at loud speaker strength of signals from distant stations is performed before rather than after the detector. Detectors in general, and the anode-bend detector in particular, such as is used in this set, has some approach to a "square-law" response curve, in that the signal-strength, expressed in terms of volts of rectified audio-frequency, is more or less proportional to the square of

The Wireless World established a record with the three-electrode valve by obtaining an H.F. stage magnification of 40 : The Wireless World Record III set, described in the accompanying text, gives no less an H.F. stage magnification than 500, thus setting a new standard in receiver design. With a balanced screen-grid amplifier and three A.C. valves, the most advanced practice in radio design is represented.

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the high-frequency voltage applied to the detector. As a result of this, an amplification of ten times at high-frequency adds, very roughly speaking, as much to the signal-strength as an amplification of a hundred times at low-frequency. Since an amplification of, say, 30 to 40 times in a single high-frequency stage is quite easily attained, while it is impossible to make a stage of low-frequency amplify by the equivalent 900 or 1,600 times, it is going to pay us to amplify as much as possible before rectification and as little as need be afterwards.

It is not possible, at present, to make the detector valve operate the loud speaker, so that in any receiver, even if this view is carried to its logical conclusion, the detector will have to be followed by a suitable output valve; there will, however, be no low-frequency amplifier between the two.

One and Two H.F. Stages Compared.

Until recently it has not been possible to dispense in this way with low-frequency amplification while still retaining sensitivity enough to receive distant stations at good strength on an aerial of only moderate excellence except when two stages of high-frequency amplification could be used to make up the necessary input to the detector, for with only one stage it is not usually possible to amplify the small signal-voltages from distant stations to a sufficient extent. Though there is no reason whatever why two stages should not be employed, it does undoubtedly necessitate the use of very extensive screening, and in addition there still lingers the old belief, though there is no longer very much justification for it, that two stages are very difficult to set up and adjust. Those, however, who have had the opportunity of handling a two-stage set such as the "Kilo-Mag Four" will realise

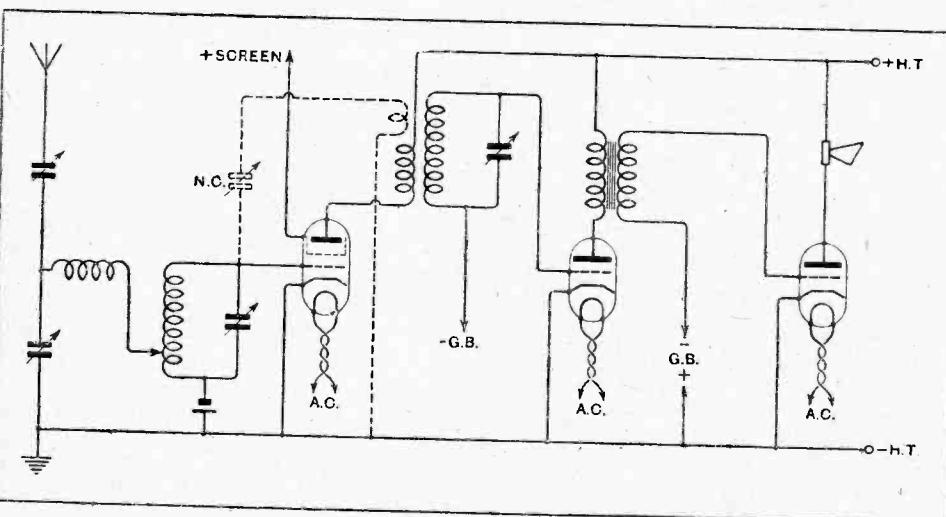


Fig. 1.—Simplified circuit diagram without decoupling devices, screening, waveband switching, etc.
The neutralising circuit is shown in dotted lines.

the truth of the suggestion already made that a receiver in which the bulk of the amplification is done at high-frequency takes a good deal of improving upon.

By the use of an indirectly heated screen-grid valve of exceptionally high efficiency in the receiver here

described, a close approach to the very desirable characteristics of a receiver containing two high-frequency stages has been attained, while employing a single stage only. It has not been possible, even by the elimination of all sources of loss that were open to removal by simple means, to push the amplification of the single stage quite up to that attainable by two ordinary stages in cascade,

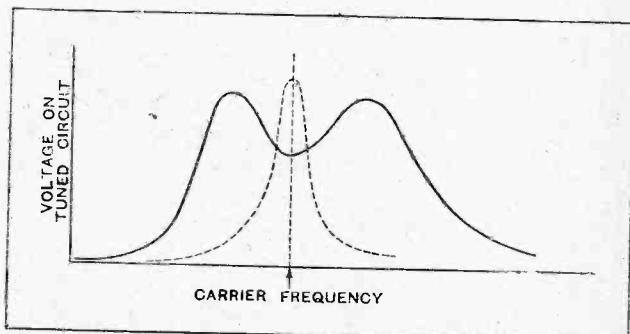


Fig. 2.—The joint resonance curve of the first two (coupled) tuned circuits is of the type shown in full line, accentuating the side-bands. The interval coupling has a resonance curve of the type shown by the dotted line.

but the use of indirectly heated valves in the detector and output positions goes far to camouflage the difference that still remains.

Reference to Fig. 1, in which is shown the circuit diagram of the receiver shorn of all such trimmings as waveband switching, will show the main lines along which the receiver has been built, and will be used as a basis for the discussion of the salient features of the design.

The first information yielded by a glance at the diagram is that three tuned circuits are employed, and that, since the detector operates on the anode-bend principle,

no provision is made for reaction. The use of an anode-bend rectifier, in conjunction with a tuned circuit of the lowest attainable losses, makes the use of reaction completely unnecessary. The sole legitimate purpose of reaction is to keep the losses in the detector grid circuit down to a low value over the whole tuning range, nullifying the damping due to a grid rectifier, if such is used, and making up for any undue natural losses that the tuned circuit may possess owing to its slovenly design or construction. In the present receiver these same results are attained, once for all,

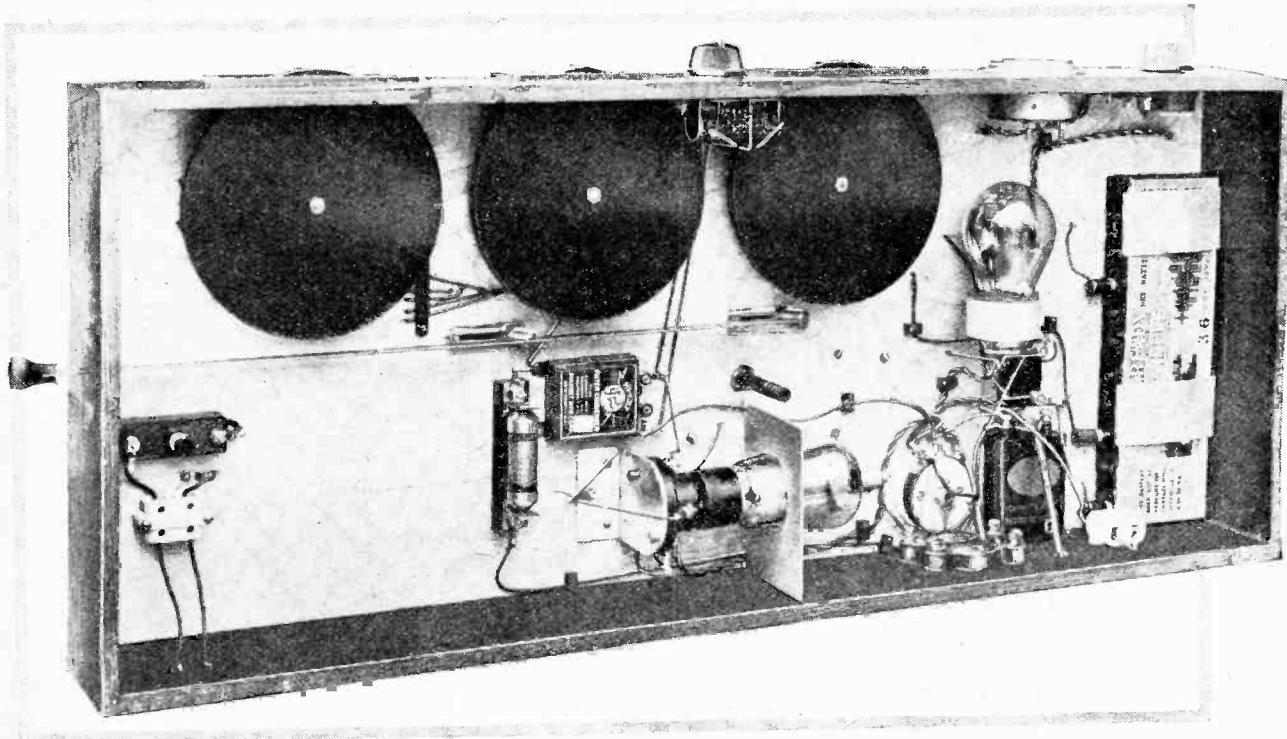
in the building of the set; the grid-circuit of the detector has been designed for the lowest losses compatible with quality, taking into consideration the slight damping due to the anode detector.

Apart from the fact that the reaction control is always

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an irritation, in that its setting depends on the operating voltages applied to the detector valve, and bears no rational relationship to the wavelength of signals being received, its disappearance has made it possible to introduce a third tuned circuit in the form of a loose-coupler without exceeding the usual number of three operating controls. As a result the selectivity of the receiver is raised to a standard that is, if anything, higher than

waves. In order that there shall be no coupling between the coils other than that intended, the coils are screened from one another by being placed in separate compartments of the screening-box. Without some precaution of this sort most of the benefit conferred by the extra tuning control is lost. Complete screening at this point is, strictly speaking, unnecessary, but it is quite essential between grid and plate circuits of the H.F. valve. After extended trials with conventional methods of construc-



View of the components attached to the underside of the baseboard. On the right can be seen the decapped detector valve in a special mounting which can be modified to accommodate individual bulbs.

that of a set of the 2HF class, and it is handled in exactly the same way.

Aerial and secondary coils are coupled by making a few turns of the grid-winding common to the aerial circuit on long waves, and by winding over the secondary a few turns in series with the aerial coil on short

tion the writers decided to have the set rebuilt in a standard container of the type advocated in this journal—not because stability was unattainable with an ordinary layout, but because its realisation involved so many constructional complications that the set was by no means easy to build.

The fact that the rebuilt set proved satisfactory from the outset would seem to promise well for the future of the new containers; at any rate, the writers are now fervent advocates of this method of construction, as they are satisfied that it affords the easiest way of attaining maximum amplification without instability.

It might be thought that the introduction of the third tuned circuit would result in accentuating to an intolerable degree the loss of high notes that occurs when tuning is over-sharp. As a matter of fact, this is not the case, for when two tuned circuits are coupled together directly, and not through a valve, their resonance curves are no longer independent. As a result, a new type of resonance curve, of the type shown in full line in Fig. 2, makes its appearance. This curve, which is the joint resonance curve of the two circuits, has two maxima situated one on each side of the carrier frequency of the station being received, and so produces

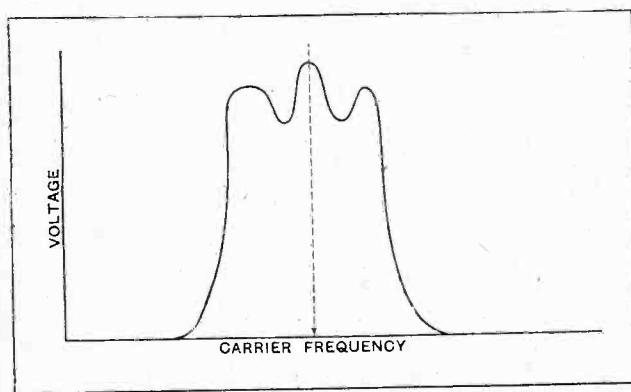


Fig. 3.—This gives the resultant of two curves such as those to Fig. 2, and shows how the use of coupled circuits tends to decrease high-note loss due to cutting side-bands, while improving the overall selectivity.

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accentuation of the side-bands at the expense of the carrier. In distinction to this, the intervalve circuit provides a normal resonance curve accentuating the carrier at the expense of the side-bands, as indicated by the dotted curve of Fig. 2. The resultant of the two curves, which represents the overall high-frequency response curve of the receiver as a whole, takes some such form as that shown in Fig. 3. This, while by no means perfect, yet makes a closer approximation than is usually attained to the ideal flat-topped curve that would represent high selectivity with no loss of side-bands.

In accordance with this it is found that the receiver combines high-note reproduction with selectivity to an unusual degree. Quantitative figures in this respect cannot usefully be given, as the position and magnitude of the maxima of the double-humped curve vary with the tuning of the aerial and secondary circuits.

Detector Considerations.

The choice of an anode detector, which we have seen to be necessary if we wish to provide the maximum selectivity with the minimum number of controls, presupposes that the amplification at high-frequency shall be great enough to provide that valve with the rather high input-voltage that it requires for satisfactory rectification. The present receiver does not fail in this respect since, as has already been indicated, the amplification it provides in its single stage approaches closely that normally associated with two stages of well-designed high-frequency amplification.

The design of the high-frequency stage for the broad-

cast wave-band has already been outlined in an article by one of the writers,¹ and to this is referred any reader who is interested in the technical details of the intervalve circuit used. The figures given in that article for

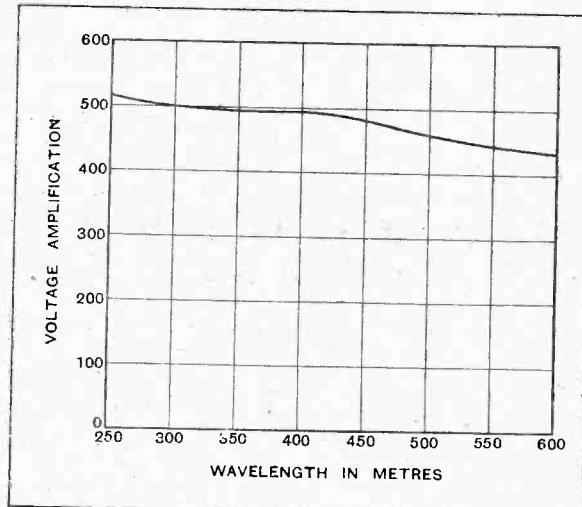


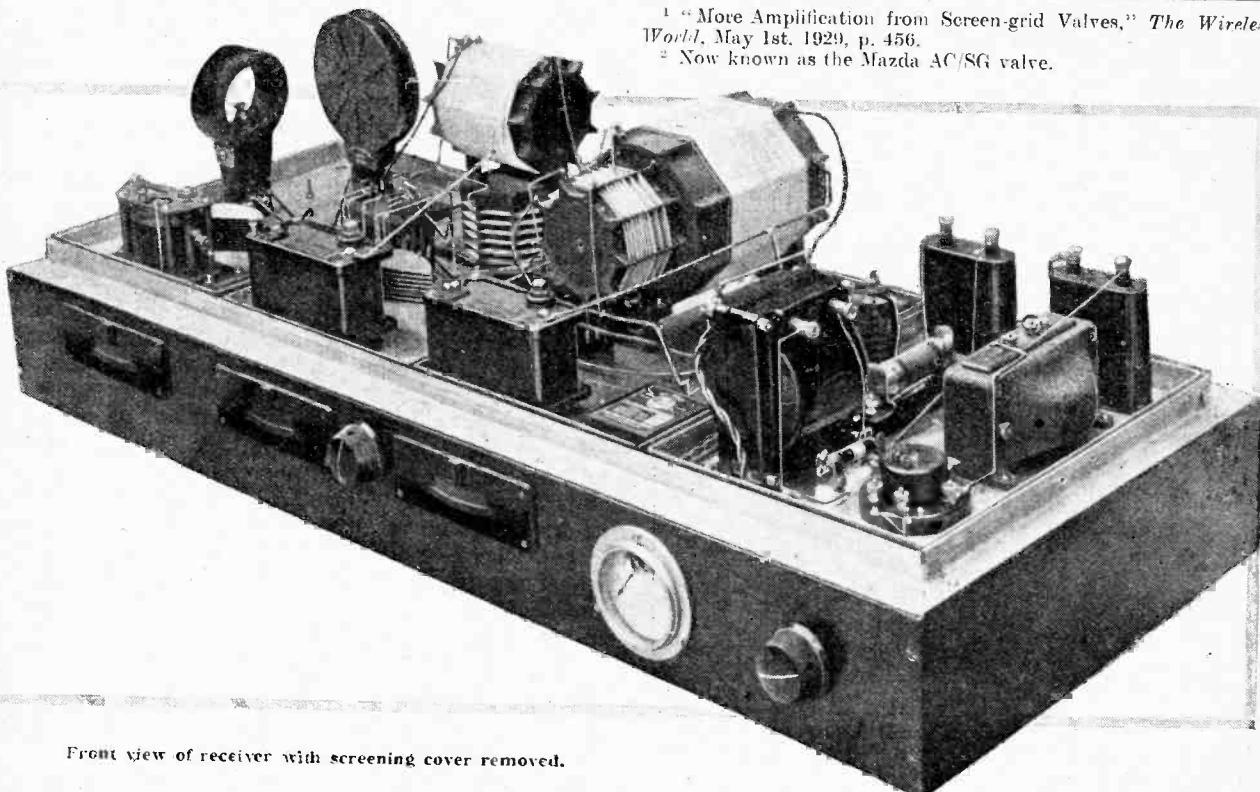
Fig. 4.—High and uniform H.F. magnification over the whole broadcast band is an outstanding feature of the receiver. The measured amplification is shown by this curve.

amplification, however, are wrong, being based on the characteristics of an early sample valve which was by no means up to the standard of those put on the market when the valve was released for general purchase.

Measurements made with three AC/S valves² that had

¹ "More Amplification from Screen-grid Valves," *The Wireless World*, May 1st, 1929, p. 456.

² Now known as the Mazda AC/SG valve.



Front view of receiver with screening cover removed.

LIST OF PARTS.

- 1 Variable condenser, 0.0005 mfd. (Lotus Log.).
- 2 Variable condensers, 0.0003 mfd. (Burndapl Log.).
- 1 Neutrovernier (Gamrell).
- 3 Fixed condensers, 2 mfd. (Ferranti C₂).
- 3 Fixed condensers, 0.1 mfd. non-inductive (Polymet).
- 1 Fixed condenser, 0.0005 mfd. (Dubilier No. G20).
- 2 Fixed condensers, 0.005 mfd. (C.D.M.).
- 1 Semi-variable condenser (Formo, Type J).
- 1 Switch, 4-pole D.T. (Utility Lever pattern).
- 1 Switch, 3-pole D.T. (Utility Lever pattern).
- 2 Single coil holders (Lotus).
- 1 Resistance, wire-wound, 10,000 ohms, and holder (Ferranti).
- 1 Resistance, wire-wound, 20,000 ohms, and holder (Ferranti).
- 1 Grid leak type resistance, 10,000 ohms (Loewe).
- 1 Grid leak type resistance, 100,000 ohms (Loewe).
- 2 Porcelain holders for above (Bulgin).
- 1 Decoupling resistance, 600 ohms (Wearite).
- 1 Potentiometer, 400 ohms (Igranic, porcelain).

- 1 Truvoll variable resistance, 50,000 ohms (Rothermel).
 - 1 Electrad Royalty resistance, 200,000 ohms (Rothermel).
 - 2 A.C. valve holders (Met-Vick).
 - 2 Porcelain 2-way connectors (Athol).
 - 1 Grid bias battery, 16½-volt (Ever-Ready).
 - 1 Single dry cell (Ever-Ready, "O" size).
 - 1 Ribbed ebonite former, 4in. dia. × 4½in. long (Redfern).
 - 1 Ribbed ebonite former, 3in. dia. × 3½in. long, 9 ribs (Becol).
 - 2 Ribbed ebonite formers, 3in. dia. × 2in. long, 9 ribs (Becol).
 - 1 H.F. Choke (Climax).
 - 1 L.F. transformer (Ferranti A.F.5).
 - 1 L.F. choke, 32 henrys (Pye).
 - 1 Meter, 0-2 mA. (Sijam).
 - 3 Wandler plugs (Lisenin).
 - 1 Special metal container.
 - 3 Special dials.
 - Ebonite, wire, Systoflex, screws, etc.
- Approximate cost, excluding cabinet, coils and dials, £10 10s.

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

been specially sent by the makers and stated to be average samples of those now on the market gave, on careful measurement, the following figures for the voltage

amplification of the stage when using the 1:1 transformer described and illustrated.

Wavelength.	Voltage Amplification.
250 metres	515 times
300 "	500 "
400 "	494 "
500 "	460 "
600 "	433 "

These figures are plotted as a curve in Fig. 4. They were taken under such conditions that reverse reaction due to the detector did not enter, so that in the receiver the amplification attained will be less. Since, however, these figures are chiefly of interest by virtue of the comparison they provide with other measurements of voltage amplification which have always been taken under the same conditions, the impression that they convey is strictly correct without taking this factor into consideration or modifying them in any way.

This high amplification is only attained when a determined attack on dielectric losses in the tuned circuit is made; for that reason the detector valve is decapped so that both the losses due to the valve-base and those due to the valve-holder are removed at one blow. If a valve is already to hand, the base may be loosened by a prolonged soaking in methylated spirit (about 48 hours is required). When the base is felt to be loose, the wires leading to grid, plate and cathode pins may be cut where they come through the base, and the tips of the heater-pins, to which their wires are soldered, may be cut off with cutting pliers. After straightening the wires, if it appears necessary to do so, the base may be gently removed. Connection is made to the five wires remaining by soldering, being careful that the hot iron does not touch the glass. The valve is supported in position, as shown in the photograph, by a metal clip lined with sponge rubber. This

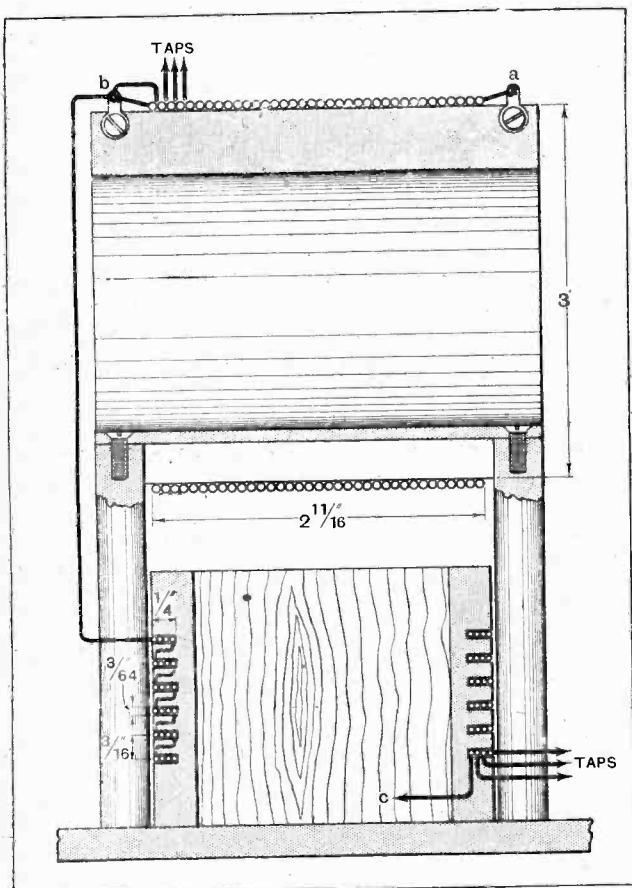


FIG. 5.—Winding data of grid coils wound on 9-ribbed 3" ebonite former. Medium-wave coil 70 turns 27 1/2 Litz. The four coupling turns shown tapped are of No. 32 D.S.C. Each slot of the long-wave former carries 35 turns of No. 32 D.S.C.

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is bolted to the under side of the base, the clip being earthed to the metal screen through the bolt. The precaution of earthing all metal parts, even to the cases of the paper condensers, has been taken throughout the set; in nearly every case the fixing screws do this automatically, though a spot of solder has been added for luck at a few points.

With an amplification rising to over 500 times even the extremely effective screening of the AC/S valve is not sufficient to provide stability, and it has therefore been found necessary to introduce neutralisation. Owing to the fact that the scheme of neutralisation adopted, which has the advantage that it permits the use of standard components, does not provide a perfect bridge, it was found necessary to cut down all possible sources of instability to the minimum in order to ensure that a balance could be found that will hold over the whole tuning range. To ensure, further, that the setting of the neutralising condenser should not depend on the magnitude or position of the aerial, or on the length of the loud speaker leads, some care has been taken in preventing the emergence of high-frequency currents from the compartment containing the output valve. The precautions shown are completely effective in this direction.

The design of the tuned circuits for the upper wave-band is something of a compromise. If any attempt is made to reach the highest attainable amplification, the attenuation of side-bands by sharp tuning becomes great enough to spoil quality completely. If

losses are introduced into the coils to remove this effect, selectivity becomes very poor before the side-bands are completely restored. The writers have not been able to hit upon any compromise between these three conflicting factors that improves in any respect on the long-wave transformers used in the "New Kilo-Mag Four," and both grid-coil and intervalve transformer are "lifted" bodily from that set without alteration save that the positioning of primary with respect to secondary

in the transformer is altered to facilitate neutralising. Inspection of the full circuit diagram will reveal the fact that the switching from one wave-band to the other has been arranged in such a way that, while high-frequency losses may be introduced on the upper wave-band

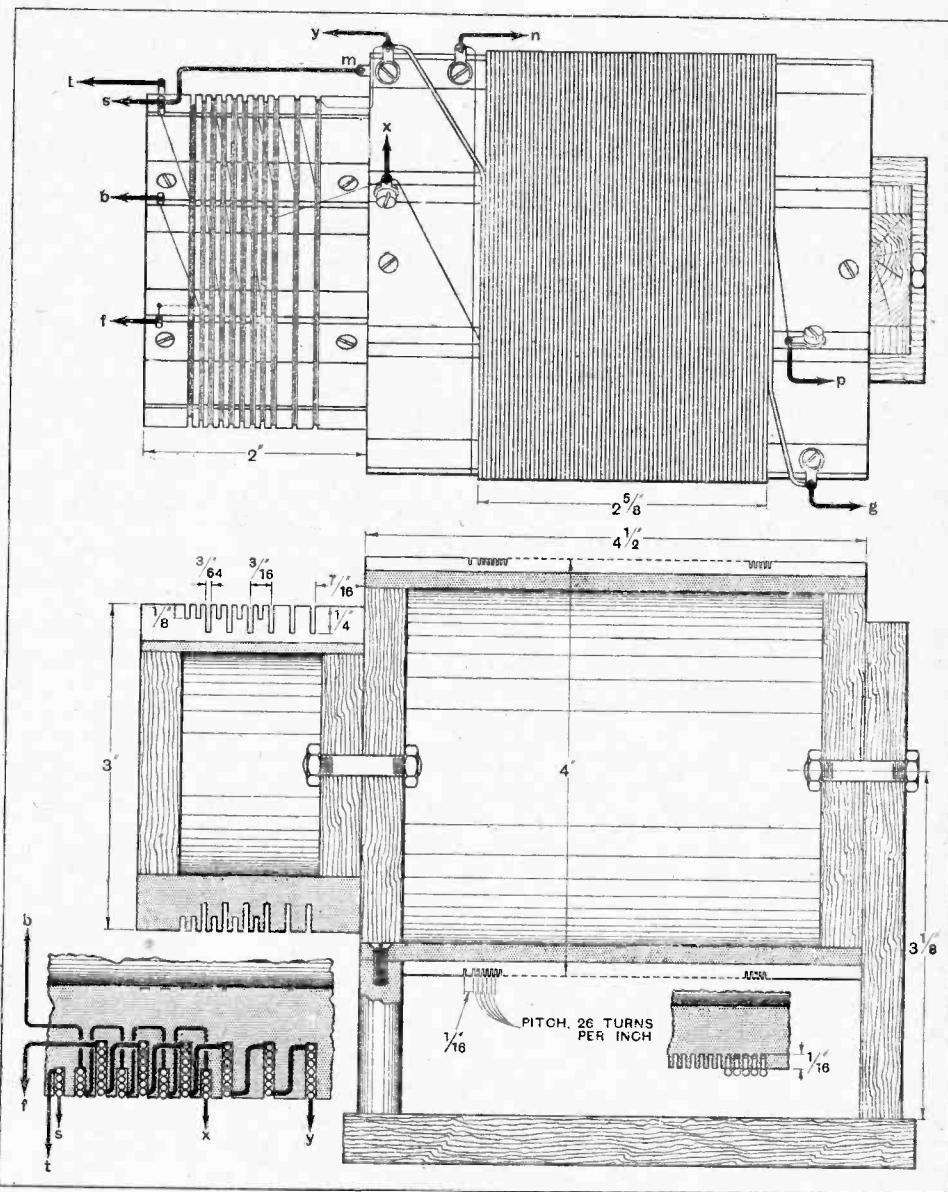


Fig. 6.—H.F. intervalve transformers. Medium-wave coils wound on 4", 8-ribbed former. Primary 68 turns No. 40 D.S.C.; secondary 68 turns 27 42 Litz; neutralising coil, 1 turn No. 40 D.S.C. Long-wave coils on 3", 9-ribbed ebonite former. Primary 4 sections each of 35 turns of No. 40 D.S.C. Secondary 35 turns No. 32 D.S.C. per slot. Neutralising coil 6 turns No. 32 D.S.C.

where they are welcomed rather than otherwise, on the lower band no additional losses are involved. The neutralising arrangements are such that no readjustment of the neutralising condenser is required on changing over from one wave-band to the other.

There are two volume-controls on the receiver; one deals with the received signals before they are rectified, and one after rectification. The former consists of a means of varying the voltage applied to the screening

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grid of the high-frequency valve, whereby the amplification that it provides can be varied over very wide limits. In this way it is possible to ensure that the detector valve is working under the best possible conditions, at least whenever a station giving loud signals is being received.³ As the detector, when working at its best, gives rather too large an output for the last valve to handle, a second volume control is advisable, and in this receiver it takes the form of a variable resistance shunted across the transformer primary, which results in a slight increase of high notes in the output, thereby counteracting any loss of side-bands that still remain in the tuned circuits. By suitable adjustment of the two volume controls, signals of high quality may be had from stations at varying distances. As an aid to estimation of the strength of signals at the detector, a

³For a full discussion of this point see "The Valve as an Anode Bend Detector," *The Wireless World*, March 13th and 27th, 1929, pp. 279 and 326.

milliammeter connected in its plate circuit is mounted on the panel of the set so that the deflection produced by tuning in a station may be read. It is not considered necessary to have a meter in the plate circuit of the output valve as an indicator of overloading because this can quite well be detected by ear.

It is the high efficiency of the indirectly heated valve that has made it possible to employ a transformer in its plate circuit in spite of the fact that it has an amplification factor of 35. As a result of its high amplification factor, the detector requires to operate it a smaller signal voltage than a corresponding battery-heated valve, and this, combined with the small output that it has to give to provide the last valve with all the signals it needs for operating the loud speaker at full strength, makes up to a large extent for the fact that the amplification of the single high-frequency stage does not quite come up to the standard of two ordinary stages, and renders not unreasonable the comparison of the present receiver with a 2-H.F. set of more usual design.

(To be concluded.)

TRACING INSTABILITY.

Checking the Effect of Small Improvements.

IT is by no means uncommon for a newly built receiver embodying a high-frequency stage to insist upon oscillating whenever the two circuits are brought into tune with one another. If this instability is due to one single cause it is generally easy enough to trace, for one may try removing one possible cause after another until the culprit is found. It is in cases where the persistent oscillation is due to two or more separate causes, each contributing its share to the instability, that the task of eliminating the trouble and persuading the receiver to behave properly offers the greatest difficulty.

Let us suppose, to take a very simple example, that the instability is due to a failure of the screening boxes to make good contact, this bad contact existing in three separate places in the screening system. If the offending edges are held up into position one at a time there are always two edges left making the bad contact, and the improvement made by sealing up the one edge will not be enough to render the set stable. If each of the three edges are tried in turn it would be very easy, since oscillation cannot be stopped by holding up any of them, to conclude that the screening is guiltless, and that the unwanted feed-back must have some other source. Much time and ingenuity may then be spent in trying to stabilise the set without success.

For such a task as this we want to be able to detect the small lessening of the tendency to oscillate that is brought about by closing up the edges separately, so that the contribution of each to the total of feed-back may be estimated, or at least detected. One is then put on the right track at once.

The roughly quantitative estimation of the tendency to oscillate may be made by connecting a grid-leak in parallel with the first tuned circuit as a damping resist-

ance, and finding by trial the lowest resistance that can be used without stabilising the set. With this in position and the receiver just, and only just oscillating when critically tuned, any lessening of feed-back brought about by closing temporarily one of our hypothetical bad joints can at once be detected by the cessation of oscillation. The alteration made then becomes permanent, and a new value of damping resistance, which will, of course, now be greater, is found, so that the original condition of critical instability is again attained. Closing up the second doubtful joint once more stops oscillation, and once again the improvement is made permanent, so that a still larger resistance is needed across the first tuned circuit to prevent oscillation. With the third bad joint closed it is found that the damping resistance can be removed entirely without incurring instability, and the problem is solved.

This mode of procedure is, of course, as applicable to instability arising from battery coupling or any other source, and provides a means of systematic attack on a difficulty which may well refuse to yield to less careful methods.—A. L. M. S.

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OCEAN STOCKBROKING SPEED RECORD.

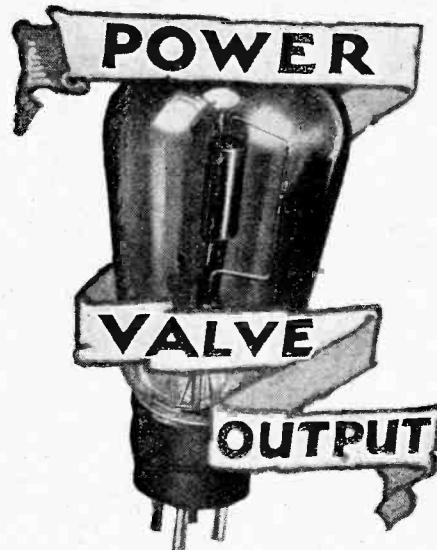
ONLY $2\frac{1}{2}$ minutes after a passenger on the White Star liner *Majestic* had handed in a request for a special stock quotation he received a reply from his brokers in New York. This is one instance of the efficiency of ocean stockbroking service on board the White Star liner *Majestic* on her latest voyage from New York to Southampton. Special Marconi equipment has been installed to provide the necessary facilities for this service without interfering with the normal wireless work of the ship.

WITH the increasing use of valves capable of giving greater and greater power output from a valve amplifier or radio receiver, the whole question of valve output is coming to be considered more and more by the amateur. There is, unfortunately, still a large section of the public who have to consider the most economical drain in current they can obtain from their source of anode supply, which is very often a dry battery, and the unfortunate valve manufacturer is still being asked in many quarters to provide a valve which will give a considerable undistorted output, with the condition laid down that it shall take little current from the H.T. battery.

As an intelligent interest in the proper use of the source of high-tension supply, in conjunction with a suitable valve, is undoubtedly growing, a few notes on this subject may be of use. The whole idea of what a power valve really is seems to be rapidly changing, when we recollect that only a few years ago the D.E.5 and its equivalent types were considered in this class and used for output purposes.

With the increasing use of loud speakers requiring more and more current to operate them, it was soon found that the normal anode current of the D.E.5 working under maximum conditions, namely, about 6 milliamps., was quite insufficient for the purpose. This led to the introduction of a modification in the D.E.5 type of valve by means of which a much larger current could be drawn from the anode battery, but, unfortunately, owing to the limited technique of valve design at that period, the modification of the valve to provide more anode current led also to a very big drop in the voltage magnification obtainable, and a much bigger input to the valve was now required. Such a valve as the D.E.5A class rapidly became very widely used by those anxious to obtain as large power output as was possible at that time without having recourse to excessively high anode voltages (see Fig. 1).

Simultaneously with the D.E.5A, the same change was occurring in valves designed for higher anode voltages, and we had the development of the L.S.5A, also capable of producing a much larger anode current



Comparative Figures for Undistorted A.C. Energy Obtainable from Typical Output Valves.

By F. E. HENDERSON, A.M.I.E.E.
(*Of the G.E.C. Technical Staff*).

energy. An interesting chart showing the improvement in overall efficiency of power valves in the 2-volt range is shown in Fig. 4, and is indicative of the development which has been taking place slowly in filament efficiency and electrode design.

It is, however, becoming more and more realised that the chief requirement of the output valve in an amplifier is its capability of producing a large undistorted A.C. power output and incidentally dealing with a considerable heat dissipation at the anode. If we could combine this property with that of high electrical efficiency, or mutual conductance, we should have an ideal state of affairs; but this is not always possible, as the requirements of high anode dissipation or high mutual conductance respectively call for entirely different features in valve design. The requirement of a power valve is its capability of producing a large A.C. component of the H.T. supply, and the response of the loud speaker is principally dependent upon the A.C. watts developed in its windings, which is roughly the product of the A.C. current and the voltage developed across the windings.

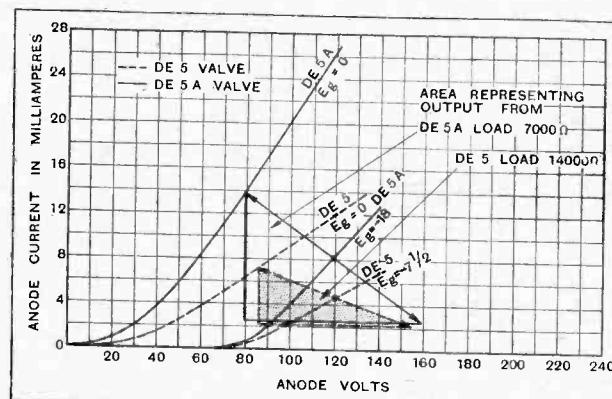


Fig. 1.—Diagram showing comparative outputs from D.E.5 and D.E.5A valves working at an anode voltage of 120.

Power Valve Output.—

permitted by that class of valve if the maximum power output is to be obtained.

To arrive at a useful indication of the undistorted power output we can utilise the above expression in the following manner:—

Consulting the anode current - anode volt characteristic of the valve in question, we can determine the negative grid bias which will give the anode current for the anode voltage specified as the maximum permissible for that particular valve by the makers. Sometimes, instead of maximum anode current for a given maximum

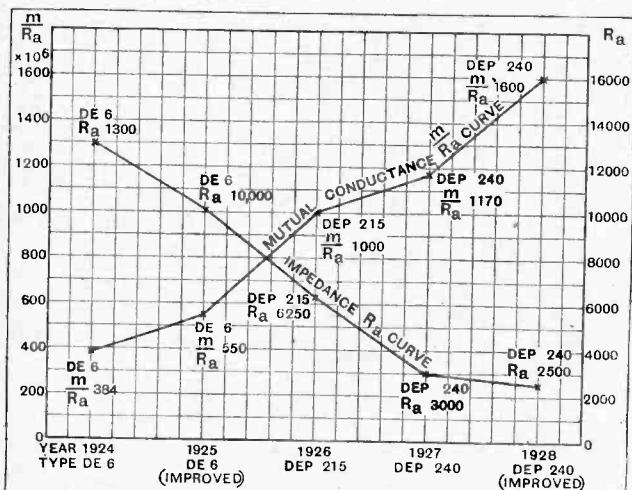


Fig. 4.—Improvement in two-volt power valve characteristics is here shown as a chart. The remarkable rise in mutual conductance is due to greater filament efficiency and attention to electrode design.

anode voltage, the maximum permissible anode dissipation in watts is specified. If this is so, the desired anode current can always be obtained by the expression:

$$\text{Anode current} = \frac{\text{watts dissipation}}{\text{anode volts}} \times 10^3 \text{ milliamperes}$$

Given this fixed point on the curve as a centre, it is possible to draw a straight line to cut each grid voltage curve; this line should be extended in the upward direction as far as $E_g=0$ if the valve is to receive full modulation—that is, maximum permissible grid swing. This is, of course, assuming that no grid current commences to flow until E_g becomes positive. For absolute distortionless output the swing of grid volts on the negative side of the bias point should be exactly equal to that on the positive side, and should give rise to exactly equal swings in anode current.

With very low impedance, low m valves, this is not always so until the slope of the line drawn becomes

exceedingly flat, and even then anode distortion may be present. The slope of this line represents the impedance of the load (R_L), and this impedance should be chosen so that the valve is delivering the maximum power output with the minimum distortion allowable.

It is usually necessary to assume a small percentage of distortion; owing to the fact that opinions may vary as to the amount of distortion permissible, it is impossible to arrive at any hard-and-fast figure for the undistorted A.C. output for any valve. Such a figure must necessarily be based on an assumption which may vary in individual cases. With power valves, we cannot then assume the load impedance twice that of the valve impedance; with the minimum of anode distortion it will usually be much higher than this figure, and as we reduce the percentage of anode distortion the power output from the valve will gradually diminish.

Although it will now be appreciated from the above that actual figures to represent the undistorted output or A.C. power developed in the load cannot be taken as definite in the same way as can the figures representing the static characteristics of the valve, yet it may be useful for the purpose of comparison to see how certain valves compare with each other in respect of the output they can deliver.

The following table is therefore given, which is intended merely to serve as a basis of comparison between different classes of valve.

VALVES OPERATED AT MAXIMUM ANODE VOLTAGE.
(Figures for load impedances quoted are assumed for greatest undistorted output.)

Type of Valve.	Anode voltage.	Load impedance assumed. Ohms.	Undistorted A.C. power output.
D.G.P. 215	150	11,500	0.15 watts
D.E.P. 240	150	7,000	0.36 "
P. 125	150	5,000	0.26 "
P. 625A	180	2,600	0.90 "
P. 625	250	4,800	0.96 "
L.S. 5A	400	9,150	2.53 "
L.S. 6A	400	4,600	5.14 "

The expression arrived at above cannot be used for other than triode valves, that is, it would be quite unsuitable for estimating the power output from a pentode valve owing to the fact that for many reasons it is very undesirable, and indeed dangerous, for the load impedance to be twice that of the valve impedance if this is a pentode.

The whole subject of power output from pentode valves is one which requires special treatment, and cannot be dealt with here.

As the use of higher power valves is coming more and more to the fore, it is possible that some of the above remarks may be helpful to those who are considering the use of such valves for the first time, and wish to operate them intelligently.

The New Company Law as it affects (a) Private Companies, (b) Public Companies, by H. W. Jordan. Showing the principal changes in law occasioned by the Companies Act, 1929, which comes into force on November 1st. Pp. 106+XIII. Published by Jordan and Sons, Ltd., London. Price 4s. post free, or, bound with copy of the Act, 9s. post free.

BOOKS RECEIVED.

Some Observations of Short-period Radio Fading, by T. Parkinson (Research Paper No. 70). Pp. 19, with 17 diagrams. Published by the Bureau of Standards, Washington, D.C., U.S.A. Price 5 cents.

Standards, Washington, D.C., U.S.A.
Price 5 cents.

oooo

Relation of Radio Wave Propagation to Disturbances in Terrestrial Magnetism, by I. J. Wymore (Research Paper No. 76). Pp. 11, with 6 diagrams. Published by the Bureau of Standards, Washington, D.C., U.S.A. Price 5 cents.

NEW SCREEN-GRID VALVE.

The Mazda 215 S.G. Battery-heated Valve.

In the course of compiling the test report concerning the new Mazda valves (now marketed by Ediswan) and to which inclusion was given in last week's issue, it was realised that the superiority of certain of the coming season's valves over their predecessors represented an important advancement. More than the customary examination has therefore been considered worth while in order that readers may the more appreciate the significance of the new data and what the improved characteristics will mean to them by way of giving better set performance. We refer in particular to the 215S.G.

External Appearance.

Outwardly the valve looks much like any other screen-grid valve, there being a terminal, connected to the plate of the valve, mounted on the top of the bulb on a small metal boss. The screening grid is connected to the base of the valve using the pin that in a triode is joined to the plate. Just above the pinch there is visible a screening disc which is set horizontally and extends right across the bulb. It bears on its edge a rim about three-quarters of an inch deep, parallel to the glass of the bulb and only just inside it. The disc, with its rim, carries on within the valve the metallic screening that must surround the tuned circuits in any receiver into which it is built. Except for a comprehensive anode surround-

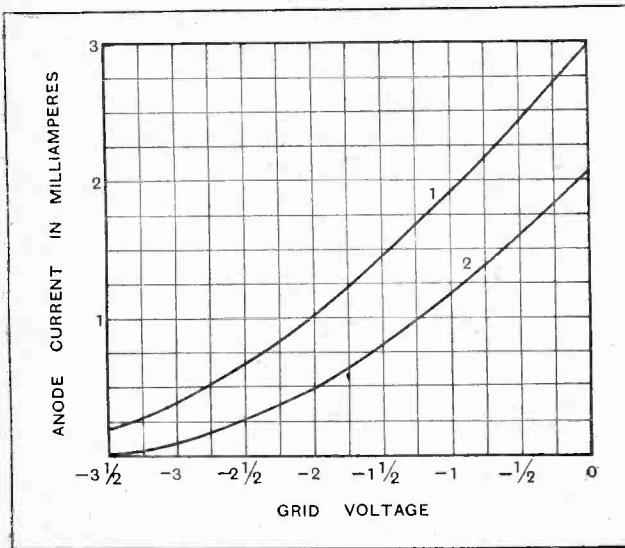


Fig. 1.—Anode current—grid volts characteristic curve 1 is taken with 150v. on the anode and 60v. on the screen, while in curve 2 the voltages are respectively 110 and 50.

ing everything little could be seen through the "gettering" of the electrodes.

The rated characteristics of the valve are as follows:—
Filament volts and current, 2.0 v. and 0.15 amps.
Amplification factor, 300.
A.C. resistance, 270,000 ohms.
Mutual conductance, 1.11 milliamps. per volt.

Static Characteristics.

Apart from the fact that the makers were unduly pessimistic as to the filament current consumed, which turned out to be only 0.125 ampere, or 20 per cent. better than the official figures, the rated characteristics were

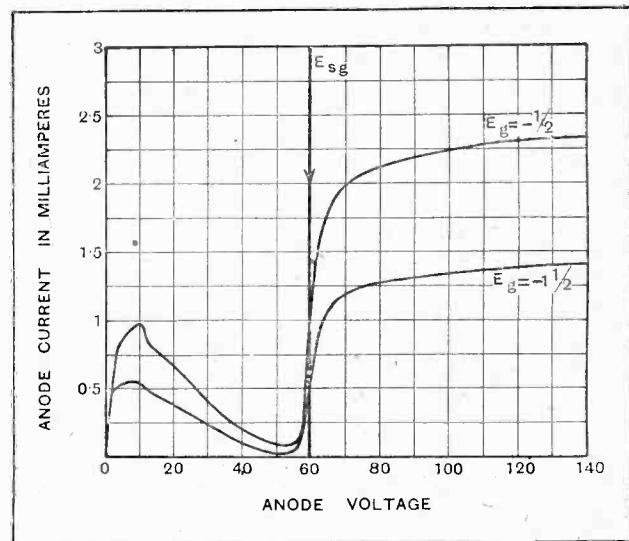


Fig. 2.—Anode volts—anode current curve. Screen volts=60.

closely adhered to by the valve examined. Under normal operating conditions it was found that the mutual conductance of the valve was 1.1 milliamps. per volt, but that both amplification factor and A.C. resistance were a little higher than the rated values. There is no doubt that by a little juggling with the operating voltages the maker's figures could be reproduced exactly, for both amplification factor and A.C. resistance of a screen-grid valve vary over enormous ranges as the anode and screening-grid voltages are altered, though the mutual conductance remains nearly constant throughout. Some of the many possible curves are reproduced herewith, from which further details may be extracted by those who require them. The normal working plate-current is of the order of two to three milliamps. at 150 volts, while the screening-grid takes something less than 1 milliamp. at 60 volts. Taking into consideration the high amplification afforded by the valve, this consumption must be regarded as very moderate indeed.

With anode and screen-grid voltages set at their usual values it was found that grid-current started at -0.1 volt, so that it is essential to use grid-bias with the valve, though a very low value of bias will suffice.

Amplification Attained.

Although the actual amplification attained at high-frequency depends very much more on the tuned circuits in use than on the valve itself, it was, nevertheless,

New Screen-grid Valve.—

thought worth while to make a few measurements to indicate the order of amplification to be anticipated with tuned circuits of various types. The circuit employed for the purpose is shown in Fig. 3, particulars of the chief components used being given below the diagram. All measurements were made at approximately 300 metres, and the anode voltage used was 150 throughout, the screen-grid voltage being adjusted for maximum amplification with each tuned circuit. Throughout the series it was found necessary to keep the screen-grid at a voltage in the immediate neighbourhood of 60 for best results.

(1) Coil L (Fig. 3) of 68 turns of 27/42 Litz on 4in. ribbed ebonite former; detector (voltmeter) valve shunted across the tuned circuit decapped to minimise dielectric losses. Amplification, 188 times.

(2) Coil of 80 turns of 27/42 Litz on 3in. ribbed ebonite former; detector valve still decapped. Amplification, 161 times.

(3) Coil as in (2), but valve-holder and valve-base shunted across tuned circuit to represent, with the decapped valve, a valve with cap and holder, as usually employed. Amplification, 131 times.

(4) Multi-layer coil (Gambrell B), with valve-holder and base in position as before. Amplification, 59 times.

For all the measurements detailed above a grid-bias of $-1\frac{1}{2}$ volts was in use. With an amplification of the order of those found the valve has to deal with a grid-swing of less than a fifth of a volt in the most unfavourable case, so that it is quite unnecessary to bias it heavily enough to permit it to accept a swing of three volts. As an indication of the increase in amplification that can

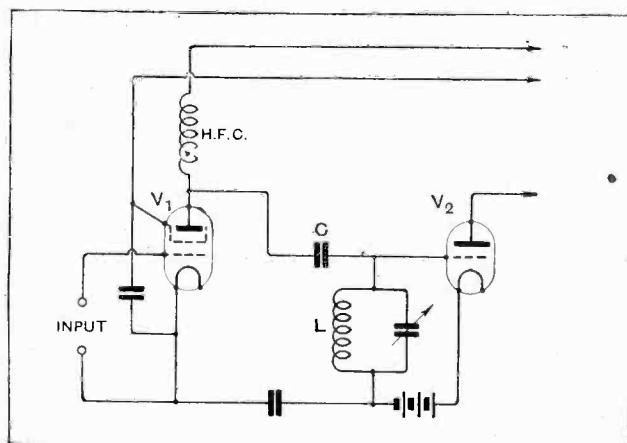


Fig. 3.—Circuit used in measuring amplification at 300 metres. V₁, Mazda 215 S.G. valve under test. V₂, Decapped valve in Moulin voltmeter measuring voltage across tuned circuit. H.F.C., Lewcos High-frequency choke. C, 0.001 mfd. L, Tuning coils—see text.

be obtained by cutting the bias down to the minimum figure that is still enough to prevent the flow of grid-current, the measurement of amplification with coil (1) was repeated while using a bias of only -0.25 volt. The figure attained was 215 times in place of the 188 times originally recorded, an increase of nearly fifteen per cent.

A stage amplification of 215 times for this battery-fed S.G. valve is the maximum that can be

obtained in a tuned anode circuit in which choke-feed is employed, and can only be had by those who are willing to go to the limit in the elimination of dielectric losses both in the tuned circuits themselves and in the components connected to them. If the tuned circuit following the valve feeds a detector valve normally capped and inserted in a standard type of holder the limit is set at about the figure of 131 already given. It is further to be noticed that it would be profitable to employ a transformer in place of tuned anode when using a tuned circuit of the very high dynamic resistance that is attained when dielectric losses are eliminated in the manner suggested; a suitable ratio would be about 1:1.25, obtained by fitting a primary of about 54 turns to the coil described under (1) above. With this transformer an amplification of about 240 times might confidently be expected.

When the tuned circuits have higher losses, whether these arise from the coil itself or from the unsuitable nature of the dielectrics connected in parallel with it, the dynamic resistance will be too low to make the substitution of transformer-coupling for plain tuned anode a paying proposition, and no appreciable increase over the figure of 131 can be anticipated. It will be noticed that this is barely more than half the amplification that can be attained when dielectric losses are reduced to a minimum.

Base Losses.

It is unquestionable that any valve which is intended for use with high-frequency circuits should not introduce any unnecessary damping into them, so that it was thought worth while to make a cursory investigation of the losses introduced into a tuned circuit by connecting across it an unlighted 215 S.G. As it is found that dielectric losses, when expressed as a shunt conductance, are nearly independent of wavelength, the losses were measured at one wavelength only, 250 metres being chosen for the purpose.

It was found that the unlighted 215 S.G. introduced into a tuned circuit losses which could be matched by replacing the valve by a non-inductive grid leak of 590,000 ohms. Where thoroughly bad tuned circuits are in use this loss does not, perhaps, matter; but in any receiver in which attempt has been made to wind coils of low high-frequency resistance in the endeavour to attain a high standard of sensitivity and selectivity the damping effect of the valve-base will be very appreciable indeed. The table that follows shows the result on the dynamic resistance of a tuned circuit of connecting the valve in parallel with it. The effect of the valve-holder is not included in these figures.

Dynamic Resistance of Tuned Circuit alone. (ohms.)	Dynamic Resistance with Valve in parallel. (ohms.)
450,000	255,000
350,000	219,000
280,000	190,000
180,000	138,000
100,000	85,000

It is to be noticed that with a tuned circuit of 100,000 ohms dynamic resistance the connection of the valve only reduces the value by some 15 per cent., while

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New Screen-grid Valve.—

the dynamic resistance of an ultra-low-loss circuit is reduced to little more than half its proper value.

On removing the base of the valve and repeating the measurement of losses it was found that the base had been contributing nearly ninety per cent. of the losses, the valve proper, without its cap, being equivalent in its damping effect on a tuned circuit to a resistance of a little under five megohms. It is perhaps permissible to assume that when the valve is in full production more care will be taken in choosing for the base a material of good dielectric properties, and that the unusually high losses introduced by the base of the sample examined is not to be taken as typical.

Internal Screening.

The residual capacity between the grid and plate of the 215S.G. is given as 0.005 micromicrofarad, which

implies that the screening is considerably more thorough than is usual in screen-grid valves.¹ No attempt was made to measure this capacity directly, but, instead, a test of stability was made by connecting in plate and grid circuits the lowest-loss tuned circuits that were available. At no point of the tuning range, which extended down to 250 metres, was the combination unstable. Recourse to calculation showed that with the tuned circuits used, after making due allowance for the damping of the input circuit by valve-base losses, a residual capacity of about 0.006 micromicrofarad would be required to cause spontaneous oscillation. It follows, therefore, that the internal screening of the valve is of a very high order indeed, and it may safely be used, so long as it is not decapped, with coils of the highest efficiency.

¹ See "The Modern H.F. Valve," *The Wireless World*. July 24th and 31st, 1929.

THE NEW BERNE LISTS.

We have received from the International Bureau of the Telegraph Union a complete set of the five volumes which now constitute the "Berne List." We have already noticed Part I (Fixed and Land Stations) in our issue of June 12th, and in subsequent numbers.

Part II is the list of the stations performing special services, and is divided into six sub-sections, (A) Direction-finding, (B) Beacons, (C) Time-signals, (D) Meteorological, (E) Notices to Mariners, (F) Press Messages, (G) Medical Advice, Calibrated Waves, etc. The stations are grouped under their respective countries. We think this section could be improved and made easier for quick reference if the titles of the sub-headings were printed at the head of each page, as it is difficult to distinguish at a glance sub-section (D) from sub-section (E). This part comprises 175 pages.

Part III is a large volume of 876 pages, giving a list of all ship stations. These are conveniently arranged in alphabetical order, and the particulars include the call-signs, country, type of installation, wavelengths, normal power and administration or company responsible for the operation of the wireless sets and the rendering of the necessary accounts.

Part IV is a list of aircraft stations, arranged in order of their call-signs, though we note that the five Swiss aeroplanes, which head the list have not adopted the group of five letters specified in the Washington Convention. The other particulars given include the nationality, type of installation, wavelengths, nature of service, customary route or home air port, and mark and type of aeroplane or airship. This list is 46 pages in length.

Part V comprises the broadcasting stations of the world, both those operated by public corporations such as the B.B.C., and the Radio Broadcasting Co., of New Zealand, and those owned by private companies. We were somewhat disappointed, however, in discovering

TRANSMITTERS' NOTES.

that, with a very few exceptions, the short-wave stations are not included and hope that these will follow in a later supplement. The stations are arranged under their respective countries, and the particulars include the call-signs, geographical positions, frequency and wavelengths, normal power, and name of administration or company operating the respective stations.

The prices of the respective parts, including their monthly supplements, are : Part I, fcs. (Swiss) 7.50; Part II, fcs. 7.50; Part III, fcs 12.00; Part IV, fcs. 4.50; Part V, fcs 4.50; and they may be obtained from the Bureau International de l'Union Télégraphique, Berne, Switzerland. The corresponding alphabetical list of call-signs, which will comprise those of all stations in the five lists, is now in preparation and will shortly be issued, price fcs. 6.40.

The subdivision of the list into five parts is undoubtedly a great convenience, as the previous editions containing all stations had become unwieldy. We would like to suggest the publication of a further list comprising only stations transmitting on wavelengths below 100 metres, but possibly the authorities do not consider the expense of compiling such a list would be justified by the demand.

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General Note.

We are asked to state that the German amateur D4QE is anxious to get into touch with English stations and to receive reports from this country. He is generally working from 22.00 B.S.T. onwards on telephony and transmits on about 42 metres. Reports may be sent via Mr. A. Brown, 7, Stanley Road, Broughton Park Manchester.

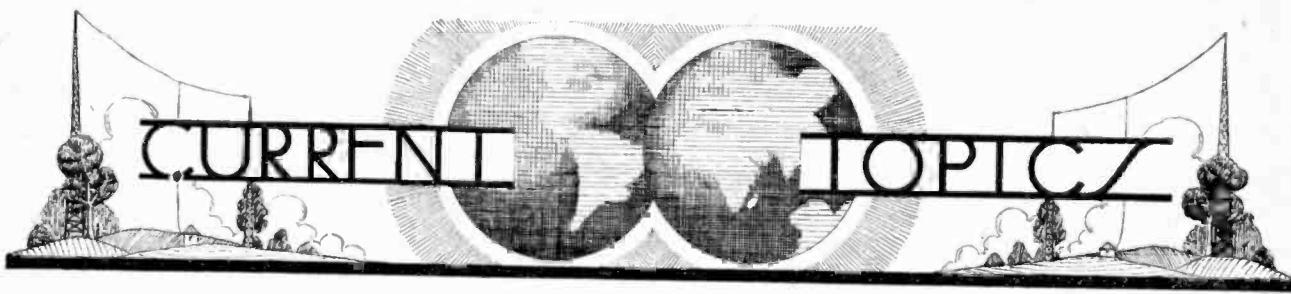
NEW CALL-SIGNS AND STATIONS IDENTIFIED

- G 5QY H. C. D. Hornsby, The Quarry, Cranlington, Northumberland.
 G 6GD S. H. Goodwin, 8, New Barns Ave., Commonside East, Mitcham, Surrey. (Change of address.)
 G 6WH G. H. Wheatley, 5, Elliot Bank, Forest Hill, S.E.23. (Change of address.)

RUSSIAN CALL-SIGNS

We are indebted to Mr. A. Lambourne, 43, Bramshaw Road, Norcot, Reading, for the following list of QRA's in the 2nd Russian District :

- EU 2DA (ex 79RB), M. Ryabov, Nijni Novgorod.
 EU 2DB (ex 80RB), M. Pavlov, Moscow.
 EU 2DC (ex 81RB), M. Petropavlovsk, Moscow.
 EU 2DD (ex 82RB), M. Homutov, Moscow.
 EU 2DE (ex 88RB), M. Zorin, Kimer.
 EU 2DF (ex 93RB), M. Gauhman, Rubinsk.
 EU 2DG (ex 97RB), M. Alekseevskiy, Voronej.
 EU 2DH (ex 98RB), M. Roshchupkin, Voronej.
 EU 2DI (ex 99RB), M. Saltakov, Tainbov.
 EU 2DJ (ex 20RW), M. Starikov, Moscow.
 EU 2DK (ex 21RW), M. Meliov, Moscow.
 EU 2DL (ex 22RW), M. Shishkov, Moscow.
 EU 2DM (ex 23RW), M. Rjanicin, Moscow.
 EU 2DN (ex 24RW), M. Sisenko, Moscow.
 EU 2DO (ex 25RW), M. Volodin, Moscow.
 EU 2DP (ex 54RW), M. Fiyaksel, Nijni Novgorod.
 EU 2DQ (ex 62RW), M. Raspletin, Rubinsk.
 EU 2DR (ex 63RW), M. Pereverzev, Rubinsk.
 EU 2DS (ex 66RW), M. Katkov, Tver.
 EU 2DT (ex 67RW), M. Lobanov, Rastayapino.
 EU 2DU (ex 68RW), M. Evseev, Nijni Novgorod.
 EU 2DV (ex 42RB), M. London, Moscow.
 EU 2DW (ex 60RB), M. Osipov, Moscow.
 EU 2DX (M. Belov, Moscow.
 EU 2DY M. Shennet, Moscow.
 EU 2DZ M. Ivanov, Yaroslavl.
 EU 2EA M. Kirlev, Yaroslavl.
 EU 2EB M. Shestakov, Tula.
 EU 2EC M. Surnikov, V. Volochek.
 EU 2ED M. Shatalov, Tula.
 EU 2EE M. Pastukov, Moscow.
 EU 2EF M. Uspenskiy, Moscow.
 EU 2EG M. Nikanorov, Moscow.
 EU 2EH M. Kucherenko, Orel.
 EU 2EI M. Shuhman, Orel.
 EU 2EJ M. Partenov, Orel.
 EU 2EK M. Pantaleynov, Voronej.
 EU 2EL M. Ronakin, Yaroslavl.
 EU 2EM M. Kojevnikov, Yaroslavl.
 EU 2EN M. Kojinkov, Khoroshevo, Moskgub.
 EU 2EO M. Nazarov, Tula.
 EU 2EP M. Kuraldev, Tula.
 EU 2EQ M. Krenkel, Moscow.
 EU 2ER M. Fedoseev, Moscow.
 EU 2ES M. Sorokov, Moscow.
 EU 2ET M. Sheydov, Moscow.
 EU 2EU M. Kojevnikov, Moscow.
 EU 2EV M. Kalinin, Voronej.
 EU 2EW M. Baydin, Moscow.
 EU 2EX M. Kruglov, Der. N. Ersh. Yaroslavsk Gub.
 EU 2ZY M. Bryanskiy, Tainbov.
 EU 2EZ M. Vinogradov, Serpukov.
 EU FA M. Chmil, Kaluga.
 EU FB M. Peychev, Moscow.



Events of the Week in Brief Review.

THE SEASON RE-OPENS.

A wave of wireless enthusiasm is reported to be sweeping over the Doncaster district. What Doncaster thinks to-day, the world thinks to-morrow.

"THE FRIENDS OF WIRELESS."

An annual prize of a minimum value of £65 has been founded by the French organisation, "Les Amis de la T.S.F.," for the best theoretical or practical book dealing with wireless.

PARIS INTERNATIONAL WIRELESS SHOW.

The first International Wireless Show to be held in Paris opens on Friday, September 27th, and will run for a fortnight. During most of this period the International Automobile Show will also be holding sway in Paris, and it is hoped that this event will bring foreign visitors to the wireless show.

NO SECOND-HAND GEAR FOR STRASSBURG.

The report that Radio-Paris will shortly close down pending the installation of more powerful equipment has given birth to a further rumour that the old equipment will be reincorporated in the new Strassburg station. This suggestion is indignantly denied by local journals, who doubt the veracity of the original report concerning Radio-Paris, contending that the rejuvenation of this station has been "in the air" since 1926, and still shows little sign of fulfilment.

COMPROMISE IN CANADIAN BROADCASTING?

A combination of British and American broadcasting methods will be the probable recommendation of the Royal Commission appointed by the Canadian Government last year to enquire into the ways and means of re-establishing Canadian broadcasting on a sound basis.

It is believed that the Commission favours the formation of a central authority not unlike the B.B.C., but giving greater individual freedom to stations in view of the wide area to be covered. It is also probable that the Commission will admit the principle of "sponsored" programmes, so that advertisers will augment the income received from listeners' licences.

THE NEW LARCENY.

A street in Utrecht has been the scene of a new form of radio robbery, according to the French journal *Fantasia*. A resident who possessed a wireless set but no

aerial recently made a secret connection to his neighbour's antenna, thereafter surprising his friends with the range and excellence of reception.

The owner of the aerial has intimated his intention of taking action in court, but his case is not regarded very optimistically by his legal advisers.

TELEPHONING TO MOOSE JAW.

On Sunday last, September 1st, the Transatlantic telephone service was extended in Canada to Moose Jaw and



THE RUNNING COMMENTATOR.
Mr. Floyd Gibbons, with the portable short-wave transmitter through which he was able to describe the arrival of the Graf Zeppelin at Lakehurst on Thursday last after its world flight. The account was broadcast by W2XAB and relayed by B.B.C. stations.

I.E.E. WIRELESS SECTION.

The Institution of Electrical Engineers announces that as no nominations have been received from the general body of members of the Wireless Section to fill the vacancies which will occur on the

Section Committee on September 30th next those members nominated by the committee are elected. The chairman of the committee for 1929-1930 will be Captain C. E. Kennedy-Purvis, R.N.

CANADA GETTING BUSY.

According to a preliminary statement issued by the Dominion Bureau of Statistics at Ottawa, the production of complete radio sets, parts, and batteries in Canada during 1928 reached a value of \$12,768,024, or 45 per cent. above the total of \$8,789,171 reported for 1927.

WHERE ONTARIO WINS.

Ontario leads the other Canadian provinces in the number of wireless receiving licences issued. During the fiscal year ended March 31st, 1929, Ontario headed the list with 296,756, Quebec being second with 49,812. In the north-west territories 111 persons took out licences.

"KONEL."

Many uses are predicted for a new metal known as "Konel" which has been developed by the Westinghouse Electric and Manufacturing Company of America. Originally prepared as a substitute for platinum in the manufacture of filaments for wireless valves, the new metal has been found to be harder to forge than steel and to be very tough at high temperatures.

The Westinghouse Company states that as a substitute for platinum, Konel is already saving £50,000 monthly in the manufacture of wireless valves, and that the life of a Konel filament is approximately ten times longer than that of others. Valves with the new filaments are operated 175 degrees cooler than those with platinum filament, but it is stated that the emission remains the same.

PRIZES FOR SET BUILDERS.

Cash prizes totalling about £200 are to be awarded to successful wireless set builders in connection with the Wireless Exhibition to be held in Manchester in October under the auspices of the *Manchester Evening Chronicle*.

A feature of the show will be demonstrations on amateur-constructed sets. Four classes of competition will be open to amateur craftsmen, as follows: Class I, Three-stage Receiver for Distance Reception; Class II, Three-stage Receiver for Quality Reproduction; Class III, Three-stage Duplex and Local Station Receiver, and Class IV, High-frequency

Saskatoon, in the province of Saskatchewan. The service was extended to include the Isle of Man, Belfast, and Dublin on August 26th.

THE NEW LARCENY.

Unit. The value of the prizes will range from twenty-five guineas to two guineas. A schedule and entry form is being prepared, and intending competitors should make early application to the Wireless Editor, *Manchester Evening Chronicle*, Withy Grove, Manchester.

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LECTURES ON A.C.

Lectures on alternating currents and electrical oscillations, with their application to wireless telegraphy and telephony, are included in the winter syllabus of the Sir John Cass Technical Institute, Jewry Street, Aldgate, E.C. Full particulars are available on application to the principal.

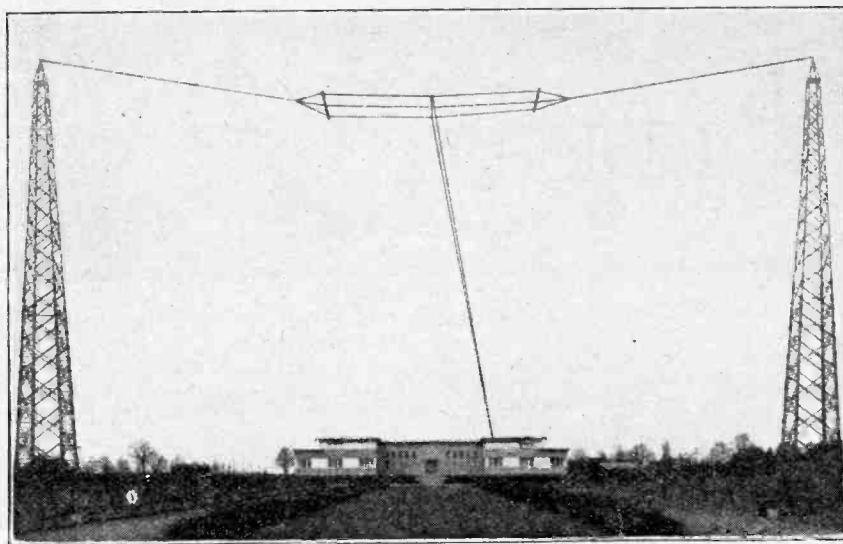
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**WEATHER CHARTS BY
FULTOGRAPH.**

The Meteorological Office of the Air Ministry issues a request to owners of picture receiving sets for copies of any weather charts they may have received since June 18th, when the experimental transmission of weather maps from Daventry 5XX by Fultograph process was begun. The experiment is now about to terminate.

The results which have been so far received indicate that these maps can be transmitted and received satisfactorily under normal conditions at least as far north as Glasgow and Dundee.

During the course of the transmissions opportunity was taken, through the courtesy of Wireless Pictures, Ltd. (in co-operation with whom the charts were being issued), to transmit a written inference of the weather to be anticipated from the chart which was simultaneously transmitted. The reception of this written inference was just as satisfactory as that of the chart.



A POPULAR DEUTSCHLANDER. A new view of the Cologne broadcasting station which relays Langenburg and can be heard nightly on 227 metres. The power is 4 kilowatts.

Copies of the maps received at the following places, Cardington, Worthy Down, Upper Heyford, Ramsgate, Streatley-on-Thames, Guernsey, Ashington, Taunton, Bradford, Glasgow, and Leuchars—have already been compared with the original charts and found to be normally satisfactory. Copies of charts received at places other than the above would be welcomed by the Director, Meteorological Office, Air Ministry, London, W.C.2. After examination they would, if desired, be returned to the senders.

EIFFEL TOWER AT BAY.

In view of continued representations for the suppression of the Eiffel Tower wireless station, the staff have produced a spirited reply in the form of a record of the station's daily output. Transmissions go out for nineteen hours each day between 1 a.m. and midnight and comprise 51 separate features, including concerts, weather forecasts, meteorological information for farmers, "chats" with ships at sea and aeroplanes in flight, traffic messages to North Africa, and Stock Exchange quotations.

Five separate wavelengths are employed, viz., 7,200 metres, 2,650 and 1,470 metres, and 73.50 and 32.50 metres.

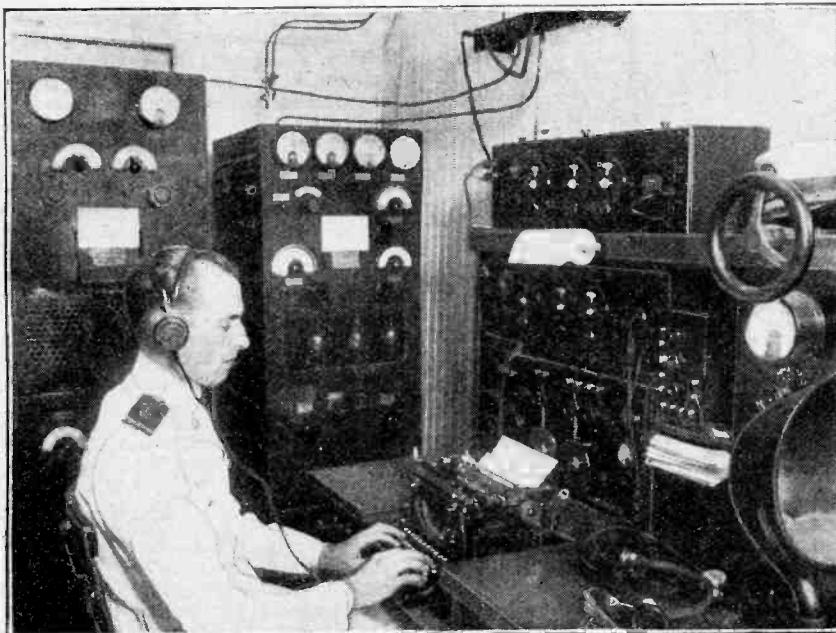
In the circumstances the idea of the suppression of FL is regarded as "grotesque and ridiculous."

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RECORD PUBLIC ADDRESS SYSTEM.

The B.B.C. arrangements for broadcasting a running commentary on the Schneider Trophy Race in the Solent on September 7th next have already been described, but most listeners will also be interested in the plans made for what will undoubtedly be the biggest public address system ever employed. Over two hundred Marconiophone loud speakers will be distributed at nineteen centres along both shores of the Solent and on liners in the roadstead, and through these it is expected that nearly a million spectators will be able to hear the B.B.C. running commentary, which will be picked up on standard receiving sets and raised to enormous volume by power amplifiers.

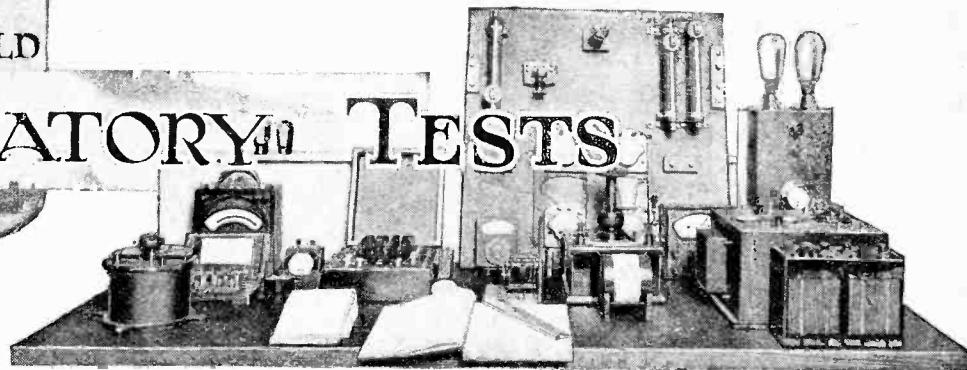
To supply power to the loud speakers no fewer than 756 valves will be used, 694 of these being of the super-power type. The supply of high-tension current will require 392 Exide 30-volt H.T. batteries and 168 large capacity 60-volt H.T. batteries. Over fifteen miles of wire will be needed to connect the various batteries, amplifiers, and loud speakers.



STOCKBROKING ON THE ATLANTIC. British, French and American liners are all successfully conducting stock exchange services at sea. This photograph, taken on the U.S. liner Leviathan, shows the second operator receiving New York stock quotations on a specially installed short-wave set operating on wavelengths between 15 and 120 metres.

WIRELESS
WORLD

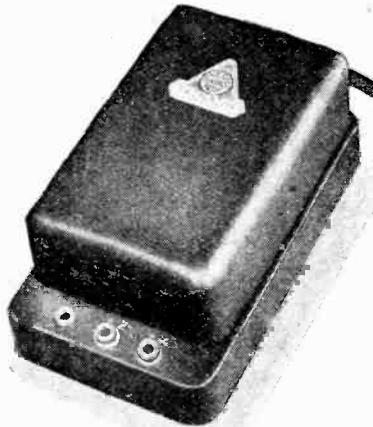
LABORATORY TESTS



A Review of Manufacturers' Recent Products.

"TEKADE" TRICKLE CHARGER.

The "Tekade" L.T. battery charger sent in for test is intended for trickle charging 2- and 4-volt accumulators from the domestic alternating current mains. The model illustrated is for use on 200- to 240-volt A.C. mains, but there are other



"Tekade" trickle charger for use on A.C. mains. This model charges 2- and 4-volt batteries.

types available for 100- to 125-volt supplies. Tests were made on a 240-volt 50-cycle supply, the charging current being 0.32 amp. for a 2-volt cell and 0.3 amp. for a 4-volt battery. It was noticed that after the charger had been in use for about half an hour the current fell to 0.25 amp. and 0.27 amp. for the 2- and 4-volt batteries respectively. This is probably due to some slight change in the resistance of the rectifier, since after this initial fall the current was maintained at a steady level.

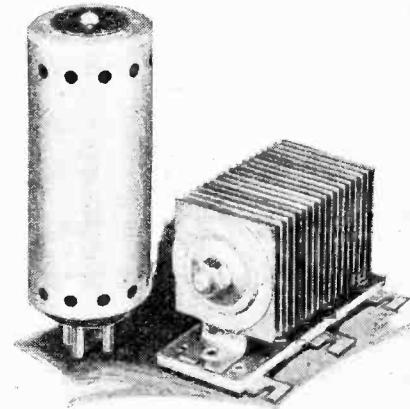
The charger consists of a small transformer and a half-wave rectifier of the "dry" type which the makers state will give a charging rate of 0.25 amp. This claim is substantiated by our tests. There was no trace of overheating, the rise in temperature being very slight after a lengthy run. The device is perfectly silent when in use.

The unit is enclosed in a metal case

measuring 6in. \times 3 $\frac{1}{4}$ in. \times 2 $\frac{1}{4}$ in. A long silk-covered twin cable terminating in an adaptor is provided for attachment to the lamp holder and two leads with plugs and spade terminals are supplied for connecting the accumulator.

Supplies are available from Dr. Nesper, Ltd., Colindale Avenue, Hendon, London, N.W.9.; the price of the 2- and 4-volt model being 29s. 6d. A unit for charging 2-, 4- and 6-volt batteries is available also; the price of this model is 38s. 6d.

voltage difference across each couple is of the order of 3.6 volts, the transformer should not give a voltage in excess of 15 (R.M.S.). A practical test showed that the unit will deliver 3 amperes of rectified current to a 6-volt accumulator without need of an external resistance, but a current-limiting resistance must be used with 2- and 4-volt

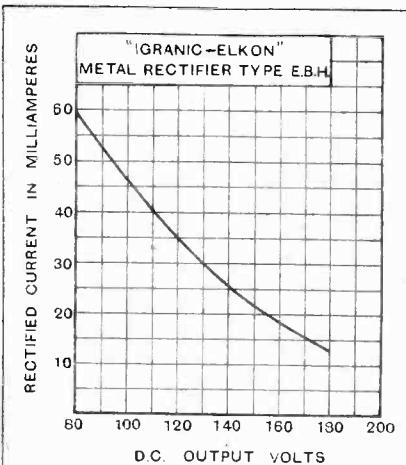


Igranic-Elkon "dry" rectifiers. Model E.B.H. is fitted with four base pins.

IGRANIC-ELKON METAL RECTIFIERS.

A wide range of these rectifiers are available, including some small units for use in L.T. battery chargers, and a high voltage rectifier for incorporation in H.T. battery eliminators. Two samples were submitted for test, a model M16, rated to give a D.C. charging current of 3 amps, and a model E.B.H., which is stated to give an output of 60 mA.—rectified current—at a potential suitable for most broadcast receivers. Full-wave rectification is allowed in both cases.

Model M 16 comprises 16 couples arranged as a bridge type rectifier with 4 couples in each arm. Since the safe volt-



Voltage regulation on load; the secondary of the transformer gave 200 \pm 200 volts R.M.S.

cells. The amount of reversed current is surprisingly small, measurements showing this to be less than 2 per cent. of the forward current under normal working conditions.

The E.B.H. unit is for use in place of a thermionic type rectifier in H.T. battery eliminators, and is accordingly fitted with a base cap provided with pins for insertion in a valve holder. The sample submitted for test was fitted with pins to fit the American valve holders, but an adaptor can be obtained from the suppliers for use in British type valve holders. This unit will withstand a voltage difference of the order of 300 across each half of the rectifier—although being a full-wave rectifier it is not arranged on the bridge principle. The transformer used during test gave 200 volts R.M.S. either side of the centre tap only, but measurements were made with this for the purpose of taking the characteristics of the unit under normal working conditions. The output voltage at different current loads is given

Wireless World

on the graph; the unit being followed by the usual network of smoothing circuits. The rise in temperature during use is comparable with that of a heavy duty thermionic type of rectifier.

The suppliers are the Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4, and prices have been fixed as follows : Model M 16, 29s., and Model E.B.H., 37s. 6d.

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B.T.H. PICK-UP AND TONE ARM.

The B.T.H. pick-up is notable for generous cross-section of its permanent magnet and the lightness of the reed. The latter is only $\frac{7}{16}$ in. in length and is mounted midway between the pole pieces of the permanent magnet, thus producing differential variations of the flux surrounding the pick-up coil. The latter is mounted concentrically with the axis of the reed. Damping is provided by rubber pads both at the pivot and the extremity of the reed. Nevertheless the movement is not unduly restricted, and record wear is absolutely negligible.

As a consequence of the light damping and freedom of movement the natural resonance of the reed is rather prominent. By careful design, however, the makers have succeeded in raising this to 3,400 cycles, which happens to be within a semi-tone of the top note of the piano. For all practical purposes this may be taken as the upper limit of the fundamentals used in music, so that, as far as

fundamental notes are concerned, the pick-up may be regarded as having a rising characteristic which will tend to correct deficiencies in the average amplifier and loud speaker. As a result the reproduction is unusually brilliant by comparison with the average pick-up.

There are no prominent resonances in



B.T.H. pick-up and tone arm.

the middle and lower registers, and the undulations in the curve would not be detected even by a trained ear. Below 100 cycles the curve continues to rise, and thus corrects for the restriction in amplitude of the low notes in the average record.

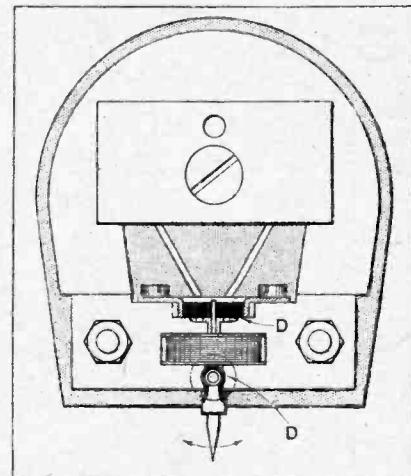
The general form of the curve is independent of the type of needle used, but a thick and heavy needle tends to reduce the natural resonance by 400 or 500 cycles, thus bringing it into the range of frequencies in common use. For best results the H.M.V. "Half Tone" or similar type of needle should be used.

The pick up is fitted to the tone arm by means of a neat two-contact plug and socket through which electrical connection is made to a twin flexible lead passing

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through the tone-arm pedestal. The tone arm is spring-loaded to relieve some of the weight of the pick-up, and friction is reduced to a minimum by the use of a ball-bearing swivel. The movement of the arm is restricted by a neatly arranged stop incorporated in the pedestal.

Without resorting to any form of link motion it has been found possible, by bending the tone arm and making it adjustable for length, to reduce the needle track error to within 3 per cent.



Constructional details of B.T.H. pick-up.

Full instructions are provided for aligning the tone arm, and the complete outfit, including a spring clip for the tone-arm, is £2 5s.

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BELLING-LEE WANDER PLUGS.

It is regretted that the illustration of this new plug, given on page 112 in our issue of July 31st last, does not show clearly the nature of the prongs fitted. As mentioned in the text, they are not split pins, but assembled from two pieces of hard drawn "D" section brass wire.

This opportunity will be taken to correct an error in the price of these. They are now marketed at 3½d. each.

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PRICE CORRECTIONS.

With reference to the Watmel fixed condensers reviewed on page 131 in our issue of August 7th last the prices of these should read as follows :—Values of from 0.00004 to 0.0009 mfd. 1s. 3d. each with grid-leak clips, and 1s. each plain. Other sizes cost 1s. 6d. each from 0.001 mfd. to 0.004 mfd., and 2s. 6d. each for 0.004 mfd. to 0.01 mfd.

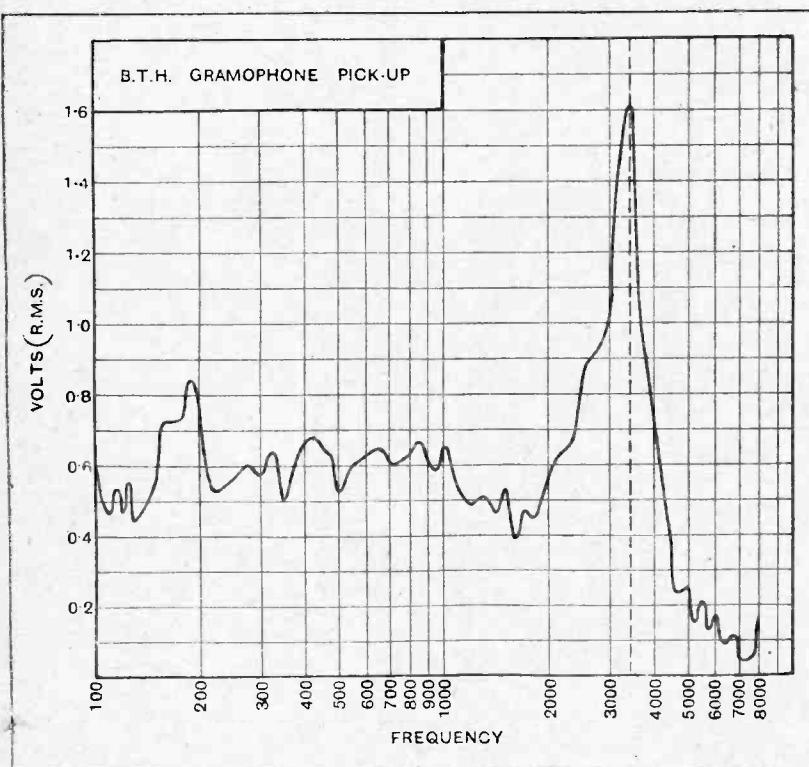
The Loewe resistances mentioned on page 96 in our July 31st issue are now sold at 1s. 6d. each and not 2s. 6d. as stated.

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CHANGE OF ADDRESS.

The Epoch Radio Manufacturing Co., Ltd., 25, Laurence Pountney Lane, London, E.C.4, have removed to more commodious premises at 3, Farringdon Avenue, Ludgate Circus, London, E.C.4. The telephone numbers will be Central 1971 and 1972.

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Output characteristic of B.T.H. pick-up, using H.M.V. "Half Tone" needle. Frequencies to the left of the dotted line represent the fundamentals used in music, so the pick-up has virtually a rising characteristic.

THE NEON LAMP AS A STABILISER.

Practical Applications.

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

(Concluded from page 202 of last week's issue.)

NOW we must consider what happens when the useful load, represented by the plate currents of all the valves preceding the output stage, is connected in parallel with the neon lamp in the circuit of Fig. 4. We then have the equivalent circuit of Fig. 6.

Let E = voltage at eliminator output terminals.

V = reduced voltage applied to load.

I_1 = useful load current.

I_2 = current taken by the neon lamp.

$I = I_1 + I_2$ = total current.

We then have $V = E - IR$ as before

$$= E - (I_1 + I_2) R.$$

But it has already been shown that the current I_2 taken by the neon lamp is given by

$$\begin{aligned} I_2 &= \frac{V - e}{r} \\ &= \frac{V - 135}{2,500} \quad \text{for the particular lamp} \end{aligned}$$

tested, and so in this case

$$V = E - \left(I_1 + \frac{V - 135}{2,500} \right) R. \dots \dots \dots (3)$$

Knowing the eliminator voltage E , the equation (3) enables us to find the series resistance R that will be necessary to give any required voltage V at the load terminals for the normal value of load current I_1 . For instance, suppose that with a load current of 15 millamps. we require a pressure of 155 volts at the terminals, the eliminator voltage being 500. Then, substituting these values in equation (3) we get $R = 15,000$ ohms. With this value of series resistance we see from the curve of Fig. 5 that when the valve load is switched off, i.e., when $I_1 = 0$, the voltage increases from 155 to 186, and the current I_2 taken by the neon lamp, as shown by its characteristic curve (Fig. 2), increases from 8.2 to 20.7 millamps. That is to say, in drop-

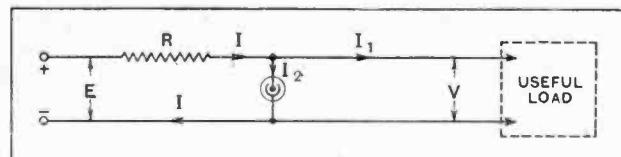


Fig. 6.—Equivalent circuit representing actual working conditions.

ping the useful load current by 15 millamps., the lamp current is increased by 12.5 millamps., resulting in a net change of only 2.5 millamps. in the current drawn from the eliminator; and so the voltage at the eliminator terminals will be practically unchanged.

Conversely it can be shown in a similar manner that any change in voltage at the eliminator output terminals results in a relatively very small change of pressure

across the neon lamp and the load in parallel with it. The neon lamp may thus be looked upon as a sort of trap which prevents voltage changes at either end of the circuit from getting through to the other end, besides limiting to a small figure the voltage changes across the load itself.

The latter effect is very clearly shown by curve A in Fig. 7, where the voltage at the load terminals is plotted against the load current. The figures were ob-

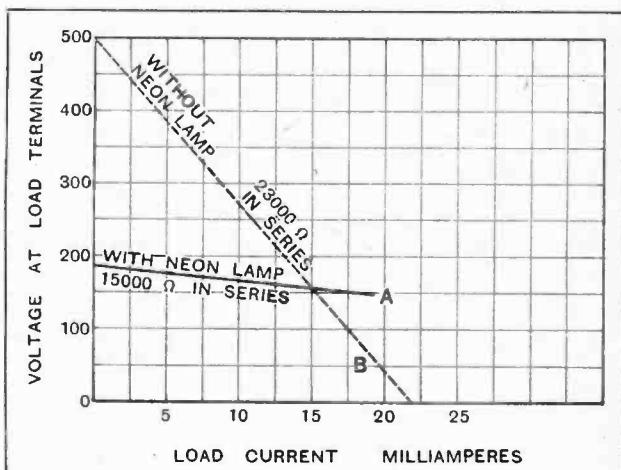


Fig. 7.—Two curves which show the marked improvement introduced by the inclusion of a neon lamp.

tained by calculation from equation (3), rewritten in a more convenient form, thus:

$$V = \frac{2,500 (E - I_1 R) + 135 R}{2,500 + R}$$

the series resistance being $R = 15,000$ ohms and the eliminator voltage 500. In order to emphasise the remarkable effect of the lamp, curve B has been added to show how the load voltage varies if the neon lamp is omitted. The series resistance in this case is again chosen to give 155 volts across the load with a current of 15 millamps., viz.:

$$R = \frac{500 - 155}{0.015} = 23,000 \text{ ohms.}$$

Remarkable Voltage Regulation.

It should be noted that when the load current is reduced to zero the voltage builds up to 500, and that, although at 15 millamps. the pressure may be 155 volts, it falls to zero for a current of 21.7 millamps.!

Comparing the two arrangements then as regards voltage variation for a given change in current: (a)

The Neon Lamp as a Stabiliser.

with neon lamp in use and 15,000 ohms in series, a current change of 1 milliamp. results in a variation of 2.14 volts at the load; (b) without the neon lamp, but with 23,000 ohms in series, a current variation of 1 milliamp. is accompanied by a voltage change of 23—nearly eleven times as great!

Although the figures and results given above have been obtained by calculation, they have been checked by practical measurements which, without exception, agreed very closely.

Application to Normal Type of Receiver.

Although the foregoing remarks and calculations apply to the particular case where the output valve or valves require an anode voltage roughly twice as great as that needed by the preceding valves, the neon lamp can be equally well applied to the more common type of receiver where all the valves, except perhaps the detector, operate with plate voltages of the order of 160. In this case the series resistance R_2 of Fig. 1 is dispensed with, the neon lamp being connected directly across the eliminator output terminals as shown in Fig. 8.

The minimum voltage at which the current can be maintained through an ordinary neon lamp is not much less than 150, and therefore the system can only be applied to those receivers in which the voltage at the eliminator terminals does not fall below 150 with all valves on, unless a special neon lamp capable of running on lower voltages can be procured. However, a great many battery eliminators are designed to give at least 150 volts when on normal full load, so that in the majority of cases the arrangement can be used.

Order of Switching On.

It is common practice to switch on the valve filaments first and then the high tension, but when a neon lamp is used it is almost essential to switch on the H.T. before the filament current; otherwise the probabilities are that the neon lamp will not light at all. Take as an example a set requiring 160 volts on the plates of all valves other than the detector, and drawing a current of 15 milliamps. from the eliminator under ordinary conditions. With such a set, if the filaments were switched on before the high tension, the voltage at the output terminals of the eliminator would never exceed 160, and

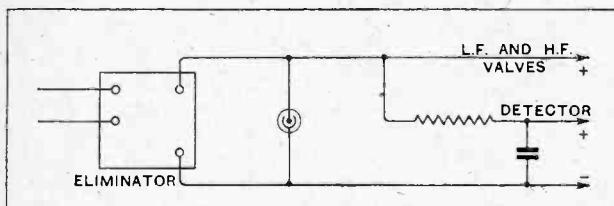


Fig. 8.—Application of neon lamp to eliminator and receiving set working on moderate voltage where no series step-down resistance is required.

a neon lamp with characteristics similar to the one considered above, connected in parallel, would not glow at all, and no stabilising effect would be obtained. On the other hand, if the H.T. is switched on without the fila-

ments, the voltage across the eliminator terminals would probably build up to a figure in excess of 200 if no neon lamp were present. With the neon lamp in circuit, however, the glow would be established directly the voltage reached the critical starting voltage for the lamp. As shown by the characteristic curve of the lamp (Fig. 2), the glow will be maintained even though the voltage fall considerably when the lamp lights up. The

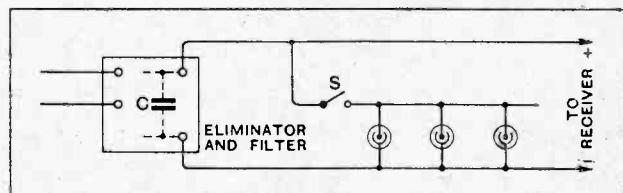


Fig. 9.—Arrangement for establishing the glow in two or more lamps in parallel where the resistance of the supply circuit is high. The eliminator is switched on first, then S is closed, and finally the filaments are switched on.

subsequent switching-on of the valve filaments and consumption of plate current will result in only a slight extra fall in voltage as explained above.

Two or More Neon Lamps in Parallel.

It would seem fairly obvious that for a particularly unstable set which refuses to be stabilised by a single neon lamp, two lamps or more may be connected in parallel across the circuit. However, it must be borne in mind that the use of a neon lamp will only cure oscillation set up on account of the high resistance of the eliminator circuits and will not cure a badly designed receiver where the trouble is due to feed-back effects within the amplifier itself. In theory the use of more than one neon lamp in parallel is thoroughly sound because it would have the same effect as connecting two or more floating batteries of equal E.M.F. across the circuit; but in practice it is not always a simple matter to get more than one lamp to glow in a circuit of this kind where the resistance is high. The reason is that the critical starting voltage for each lamp is not quite the same, and therefore as the voltage builds up after switching on, one of the lamps will suddenly light up and, due to the resistance of the circuit, pull the voltage down again before the remainder have a chance to establish a glow.

Obtaining the Starting Voltage.

The difficulty can often be overcome, however, by adopting the expedient of allowing a condenser of fairly large capacity to be charged up to a voltage well above the critical starting voltage of the most obstinate lamp, the lamps being temporarily disconnected as shown in Fig. 9 by the switch S. Fortunately the necessary condenser is already provided in the filter circuit, across the output terminals of the eliminator. The eliminator is first switched on with the isolating switch S open and filaments off; then, after a second or so, S is closed and all lamps should light. If not, the capacity of C is too small or the no-load voltage of the eliminator is insufficient. The latter can be checked by testing the lamps one at a time, the remainder being removed from their sockets.

BROADCAST

BREVITIES



By Our Special Correspondent.

Brookman's Park Gets Busy.—Fire Drill at H.Q.—Controversial Talks.**Enter the Regional Scheme.**

Monday, September 16th, is the date definitely decided upon by the B.B.C. for the first publicly announced transmissions from the new London Regional station at Brookman's Park. This is two days later than the date I ventured to suggest in *The Wireless World* of August 14th.

To split hairs, it may be more accurate to say that the inaugural programme will go out on September 17th, the transmission beginning at 00.00 B.S.T. on that date; but no doubt Savoy Hill considers that homage is due to G.M.T.

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A Four Weeks' Change-over.

Starting off with an aerial power of 30 k.w., London Regional will operate for one hour nightly, from midnight to 1 a.m., during a period of a fortnight from September 16th. During the following fortnight it will transmit the normal programmes from about 10.30 p.m. onwards, the exact time depending upon the occurrence of a suitable interval between programme items. The wavelength will be the same as 2LO's, viz., 356.3 metres.

At the end of four weeks, i.e., on October 14th, the new station will take over entirely from the existing Oxford Street transmitter, which will then close down.

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Troubles Anticipated.

Double transmissions from Brookman's Park must not be expected, I learn, until December, when the engineers have satisfied themselves that the single wavelength working is a success.

Two fruitful causes of complaint are likely to arise during the next month or two. In the first place, crystal users in the neighbourhood of Oxford Street who have been absorbing 2LO morning, noon and night without the slightest difficulty, will experience an aching void after October 14th. To console them, the B.B.C. has prepared a special tonic-talk pamphlet, available on request, which shows that, provided one's aerial is readjusted, there need be no occasion for such morbid ditties as "I dreamt I dwelt at Marble Arch."

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Alternative Programmes.

A second chorus of complaint is expected from North London listeners, who may experience difficulty in separat-

ing 5GB from the London Regional. Except in cases where unusually selective sets are employed, it is to be feared that dwellers on the northern heights may have to forgo an undisturbed alternative programme until Brookman's Park sends out its twin transmissions.

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"Outside" Broadcast.

Kluxon horns proclaimed a new form of "Surprise Item" on Wednesday last, when Savoy Hill held its first full dress fire drill. Within three minutes of the alarm, artistes, visitors, and all members of the staff found their way into the street, where they waited, self-conscious and hatless, until bidden to

speaker to-morrow will be the Rt. Hon. Arthur Henderson; other speakers in the series will be Mrs. M. A. Hamilton, M.P., Prof. P. J. Baker, M.P., and Viscount Cecil. I believe, also, that there is a possibility that the Prime Minister may find an opportunity to talk to British listeners from Geneva.

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"Giants" in the Studio.

The last vestige of the ban on controversy seems to have vanished with the inclusion in the programmes at the end of September of a new series of talks to be given at 9.15 on Monday evenings by some of the most original thinkers of the day. These will include Mr. H. G. Wells, Mr. George Bernard Shaw, Dean Inge, Sir Oliver Lodge, and Prof. J. B. S. Haldane. The talks will bear the title "Points of View," and it is understood that each speaker will give a candid account of his own philosophy of life in general, with possible excursions into the philosophies of other people.

In a typically Shavian letter to Savoy Hill, "G. B. S." has agreed to speak if he is allowed to say just what he likes!

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More National Lectures.

The Lord Chief Justice, the Rt. Hon. Lord Hewart, D.C.L., LL.D., is among the eminent authorities who have consented to broadcast National Lectures during the coming winter. The other lecturers will be the Master of Trinity, Sir J. J. Thomson, O.M., D.Sc., F.R.S., and Professor G. M. Trevelyan, C.B.E., Litt.D.

The dates and subjects are as follows:

November 18th.—Prof. Trevelyan: "The Historical Aspect of the Union of England and Scotland, 1707."

January 27th.—Sir J. J. Thomson: "Tendencies of Recent Investigations in the Field of Physics."

March 24th.—Lord Hewart: "Law, Ethics and Legislation."

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"Prom" Broadcasts.

During September, Promenade Concerts will be relayed from Queen's Hall on the following dates:

2LO, 5XX and other stations: September 5th, 7th, 9th, 11th, 13th, 17th, 20th, 23rd, and 26th. 5GB: September 4th, 6th, 10th, 12th, 14th, 16th, 18th, 21st, 24th, 25th, and 27th.

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.

AMATEUR STATUS.

Sir,—As a transmitter since the days of Writtle and one of the original members of the T. and R. Society, I would like heartily to endorse Mr. J. Ashton Cooper's remarks.

I think there are a number of transmitters in this country who do not realise that the Postmaster-General will under no circumstances grant transmitting privileges for amusement purposes. That being so, if we wish to retain our licences we must treat them as a means of pursuing a scientific hobby.

The success or otherwise of the R.S.G.B., as in any other society, depends entirely on the efforts of its individual members. We elect our committee, also our area officials to look after the provinces. If they are not doing their work satisfactorily, we can turn them out at the next annual meeting.

I am afraid that the root of a lot of the trouble is that too many of the members are apathetic. If all the members of the R.S.G.B. would only get together and show some interest in the conduct and welfare of the Society, and air their grievances, if there be any, and take the trouble to elect the committee members they really want, the R.S.G.B. could satisfy any reasonably minded member, and, what is more, the Society has the added advantage of being already respected by the Post Office officials.

Now then, you fellows, let us have a little of the constructive criticism and less of the destructive!

Iford, London.

J. W. COVENEY.

Sir,—Having read your editorial in the issue of August 21st, and also the letters appearing under correspondence, I would like to avail myself again of your correspondence columns.

First, let me say, regarding your editorial, that I quite agree that it is impossible for a journal such as yours to take sides with any one society, yet I still consider that undue prominence was allowed to anti-R.S.G.B. bodies, e.g., the C.G. and the A.B.R.S., to rush into print with statements which have absolutely no foundation in fact.

Regarding the C.G., it is a very well-known fact that the reason for their very strong bias against the Radio Society is that they do not have the same privileges as the membership, it apparently being their idea that, whilst not paying the subscription due from a member, they should, nevertheless, be allowed to partake of the benefits of such membership.

Therefore it is, I think, safe to assume that very little credence will be attached to their statements.

With the A.B.R.S., however, the situation is very different, as here we have one society definitely attacking another through the columns of a journal and seeking to attach to itself the credit which rightly belongs to another.

Mr. Kemp, in his letter, tells us of what the A.B.R.S. has done for the amateur. Well, what has it done? I would submit that the answer is: Nothing, except talk.

As an offset to this, let us look at the record of the R.S.G.B. Let a transmitter look at his licence; he is allowed definite bands of waves; this is due to persistent effort on the part of the R.S.G.B. The 80-metre band is, I know, more or less closed, but in this case it is because of a definite stand by the P.M.G., and not, as suggested by the C.G., that the R.S.G.B. has "reserved" it for the use of members.

Again, take the greater measure of freedom in the matter of personal messages, and also the permission to use the word "test" as a general call.

Who obtained these privileges? Again, the R.S.G.B.; and, furthermore, I can state, from personal experience, that no stone will be left unturned in the continued efforts of the Society towards the helping of the cause of amateur radio.

Some people may say that the above are very small matters; that is as may be, but, nevertheless, they are steps in the right direction, and are more than any other society can claim to have done, and these are only illustrations from many similar efforts.

No, Mr. Editor, the trouble is not with the R.S.G.B.; it is still ready, and competent to lead, but obviously it is an

uphill task when there are bodies, with an axe to grind, who are constantly doing their utmost to injure, and hinder, the work that the society is trying to do.

In conclusion, I would suggest that the amateurs of this country will, if they back it up, find that the Radio Society of Great Britain is, and always will be, ready to give of its best to the cause of amateur radio.

Croydon.

CLEMENCE S. BRADLEY.

Sir,—Having read various correspondence on amateur status, I should like to comment upon the same from a fair and square view.

Many of the comments have been hurled at the R.S.G.B., and I do not think it is quite the game to blame the officials for not being in a position to grant or to stick out for more, or a better share of the ether. In some respects the position is far better than it was in 1927, and, as the R.S.G.B. advised its members, let us show them that the amateur can still, apart from the restrictions, come out on top.

We must not forget that the condition of the ether practically forced these restrictions, and many experimenters were forced to apply for other frequencies, due to the amount of Q.R.M. on other waves. If anybody is granted a permit without anything being known of the applicant's experience, and the R.S.G.B. supports such application, I am afraid the Postmaster-General would fail very soon to recognise the R.S.G.B. in any way.

I have always applied direct to the P.M.G., and I am sure that, provided you can satisfy him as to your abilities and your requests are reasonable, he will grant them.

So why blame the R.S.G.B. Let us make the best of a bad job and see what 1930 will bring.

W. WICKS.

Hayes, Middlesex.

THE RADIO SHOW AND EXPERIMENTAL MODELS.

Sir,—Doubtless at this time the majority of manufacturers are concentrating their energies in perfecting their 1930 components. I would urge on them the futility of exhibiting these at the show in an experimental state, and would assure them that considerable annoyance results through exhibiting components that cannot possibly be supplied to the public for three or four months. If the idea is only to see if the article catches the public fancy, then I would advise the manufacturers to give up wireless and enter the toy trade.

Experimenters may favour a particular make, but they certainly are not subject to fancy. They know by experience that such a make is reliable and efficient and at any rate equal to others at the price. If a better component is available, however, at the same price, they will buy it. It is useless to show an article with bad characteristics and expect the public to buy it because it is put in a highly coloured box ornamented with pink parabolas. If it is a good firm, and characteristics are not issued, the public buy one or two, find out their mistake, and then—exit the firm's reputation. Beyond the fact that the anticipated furore is not created, the sale of other components suffers also.

As for the other class of manufacturer, he who cannot supply the demand, it is unfortunately true that the components he markets are of really good quality. Indeed, some experimenters would manage with old components for weeks on end in the hope of obtaining ultimately the particular article they favoured. It is up to the manufacturers, who assumedly know the value of their goods, to obtain a large enough stock of them before the article is put on the market. Summer is a slack season, and there is not a reason why they should wait until after the exhibition and then say that it is impossible to increase their staff to deal with a temporary rush. Surely they have sense enough to see this.

Further, to concentrate on the export demand is not fair to home trade. Will they realise this in good time?

Shortlands, Kent.

HUGH A. RAMPTON.

READERS' PROBLEMS

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

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

The Aerial as a Stabiliser.

My "Everyman Four" set worked well on a full-sized outside aerial, but now that I have moved into a flat, and consequently use a short inside aerial, I find it impossible to receive any transmission other than the local, for the reason that self oscillation is produced when the two circuits are brought into tune. Is the set suitable for use with my present type of aerial, and, if so, can you suggest the cause of instability?

S. E. F.

We expect that the H.F. valve was fairly close to the oscillation point when the damping effect of a full-sized aerial was applied, and that its present instability was entirely due to the removal of this load. The design of the set is such that it should be perfectly stable with a very short aerial, or even with no aerial at all, and consequently you should pay careful attention to the neutralising circuit, the disposition and wiring of the coils, and to the effectiveness of inter-stage screening. Before beginning to overhaul the set, it would be as well to assure yourself that the aerial lead-in wire does not pass in close proximity to the H.F. transformer, or, indeed, to the output end of the set.

○○○○

A 2-H.F. "Everyman Four."

Will you please say if it is possible to add a second stage of H.F. amplification to the original "Everyman Four" receiver, and, if so, give me a few hints as to how it can be done?

S. S. M.

Speaking from a strictly practical point of view, our answer must be that it is impossible to add a second high-efficiency H.F. amplifying valve. It would be obviously incorrect to say that the required alteration could not be made by rebuilding the H.F. side of the set, but to do this successfully would involve such drastic alterations that the remodelled receiver would bear little resemblance to the

original. Vastly more complete screening and decoupling is necessary when one is aiming at an overall gain of perhaps 1,000 as compared with about forty times, and, in particular, special care has to be taken to avoid interaction between the input and output ends of the set.

○○○○

Two Volts from a Six-volt Accumulator.
Can you give the solution of my problem?

On reconnecting my six-volt accumulator on its return from the charging station, signals could not be obtained, and on making voltage measurements it was found that the battery had dropped to about two volts. Although the cells are by no means new, they all appear to be in good condition, and, strange to say, each individual cell shows a reading of two volts.

K. M.

We can only conclude that, after your battery was charged, the inter-cell connecting straps were removed for cleaning purposes, and that they were afterwards incorrectly replaced, with the result that

RULES.

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

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

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

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

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

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

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

one cell is in opposition. Admittedly, the great majority of batteries are connected in such a way that it is impossible to make this mistake, but we have seen groups of cells arranged in such a way that it might occur.

○○○○

Tuned Anode versus Tuned Transformer.
I have read a recent article in your journal entitled "The Modern H.F. Valve," and have come to the conclusion that an H.F. transformer is always superior to the tuned anode arrangement as regards stage amplification. Am I right in this assumption, or is there a condition in which "T.A." is superior to "H.F.T.?"

M. W. M.

Your statement may, generally speaking, be considered as correct enough, provided the ordinary tuned anode coupling is used, but it must be modified where the anode coil is tapped for the plate connection. A tuned anode coupling is theoretically equivalent to a 1:1 transformer, and this ratio only affords the greatest possible stage gain when the dynamic resistance of the tuning coil is equal to the A.C. resistance of the valve. A coil can easily be wound in which the dynamic resistance is of the order of 250,000 ohms; it can therefore be seen that with a triode having an A.C. resistance of some 30,000 ohms the tuned anode arrangement would give very poor amplification. With a screened valve if the A.C. resistance happens to equal the dynamic resistance of the tuning coil the tuned anode coupling is actually a little superior, as far as amplification is concerned, to the 1:1 transformer, as coupling losses between the primary and secondary windings are avoided. Isolation of the detector grid circuit from L.F. impulses and considerations of selectivity have generally rendered it expedient to forgo a small percentage of the amplification and use a double-wound transformer with a step-up ratio with screen-grid valves.

Wireless World

SEPTEMBER 4th, 1929.

Larger Condenser Wanted.

For temporary use, I have made up a det.-L.F. set with a commercial double-range tuning coil. The receiver did not reach the wavelength of 5GB, although the stations at the lower end of the broadcast waveband could be tuned in; accordingly, I added turns to the grid coil. With this alteration 5GB can be received but the minimum wavelength seems to be unduly high. Can you tell me what is wrong?

T. H. F.

In the first place, we would say that your tuner is almost certainly designed for a variable condenser of 0.0005 mfd.; it is safe to hazard a guess that you are using a considerably smaller capacity, and we would advise you to make a change.

Should you prefer to retain your present tuning capacity, it will be necessary to experiment with the number of added turns; unless incidental capacity across the grid circuit is exceptionally high, it should be possible to arrive at an inductance value that will enable you to cover the normal medium waveband with a 0.0003 mfd. condenser.

.....

Where Free Grid Bias Fails.

My set is the original "Everyman Four," in which a two-volt detector is used with six-volt valves in the remaining positions. I am thinking of substituting a modern low impedance "D" valve for the present detector, and should like to know what filament resistances to use for the free grid bias scheme.

J. D.

The plan of obtaining grid bias voltage from the L.T. battery is hardly applicable when the set is modified as you suggest; the maximum obtainable bias voltage will not be greatly in excess of four volts, and this will be insufficient for a low impedance anode bend detector unless the H.T. pressure is reduced to something considerably below the optimum value.

For use with this particular set, it is unlikely that the newer type of valve will confer any very obvious benefits, but if you wish to use it, it will be necessary to modify the receiver by abandoning the free bias scheme, and making arrangements to apply the necessary pressure to the grid from a dry battery—either a separate unit or (preferably through a de-coupling resistance) from the battery feeding the L.F. grids.

.....

Momentary Oscillation.

My four-valve set, fed from an H.T. eliminator, gives quite satisfactory results, but I notice that when switching off the filaments a shrill whistle, of momentary duration, is produced in the loud speaker. Can you tell me the cause of this, and will you also say where it suggests that something is wrong? P. C. L.

It is difficult to make a definite statement as to the cause of this effect, but the following explanation is at least plausible, and in more than one instance has been proved to be correct. In the average receiver the output valve consumes more anode current than do all

the others put together, and, moreover, its filament is generally of a type which tends to cool more quickly on switching off than do those of the remaining valves. When the L.T. supply is interrupted consumption of current in the output anode circuit will fall off very quickly, and there will be a sudden rise of voltage on the anodes of the earlier valves. If this state of affairs is reached while their filaments are still hot enough to emit freely, it is quite likely that self-oscillation will be produced, although the set may, with normal anode voltages, be reasonably stable.

Regarding the second part of your question, we do not think that the effect described is an indication that anything is radically wrong, but it seems probable that there is at any rate some slight tendency towards instability, and it might be well to see if it is not possible to improve the effectiveness of your shielding and de-coupling devices.

.....

"Kilo-Mag" Pick-up Connections.

Will you please suggest a method of connecting a pick-up to the "New Kilo-Mag Four" set—provided, of course, that the receiver is suitable for this addition?

M. V. P. R.

In common with all other receivers having a detector followed by a single L.F. amplifier, this set can easily be modified for gramophone work, but care must be taken to choose a pick-up sufficiently sensi-

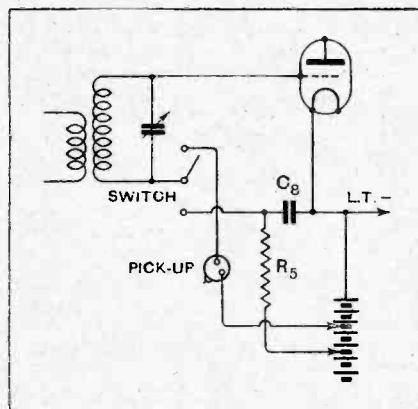


Fig. 1.—How to insert a gramophone pick-up in the detector grid circuit of the "New Kilo-Mag Four."

tive to give an adequate output when followed by two amplifying stages—the maximum possible with sets of this type. As you will have gathered from a recent article dealing with commercial pick-ups, a large number of units satisfy this requirement.

A suitable method of connection is shown in Fig. 1, from which you will see that a single-pole change-over switch is required; this component may be mounted through the base board and controlled through a push rod. An extra tapping on the grid bias battery, giving about half the voltage needed for detection, will be required for the valve normally performing the function of a rectifier when it is converted into a first stage amplifier.

Testing Made Easy.

I have just completed rather an ambitious set, with two H.F. stages, detector, and two L.F. magnifiers. The receiver is supplied with anode current through an eliminator, and I am sorry to say that preliminary tests seem to indicate that both H.F. and L.F. sides of the set are lacking in stability. If necessary, I can borrow a battery of H.T. accumulators for testing purposes. Do you think that their use would be of any advantage (as compared with an eliminator) when searching for the fault or faults?

N. P. H.

The golden rule in fault-finding is to eliminate as many uncertain factors as possible, and accordingly we strongly advise you to take advantage of your opportunity to use batteries while making the initial adjustments, if only for the reason that with this form of supply it is an easy matter to measure the voltage actually applied to the various anode circuits. Unless the set is stable, with a battery feed, it cannot be expected to work with an eliminator.

.....

Where Paper Condensers are Unsuitable.

I am under the impression that the use of paper condensers as interstage couplings (in a resistance-coupled amplifier) is usually deprecated, on the grounds that their insulation resistance is usually rather lower than that of components having a mica dielectric. Is this correct? D. A. J.

We think that it is unwise to make a practice of using paper condensers for this purpose, in spite of the fact that the insulation resistance, particularly of the lower capacities, is generally of a high order. Admittedly, any small positive voltage on the grid of the succeeding valve (due to leakage) can be balanced out by increasing its negative bias, but it must not be forgotten that such leakage is generally a variable quantity.

Mica condensers are certainly the safest for interstage couplings, as their insulation resistance is almost invariably both high and constant.

.....

Independent of Mains Voltage.

I gather that the "Flat Dwellers' A.C. Three," as described in your journal, is intended for use on 240-volt m.s. My own supply is at 100 volts; will you please tell me what alterations will be necessary in the values of the voltage-dropping resistances?

T. L.

It should be made clear that the design of any A.C. set of this type is unaffected by supply mains voltage—always provided that the power transformer is suitably chosen. Certain voltages are required across the various secondary terminals, and these can be obtained with any input voltage by correct arrangement of the windings.

You will not find it necessary to make any alterations, but it will be essential for you to specify your mains voltage when ordering the power transformer.

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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.

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OLYMPIA SHOW COMPETITION.

AFORTNIGHT from to-day the annual Radio Show at Olympia will be in full swing, and the secrets of the manufacturers, jealously guarded for months past, will be revealed to the public. The importance of the Olympia Show grows from year to year, and one is amazed to look back only two or three years and observe the progress which has taken place in the design and production of apparatus for broadcast reception. It becomes increasingly difficult to decide what is the best apparatus in every class, but certainly very many visitors go to the Exhibition with the idea of arriving at such a decision.

The Wireless World is again conducting this year, in conjunction with the Olympia Show, a ballot amongst its readers, having as its object to decide what, in the opinion of those entering for the ballot, are the best products in various classes to be seen at the Show. The result of this competition is of very great interest, not only to the readers, but also to the whole of the wireless industry, for the manufacturers naturally wel-

come the collective opinion of readers of *The Wireless World* on so important a matter.

How to Enter.

The competition has again been organised on the basis that every entrant shall be entitled to one vote for what he considers to be the outstanding single exhibit at the Show in any classification, and to vote also for the best piece of apparatus in each of the several classes into which we divide the exhibits as a whole.

Our classification of the exhibits is as follows:—

- (1) Complete receiver of 5 valves or more, that is to say, receivers exclusive of loud speaker and batteries—unless these should happen to be incorporated as part of the receiver.
- (2) Complete receivers of 4 valves or less, similarly defined.
- (3) Batteries of all kinds, including accumulators for both high tension and low tension.
- (4) Mains supply units, both D.C. and A.C., and including those which provide filament heating circuits.
- (5) Loud speakers of all types. (6) Valves.
- (7) Other apparatus not classified above, also amplifiers, component parts such as transformers, condensers, tuning coils, resistances, etc.

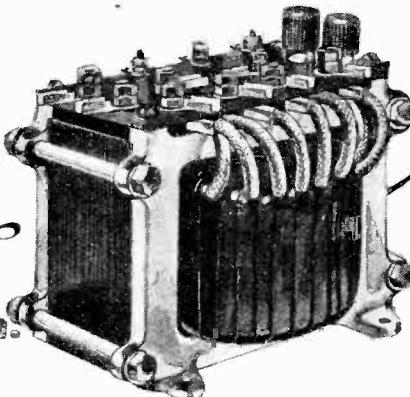
Details of the competition will be found on the entry form, which will be published in the advertisement pages of the next three numbers of *The Wireless World*, which constitute the special show numbers reviewing the Exhibition. Entry forms will also be available at Olympia.

The Prizes.

A cash first prize of £50 will be awarded by *The Wireless World*, as last year, 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 classes. In addition, second, third, fourth, and fifth prizes to the total value of a further £50 in the form of vouchers for the purchase of apparatus will be presented.

Voting for apparatus is, by the rules of the competition, confined to products exhibited at the Olympia Show, and competitors should bear in mind, when completing their ballot forms, that choice should be guided largely by a consideration of the value of the apparatus at the price asked for it.

We hope that every reader of *The Wireless World* will enter for the competition, as the value of the results must necessarily be proportional to the number of voters.



The Design of A.C. Mains Sets

A Simple Explanation of the Underlying Principles.

By W. T. COCKING.

IN a few years' time receivers operated from A.C. mains will be practically universal, except in remote districts where there is no electric supply available. This would be the case now if it were not for the innumerably different A.C. supplies in this country; but these are rapidly becoming more standardised, at least in frequency. Direct current, however, still remains a problem; such, in fact, that a set with a powerful output stage cannot be worked economically. The voltage of an A.C. supply is not really important, as transformers can be wound for any voltage, although if it were standardised the necessary apparatus would be more generally available, and, more important still, it would be cheaper. In America, due to the uniformity of the supply mains, mains-operated sets are becoming almost universal.

Advantages of Mains Drive.

Unless one has used a mains-operated set it is hard to realise its convenience. It is always ready for use; it requires no attention beyond very occasional renewal of the valves; there is no accumulator to run down just when a particularly interesting item is being broadcast; there are no high-tension batteries to renew; and the valves are always being worked with their correct high- and low-tension voltages.

Many people seem to think that a mains-operated set is difficult to design and build. It is, of course, more difficult than a battery-operated set, but the difficulties are so slight that they need not deter anyone capable of designing a battery set from attempting a mains set. If the proper precautions are taken to ensure that the apparatus conforms to the regulations of the Institute of Electrical Engineers, there is no danger whatever of getting shocks. As far as results are concerned, they will be better with a mains set than with a battery-operated one, for not only have mains valves better characteristics than the battery-heated type, but when mains are used there is little object in limiting the high-tension voltage to the low figure necessary when dry batteries are used, so that a greater undistorted power output can be obtained economically.

Although the building of the complete receiver with

mains equipment into a single cabinet is obviously very convenient, the writer favours a two-cabinet arrangement. One cabinet contains the receiver and the grid bias arrangements, while the other, which may well be of steel, contains the complete power unit.

Coming to the actual designing of the receiver, there is no great difference between a mains-operated set and one worked completely from batteries. What difference there is exists only in the filament circuit and the arrangements for grid bias.

The rules for design are simple. Design the set on paper first, exactly as for battery working, but omit all filament connections. Choose the valves and coupling components in the usual way, and decide upon the values for H.T. and grid bias which each valve will require. Then find out from the valve curves what the anode current for each valve will be.

The next point—and this is where a mains set becomes more complicated than a battery set—is to provide these potentials. The maximum current which the set will require is known, for it is the sum of all the separate anode currents; and the maximum voltage is that of the H.T. required for the power valve plus the amount of its grid bias—that is, the eliminator output voltage must equal the sum of the H.T. and grid bias voltages for the last valve. Now, knowing the eliminator output—for it must be built to give this output—the values for the anode feed and grid bias resistances can be calculated. The whole point, if the finished receiver is to give real satisfaction, is that back-coupling must be completely eliminated. A mains set is more prone to back-coupling than one operated from batteries, for several reasons; mains valves are usually more efficient, thus giving more amplification per stage, which means that precautions against back-coupling must be greater; in addition, there are more places where back-coupling can occur, for it can take place not only in the anode circuits but in the grid and filament circuits also.

Back-coupling in anode circuits can be cured in exactly the same way as with a battery-operated set, by the addition of anode feed resistances; as the valves may be more efficient the resistances should have a higher value, but this is not usually possible, so it is best to use a separate

The Design of A.C. Mains Sets.—

smoothing circuit for each valve. The cost is not so very much greater, as resistances and condensers can be used for all valves other than the detector and power stages.

Back-coupling in grid circuits can be cured very easily; it is only necessary to use one resistance and one fixed condenser in each grid circuit to obtain complete immunity from feed-back troubles here. The resistance can be of the grid-leak type, and as long as it is fairly high its value does not matter much. The requirement is that its resistance must be high in comparison with the reactance of the condenser at the lowest frequency which the set will amplify. The connections are shown in Fig. 1, where R is the filter resistance, C the filter condenser, and R_1 the grid bias resistance. Very good values for R and C are 0.25 meg. and 1 mfd. respectively; these values are suitable for any set, but the value for R_1 must be calculated afresh for every different valve.

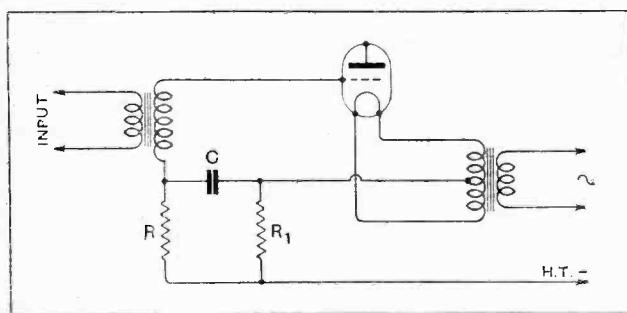


Fig. 1.—How to decouple the grid circuit of a valve deriving its grid bias and filament current from A.C. mains.

Back-coupling in filament circuits is at first sight not so obvious; it was first brought to the writer's notice by motor-boating in a set which was otherwise perfectly filtered. In an A.C. set the grid and anode return leads are all connected either to the slider of a potentiometer across the filaments or to the centre tap of the filament transformer. These components all have a resistance, and the passage of currents through it sets up potentials which are communicated to the previous valves in the set. It is impossible to provide an economical filter here, but the difficulty can be got over in another way. The best way—for it is one which completely eliminates the trouble—is to run each valve from a separate winding on the transformer. This is not always possible, in which case there is no alternative but to use valves of the indirectly heated cathode type, with which the trouble does not occur, as all return leads are taken directly to the cathodes.

Separate Filament Windings.

In practice, however, it is not always desirable to use this type of valve throughout a receiver, and the writer has found that the best results are obtained when two or three separate transformer windings are used with a mixed lot of valves. Ordinary 6-volt power valves for the output stage are recommended, although if their power output is sufficient there is no objection to using the four-volt type, the 0.8-volt type for the low-frequency stage, and 4-volt indirectly heated cathode type for the

rectifier. For the H.F. stage it does not matter so much, as long as the H.F. couplings will not pass low-frequency currents; but the indirectly heated type are best, for with them it is easier to arrange grid bias. Another advantage of using as many separate windings on the transformer as possible is that it simplifies the grid bias arrangements considerably.

The next piece of work to be done in the designing is to calculate the anode feed resistances necessary for breaking down the H.T. volts for the early valves (no resistance is needed for the last valve). The values for these resistances may be found by subtracting the sum of the grid bias voltage and the required anode voltage from the eliminator output voltage, and dividing the result by the anode current, expressed in amperes, as in the following example: Suppose the required anode voltage is 120, the grid bias voltage 6, and the eliminator output voltage 270, while the anode current is 5 mA. (0.005 ampere); then the volts to be dropped in the resistance are $270 - (120 + 6) = 144$, and the required resistance = $144 / 0.005 = 28,800$ ohms.

The value for the grid bias resistances can be found in a simple manner provided that no current other than the anode current for that particular valve passes through the resistance; that is, no other valve must be worked from the same filament winding unless it be a grid rectifier requiring no grid bias. The required resistances are found by dividing the grid bias in volts by the anode current in amperes, as in the following example: Let us suppose that the bias required is 6 volts and that the anode current is 5 mA.; therefore the resistance = $6 / 0.005 = 1,200$ ohms.

The anode feed resistances can always be worked out as described above, but when more than one valve is

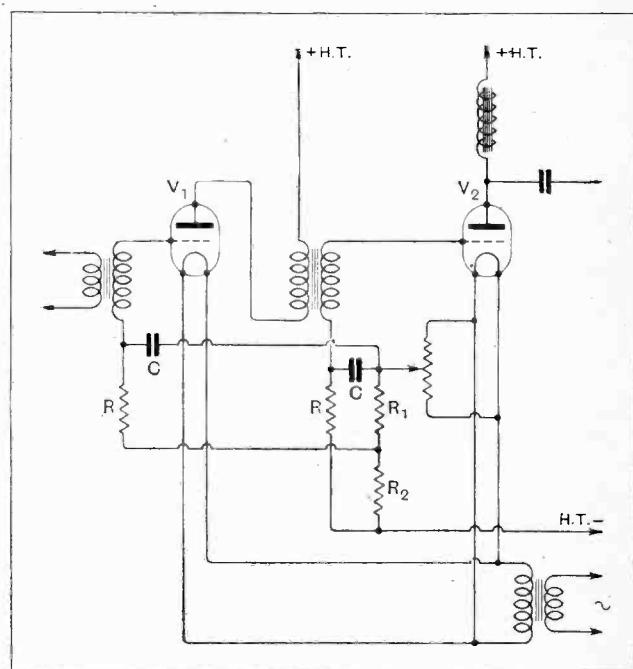


Fig. 2.—A two-valve amplifier shorn of its complications. Both valves are run from the same winding of the transformer.

The Design of A.C. Mains Sets.—

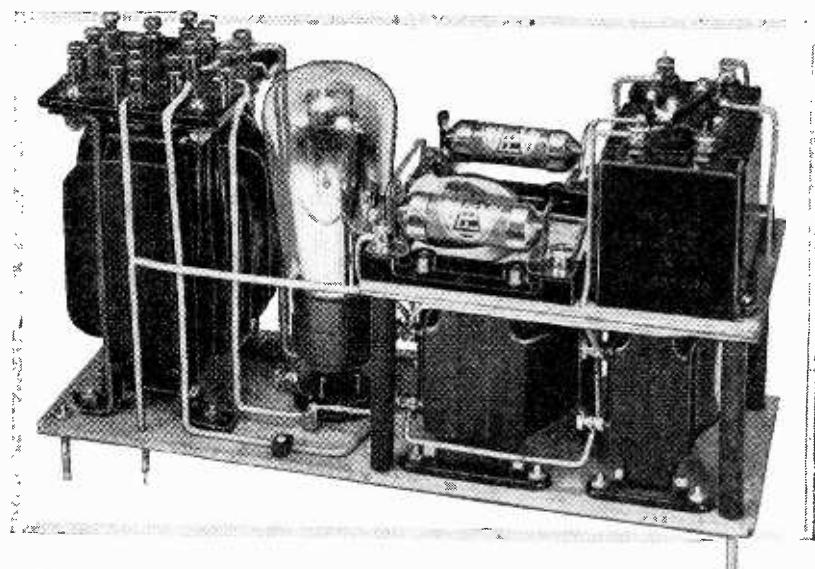
worked from the same filament winding, and each requires grid bias, the resistances for the latter must be calculated in a different manner.

In Fig. 2 is shown the skeleton circuit of a two-valve amplifier in which both valves are run from the same winding of the transformer; R and C are the filter resistances and condensers, while R_1 and R_2 are the bias resistances. It is required to find the values for these resistances. Let the anode current of V_1 be Ia_1 , and that of V_2 be Ia_2 ; the total resistance which will provide the bias for V_2 is $(R_1 + R_2)$, and the total current through it is $(Ia_1 + Ia_2)$. Therefore the bias voltage for V_2 is $(R_1 + R_2)(Ia_1 + Ia_2)$. But the bias voltage for V_1 is provided by the drop across R_1 only; it therefore equals $(Ia_1 + Ia_2)R_1$. As an example, suppose that the valves require the following voltages and currents:—Anode current of V_1 is 5 mA., anode current of V_2 is 24 mA., bias voltage for V_1 is 6 volts, and bias voltage for V_2 is 27 volts. Then $(Ia_1 + Ia_2) = (5 + 24) = 29$ mA. = 0.029 ampere and $(R_1 + R_2) = 27 / 0.029 = 930$ ohms and $R_1 = 6 / 0.029 = 206$ ohms, therefore $R_2 = 930 - 206 = 724$ ohms.

When working valves from A.C., if ordinary power valves are used in the last stage, it must not be forgotten that the negative grid bias which is correct for battery working must be increased by an amount equal to half the filament voltage—that is, for a 6-volt valve, by 3 volts.

In calculating the biasing resistances, unless the potentiometer across the filaments is of very low resistance it must be taken into account. The anode current passes through it, and the voltage drop across it will be in the same direction as that across the proper bias resistance, with the result that the negative bias will be increased. It must not be forgotten that its resistance is less than that marked on it, for the marked resistance is that between the ends of the winding, while the effective resistance when connected in circuit is that between the slider and the valve filament. The slider will be connected to the centre of the potentiometer, which means that the two halves are virtually in parallel, so that the effective resistance of a 400-ohm potentiometer will be 100 ohms.

It is true that in many cases this resistance will make no appreciable difference, but when more than one valve is being run from the same filament supply, and the anode current is fairly heavy, it may make a big difference. It is worthy of note that many American sets use potentiometers of 20 ohms resistance, which means an effective resistance of only 5 ohms. Another advantage of using a low resistance potentiometer is that the danger of back-coupling is greatly decreased; in practice, with a two-



The rectifier and smoothing unit of the "Flat Dweller's A.C. Three," an all-mains receiver described in our issues of May 1st and 8th, 1929.

valve amplifier which will amplify the bass, when both valves are run from the same filament winding and a 400-ohm potentiometer is used, motor-boating occurs, although all the other circuits are effectively filtered. With one particular set where no potentiometer was used, even the resistance of the transformer secondary, a centre-tapped winding, was sufficient to give bad motor-boating. It is these troubles that have made the writer always recommend the use of separate transformer windings for supplying the detector and each of the low-frequency stages. It does not greatly increase the cost, and it gives complete freedom from all biasing and motor-boating troubles.

(To be concluded.)

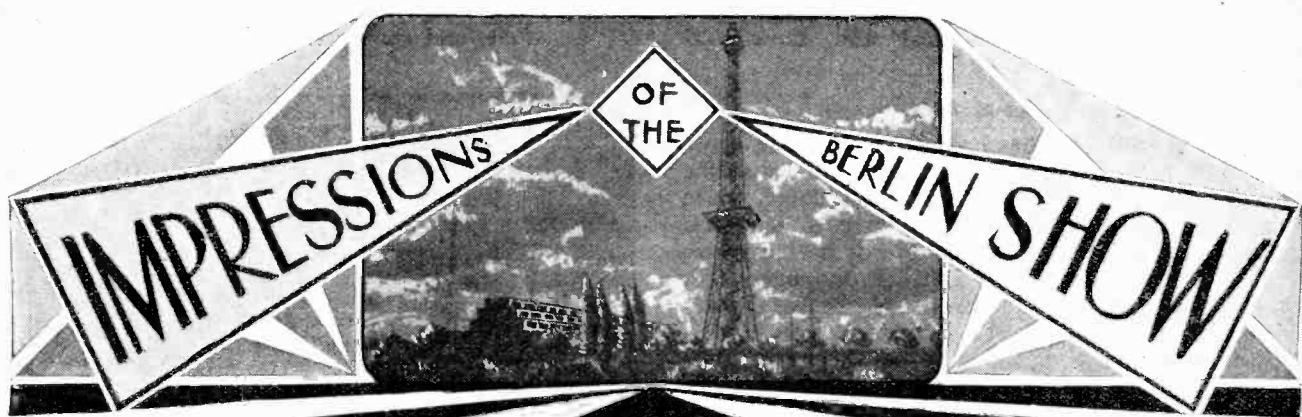
PLUS OR MINUS?

A Note on By-pass Condenser Return Leads.

IN a receiver embodying a single stage of screen-grid high-frequency amplification that was recently set up, persistent oscillation that could not be traced to any of the usual sources was experienced. Eventually, after many hours of work, it was noticed that, although all other by-pass condensers had been taken direct to the negative filament leg of the valve, the condenser between screen-grid and filament had been brought to the positive side instead of the negative. On changing this connection over, as a last resource, the receiver instantly subsided into perfect behaviour.

It must be admitted that extremely low-loss tuned circuits were in use, and that the precaution of decapping both high-frequency and detector valves had been taken for the sake of cutting down dielectric losses to the minimum, but even so it seemed hardly to be expected that so trifling a detail should be enough to render the set unworkable. Nevertheless, such was the case, and the experience is published to draw the attention of others who may also be contending with unaccountable oscillation to a point that might very easily be overlooked.

A. L. M. S.



A Wide Range of Screen-Grid Mains-Driven Sets but Few Portables.

IT is perhaps only natural that, when visiting the Berlin Radio Show, which opened on August 30th, the inclination was to look at every aspect of the Exhibition in terms of comparison with our own Olympia Radio Show, especially when our own Show is to follow so quickly after that of Berlin.

The fact that an important section of the Exhibition is devoted to a display arranged by the German Post

Office creates a strong impression, which subsequent observations do nothing to dispel, that the Berlin Radio Show is very strongly supported and encouraged by the Post Office and the Government. It is more a national Exhibition than our own can be considered to be in this respect, because at home we never quite get away from the feeling that the Post Office and the authorities take no part or interest in the Exhibition, whilst the B.B.C. is in a position rather aloof, after the style of an independent exhibitor.

Perhaps time will remedy this state of affairs, but at the moment the British wireless industry is certainly at a great disadvantage compared with our German colleagues in so far as official support and encouragement are concerned.

The special exhibit of the German Post Office included a duplicate of the apparatus now installed in Berlin, whereby the stations of Berlin, Stettin, and Magdeburg, all operate on the same wavelength. The control frequency is generated at the Berlin station and passed by ordinary cable to the two other stations. This system is also being operated with other groups of stations in Germany, and is proving satisfactory. The grouped stations have a common wavelength, but are independent so far as programmes



Telefunken screen-grid valve. The glass bulb is covered with an earthed metallic coating which reduces the residual inter-electrode capacity.

are concerned, or they can transmit simultaneous programmes if desired.

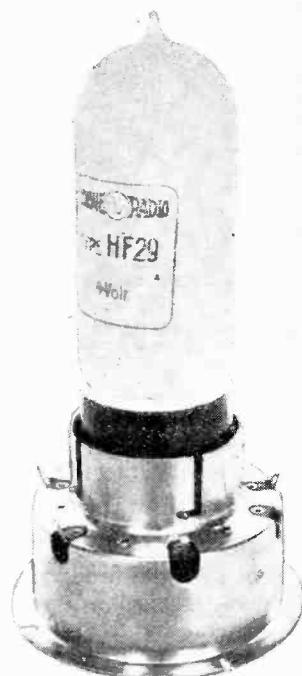
Another exhibit of special interest was a duplicate of the German short-wave "world transmitter," which has so successfully established communication with South America and other distant parts of the world.

Next should be mentioned a special short-wave receiver designed by Telefunken for the Broadcasting Company, a particular advantage of which is a new method of controlling fading and ensuring a constant signal value. Details of the circuit are not yet available for publication, but will no doubt be released later on.

Adjoining these exhibits is a room devoted to a series of demonstration stands to make public the present state of progress of television, as illustrated by several of the systems now developed, including Baird, Mihaly, Nipkow, and Karolus-Telefunken. The room is darkened so that projections can be seen through apertures in the sides of the walls of the stands enclosing the apparatus.

Utilitarian rather than Decorative Apparatus.

Germany is an eminently practical country, and so it may not seem surprising that the receivers have had more attention paid to their technical design than to outward appearances. There are, of course, many exceptions, but, taken as a



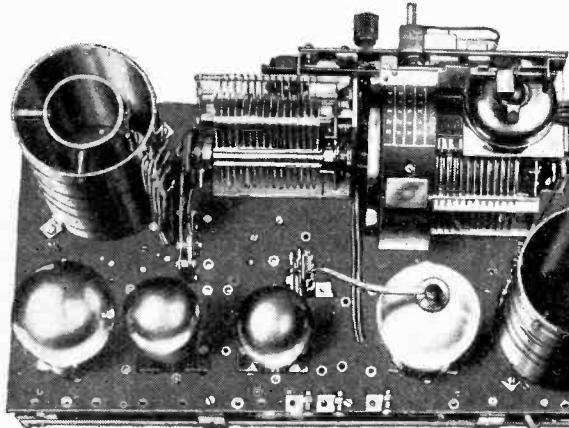
New Loewe multiple valve with metal-coated bulb and screened base.

Impressions of the Berlin Show.—

whole, the artistic merit of the exteriors of the sets has taken second place to electrical and mechanical efficiency.

Screen-grid Mains Sets.

The screen-grid valve has been incorporated in many of the better sets, and it would seem, too, that the demand for battery-operated sets is declining, since mains-driven receivers were everywhere to the fore. The general practice is to utilise indirectly heated valves for H.F. stages, detector and first L.F. amplifier, with a power valve following having a heavy filament directly heated. Alternating current being more general in Germany than here, D.C.-operated sets are scarce. Telefunken, in the manufacture of screen-grid indirectly heated valves, have adopted a method of metallising the glass bulb, the bulb being connected electrically to the negative of the filament. The purpose of rendering the bulb a conductor is to reduce the residual inter-electrode capacity. The manufacturers of the Loewe multiple valves have also employed this method, but in this case for the different object of screening the valve and the couplings included in the valves from one another and from other parts of the receiver, the metallised glass bulb being again connected so as to be at earth potential. It is stated that in the Loewe valve this process has permitted an increase in stage gain of about 70 per cent.

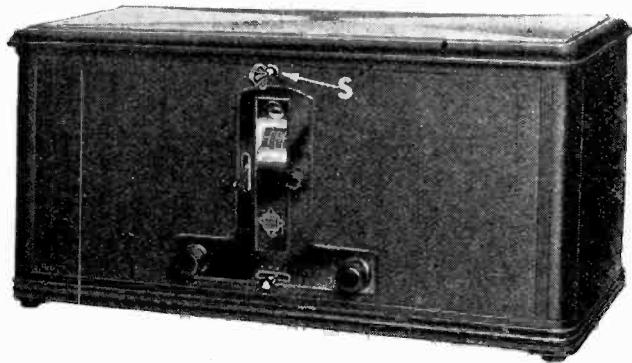


Interior views of the Telefunken "40" receiver showing elaborate screening and mass-production methods of manufacture.

The general introduction of the screen-grid valve has brought with it, naturally, problems of metal screening; here the manufacturers have in some cases been particularly thorough.

It is quite impossible in the space available for recording impressions of the Show to attempt to deal with the products shown on over 400 stands, so that only typical examples can be taken to illustrate the general trend of design. The "Telefunken 40" receiver is a new product, and the accompanying illustrations give a good idea of its construction. The valve with the frosted appearance is the metallised screen-grid valve, and is indirectly heated. It is followed by delec-

tor and first L.F., both indirectly heated, and finally a power valve directly heated. On the right is seen the rectifier. Coils and condensers are carefully screened.

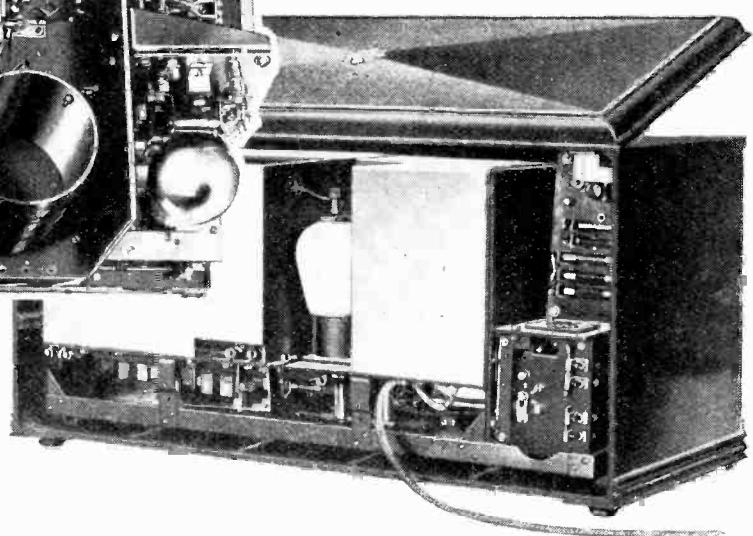


The Telefunken "Type 40" receiver—an example of the best—A.C. mains-driven sets now popular in Germany. The set cannot be put into operation until the cabinet is locked by the key switch S.

The wavelength range is 200 to 2,000 metres. A point of interest is a key which operates a switch lock, so that the set is only "live" when the lid is closed and locked.

A New Tuning Method.

Another receiver of interest, which also operates from the mains and includes a screen-grid valve for H.F. amplification, is due to Siemens, and is illustrated in the photograph reproduced. Tuning with this receiver, which covers 200 to 2,000 metres, is

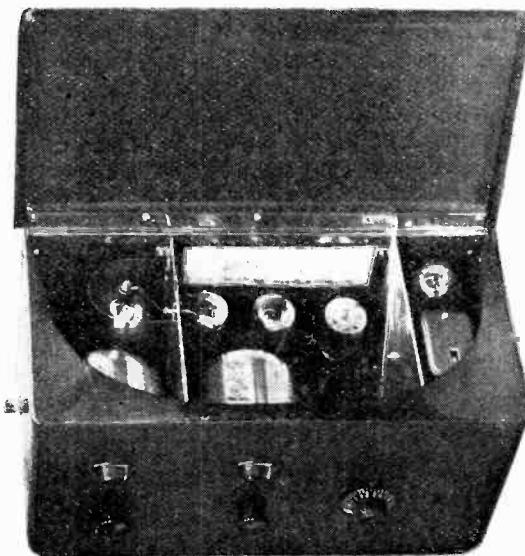


by means of variometers coupled to variable condensers, and as the control knobs are rotated the proportion of inductance to capacity is correctly maintained and amplification remains constant through the wave range. The screening of the variometers and condensers is very complete, as the illustration shows.

Quite a number of receivers employ metal lids which

Impressions of the Berlin Show.—

close down over the apparatus on to a wood or metal baseboard, on which the components are mounted. The arrangement is very similar to that adopted in recent *Wireless World* set designs, except that the screening provided is not so complete in the German sets, as the partitions separating stages are not incorporated in the metal lid, but stand up from the base so that complete screening where the uprights join the lid cannot be ensured. The metal cases are mostly treated to represent wood grain, and are hard to distinguish from polished wood except by close inspection. German metal work is particularly good, and this is, perhaps, one reason why the great majority of the sets are metal



Siemens screen-grid valve receiver in which tuning is effected by a combination of variometers and variable condensers. Uniformity of H.F. amplification from 200 to 2,000 metres is claimed for this system.

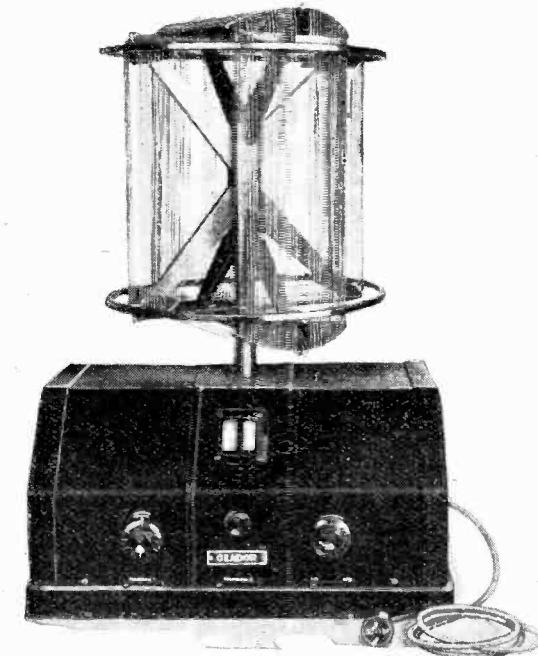
cased, though there are outstanding examples in the two sets referred to above, namely, Telefunken and Siemens, where the whole cabinet is of moulded material made in two pieces, the box and lid, and beautifully finished.

Frame aerial receivers do not appear to be popular, as very few examples were to be seen. The same observation applies to portable receivers, and we learned that these have never been popular with the German public.

From amongst the few frame aerial sets we would mention the A.E.G. (Allgemeine Electricitäts-Gesellschaft) five-valve receiver operating from the mains and having two stages of screen-grid amplification, detector, and two L.F. stages, all valves except the output valve being indirectly heated.

Another example of a frame aerial set is that of "De Te We," which is an eight-valve mains-operated superheterodyne. The same firm also exhibits a universal short-wave receiver also operating on the superhet. principle. The wave range is from 10 to 100 metres. The coils for the wave ranges are contained in a circular holder with stud contacts on the side. An edgewise

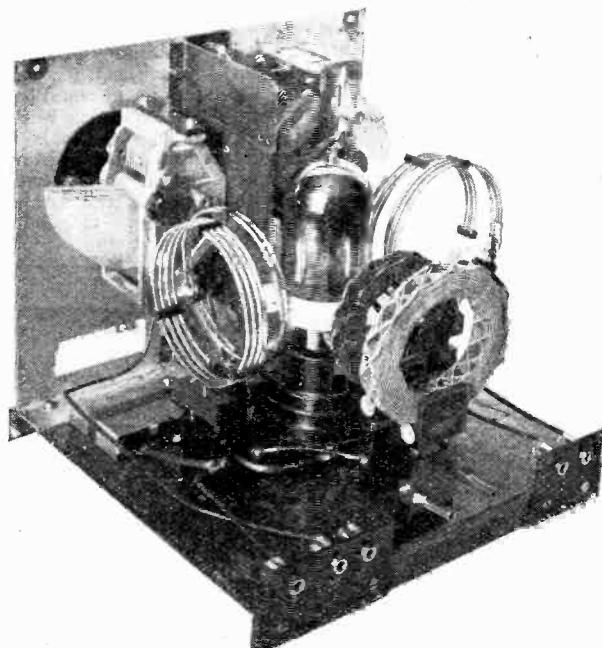
rotating drum makes contact with the studs for different wavelength ranges, whilst reaction is provided by a coil with variable coupling to the various coils. The design



A.E.G. mains-operated five-valve frame aerial set. There are two stages with screen-grid valves followed by a detector and two L.F. stages. With the exception of the last stage, indirectly heated valves are used throughout.

is not according to accepted short-wave practice, but a very good performance is claimed for the set.

A short-wave unit removed from its case is illustrated in the photograph. This is made by Loewe Radio, and incorporates a new Loewe valve, which has connections



Loewe short-wave unit; wave-range, 16 to 60 metres. Parts of the screening system have been removed for the purpose of this photograph.

Impressions of the Berlin Show.—

for external couplings instead of the couplings being associated within the bulb in the usual way with valves of this type. This unit is intended to be followed by an amplifier, and the wavelength range without change of coils is from about 16 to 60 metres. The screening for the coils has been removed for the purpose of the photograph.

Loud Speakers.

It was interesting to observe that the ordinary horn loud speaker appears completely dead. It was necessary to search the Exhibition to see one at all. Manufacturers are all showing cone or other non-horn types with, perhaps, the exception of one firm, Lenzola, which specialises in a folded exponential horn which, on demonstration with a moving-coil diaphragm unit, certainly gave very satisfactory reproduction. The ability to demonstrate loud speakers in cubicles behind the stands is a great advantage to exhibitors, though perhaps not to visitors as a whole. The moving-coil loud speaker is extremely popular, and many types were to be seen.

Amongst accessories an electrostatically screened frame aerial designed by M. von Ardenne attracted attention.¹

¹ Referred to elsewhere in this issue.

A survey of the Exhibition as a whole leads to the conclusion that Germany is making very great progress in the production of broadcasting receiving apparatus, but there is not very strong evidence of originality in design. Quite a number of sets, although manufactured on German lines, are strongly reminiscent of American products, whilst some apparatus of types already familiar to us in this country are now new in Germany.

German methods of manufacture are certainly interesting, though probably less pleasing to an English visitor than the more substantially constructed, though probably more bulky and expensive, British product. Metal stamping work and mouldings of all kinds have been developed to a fine art, and in few sets where quantity production is considered do we find that wiring has been done by hand except where it has been unavoidable. The tendency is for all wiring before the low-frequency amplifier to be metal ribbon riveted on an insulating material, which is probably all produced in one or two automatic processes. Post-detector wiring of the L.F. amplifier is often cabled as in telephone work.

It is interesting to remember that, unlike America, Germany has the same problem in receiver design which confronts ourselves, namely, that provision must be made for both long and short wavelength reception.

NEW METAL SCREENING' CABINETS.

A Commercial Design of the "Wireless World" Screening Box.

THERE is no reason why screening containers built in conformity with the general principles laid down in this journal and used for the Kilo-Mag IV and Record III receivers should not be decorative in design. By the exercise of a little ingenuity in design, these cabinets can be both workmanlike and attractive in appearance. This is confirmed by an examination of a container submitted by Messrs. Rigby & Woolfenden, Sheet Metal Workers, Rochdale. The addition of a flared extension to the top of the metal cover and of a beading round the upper projecting surface of the base tends to improve the balance and artistic propor-

tions of the whole, while the practice of finishing the metal in imitation oak or whatever is required to harmonise with the wooden base makes the container sufficiently attractive to satisfy the most exacting requirements. It is priced at 57s. 6d.

Accuracy of workmanship is beyond reproach, and the width of the various channels in the metal base is perfectly uniform, although this is rather greater than is strictly desirable in cases where perfect sealing is necessary. The makers point out, however, that the cabinet submitted is an experimental specimen, and that this has been rectified in commercial models

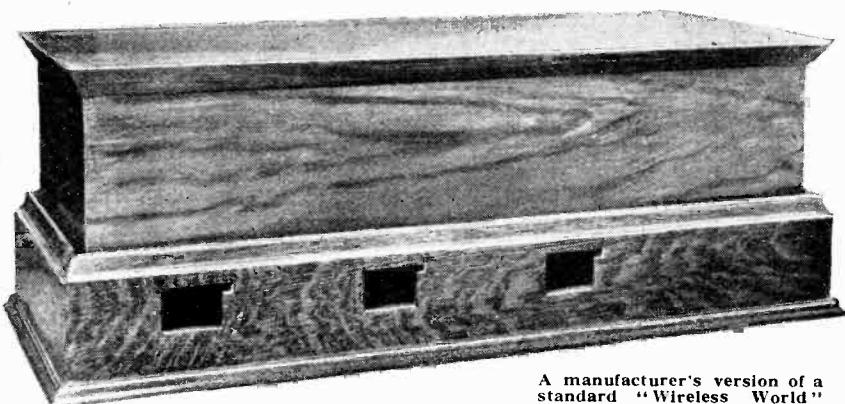
in the form in which they will be supplied to the public.

.....

THE NEW COSSOR VALVES.

THE Cossor programme for the coming autumn season provides for the production of no fewer than thirty-five different types of receiving valves. This range is made up of indirectly and battery-heated valves, and includes pentodes. In each of the two-, four-, and six-volt classes there are six types—the "S.G.," "R.C.," "H.F.," "L.F.," "P," and "X.P." While the filament current is in most cases 0.1 ampere, an increase is made to 0.2 and 0.3 ampere for the "P" and "X.P." types in the two-volt class, and to 0.15 ampere for the "X.P." in the four-volt class. To compensate for the small increase in current consumption, the power output of the "P." and "X.P." types is correspondingly increased.

The "S.G." all have an amplification factor of 200 with an A.C. resistance of 200,000 ohms, and should therefore give a single stage amplification of over 70 when used with a H.F. transformer ratio of 1 to 3. This ratio is adopted in order to provide adequate selectivity while avoiding the possibilities of oscillation. Of particular interest is the indirectly heated screen-grid valve, the "M.S.G.41." A H.F. stage gain approaching 150 is obtainable under the conditions just mentioned.



A manufacturer's version of a standard "Wireless World" screening cabinet.



CURRENT TOPICS

Events of the Week in Brief Review.

THE SHEEP AND THE GOAT.

A distinction was drawn in the Birmingham Police Court recently between defendants who had installed unlicensed wireless sets and one who had committed the additional offence of operating the set. He was fined £3, the others being mulcted of £2 each.

A.C. SETS FOR IRELAND.

Now that the Shannon Electricity Scheme is making progress, the talk in Irish radio circles is turning upon the approaching era of the A.C. mains-operated set.

During the last fourteen months, says *Irish Radio News*, the construction of the networks has progressed steadily and new works have been completed in nearly sixty towns.

It is expected that current will be available for certain towns before the end of the year.

BAIRD TELEVISION TESTS.

We learn from the Baird Television Development Company that it has been decided to accept the proposal of the Postmaster-General, Mr. Lees Smith, and of the British Broadcasting Corporation to permit five half-hourly periods per week for experimental television transmission from a B.B.C. station. At the time of going to press no definite programme of tests has been prepared.

It is understood that nightly television tests are about to take place at the Brussels broadcasting station between 10.30 and 11.30.

WIRELESS-EQUIPPED ARK.

According to a correspondent of *The Jewish Chronicle*, the Adventist body in Boston, U.S.A., foresees a world flood in the near future, and is therefore planning a luxurious and up-to-date Ark which is to be fitted with radio apparatus. The question is asked. If the world flood does occur, with whom will the Ark exchange wireless messages?

FOREIGN SETS: NO MARKS REQUIRED.

The application made to the Board of Trade for the marking with an indication of origin of imported wireless receiving sets, components, and accessories has been withdrawn.

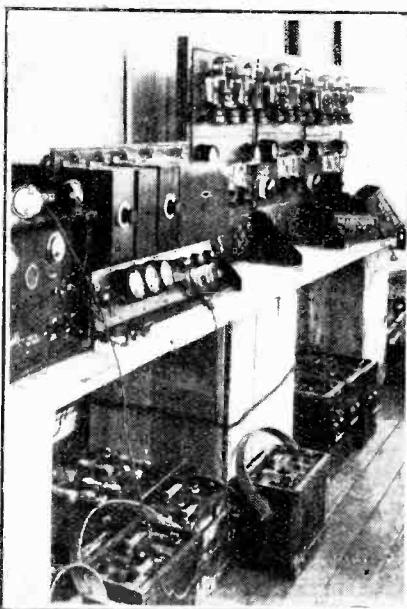
B 21

THE RADIO TRUMPET.

From the *Exchange and Mart*:—
Wireless : Cornet, 4-valve . . .
Is this a new all-metal portable?

HAGUE WIRELESS CONFERENCE.

Practically every phase of modern radio will be discussed on the technical side at an international conference which opens at The Hague on Wednesday next, September 18th, and continues until October 2nd. It will be composed of members of the International Technical



PUBLIC ADDRESS RECORD. One of the nineteen amplifying installations used by the Marconiophone Company to distribute the B.B.C. running commentary on the Schneider Trophy Race. Over 700 valves were used, together with 15 miles of wire.

Consultative Committee of Radio Communications.

The principal matter on which recommendations may be made will be that relating to wavelength distribution. Discussions will also take place on recent engineering advances, radio nomenclature, and the use of frequency control devices to limit interference.

RUMANIA'S RADIO SHOW.

The Bucharest International Wireless Exhibition, which opened last week, is continuing until September 20th.

R.C.A.'S MILLION POUND PROFIT.

During the six months ended June 30th, 1929, the Radio Corporation of America showed a surplus profit of \$4,996,487.

COLUMBIA ENTER WIRELESS FIELD.

The Columbia Graphophone Company has decided to manufacture combined gramophones and radio receivers in this country on a large scale. The first sets may be on view at Olympia.

POLYTECHNIC WIRELESS COURSES.

Evening courses in wireless and high-frequency engineering will begin on September 23rd at the Polytechnic, 307-311, Regent Street, London, W.1. The Polytechnic laboratories are equipped with modern apparatus and include a complete commercial installation for telegraphy and telephony (6RA). Enrolments begin on September 16th, and full particulars of the courses, which extend over a period of five years, can be obtained on application.

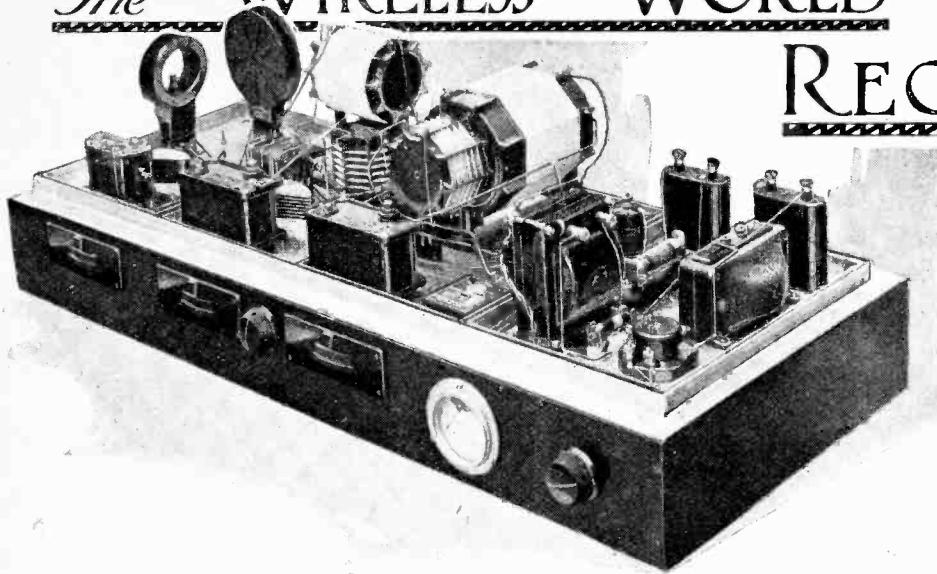
FIRST RADIO SHOW IN NEW ZEALAND.

Five years ago there were only 3,000 licensed wireless sets in New Zealand. Now there are 44,000, according to a statement made by the Postmaster-General, Mr. J. B. Donald, at the recent opening of the first New Zealand Wireless Exhibition at Wellington Town Hall. The principal attractions of the Show, writes a correspondent, were the Post Office experimental laboratory and a studio from which programmes were broadcast through the local station, 2YA.

NEW BATTERY COMBINATION.

We are informed that the two well-known makers of portable batteries, Peto and Radford, and the Hart Accumulator Co., Ltd., joined forces as from the 9th of September under the name of the National Accumulator Co., Ltd. The object is the development of sales of portable batteries, particularly for motor cars and wireless.

The WIRELESS WORLD RECORD III



Constructional Details and Final Adjustments.

(Concluded from page 218
of last week's issue.)

By A. L. M. SOWERBY, M.Sc., and H. F. SMITH.

AS was mentioned last week, it takes some 48 hours of soaking in spirit to soften the cement holding the base of a valve in position. The first step in construction will therefore be to stand the valve in spirit in order that it may be ready when required. Methylated spirit evaporates rather quickly, so that it will be necessary to fill up the vessel again from time to time during the period of soaking. Once the cement is thoroughly soft there is no danger whatever of damaging the valve if the base is withdrawn gently after cutting the connecting wires.

The remaining components that will have to be got ready before beginning to assemble the set comprise chiefly the tuning coils. It is not unlikely that manufacturers may offer these coils ready wound, but those who prefer to wind their own will find full practical information in the illustrations and the notes below them. The following additional notes may be useful:—

Medium-wave grid coil: Two or three coupling turns will be suitable for the average case; one turn will suffice if highest selectivity is required.

Long-wave grid coil: Four to six coupling turns provide normal coupling; two or three will be preferred by those living near 5XX.

Medium-wave transformer: An alternative construction is to wind the primary over the secondary, using ebonite spacers to keep the windings about $\frac{1}{16}$ th inch apart. This entails less work, but makes a rather frail coil. Efficiency will not be impaired.

Long-wave transformer: Some practical hints on winding coils of this type will be found in the description of the "New Kilo-Mag. Four" (*The Wireless World*, August 14th and 21st). Note that one primary slot is outside the secondary, and that the 6-turn balancing coil is coupled to this section. In each case the balancing turns are wound in the same direction as the

other windings on the former, the inner end being connected to earth and the outer end to the balancing condenser.

The coils are mounted with the help of wooden discs inserted into their ends. The remaining details of mounting may be gathered from the various illustrations.

The screen-grid valve, mounted below the base to keep it out of the field of the coils, is fixed to a bracket that carries its centre $1\frac{1}{2}$ in. from the wood. The capacity screen shown is 3in. \times 4in., exclusive of the turned-over rim that supports it, and has a $\frac{1}{16}$ in. hole at its centre. The valve-holder is that sold by the makers of the valve, and has five contacts; another of same pattern is used for the output valve.

The detector mounting shown in the diagram, in which the valve is held by rubber bands against a rubber pad, is an alternative to the metal clip seen in one of last week's photographs. The change was made because it was found that some AC/G valves tend to slip out from a clip owing to the shape of the glass bulb.

Reducing the Tuning Condenser Minima.

The Burndepth condensers shown were specially selected for their very low minimum capacity, which is a point of considerable importance where the inductance of the coil is raised to the highest practicable value. Their minimum has been still further lowered by removing the metal screens supplied with them, as these are not needed when the receiver is completely screened. To help in keeping down the minimum capacity, the lead that runs through the base to the grid of the detector should pass through an oversize hole of not less than $\frac{1}{16}$ in. diameter.

The balancing condenser, a Ganibrell "Neutrovernia," is attached by its one-hole fixing bush to

The Wireless World Record III.—

an odd piece of ebonite about $1\frac{1}{2}$ in. \times 2 in., and is mounted upside down, as shown, so that it can be adjusted from below the baseboard. A large clearance hole is cut in the screening to prevent a short-circuit of the balancing system.

Owing to the fact that it was found very essential to keep all high-frequency currents out of the low-frequency stage, a choke is placed between the anode of the detector and the primary of the transformer, while a 0.0005 mfd. condenser is connected directly from plate to cathode of the valve to "earth" the

the switches, which are fitted with slotted heads. Constructional details of these heads need hardly be given, as those who have the necessary tools will be able to design them for themselves, and it is anticipated that these heads, which will be applicable to almost any receiver, will shortly be marketed by the makers of the switches. The operating knob is left to the constructor's taste.

The rest of the constructional work, which, owing to the design of the screening box, is quite straightforward, needs no special comment, as it amounts to no more than fixing each component in the position prescribed in the detailed diagrams which accompany this article.

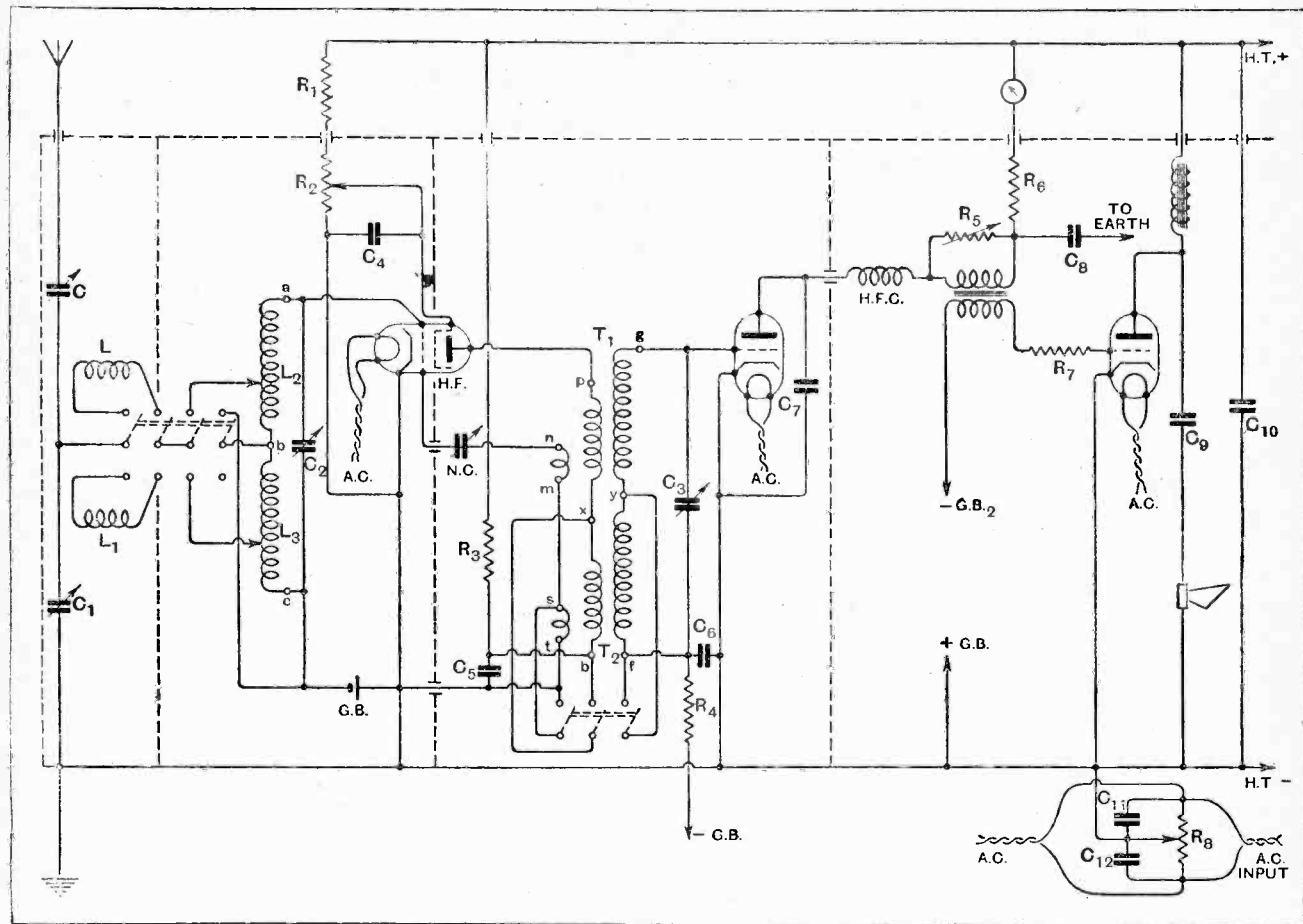


Fig. 7.—Complete circuit diagram. C₁, 0.0003 mfd. (semi-variable); C₁₁, 0.0005 mfd.; C₂, C₃, 0.0003 mfd.; C₁₂, C₁₃, 0.1 mfd.; C₇, 0.0005 mfd.; C₈, C₉, C₁₀, 2 mfd.; C₁₄, C₁₅, 0.005 mfd.; R₁, 10,000 ohms; R₂, 25,000-ohm potentiometer; R₃, 0-200,000 ohms (variable); R₄, 23,000 ohms; R₅, 100,000 ohms; R₆, 600 ohms; R₇, 100,000 ohms; R₈, 400-ohm potentiometer.

high-frequency currents. In view of the presence of this condenser, it was thought advisable to remove the condenser which is incorporated across the primary of the AF5 transformer. This was done by removing the case on the primary side, and cutting through, with a hacksaw, the terminal block in which the condenser is embedded.

When these preparatory details have been attended to the work of assembly can begin in earnest. It will be well to begin by mounting the switches in position, and making up the simple "ganging" device shown. Standard strip brass is used for joining the handles of

There are a few points in connection with the wiring, however, to which attention must be drawn.

Although it is not immediately obvious from the diagrams, the principle of "Scientific Wiring" (see *The Wireless World*, April 25th, 1928) has been incorporated to a large extent, so that the run of the wires should follow the practical wiring diagram closely. In particular, care has been taken to connect all by-pass condensers direct to the cathode of the valve in whose plate or grid circuit they are placed, so that each high-frequency circuit is completely independent. To bring all earth returns indiscriminately to the nearest point

The Wireless World Record III.—

of the screening is *not* a satisfactory substitute, and the writers disclaim any responsibility for the behaviour of a receiver in which the precautions described are not taken.

and cathode were at the same high-frequency potential. Logically, this double condenser bridge should be fitted to each valve separately, thus involving six such condensers in the set, but the less expensive expedient of using two condensers only, situated close to

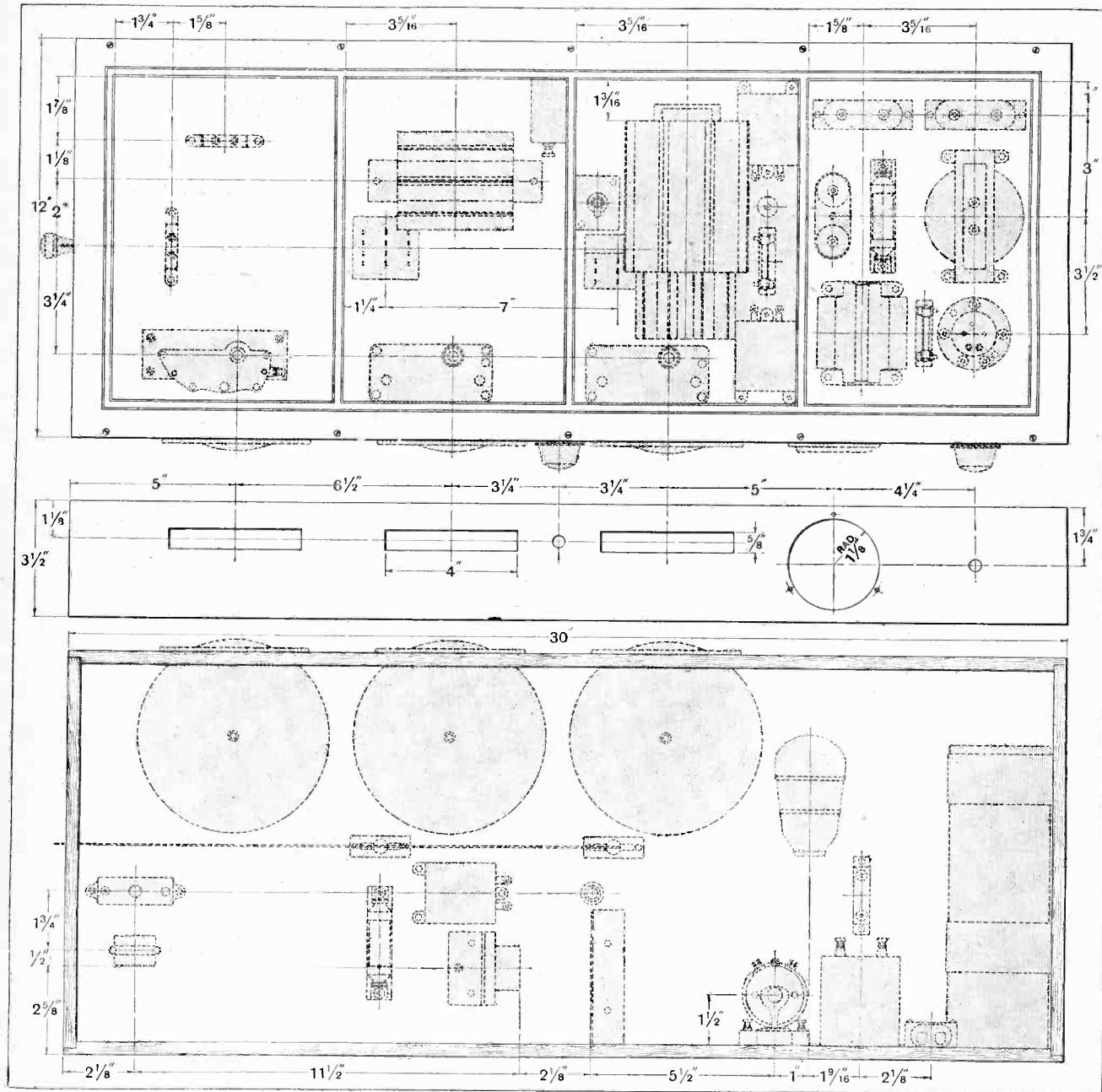
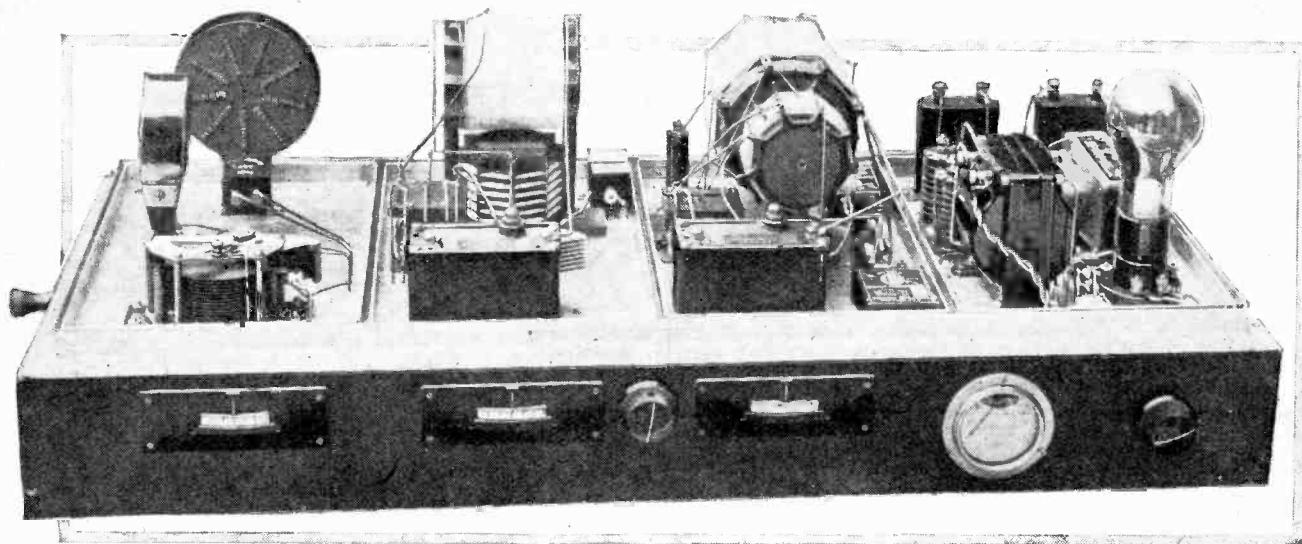


Fig. 8.—Baseboard and under-baseboard layout.

Indirectly heated valves require one precaution that does not enter with battery-heated valves; in the present receiver the cathodes are, as usual, connected to the slider of a potentiometer placed across the heater terminals. It was found necessary to join each end of this potentiometer to the slider by a condenser of 0.005 mfd. to ensure that heater

the potentiometer below the baseboard, was found amply adequate. These condensers, which appear in the photographs and diagrams, are essential to the proper working of the set.

Apart from odd metal objects, such as the cases of the fixed condensers and the capacity-screen round the H.F. valve, connection is only made to the screening



Front view of receiver without screening cover. The screens visible on the two Burndepot condensers should be removed.

box by one wire from the cathodes of the valves. As already emphasised, the screens are *not* used as omnibus return leads.

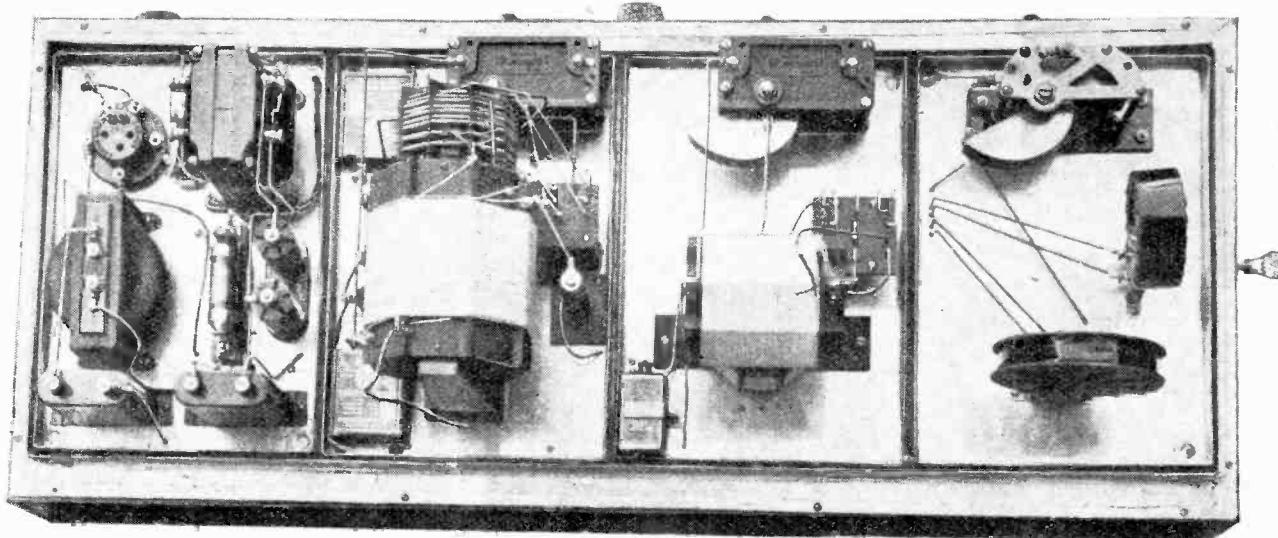
Decoupling is fairly complete, being applied even to the grid-circuit of the detector, thus enabling the detector and output valve to share a grid-bias battery. A 10,000 ohm Loewe resistance and a 0.1 mfd. condenser are used here, while a wire-wound resistance of 20,000 ohms has been used for the plate circuit of the detector valve, where currents up to several milliamps. may flow, if only for a moment. There is a resistance of grid leak type in series with the grid of the output valve to help to keep high-frequency currents out of the loud speaker leads; 100,000 ohms is a suitable value here.

The potentiometer used to control the voltage applied to the screening-grid is of American origin, and has

proved perfectly satisfactory. Those who prefer to use British components may like to note that Messrs. Oliver Pell Control, Ltd., have just issued a series of Varley potentiometers of similar type.

Operating Notes.

It is intended that both filament (heater) and anode currents should be drawn from A.C. mains. For this reason no switch is fitted to disconnect the screen-grid potentiometer, which, from batteries, would draw a continuous current. The receiver consumes about 25 to 30 milliamps. at 180 volts if a Cosmos AC/R is used as output valve; this will rise by about 10 milliamps. if a Cosmos AC/P1, which gives less amplification, though handling stronger signals, is substituted. Sufficient decoupling has been provided in the receiver itself to permit of the use of any eliminator, however



Plan view of receiver. The mounting of the balancing condenser is clearly shown.

The Wireless World Record III.—

simple, that will provide the necessary current; this runs up the cost of the set, but it is only fair to remember that the eliminator is correspondingly cheapened.

Balancing is performed by setting the balancing condenser half-way between the two settings that give critical instability, the tuning condensers being preferably near the middle of their range. In the unlikely event of the same setting not giving stability on the

current to about 1 milliamp. to ensure minimum distortion at this point. The output should be controlled independently by the second volume control.

It may be found that the wave-range of the aerial circuit is too high or too low to tune over the ranges of 240 to 600 and 900 to 2,000 metres covered by the other two tuned circuits. Using 60 and 200 turn coils, this fault may be remedied by adjustment of the semi-variable condenser in series with the aerial.

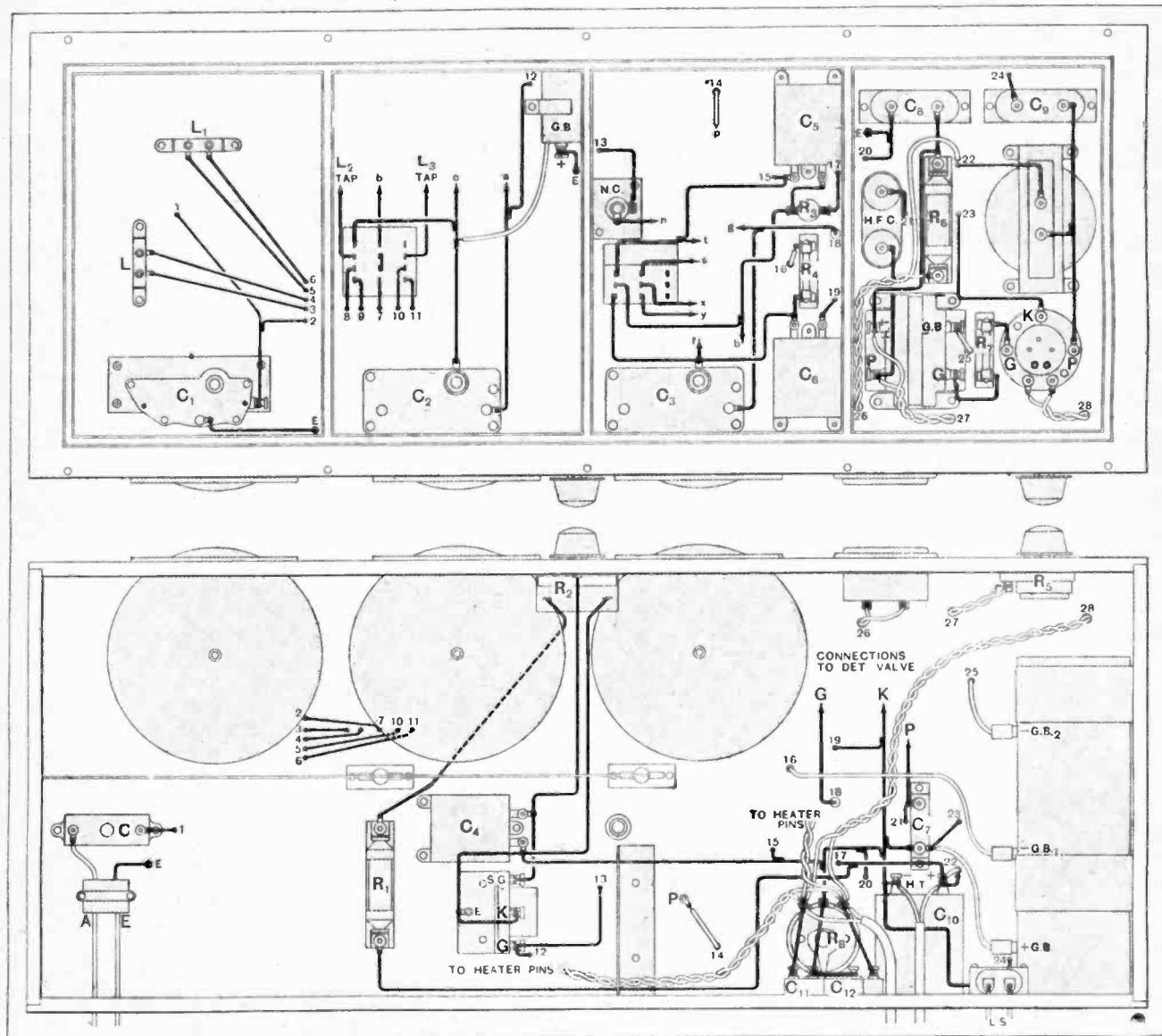


Fig. 9.—Practical wiring plan. The detector valve has been omitted from the plan underneath the baseboard, and the grid, plate and cathode connections have been marked G, P and K respectively. Earth points are indicated by E, and the lettering of the coil tappings corresponds with the lettering of Figs. 6 and 7.

long-wave range, the number of turns in the long-wave balancing coil may be altered suitably.

The standing current of the detector valve, when no signals are being received, should be about 0.4 milliamp. Signals should be tuned in accurately, using the deflection of the meter as a guide, and the screen-grid potentiometer should be used to adjust the detector

In spite of its high amplification, this receiver is not intended to bring in American broadcasting stations, or quarter-kilowatt relays at the other end of Europe. It may, however, be relied upon, when used with any but the most inadequate aerial, to bring in every station of the slightest entertainment value at good loud speaker strength.



By Our Special Correspondent.

B.B.C. at the Show.—“Moorside Edge.”—Crystal Users and Brookman’s Park.

A Diorama at Olympia.

Not to be outdone by the enthusiasm and enterprise of the wireless trade at this month's Olympia Show, the B.B.C. promises its patrons an exhibition novelty in the form of a diorama. This, I gather, will be a kind of multi-dimensional panorama, in *papier mâché*, measuring 12ft. x 2ft. x 3ft., which will portray the story of a broadcast transmission from the studio, through the control room to the transmitter, and thence to the aerial and loud speaker of the listener.

Familiar to many visitors will be the small scale models of a typical studio and of a control room. And, of course, there will be a bookstall, without which no B.B.C. exhibit would be complete.

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“Moorside Edge.”

It was inevitable that controversy should flare up over the pronunciation of “Slaithwaite,” and I am glad that the B.B.C. has gracefully circumvented the difficulty by deciding that the site of the Northern Regional station shall be known as Moorside Edge. Whether or not there is geographical justification for the new name matters very little, since the B.B.C. has shown that it can be a law unto itself in terminological questions, thereby saving a good deal of bother.

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Northern Regional Next Year.

The important point is that in all probability the agreements for the transfer of the property will have been completed by the time these lines appear, and that contracts for the constructional work are to be signed almost immediately. Preliminary work will begin before the end of this month, and it is confidently predicted that the Northern Regional station will be ready for operation within a year.

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Crystal Users: New B.B.C. Policy.

Talking of Brookman's Park, I am interested to discover that the B.B.C. is at last taking steps to discourage crystal reception where the listener's purse will admit of the purchase of a single valve set. In the new B.B.C. pamphlet for crystal users in London area, the writers state that while no particular preference on the part of the B.B.C. for either crystal or valve sets is to be inferred, it is relevant to say that “in these days of

low-voltage dull-emitter valves, the initial outlay for a one-valve set is but little more than a really good crystal set with an outside aerial, and the maintenance costs are very low.”

Further, “the installation of a one-valve set with its own tuning unit, etc., is suggested in preference to any form of low-frequency amplifier as an addition to your present crystal set,” the former being recommended, of course, as a more selective arrangement.

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Auspicious Occasion.

In the “wee sma’ hours” of Monday next Brookman's Park will send out the first scheduled transmissions under the regional scheme—a scheme which has been talked and written about for three years and more. Yet I am prepared to wager that before the week is out there will be indignant letters pouring into Savoy Hill from honest and respectable listeners who have “never heard tell” of such a villainous arrangement for cheating them of their rightful signal strength.

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Women M.P.s at the Microphone.

The general layout of the B.B.C. Talks Programme for the remainder of the year shows little change. Seven o'clock remains the critics' hour, and the critics include, as before, Mr. Desmond Mac-

Carthy and Miss V. Sackville-West, Mr. Ernest Newman and Mr. Francis Toye, Mr. James Agate and Mr. Basil Maine, who returns to the microphone after a spell of absence.

Adult education talks will be continued at 7.25 p.m. daily, while late evening talks will be given by those established favourites, Sir Walford Davies, Mr. Vernon Bartlett, and Mr. Gerald Barry.

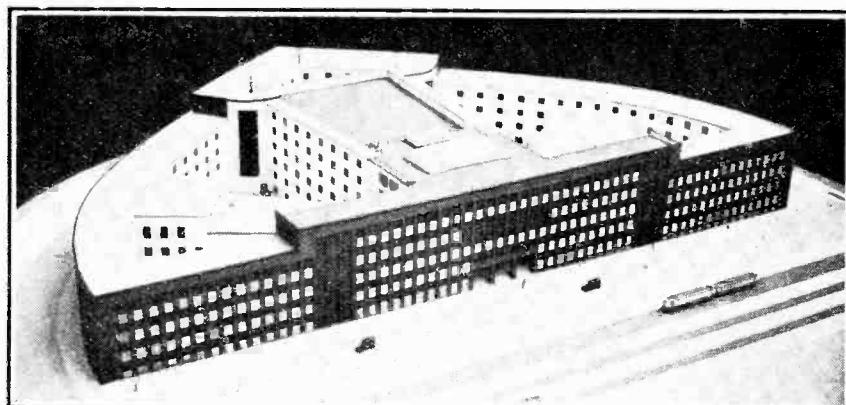
One of the most startling innovations will be a series of talks on Wednesday mornings entitled, “The Week in Parliament,” to be given by women M.P.s.

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2,000 Miles of Landline.

The Prime Minister's speech from Geneva entailed the use of 2,000 miles of landline—the longest cable link ever used in a B.B.C. transmission—with forty repeater stations. From Switzerland the speech was relayed to Berlin and thence to Brussels, and from there via the Post Office line to the La Panne-Thanet cable used in previous Belgian relays.

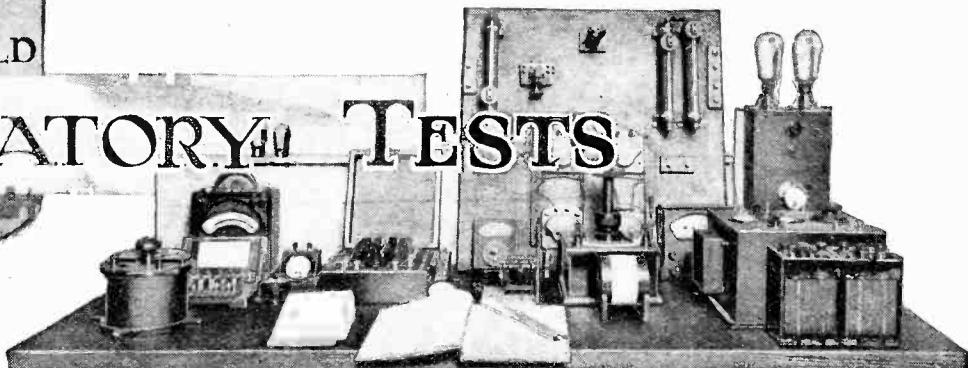
Although partially marred by extraneous noises, Mr. MacDonald's address was heard at times with astonishing clarity. That this was due, as one newspaper put it, to the fact that “the commanding voice of the Premier triumphed over the handicap of the forces of nature” is hardly fair to the engineers!



GERMANY'S “RADIO HOUSE.” As becomes a new art, wireless is making its influence felt in the other arts with which it comes in contact, notably architecture. The picture shows a model of the new Radio House now under construction in Berlin.

**WIRELESS
WORLD**

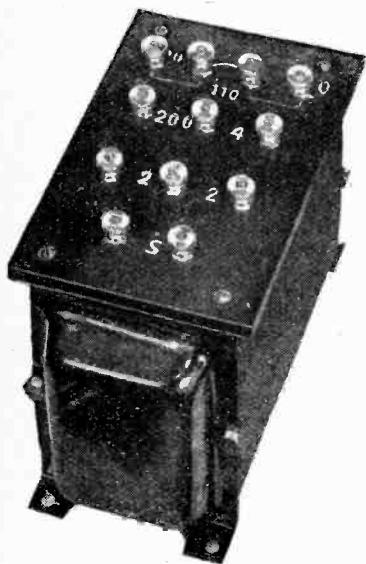
LABORATORY TESTS



A Review of Manufacturers' Recent Products.

"ISO" MAINS TRANSFORMER.

In addition to a transformer carrying windings to give three output voltages, this unit incorporates also a smoothing choke rated to pass 25 mA. and maintain an inductance of 50 henrys.



"Iso" mains transformer with built-in smoothing choke. A half-wave rectifying valve can be used.

Half-wave rectification is allowed for, but since the filament supply for the valve—4 volts—is derived from a tapping on the 200-volt secondary winding, particular attention to the design of the eliminator will be necessary. A separate secondary winding, giving 4 volts and centre-tapped, is included for supplying the heater current to three indirectly heated cathode type valves.

The primary winding consists of two separate coils terminating at four terminals on the top of the unit. When used on a 220-volt supply main these should be connected in series, and for a 110-volt circuit a parallel arrangement is necessary.

Supplies are available from Messrs. Haw and Co., 20, Cheapside, London, E.C.2, and the price is 35s.

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"PEP" DRY-CELL H.T. BATTERIES.

Two batteries, one 60 volts and the other 105 volts, nominal, were sent in for test and it was decided to commence the discharge at different rates for the purpose of computing the most economical discharge rate. Since both appeared to consist of the same size cells, this arrangement would be satisfactory in spite of the difference in voltage.

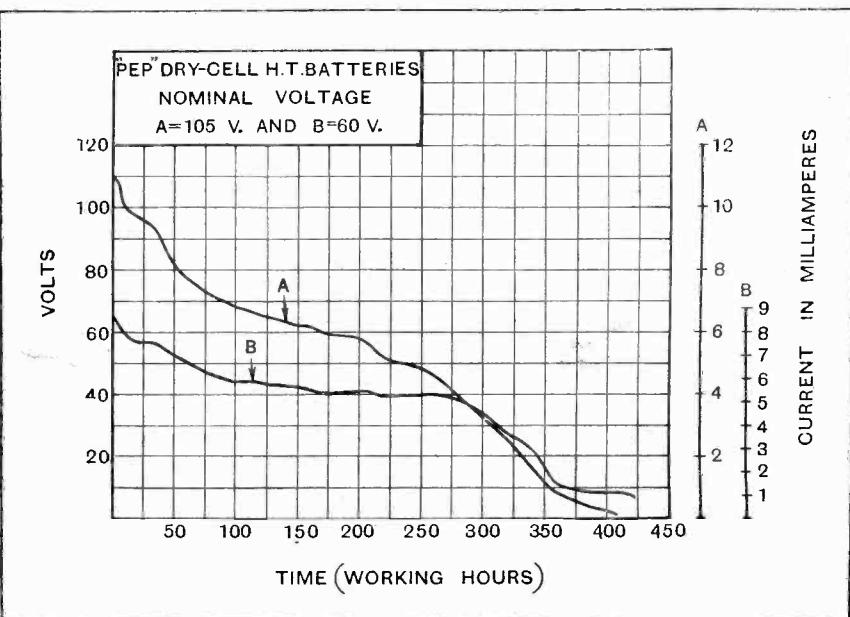
The 105-volt battery was started at 11 mA and the 60-volt type at just over 8 mA. The lower discharge rate would appear to be the more satisfactory since in this case the current was well maintained for a period of approximately 250 hours after the initial fall and when the steady state had been reached. This curve is marked "B" on the graph.

In the case of the higher discharge a less satisfactory performance is obtained,



"Pep" 105-volt
dry-cell
H.T. battery.

but it is significant that the natural "cut-off" coincides with that shown for the lower rate. This curve is given at "A" on the graph. The useful life of the samples tested can be taken as about 300 hours and although this will not be



Discharge curves of "Pep" H.T. batteries. "A" refers to the 105-volt size and "B" to the 60-volt unit.

extended materially by keeping the current drawn from the battery down to about 8 mA, the voltage will be maintained at a steadier level during its useful life if this course is adopted.

These batteries are supplied by Messrs. R. Cadisch and Sons, 5 and 6, Red Lion Square, London, W.C.1., and the prices have been fixed at 12s. 11d. for the 105 volt size, and 7s. 11d. for the 60 volt unit.

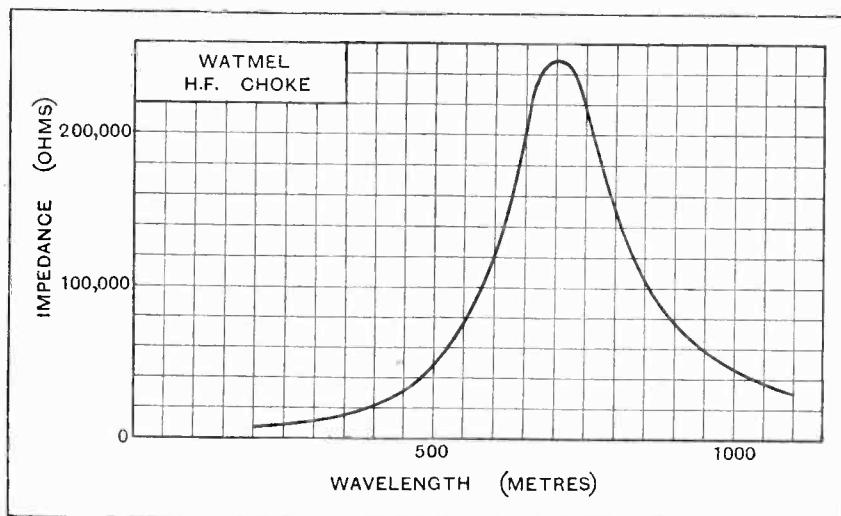
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WATMEL H.F. CHOKES.

An ingenious system of winding is employed in the "Imperial" H.F. choke made by The Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware. The choke is wound in four sections on a long cylindrical former, and the turns in each section are cross-wound, the prin-

of wire. This supposition is confirmed by the impedance curve which shows that with an external capacity of 8 micro-mfd., resonance occurs at 700 metres, and in these circumstances self-oscillation might occur from 700 metres upwards if the choke were connected in the anode circuit of a valve associated with a tuned grid circuit. In practice the associated circuit capacity would exceed 8 micro-mfd., and it is possible that in these circumstances the choke would be free from self-oscillation up to the Daventry wavelength. The impedance values at certain selected wavelengths were as follows :—

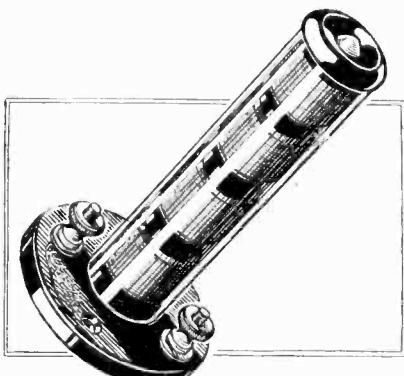
Wavelength (metres).	Impedance (ohms).
200	6,600
500	48,000
Resonance	248,000



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

ciple being reminiscent of the well-known duotrigesimal bank winding employed in certain plug-in tuning coils. Double-silk-covered wire is used, and the coils are protected by a thick celluloid tube. Terminals are provided on the moulded base which is 2in. in diameter, the overall height is 3½in.

The D.C. resistance is 49 ohms, which would seem to indicate that the windings contain less than the usual quantity



Watmel "Imperial" H.F. choke; D.C. resistance 49 ohms.

B 29

Another specimen choke submitted for test attained resonance at 750 metres, and had an impedance at this wavelength of 256,000 ohms, which shows that the constants of the choke are repeated with fair accuracy in manufacture. The price of the Watmel "Imperial" choke is 5s.

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READY RADIO PRODUCTS.

Among the items sent in for test was a "selectivity unit" which an examination proved to be a rejector and as such should be extremely useful as an aid to distant reception under the shadow of a nearby broadcast station. The design is such that it can be connected to most sets without alteration to the internal wiring, all necessary connections being made external to the receiver. A practical test made with the "Ready Radio" wire-wound resistances and H.T. safety fuse.

A practical test made with the "Ready Radio" wire-wound resistances and H.T. safety fuse.

Tests show that the average fusing current of the samples examined is between 170 and 180 mA. The makers are Ready Radio, 159, Borough High Street, London Bridge, London, S.E.1.



"Ready Radio" selectivity unit.

increase in the number of stations receivable.

This particular model is for use on the 250 to 600 metre waveband, and is offered at 20s.

Some samples of cartridge-type wire-wound resistances ranging from 500 ohms to 250,000 ohms were tested; the measured values were as follows :

Nominal Resistance.	Measured Value.	Percentage Error.
250,000 ohms.	247,000 ohms.	-1.2%
10,000 "	9,850 "	-1.5%
2,500 "	2,550 "	+2%
1,000 "	1,066 "	+6.6%
500 "	489 "	-2.2%

Prices of these are as follows :—

200,000 and 250,000 ohms, 8s. 6d.; 10,000 ohms, 6s. 6d.; 2,500 ohms, 4s. 6d.; 1,000 and 500 ohms, 2s. 9d. The base is included in this price.

The same firm have marketed an H.T. safety fuse which sells complete for 1s. 6d.



IMPROVING the FRAME AERIAL

A New Method of Eliminating Local Interference.

A FRAME aerial in combination with a good high-frequency amplifier undoubtedly offers the best means for eliminating the local station in favour of transmissions from a distance. If, however, a high degree of amplification is used, it becomes uncomfortably apparent that even at the minimum setting of the frame the local station does not disappear nearly so completely as theory would lead us to expect. There are various possible reasons for this annoying phenomenon, of which one may be a lack of symmetry in the frame. This can be caused by objects, especially those of a metallic kind, in the neighbourhood of the frame, but the trouble can be avoided fairly easily by careful construction and by ensuring that the frame occupies a suitable position in the room. Another common obstacle to the complete elimination of the local station in the minimum position is the "aerial effect" of the frame itself, which, by acting as a small elevated aerial, picks up a second supply of high-frequency energy in addition to that collected in its capacity as a pure frame.

The true frame collects energy only from the magnetic lines of force in the received waves, whereas the aerial effect is due, as in the case of the ordinary outside aerial, to the lines of electric force.

Recently the experiment has been tried of introducing an electrostatic screen to protect the frame from the electric field while permitting the passage of the magnetic. Shielding arrangements of this kind have been used previously in connection with direction-finders using frame aerials. On attempting to use a similar degree of screening for the frame in broadcast reception, M. von Ardenne found that the screen introduced considerable losses. When, for

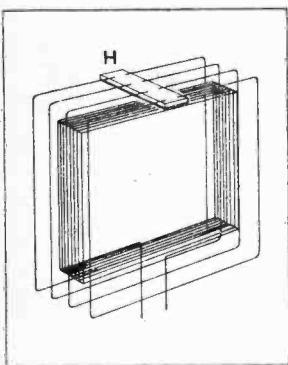


Fig. 1.—A diagrammatic view showing the screen of parallel copper wires which effectively prevents the lines of electric force from influencing the frame when in the "minimum" position.

example, the frame was enclosed within a box of sheet metal, cut through at one place to avoid producing a shorted turn which would absorb the magnetic lines as well as the electric, it was found that the high-frequency resistance of the frame was very considerably increased. However, the beneficial effect of the screen in permitting the local station to be completely, or nearly completely, cut out was very marked. Another solution that suggested itself, but which also led to heavy losses in the frame, consisted in enclosing the frame in a wooden box lined inside with thin sheet aluminium with, as before, a gap in the metal at one point.

A Frame Aerial Screen.

It was finally found that the best all-round type of shielding, having practically no effect on distant reception, but removing the "aerial effect" completely, consisted of a screen of parallel copper wires, as shown diagrammatically in Fig. 1. Outside the frame winding, parallel to it, and at a distance of about 3cm. are wound about half as many turns as those in the frame itself. The continuity of these turns is broken at one point, the piece of ebonite H serving as support for the wire. A finished frame aerial of this design is shown on the left in Fig. 2, while the large frame on the right shows an older arrangement for the reception of longer waves. The wooden frame carries both the aerial and its electrostatic screen. The pieces of insulating material used at the break in the screening-wires are shown in Fig. 3.

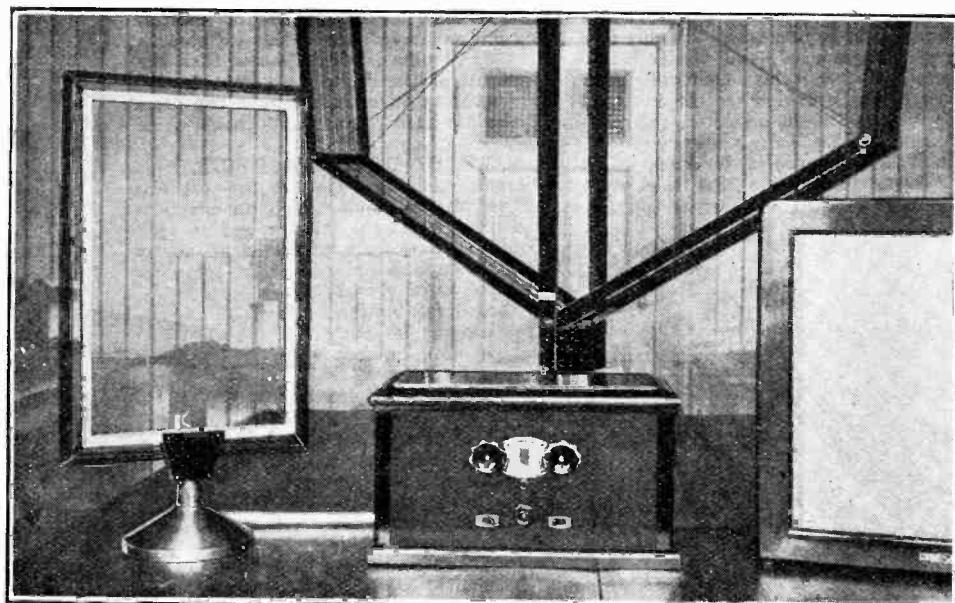


Fig. 2.—The frame aerial on the left has been made to the specification described in this article. In addition to the copper wire screen surrounding the aerial, note the metallic casing enclosing the leads to the receiver.

Improving the Frame Aerial.—

It is not enough, however, to screen the frame alone; the leads to the receiver must also be surrounded with a metallic casing, in some such manner as that to be seen in the title illustration. This metal screen round the leads is in electrical connection on one side with the screening wires of the frame, and on the other with the screening-boxes containing the receiver and amplifier.

The value of such an arrangement of screens is not limited to its ability to cut out the local station; the arrangement makes it possible to employ the directional effect of the frame aerial for minimising interference from such sources as electric trams and high-frequency apparatus. It has been found that in most cases interference of this type is quite definitely directional, so that while it can be only partially eliminated with an ordinary frame, the screened frame is completely effective in the majority of cases.

Some interesting observations can be made with a frame of this type used in conjunction with a good amplifier. It has been found that while the carrier of the local station can be completely cut out, single side-bands, especially at dusk, apparently arrive from quite a different direction, so that signals from the local station reappear, though in a peculiarly distorted form.

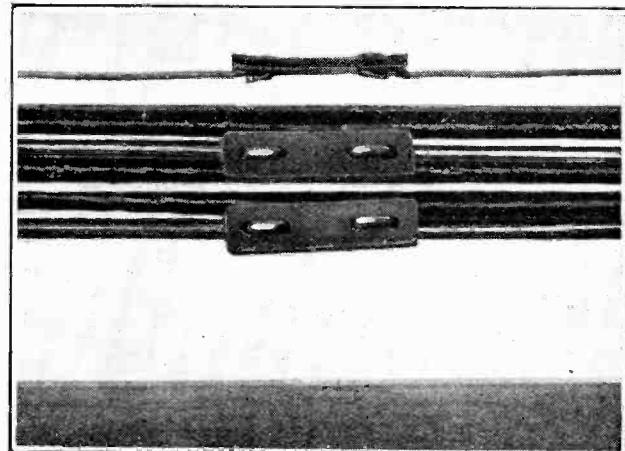


Fig. 3.—A "close-up" of a portion of the frame aerial showing the insulating material used at the break in the screening wires.

Fortunately, this phenomenon occurs but seldom, and as a rule lasts only for a short time.

In general the screened frame offers a considerable improvement, especially in cities, in the reception of distant stations.

USEFUL DATA CHARTS. No. 27(a) and 27(b).

Stage Gain with (1) H.F. Transformer : (2) Tuned Anode Circuit.

WHEN a coil and tuning condenser are arranged in parallel in the plate circuit, the circuit when on tune behaves as a pure resistance R whose magnitude is given by

$$R = \frac{\text{square of coil reactance}}{\text{coil resistance.}}$$

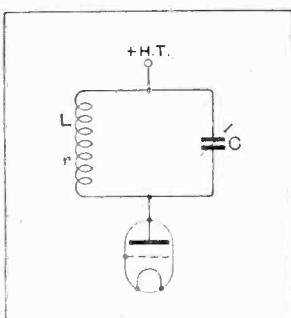


Fig. 1.—When the circuit is tuned to the incoming frequency the coil reactance $2\pi f L$ equals the condenser reactance $1/2\pi f C$ and the plate load is equivalent to a pure resistance $2\pi f L \times \frac{2\pi f L}{r}$ = coil or condenser reactance \times coil amplification.

$$x^2 = R/R_1 = \frac{\text{condenser reactance} \times \text{coil amplification}}{\text{valve resistance}}$$

B 31

As explained in Fig. 1, R is also given by the formula $R = \text{condenser reactance} \times \text{coil amplification}$. Thus at 300 metres with the condenser set to tune at 0.0003 mfd. the condenser reactance is 531 ohms (by Chart 8) and the coil amplification may be expected to be 150 under working conditions if solid wire is used. Hence the equivalent parallel resistance is $531 \times 150 = 80,000$ ohms.

Fig. 2 shows the equivalent circuit; m is the voltage amplification of the valve and R_1 is its differential resistance. We find that the stage gain is $mx^2/(1+x^2)$, where

The corresponding result for a H.F. transformer using the optimum step-up is shown in Fig. 3 and the corresponding stage gain is $mx/2$.

Accordingly we can easily calculate the stage gain once x is known and the efficiency of the H.F. transformer with best turns ratio can be compared with that of the tuned anode circuit. It is interesting to note that x is roughly the ratio of the secondary to the primary turns in the H.F. transformer; as explained in Chart 26, the actual ratio is usually about 10 per cent. less than

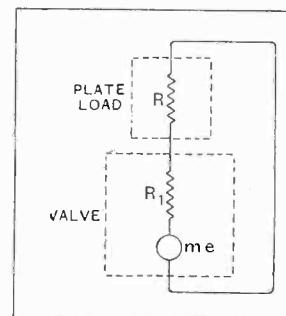


Fig. 2.—When the plate load is replaced by its equivalent pure resistance R and the valve by a resistance R_1 with an e.m.f. me , the stage gain is $mR(R+R_1) = mx^2/(1+x^2)$ where $x^2 = R/R_1$.

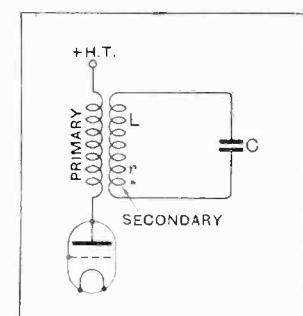
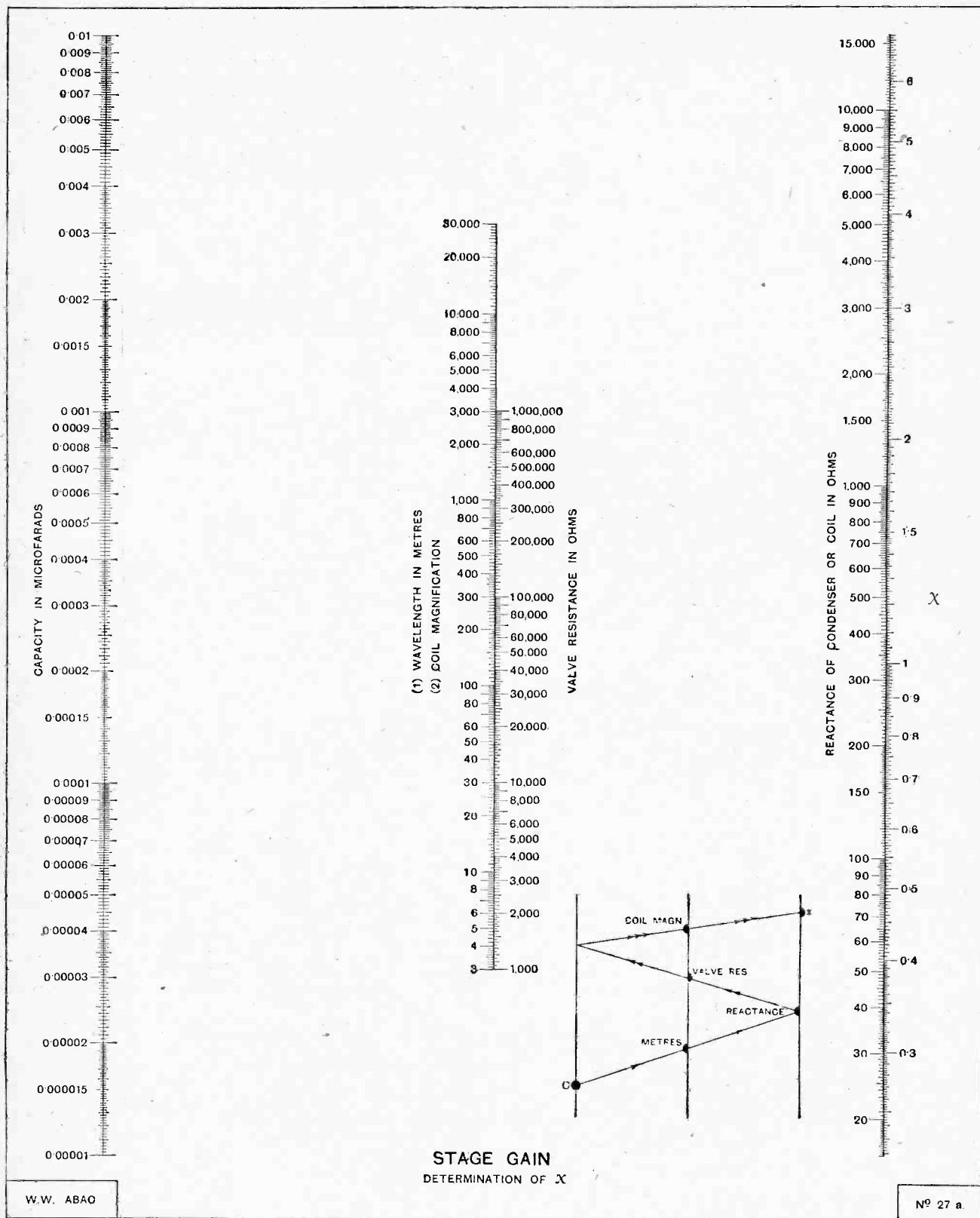
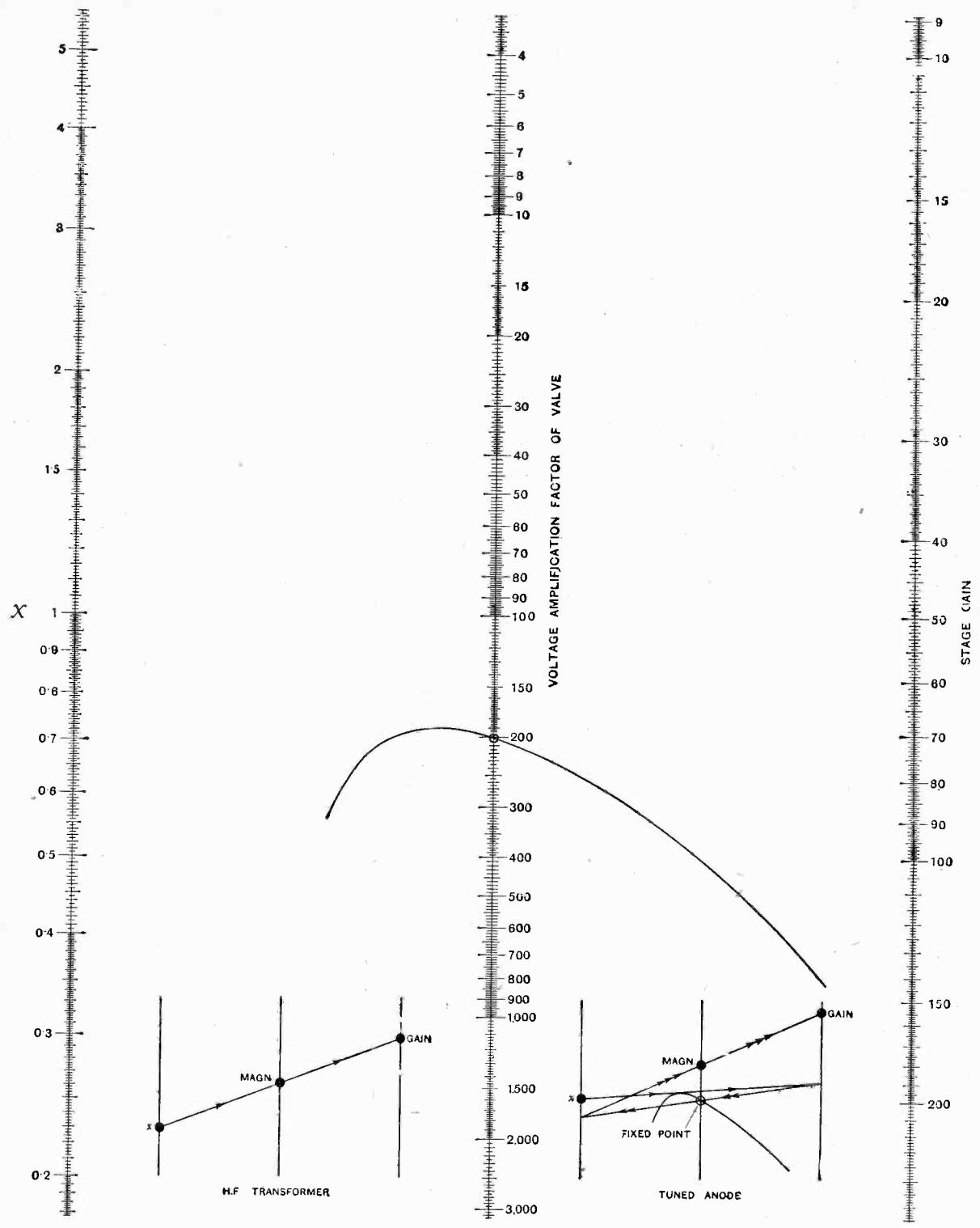


Fig. 3.—When the tuned circuit is used as the secondary of a H.F. transformer and the primary turns have been found by Chart 26 the stage gain is $mx/2$ where x has the same meaning as in Fig. 2.

the value of x , due to imperfect coupling between the coils.
(Continued on page 256.)

SEPTEMBER 11th, 1929.





STAGE GAIN WITH (1) H.F. TRANSFORMER (2) TUNED ANODE

W.W. ABAC

Nº 27.b

Useful Data Charts. No. 27(a) and 27(b).—

The stage gain here calculated does not take into account reaction effects due to internal coupling of the grid and plate circuits through the grid-plate capacity of the valve; we are only considering conditions well removed from instability.

Chart 27(a).

This chart enables us to find x . Thus with a condenser tuning to 300 metres at 0.0003 mfd. and an 80,000-ohm valve, the coil magnification being 150, we find $x=1$. Again, if we set at 0.0015 mfd. for 150 metres and use a 40,000-ohm valve, with a Litz-

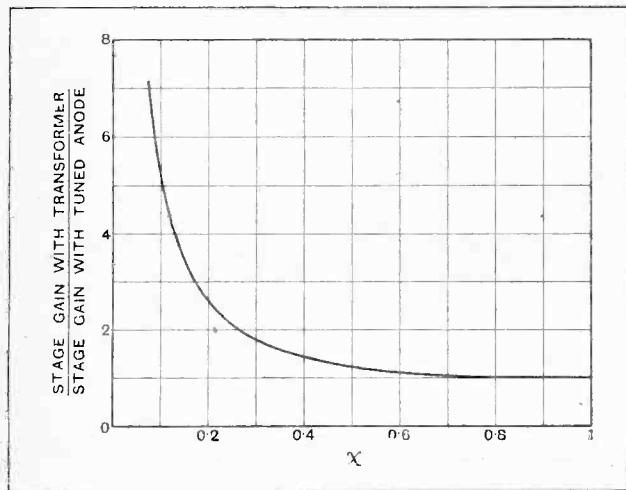


Fig. 4.—The relative merits of tuned transformer and tuned anode can be seen from this graph.

wound coil whose magnification is 300, we find $x=2$.

Chart 27(b)

We can now find the stage gain. If the voltage amplification of the valve is 100 and $x=1$, then on using

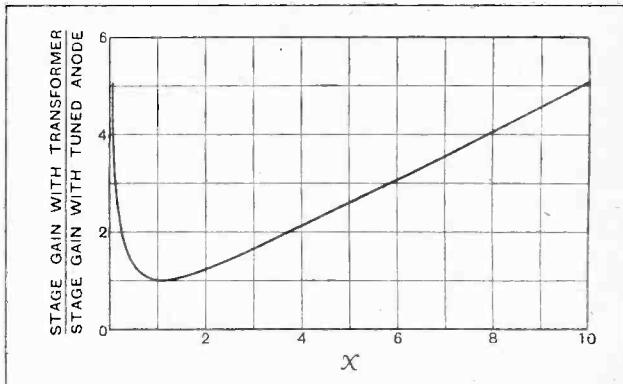


Fig. 5.—Further comparative figures for tuned transformer versus tuned anode.

a H.F. transformer the stage gain is 50 according to this chart; if a tuned anode system is used instead, the stage gain turns out to be exactly the same. This only occurs for $x=1$, while for any other value the H.F. transformer gives the bigger stage gain.

Thus when $x=0.4$ and the same valve is used ($m=100$), the stage gain is 20 with the H.F. transformer and only 13.8 with the tuned anode circuit.

Figs. 4 and 5 show the stage gain with transformer relative to that with tuned anode for different values of x .

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.

EMPIRE BROADCASTING.

Sir,—I have studied your correspondence columns during the past few months, and apparently the subject of Empire broadcasting is still provoking considerable discussion, while it is obvious, judging by criticisms, that little progress has been made.

As one who did a certain amount of pioneer work in this direction, I realise that private enterprise, in any shape or form in connection with Empire broadcasting, will not receive any official support in this country. I carried on my experimental transmissions for over twelve months, with only one breakdown, and it was unanimously agreed that the quality and nature of the programmes left nothing to be desired. From hundreds of letters and cables I received from every part of the world, the appreciation was more than I ever expected, and I have since received signed petitions urging me to carry on.

When the Washington wavelengths came into force, my wavelength had to be changed, and only a very limited licence was offered me; therefore, I did not consider I was justified in going to the expense which the change would have incurred.

The bone of contention amongst our scattered Empire is that nothing is provided during the week-end when naturally listeners have the most time for listening-in to the Old Country, and I am still anxious and willing to carry on, on a suitable wavelength, concentrating on week-end transmissions, at my own expense, not that I have the slightest commercial interest in wireless, but simply out of amateur enthusiasm in order to fill the gap which, it seems to me, is not filled by those whose duty it is to fill it.

The Post Office have always shown a sympathetic interest in my endeavours, and possibly with the present change of Government, the vested interests may also show some enthusiasm in my proposal. In conclusion, 2 NM has been dismantled and is now being rebuilt in a more favourable location, and could be ready to start in two months' time. GERALD MARCUSE.

President, Radio Society of Gt. Britain,
Vice-President, International Radio Relay League.
London, E.C.3.

G5SW—THE "EMPIRE STATION."

Sir,—We have had a change of Government, and it quite possible this might meet the eye of someone who will be responsible for the vagaries of the B.B.C. Empire Short Wave station, which apparently is still hiding behind its experimental cloak. Looking through the many letters which have appeared in your journal from time to time, one can deduce the following complaints, really indictments, against G5SW:

- (1) Its callousness to public opinion.
- (2) Its failure to come out into the open and tell us the truth about the results of its broadcasts, except on exceptional occasions.
- (3) Its total disregard of transmission hours to suit an Empire to the East of the Greenwich Longitude.
- (4) Its lack of propaganda and even provision.
- (5) The exclusion of the news items from its programmes.

(6) Its deliberate closing down on Saturdays and Sundays, when its programmes could be best appreciated.

To begin with, this fact must be realised, that for some time now the Dutch transmissions starting at about 1 p.m. G.M.T., broadcast and telephony, are regularly heard at *loud speaker strength* on three valves, even at this the hottest season of the year in India, while the luncheon broadcast, scarcely half an hour earlier, is dumb, even to its carrier wave, on G5SW.

We have to wait till close on midnight before the regular London programme at seven o'clock starts with many a hiatus and wait; and sometimes, if we tune in a little late and find no carrier, we give it up as hopeless, though it might have been a period of waiting. Comparisons are odious, but, geographically, Chelmsford is 200 miles across the sea from Huisen and 200 miles on short waves is nothing, probably only a fraction of the "skip" distance.

Aguin, on whose behalf are these lines written? They are for the Planter and people living in remote places, or also on behalf of 50,000 British troops scattered far and wide from Cairo to Singapore and Hong Kong, who would gladly form themselves into wireless clubs if they were certain that G5SW would function at some reasonable hour for four or five days in the week. No one requires a Home connection more than the British soldier in the East, and no one would appreciate a boom of this kind more than he; but do not deprive him of the local news (news which the cables never worry about, and such sports items as he is keen on, and which would not deprive the newspapers of any really first-hand news). Besides, it has been proved that news broadcast whets the appetite for further details.

People in England never hear G5SW except as a ground wave, so there does not appear to be any necessity to "beam" and flirt with Los Angeles, Illinois, etc., when we in India, for instance, have broadcast stations 500 miles away, 50 per cent. Oriental music, and eight out of the twelve months mush and Xs. The want is felt here, not in the U.S.A. This, therefore, is the position:-

(1) The short wave is the only medium of any certainty for Empire receptions. The wavelength should be well clear of any beam station and as low down as possible; 20 metres is suggested.

(2) That from 1 p.m. G.M.T. selections from the programmes of 2LO and 5GB, or other relay, should be broadcast, and such should be continuous. As a trial, "beaming" might be tried, Canada and the West Indies coming last, being "with the sun." I may note that PCJ broadcasting to Mexico and South America is clearly received here; in fact, it does not seem to matter much in which direction PCJ twists its "Antenna" (why not aerial?), if it has got such a thing.

(3) That such transmissions should be on at least five days in the week, and to include Saturdays and Sundays. I have suggested in a previous paragraph that they should be continuous or that the carrier wave should be in evidence all the time.

(4) News items and sporting news should be included, and any special event should be relayed. A time signal would be most useful.

RADIOX.
India.

"THE GLUT IN THE ETHER."

Sir.—I should like to make some comments in regard to the article, "The Glut in the Ether," in *The Wireless World* of August 21st.

In reality, the percentage of listeners in Holland is much higher than 1.7—at least 3, although still higher, in my opinion—but, as we do not have to take out licences, and as most people, even dealers, do not know that we must advise the Postal Authorities, no verification of this figure is possible. The percentage given by your journal is that of the Postal Authorities.

The German figure, and, perhaps, for the same reason, the British also, is much inflated owing to the many crystal sets in use in those countries.

Why the French need such a number of stations is a riddle to me. If I am to believe their papers, the most popular sets have at least four valves (Isodyne), while most sets seem to have even more.

For what reason, then, should other listening communities suffer under such old-fashioned conditions, as with three valves alternative programmes are available everywhere, and two valves are enough in most places?

Any suggestion that Great Britain and Germany should have the first pick of wavelength, as they were first in the field, is wrong. On this basis Holland should have the very first pick, and Germany only come in at the third or fourth place.

Amsterdam.

TH. A. KAMMINGA BRUYN.

Sir,—May I be permitted to comment upon the question of "The Glut in the Ether"? From the standpoint of a Poleander, I am compelled to explain why we have only 0.7 per cent. of inhabitants who are officially interested in radio programmes.

The greater part of our country was devastated during the world war. For this reason, the population is very poor. Public duties and modest living claim all the salary which one earns. I am sure, however, that the population is at least 100 per cent. more interested in radio than the official records show.

The writer of the article maintains that the number of transmitters should be reduced. I agree with him, but the reduction must be executed proportionately by each country on the basis of the Prague scheme.

M. S. MARCINKOWSKI.

Warsaw.

AMATEUR STATUS.

Sir,—Your recent leading articles, and subsequent correspondence, on the subject of amateur status urge me to register a very strong protest against the flow of criticism poured out against the Radio Society of Great Britain. That Society, of which I am proud to be a member, is in an unavoidable position, like the B.B.C., because it has to cater for people of widely diverging mentality, and, as is the case the world over, the very few grousers always gain a far bigger hearing than the huge majority of well-satisfied persons who are in possession of the true facts, and who stop to think before rushing into print with their grievances.

The R.S.G.B. is accused, most unjustly, of not gaining for the amateur facilities which the authorities have very definitely refused to grant, and you yourself must realise this.

Mr. Kemp complains of the treatment meted out to his Society, the A.B.R.S., by the Postmaster-General, in connection with what really seemed like a direct infringement of the monopoly granted to the B.B.C. I would point out to him that the treatment they received was only such that any amateur would have expected had he attempted the same thing.

With regard to the question as to which is the premier amateur society in this country, the fact that the R.S.G.B. was responsible for (1) the issue of 23- and 45-metre permits to amateurs, (2) the issue of 32-metre permits to competent persons, (3) the issue of permits to use higher power than 10 watts, (4) the issue of 80-metre permits to a properly organised group, (5) the establishment of a "free to all" QSL card service, (6) the organisation of transoceanic tests, which paved the way for the world-wide communication we enjoy to-day, (7) assisting the Postmaster-General to frame the new regulations laid down by the Washington Conference, leaves not the slightest doubt as to which is the only society in this country worth considering.

Wanstead, London.

LAWRENCE FULLER.

OLDEST RADIO SOCIETY.

Sir.—The subject of amateur organisation is of great interest to us in Ireland, so I have closely followed the discussion of the subject in your columns. We may get some useful hints from the constitution of any national amateur organisation that may finally be evolved.

Just now, however, a little point of interest has cropped up in a letter in your issue of the 21st inst. from Mr. Ashton J. Cooper. He suggests that the R.S.G.B. is the oldest wireless society in the world.

Some Dublin wireless men claim that The Wireless Society of Ireland, through one of its parents, The Dublin Wireless Club, is the oldest society. It should be easy to settle the question. I have looked up the old minute books of The Wireless Club, and find that the inaugural meeting took place on June 17, 1913. I see that a letter from The Derby Wireless Club was read at a meeting on July 14th, 1913.

When was The London Wireless Society founded?

DESMOND McAFFEE,

Hon. Sec., Wireless Soc. of Ireland.

READERS' PROBLEMS

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

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

Poor Reaction Control.

My set is a fairly conventional arrangement of a single H.F. amplifier, anode bend detector, and two resistance-coupled L.F. stages. Condenser reaction control (applied from the anode circuit of the detector to the H.F. transformer secondary) is by no means satisfactory, and, indeed, at the upper end of the tuning scale it is impossible to bring about self-oscillation. Fortunately, sensitivity is quite good, even without reaction, but I should like to improve matters if possible, and would welcome any suggestion.

P. A. N.

It is a fact that reaction is seldom a great success in a receiver such as you describe, and it will be observed that it is not included in the majority of Wireless World sets of this type. We advise you to reduce your detector anode resistance to the lowest value giving adequate magnification, and to increase the associated by-pass condenser to the highest

value consistent with the retention of high notes. It is wise to arrange matters in your reaction control circuit so that a large condenser—and consequently a small coil—is used.

Detector grid bias should be set rather below than above the value needed for best rectification, and its adjustment should be carefully made.

○○○

Frame Aerial Details.

Although it is realised that the "Flat Dwellers' A.C. Three," can be used with any type of frame aerial, I should like to copy the design illustrated in the published description as closely as possible, as it would match my containing cabinet. Will you please supplement the details given in the article with a sketch showing the various dimensions and method of construction?

G. B. A.

We think that a consideration of Fig. 1, in conjunction with the published photographs, will make clear the method of

construction employed. It will be evident that the windings are divided into two parts in order to afford a clearance for the central supporting rod.

○○○

Too Many Volts.

I have made a three-valve H.F.-det.-L.F. set with anode bend detection on the general lines embodied in several sets described in "The Wireless World." The receiver works quite well, but its sensitivity seems to be capable of improvement. I have noticed that when the H.T. plug feeding the detector valve is removed from its socket, signal strength momentarily increases to a very marked extent, and then gradually fades to inaudibility. Does this convey a suggestion to you as to what may be wrong?

L. V. F.

The symptoms you describe would suggest fairly definitely that negative grid bias for the detector valve is insufficient, having regard to the H.T. voltage applied; when you remove the H.T. plug the valve will, of course, be fed from the charge accumulated in the reservoir by-pass condenser included in this circuit, and the observed increase in signal strength will doubtless coincide with the moment when the voltage charge has dropped to a value suitable for the grid bias applied.

We recommend you to pay special attention to the setting of detector bias. As previously pointed out in these pages, this adjustment can best be effected when listening to very weak signals.

RULES.

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

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

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

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

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

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

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

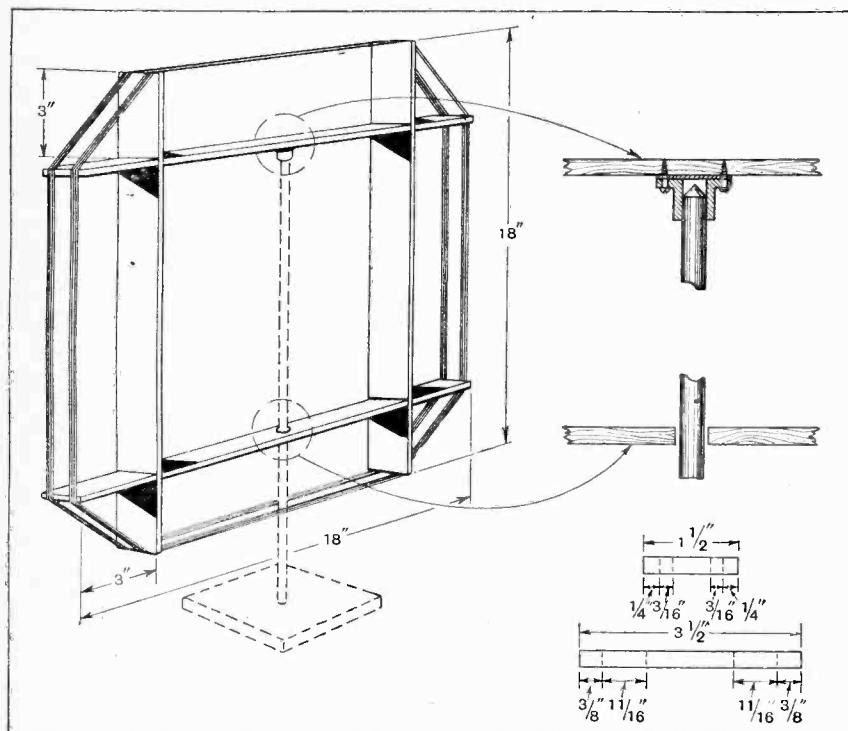


Fig. 1.—Constructional details of "Flat Dwellers' Three" frame. Particulars of the windings for long and short waves were given in the original article.

The Wireless World

AND
RADIO REVIEW
(17th 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.

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OUR EXHIBITION FORECAST.

AS year by year the Radio Exhibitions succeed one another it is noticeable that each Exhibition has some outstanding feature which perhaps we may describe as a phase in development. Last year might well have been termed a screen-grid valve year, and the Show preceding that undoubtedly served to emphasise the popularity of the moving-coil loud speaker, and, in fact, at every Exhibition we find that some particular phase has been especially prominent.

What, then, is going to be the predominant note to mark the stage to which the design of broadcast receiving apparatus has reached as indicated by the Olympia Show this year? It is a difficult matter to form a conclusive opinion without all the facts necessary to guide one in coming to a decision, and at this stage in advance of the Exhibition it is probable that a good deal of information is still withheld which will not be available until the doors of Olympia open, but, judging from data which has reached the offices of *The Wireless World* up till now, we would say

that 1930 is to be an "all-electric" year, battery sets being replaced by receivers working direct from the mains wherever electric light is available. The provision of apparatus within the set to replace batteries must, of necessity, add something to the cost, but it probably is a trifle when compared with the advantages which are gained and the saving in battery replacements and trouble.

Next in order of importance in forecasting the tendency of design must be mentioned that manufacturers have devoted special attention to a consideration of the need for increasing the selectivity of the most popular sets in order to make them applicable for use under the Regional Scheme.

The Three Valve Set as Standard.

A third observation is that whereas last year the sets to which designers had paid the greatest attention were those incorporating four valves, this year, with the improvement in valve efficiency and the consequent ability to obtain greater high-frequency amplification, the three-valve receiver appears to be gaining the position of being regarded as standard; in fact, a very large number of outstanding sets of this season will be found to correspond closely to the specification adopted by *The Wireless World* last season in the receiver known as the "Megavox Three."

We anticipate that in the coming year there is likely to be an enormous increase in the number of valve sets in use, partly on account of the simplicity of the modern receiver operating from the mains proving an attraction to those who could not be bothered with battery sets, but more especially because the next few months will undoubtedly see the almost total eclipse of the crystal receiver. Under the Regional Scheme we have contended that crystal sets will no longer be serviceable, except in particular areas. There will, therefore, be a big demand for simple valve sets, and the Exhibition this year will undoubtedly cater admirably for this class of user, and there is ample evidence that two- and three-valve receivers of simple construction will be available to the public at prices which a year ago would have been considered impossible. But it is not for us to say at this stage what will be the best products at Olympia; the ballot which *The Wireless World* has arranged again this year provides the solution to this problem, and we would urge every reader to make it a personal duty to vote, so that we may be certain that the decisions on what is best in every class of exhibit at Olympia is truly representative of the views of our readers.

The Wireless World

"KIT" SET



An Easily Constructed Three-valve Receiver of High Selectivity.

THE "kit" set is now so familiar an object of daily life that it requires no introduction or definition as far as *Wireless World* readers are concerned. Its popularity was originally established owing to the simplicity of construction and assembly, but it has other qualities which are frequently overlooked, or at all events insufficiently appreciated. Not

the least important contribution made by the kit set to the art of broadcast reception has been to demonstrate that the requirements of the average broadcast listener can be satisfied by a simple three-valve set of compact dimensions. The results obtainable with the best types of kit set at present on the market are excellent both as regards range and quality, and there must be many

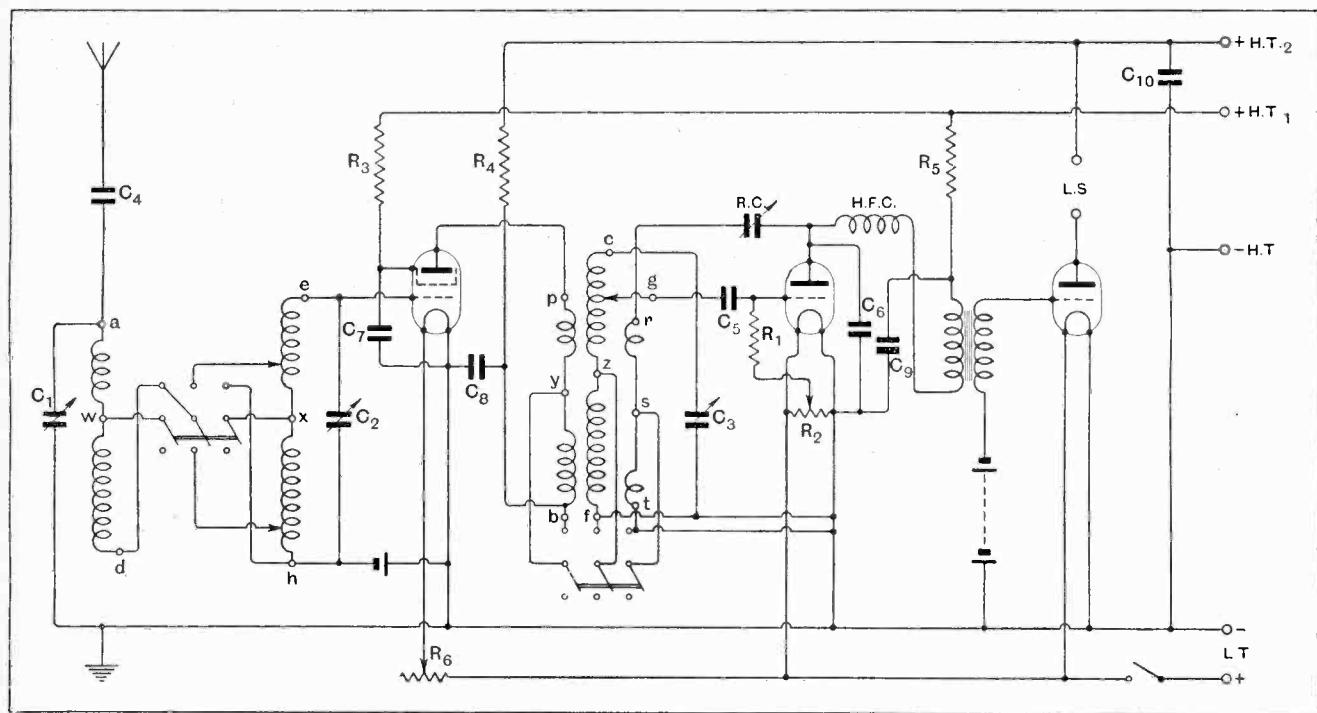


Fig. 1.—Complete circuit diagram. C_1 , 0.0005 mfd.; C_2 , C_3 , 0.0003 mfd.; C_4 , 0.0002 mfd.; C_5 , 0.0003 mfd.; C_6 , 0.0001 mfd.; C_7 , C_8 , 0.1 mfd.; C_9 , C_{10} , 2 mfd.; R_1 , 2 megohms; R_2 , semi-variable potentiometer, not less than 400 ohms; R_3 , R_4 , 600 ohms; R_5 , 20,000 ohms; R_6 , 50-ohm rheostat. The coil connections are lettered to correspond with Figs. 2 and 4.

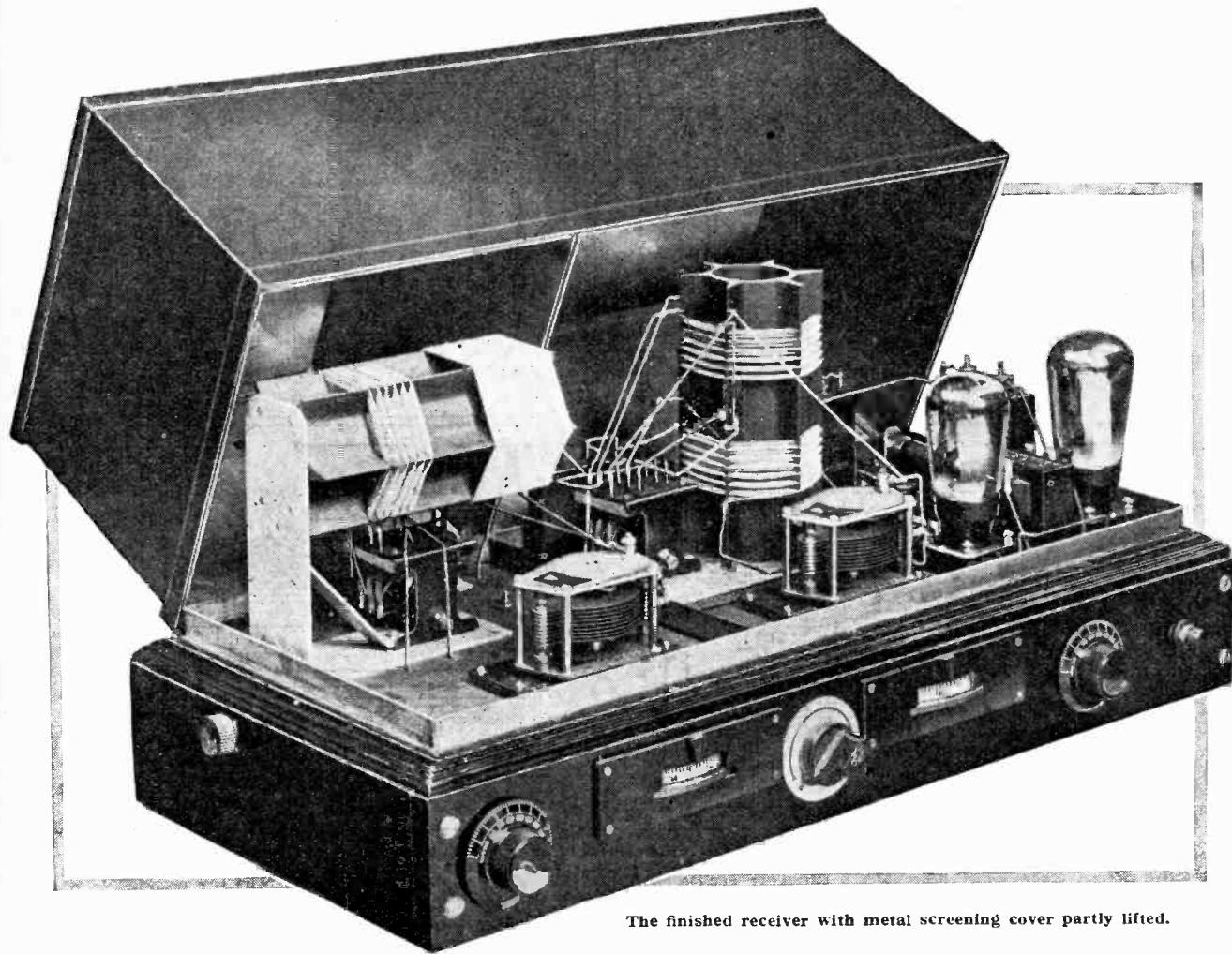
The Wireless World "Kit" Set.—

thousands of listeners, nay, millions if we are to accept the makers' figures, who have served their apprenticeship to wireless receiver construction in this way.

To this large class of reader *The Wireless World* "Kit" Set should make a special appeal. It has been built in the new type of metal cabinet described in recent issues with the result that constructional difficulties have been reduced to a minimum. But the chief merit and justification of the set is that it incorporates the best practice in tuning circuit and H.F. transformer design as proved in such sets as the "New Kilo-Mag Four." The result is a kit set which may be relied on to produce

ciated by those who build the set when the transmission of alternative programmes commences from the new regional stations. Even under present conditions the improved selectivity is essential if full use is to be made of the range and sensitivity of modern H.F. valves.

In designing the tuning coils and H.F. transformer the constants have been chosen to give the maximum H.F. amplification, having regard to manufacturing difficulties and the fact that the set will be called upon to function with all types of screen-grid valves. Incidentally it may be mentioned that a coupled aerial circuit is not without its compensations, for the secondary or grid circuit can be made to give a useful voltage



The finished receiver with metal screening cover partly lifted.

something out of the ordinary in range and selectivity without departing from the essential qualities of compactness and simplicity. The cost of the complete set with the exception of valves, batteries and loud speaker should be between £10 and £12, depending on the quality of the components chosen.

Reference to the circuit diagram of Fig. 1 shows that a coupled aerial circuit, involving an extra tuning control, has been introduced. We are reluctant to add this complication to the usual kit set circuit, but, in our judgment, it is a measure which will be duly appre-

amplification for a given energy in the aerial if the coils are well designed.

The screen-grid valve H.F. circuit is designed on well tried lines, and a filament rheostat has been introduced as a volume control. A considerable improvement in the characteristics of the valve under working conditions has been made possible by the introduction by Messrs. Siemens Bros. and Co., Ltd., of a special grid cell with a potential of 0.9 volt; most screen-grid valves are overbiased by the standard 1½-volt grid cell.

The detector functions on the leaky grid principle

The Wireless World "Kit" Set.—

which gives greater sensitivity to weak signals than anode bend, and also permits the use of an inexpensive L.F. transformer. The grid circuit of the detector is connected across two-thirds of the short-wave secondary winding in order to reduce damping. To introduce a

be explained in greater detail in next week's issue. Reaction is applied to the H.F. transformer so that there is little fear of radiation if the set oscillates, the screen-grid valve with its low interelectrode capacity acting as an effective barrier to H.F. oscillations generated by the detector. The by-pass condenser C_6

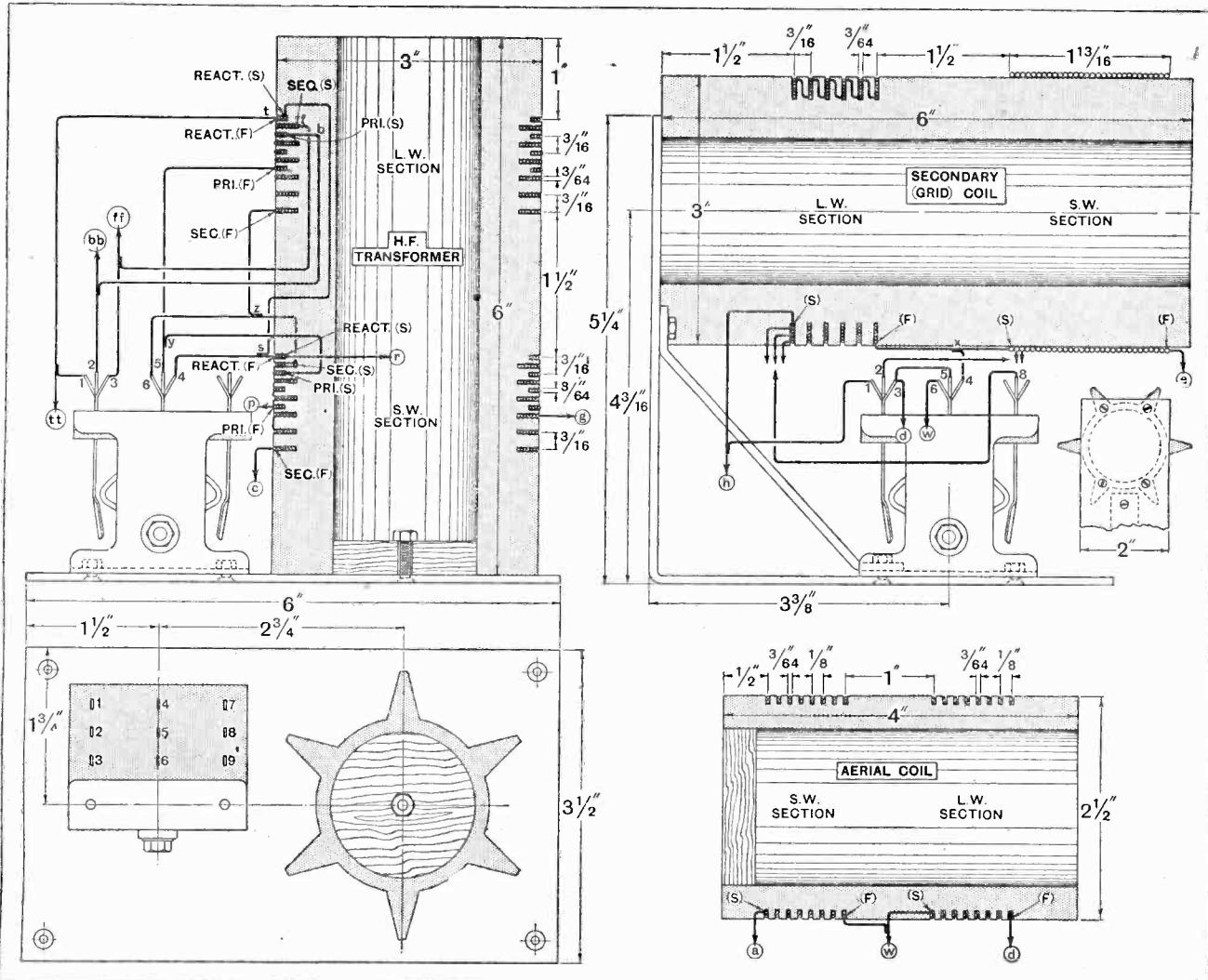


Fig. 2.—CONSTRUCTIONAL DETAILS OF COIL UNITS. The depths of slots are as follows: Aerial coil $3\frac{3}{8}$ in., secondary and H.F. transformer coils, primary and reaction $1\frac{1}{8}$ in., secondary $1\frac{1}{4}$ in. The windings require the following turns and tappings: **AERIAL COIL:** Short wave, 8 sections, 6 turns per section No. 26 D.C.C. Long wave, 8 sections, 20 turns per section No. 32 D.C.C. **SECONDARY (GRID) COIL:** Short wave, single layer 65 turns No. 26 D.C.C. tapped at 2nd and 3rd turns from low potential end; Long wave, 6 sections, 35 turns per section No. 32 D.C.C. **H.F. TRANSFORMER:** Short-wave secondary, 6 sections, 10 turns per section No. 32 D.C.C. tapped at the 3rd, 5th and 6th turns. Long-wave secondary, 6 sections, 35 turns per section No. 32 D.C.C.; Short-wave primary, 3 sections, 11 turns per section No. 38 D.C.C.; Long-wave primary, 3 sections, 35 turns per section No. 40 D.C.C.; Short-wave reaction, single section, 8 turns No. 38 D.C.C.; Long-wave reaction, single section, 20 turns No. 40 D.C.C. The start and finish of each winding is indicated by (S) and (F) respectively and connections to other parts of the circuit are indicated by circled lettering.

similar tapping on the long-wave secondary would considerably complicate the switching so that the grid circuit damping is somewhat higher on long waves. Experience shows, however, that the use of reaction compensates for this shortcoming to a marked degree. In order that the degree of positive bias may be adjusted to suit different types of valves and to permit the use of a 2-, 4- or 6-volt filament circuit, a semi-variable potentiometer has been incorporated, the use of which will

may at first sight seem superfluous, seeing that there is already a by-pass in the form of the reaction condenser R.C., but it is essential to the proper working of the circuit, and conduces to H.F. stability and smooth reaction control.

The remainder of the circuit is perfectly straightforward and calls for little further comment. Anode feed resistances have been introduced wherever necessary, and the receiver can be relied upon to work

The Wireless World "Kit" Set.—from any standard battery eliminator without fear of "motor-boating."

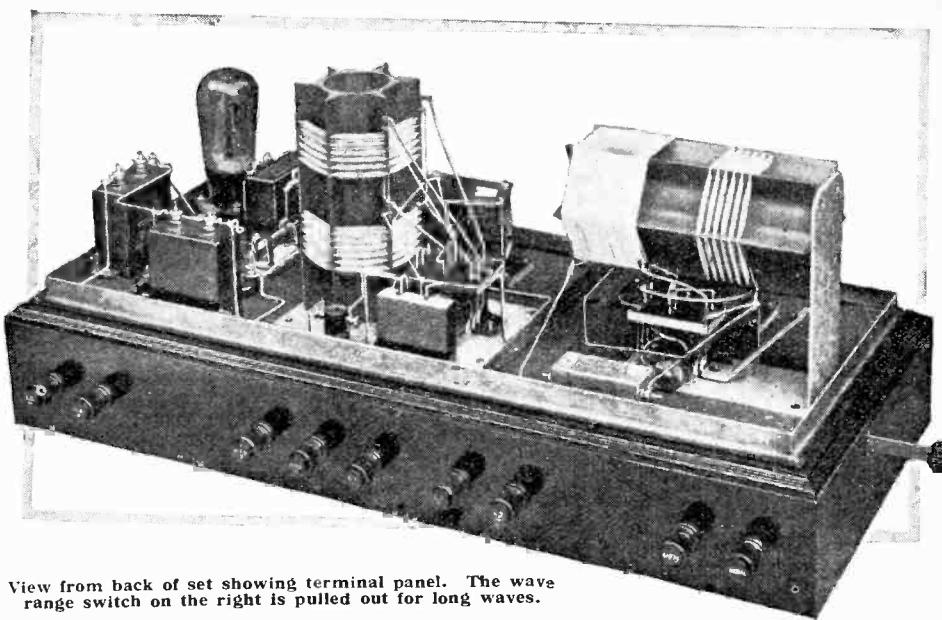
Components.

With the exception of the coil units, which have been specially designed for this receiver, wide latitude is permissible in the choice of components. Provided the following qualities are retained, any parts of reputable make can be substituted for those used in the original design, if the constructor so desires.

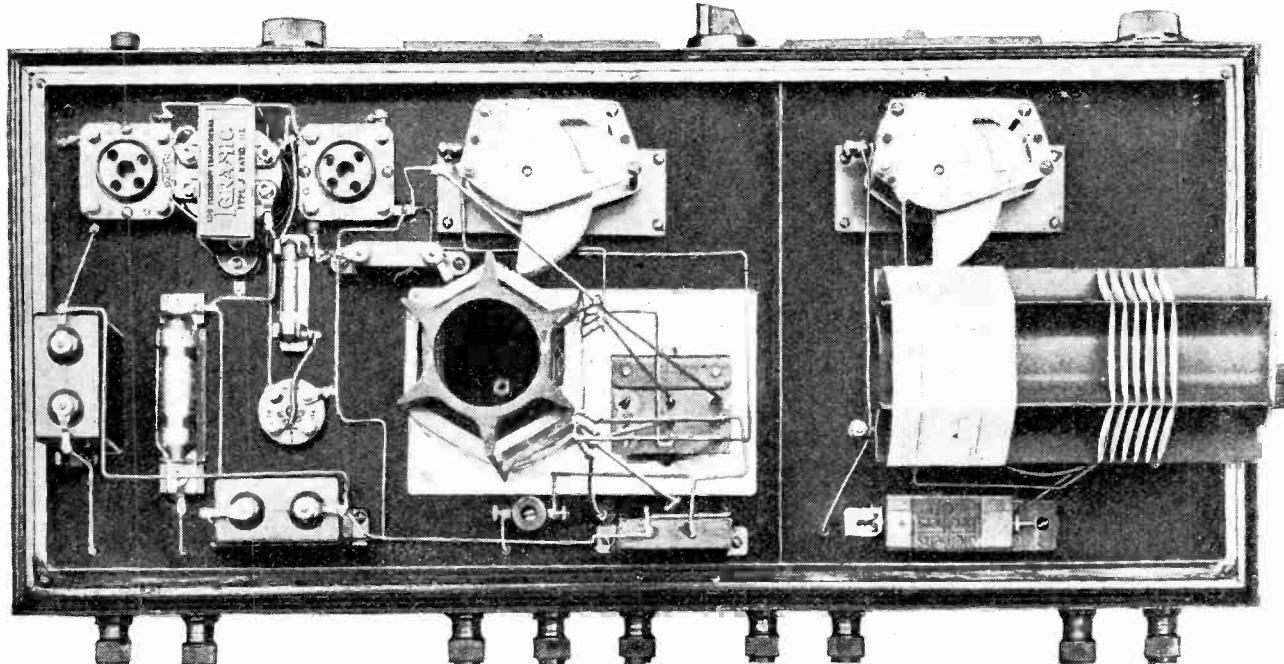
In the first place the two variable condensers tuning the aerial secondary and H.F. transformer must be mechanically rigid, and there must be no trace of side or end play in the bearings, or this will be magnified at the edge of the large diameter dials. Also, the depth of the fixed vanes or end plates, measured from the centre of the spindle, must not exceed $1\frac{1}{2}$ in., or the front edge of the condenser will interfere with the fitting of the cover at the front, and may result in short-circuiting the grid cell. Any good L.F. transformer having a ratio of approximately 3:1 is suitable provided the primary is capable of carrying up to 3 or 4mA. without saturating the core or seriously affecting the characteristics of the transformer. The H.F. choke should be compact and preferably of the binocular or astatic type

with a view to keeping the external magnetic field within reasonable bounds. Finally, the paper dielectric bypass condensers must be reasonably non-inductive, preferably of the type in which the foil is tapped at frequent intervals.

To simplify assembly, the coil units have been designed with integral change-over switches, and it is anticipated that these units will soon be available ready made and wired from those manufacturers specialising in this type of work. For those who may wish to construct their own coils full details are given in Fig. 2. The aerial coil, which is mounted under the base, is



View from back of set showing terminal panel. The wave range switch on the right is pulled out for long waves.



Plan view with valves removed showing layout and wiring.

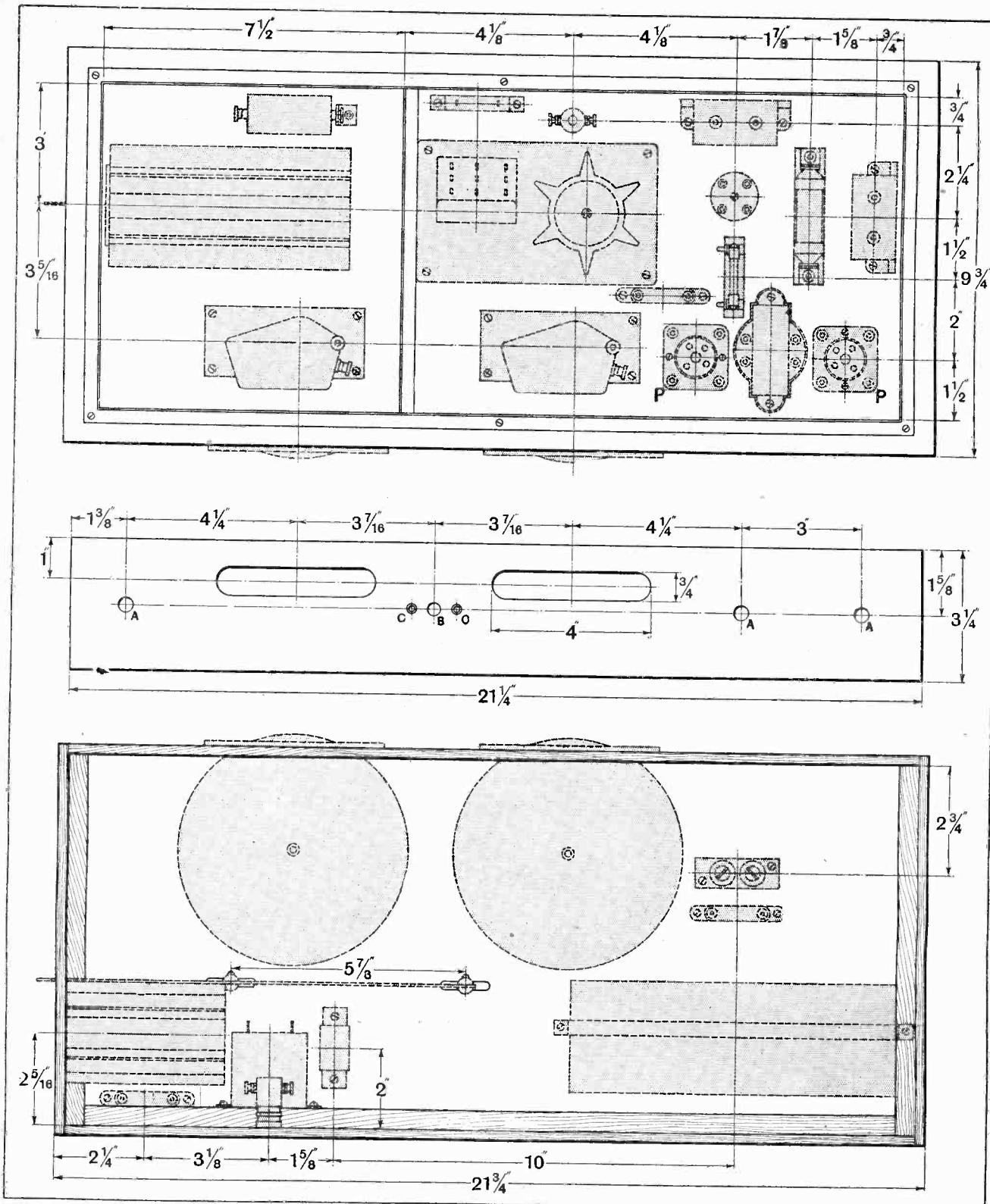


Fig. 3.—Layout of components and drilling details of front panel of base. A, 3 8in. dia.; B, 5/16in. dia.; C, 1/8in. dia., countersunk for No. 4 B.A. screws.

LIST OF PARTS.

2 Variable condensers, 0.0003 mfd., Type No. 3 (Polar).
 1 Variable condenser, 0.0003 mfd. (Utility, "Mite.")
 1 Variable condenser, 0.0005 mfd. (Utility, "Mite.")
 2 Condenser dials, 5½in. dia. and escutcheon plates.
 2 Fixed condensers, 2 mfd., 400 volts D.C. test (T.C.C.).
 2 Fixed condensers, 0.1 mfd., 400 volts D.C. test (T.C.C.).
 1 Fixed condenser, 0.0001 mfd., mica (T.C.C.).
 1 Fixed condenser, 0.0002 mfd., mica (T.C.C.).
 1 Fixed condenser, 0.0003 mfd., mica (T.C.C.).
 2 Valve holders (Formo).
 1 Anode resistance, 20,000 ohms and holder (Ferranti).
 1 Grid leak, 2 megohms (Dubilier).
 1 Porcelain base for above (Bulgin).
 2 Decoupling resistances, 600 ohms (Wearite).

1 Fixed potentiometer, 4,000 ohms (Polar).
 1 Rheostat, 50 ohms (Igranic).
 1 L.F. transformer, ratio 3 to 1, Type J (Igranic).
 1 Special S.G. cell (Siemens).
 1 Grid bias battery, 15 volts (Ripaults).
 1 On-and-off switch, Type W.188 (Utility).
 1 H.F. choke, Binocular Junior (McMichael).
 9 Ebonite shrouded terminals (Belling-Lee).
 1 Special metal cabinet (Rutherford & Co., Ltd., North Bridge Mills, Deansgate, Bolton).
 1 Special aerial coil unit.
 1 Special aerial grid coil unit incorporating switch.
 1 Special H.F. transformer unit incorporating switch.
 Glazite, screws, etc.

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

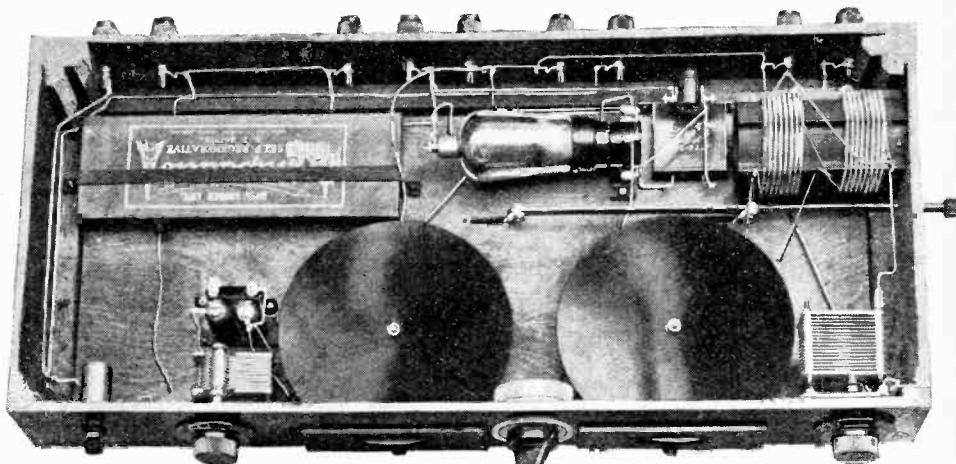
wound on a 2½in. dia. shallow-ribbed former, and is fitted with a wood disc at one end for fixing to the side of the wood plinth. The secondary (grid) coils is mounted horizontally, and is wound on a 3in. dia. deep-ribbed ebonite former. The supporting bracket is bent up from thick sheet aluminium, braced at the corner, and the switch secured from below with the countersunk screws to give a flush fitting base. A slot is cut in the aluminium to pass the switch operating knob. The H.F. transformer and switch are mounted on a rectangular aluminium base plate with holes at each corner for baseboard fixing. The wiring is lettered to correspond with the circuit and wiring diagrams, circled letters indicating external wires from the units to other parts of the circuit.

Assembly.

The special form of combined cabinet and screening box adopted for this design reduces constructional work to a minimum. The process of assembly resolves itself merely into screwing the components to both sides of the baseboard. The first step is to cut ¾in. clearance holes in the base for the two tuning condenser spindles. A small pilot hole should first be drilled from the top and then the wood underneath should be partly cut away with a ¾in. carpenter's bit. The exact position of this hole from the front edge of the wood plinth will be determined by the diameter of the tuning dials used, and may coincide with the dimension given in the layout in Fig. 3. This distance should be checked before drilling the pilot hole. A ring of small holes round the circumference of a ¾in. circle scribed on the top will

soon break away the metal, and the edge may then be finished off with a rat-tail or half-round file. Now make the ebonite condenser sub-panels which measure 4in. × 1½in. with a ¾in. clearance hole and holes for No. 4 wood screws at the corners, and fit the condensers to the box, making sure that the bushes clear the metal at the edge of the ¾in. hole in the base.

The detachable wood panel at the front of the plinth should next receive attention. First, cut the wood



View underneath base showing condenser dials, aerial coil and screen-grid H.F. valve

away behind the escutcheon plates and fit the latter in such a position that they do not chafe the condenser dials. Then mount the aerial and reaction condensers, the "volume control" rheostat and the on-and-off switch. To complete the constructional work on the base cut the slot for the switch control rod in the left-hand end of the plinth and drill holes for the terminals at the back; as a refinement the latter may be insulated with ebonite bushes if desired.

The remainder of the components may now be screwed above and below the baseboard in the positions indicated in the dimensional layouts. For this purpose,

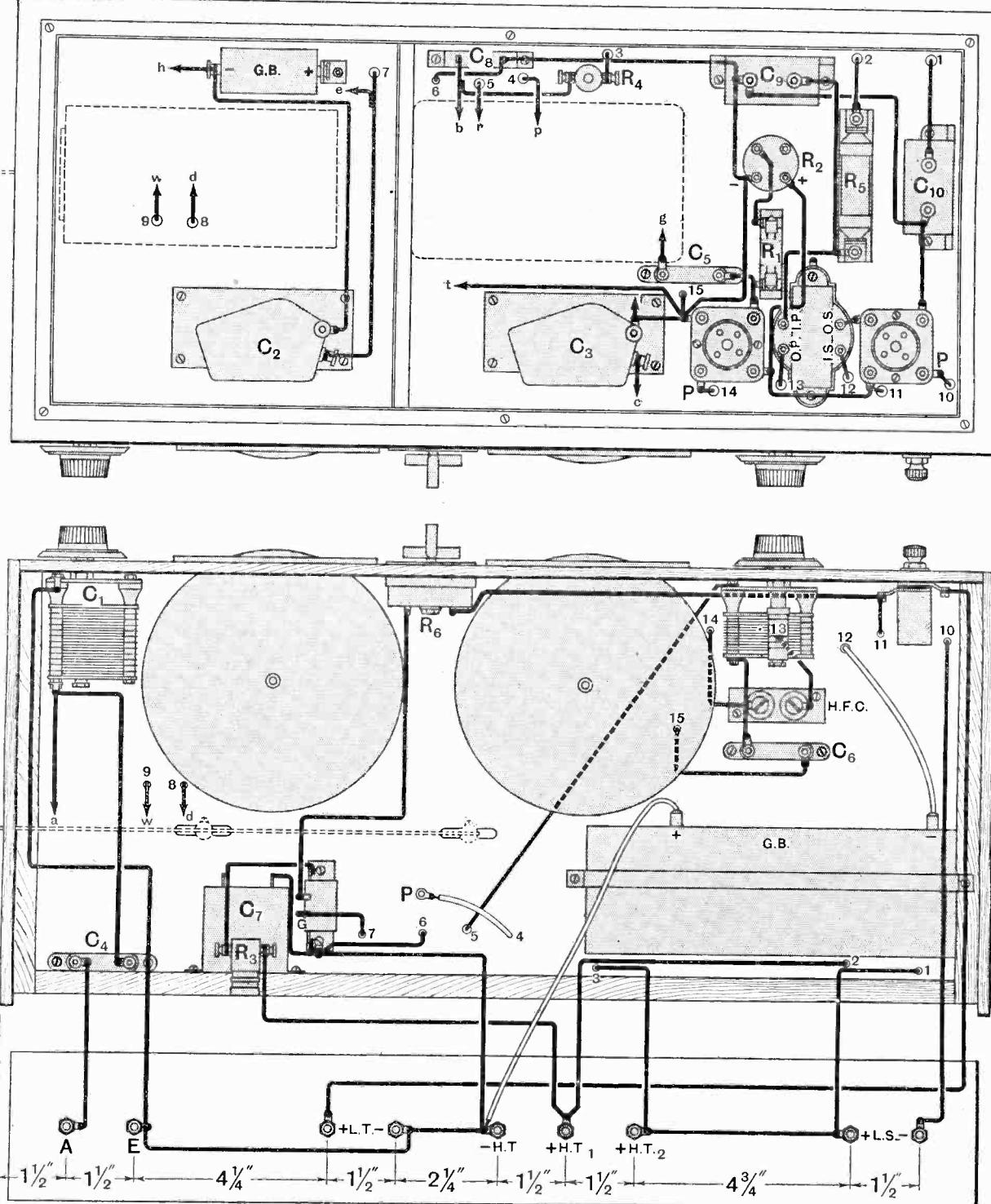


Fig. 4.—Complete wiring plan. Holes through the baseboard are indicated by corresponding numbers. Clearance holes in the metal for wires above earth potential are indicated by large diameter circles; all holes underneath the base in the wood are of small diameter. The lettering corresponds with the coil drawings in Fig. 2 and the circuit in Fig. 1.

The Wireless World "Kit" Set.—

wood screws are in most cases satisfactory, but B.A. nuts and bolts may be used with advantage for the L.F. transformer on account of its weight and the valve holder in view of the strains likely to be imposed when inserting or removing the valve. If the fitting of the coil units is left until the last they will be less likely to suffer damage when turning over the base to work underneath.

Wiring.

The process of wiring involves repeated turning upside down of the base, so the first step is to procure two boxes of sufficient height to clear the coils from the bench and to rest the base across these. It is as well to leave the wiring of the coils until last, and to commence in the usual way with wires at low H.F. potential such as H.T. and L.T. leads from the terminals, running these close to the baseboard on either side. Then start working through the set from the loud speaker end to the aerial, using the circuit diagram as a guide in addition to the wiring plan, and marking off wires with a blue pencil on the diagrams as they are fitted. Covered wire such as "Glazite" is convenient, the insulation being removed at the ends by running round the wire with a sharp knife or razor blade. As an alternative No. 18 S.W.G. tinned copper wire may be used with "Systoflex" tubing. Holes through the base should be drilled slightly larger than the insulated wire, and in the case of +H.T. leads or wires carrying H.F. the metal only should be opened out with a size larger drill;

the smaller pilot hole in the wood will then hold the wire central in the clearance hole in the metal. The L.F. transformer core and case if provided with a terminal or soldering tag should be earthed to the metal base of the set.

To facilitate identification, holes through the baseboard are given corresponding numbers in both the top and bottom wiring plans.

Testing.

Full particulars of suitable valves will be given later. In the meantime, for the purpose of testing, any make of screen grid may be used in the first stage, a 20,000 ohm H.F. valve in the detector and a power or super-power valve in the output stage. To commence with, the tapping points on the secondary (grid) coil may be set at 2 turns for short waves and 5 turns for long waves. This will give average selectivity for purposes of testing and sufficient sensitivity for a large number of foreign stations. About 80 volts for +H.T.₁ and 120 volts for +H.T.₂ will be about right, and the grid bias underneath the base should be adjusted in accordance with the requirements of the last valve with 120 volts on the plate. If the connections have been correctly made the set should work first time and give at least three foreign stations on long waves and 10 or 12 after dark on short waves in addition to the B.B.C. local and high-power stations without using reaction.

The refinements of tuning and adjustment will be dealt with in next week's issue with full particulars of performance and suggested combinations of valves.

GRID BIAS FOR HIGH-FREQUENCY AMPLIFIERS.**Obtaining Greater Stage Amplification with Less than One Volt Bias.**

WHEN using a valve of fairly high amplification factor, whether a screen-grid valve or a triode, as a high-frequency amplifier, it is often well worth one's while to use no more grid bias than is enough to prevent the flow of grid current. By so doing the A.C. resistance of the valve is kept down to a minimum, with a consequent increase in the amplification afforded by the stage.

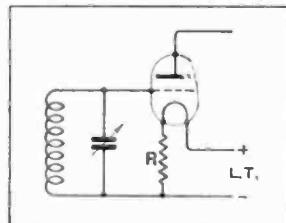
Since the signal voltage with which a high-frequency amplifier has to deal is only a small fraction of a volt, there is usually no need to use more than a maximum of half a volt grid bias in order to ensure that no grid current flows even at the moments when the signals make the grid most positive. If the grid bias is increased above the necessary minimum, every extra volt of grid bias is equivalent to reducing the anode voltage by μ volts, where μ is the amplification factor of the valve. With a triode for which $\mu=30$, it is only necessary to use 90 volts H.T. to obtain the results for which 120 volts would be necessary if 1½ volts of grid bias were applied. It is clearly uneconomical to pay for an extra 30 volts of high tension and get nothing for it.

With 6-volt valves, one can practically always spare half a volt from the filament battery, so that by putting a small fixed resistance in the negative L.T. lead, as in the figure, the desired grid voltage is obtained. The value of R is computed by dividing 1 by twice the filament current of the valve, so that for a 0.1 amp. filament R would have to be 5 ohms.

With 2-volt valves this simple means of obtaining half a volt usually cannot be adopted, and it is necessary to use a potentiometer connecting the positive terminal of a 1½-volt cell to the slider and setting this at the half-way position. If there is no room for a potentiometer, two equal resistances of about 200 ohms each (8 yards of 38-gauge Eureka) may be substituted, as there is no real need to have the setting adjustable. Alternatively, one may use a 3-volt cell, connecting the positive terminal to L.T. This gives 1 volt of negative bias when the cell is new, but

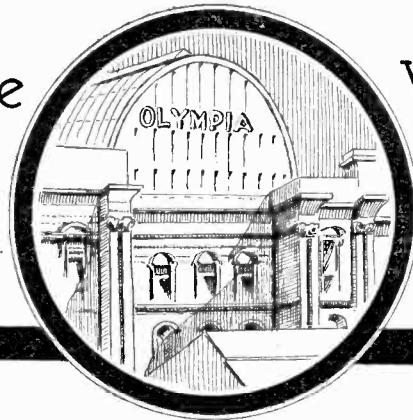
very soon in its life the value will be hovering round the desired half-volt for most of the time during which the cell is in use.

A. L. M. S.



By interposing a resistance R in the negative filament lead of a 6-volt valve, a small bias can be applied to the grid.

The



1929

Wireless World LYMPIA SHOW COMPETITION

NATIONAL RADIO EXHIBITION

1929

THIS is now the second year in which *The Wireless World* has held a special competition in connection with the annual Olympia Radio Show, and we anticipate that the results from this year's ballot will be even more interesting than were those of a year ago.

Objects of the Vote.

We had felt for a long time that it would be of interest to all our readers, and to the wireless world generally, to discover what, in the opinion of the majority, were the best products developed by the manufacturers at each successive annual Exhibition. In launching the idea of the competition last year we did so in some trepidation, realising, first, how difficult a matter it was to classify the exhibits fairly, and, secondly, because we had no means of ascertaining the degree to which our readers would respond to the idea and record their votes. But the success of last year's competition more than justifies a repetition of the idea.

In the advertisement pages of this issue an entry form for the competition will be found, and the form will also be repeated in the next two issues of *The Wireless World*. Only one form should be used by each entrant, and the forms need not be forwarded until after Wednesday, October 2nd, but should reach the offices of *The Wireless World* not later than Monday, October 7th. The reason for delaying the forwarding of the entry forms is in order that those readers who are not able to visit the Exhibition personally can have the full benefit of the published reports of the Show, which will

appear in this and also in the two further special Show Numbers of *The Wireless World*, to be dated September 25th and October 2nd. These issues will be found very helpful to readers in assisting them in their choice.

All Classes of Apparatus Included.

It should be remembered that only apparatus exhibited at Olympia may be included in the votes, and in choosing apparatus in each class the competitor should be guided in his choice principally by a consideration of the value of the apparatus at the price asked for it in order that low-priced apparatus may stand an equal chance with apparatus for which a high price is asked.

**VOTE FOR
YOUR
CHOICE
AT OLYMPIA**

We repeat the general instructions for entering the competition. The ballot is organised on the basis that every reader of *The Wireless World* should be entitled to one vote for what he considers to be the outstanding single exhibit at the Show, whether a complete set, a component, or a valve. In order to reduce the possibility of ties each competitor is required, in addition, to vote for one piece of apparatus in each of the following classes into which we have divided the exhibits as a whole. Our classification of the exhibits is as follows:

(1) Complete receiver of five

valves or more, that is to say, receivers exclusive of loud speaker and batteries—unless these should happen to be incorporated as part of the receiver.

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

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

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

(5) Loud speakers of all types.

(6) Valves.

(7) Other apparatus not classified above; also component parts such as transformers, condensers, tuning coils, resistances, etc.

Prizes for Competitors.

Further details of the competition are given on the entry form to be found in the advertisement pages of this and the next two issues.

We believe that our readers will, as last year, welcome the opportunity of taking part in a vote which is of so much general interest, but to add additional attraction to the ballot special prizes are being offered by *The Wireless World*.

A cash first prize of £50 will 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 classes. In addition, second, third, fourth, and fifth prizes to the total value of a further £50, in the form of vouchers for the purchase of apparatus, will be presented. Details of these are to be found on the entry form.



SHOW FORECAST.

Notes on Some Typical New Products.

WITHIN a week the annual Radio Show at Olympia, organised by the Radio Manufacturers' Association, will be in full swing, and the public will be admitted to inspect for themselves at close range those products of the manufacturers which have been jealously shielded from prying eyes right up to the time of the opening of the doors of Olympia.

Design of Modern Apparatus.

There is always an air of mystery concerning the annual shows of the various industries, for every effort is made to keep confidential, as far as possible, the particulars of new products. Perhaps it is easier in the radio industry than in some others for this information to be withheld until the last minute, because manufacturers find that in the case, at any rate, of component parts, production can be delayed until shortly before the Show. The same argument applied with regard to complete receivers of the past, when these were little more than an assembly of components, but to-day matters have changed very much in regard to receivers, for the methods of manufacture and the general design necessitate that the machinery to be set in motion for the production of complete sets must be ready in good time, and there is no longer the feeling that early release, before the Show, of information regarding receivers might result in special ideas incorporated in them being copied by other manufacturers for their own season's sets, because more time is required in the manufacture of the modern receiver than has been necessary in the past.

In making a statement of this kind it is necessary to enlarge a little and give reasons for it. Receiving conditions have changed, and at the same time the character of some of the apparatus incorporated in the design of modern sets has been radically modified. The public to-day require that receivers should be far more selective than has been the case

in the past, because the introduction of the Regional Scheme and the increase in the number of stations abroad which can be listened to with enjoyment have both contributed to make it essential that a degree of selectivity far in excess of the standard of a year or so ago should be a feature of the modern set.

The use of the screen grid valve has made it possible for the modern receiver to provide greater selectivity and amplification, but in attaining these results it is necessary for the designer to pay much closer attention than in the past to design of couplings and to the question of screening. It is these considerations primarily which have made the designing and manufacturing of the modern receiver a more exacting task than it has been in the past, and add to these considerations the fact that the public is now expecting to be supplied with re-

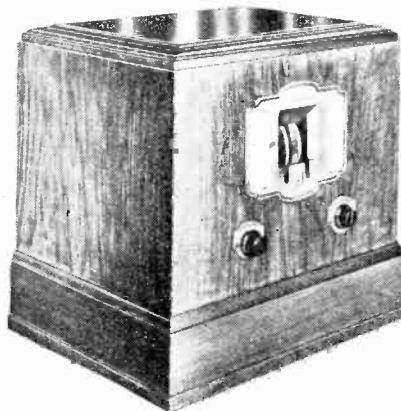
year be a little on the upward rather than the downward scale; but we must remember how much more we are getting in the modern receiver as compared with its predecessors.

In the simpler sets, of which, naturally, there will be a very wide choice at the Show, we shall find that prices have in most cases been substantially reduced, and this season should see the eclipse of the crystal set in favour of valve sets throughout the country. Even the B.B.C., so long the champions of the crystal set user, have at last been forced to admit that under the Regional Scheme the purchase of a valve receiver is to be strongly recommended.

Newcomers in the Industry.

This year we are able to welcome some newcomers in the sphere of broadcast receiver manufacture, notably the Columbia Graphophone Co., Ltd., which enters the wireless industry for the first time, and Graham Amplion, Ltd., who are extending their interests to the production of broadcast receivers, whereas hitherto they have specialised exclusively on loud speakers. The exhibits of Columbia will be found on Stands 94 and 96, and their two principal models of receivers are both five-valve types, one a Table Model 304, and the other a portable receiver. It must be pleasing to a designer to come into the field of set manufacture with, as it were, a clean slate, able to look round and gather ideas and develop entirely new designs unhampered by any past traditions of his firm in the matter of broadcast receiver design; it is, therefore, not surprising to find that these firms which have just entered the field of receiver manufacture should have products of special interest.

The Columbia Table Model 304 is housed in a cabinet reflecting the severe simplicity of modern decoration, and is available in three types for operation from A.C. or D.C. mains or batteries. The first three stages are devoted to H.F. amplification with screen grid



Mechanical ganging of four circuits simplifies tuning of the Columbia table model cabinet receiver.

receivers working direct from the mains, everything being incorporated into one outfit, and we have the explanation as to why the tendency in price for complete sets of the most modern type will this

Wireless World

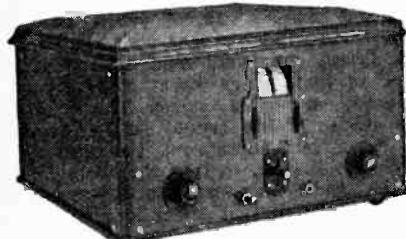
Show Forecast.—

valves and transformer coupling, and the constants of the tuned circuits have been adjusted to give the maximum selectivity, consistent with good quality of reproduction. Mechanical ganging has been introduced for the four tuned circuits, but individual adjustment is possible when receiving distant stations. The tuning drum is calibrated directly in wavelengths, and wavebands covered are 230-550 and 1,000-2,000 metres.

The H.F. stages are followed by an anode bend detector feeding through resistance-capacity coupling to a super-power output valve operating on 200 volts. The comparatively small degree of L.F. amplification means that the H.F. input to the detector must be large, and this valve is, therefore, functioning under most favourable conditions. A volume control is incorporated, giving a wide range of output power.

An interesting feature of the A.C. model is the use of a Westinghouse rectifier for feeding the filament circuits.

The Model 303, Columbia Portable, is also a five-valve receiver, but in this case only two valves are devoted to H.F. amplification, and all valves are of the



Ampion standard mains-operated 5-valve receiver shown on Stands 164 and 187. The last two valves are connected in parallel.

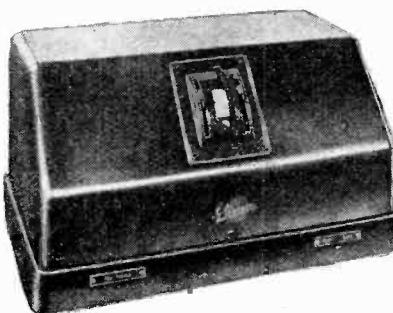
three-electrode type. The first H.F. stage is tuned and is supplemented by reaction, while the second stage is aperiodic. The leaky-grid detector is followed by two transformer-coupled L.F. stages, the output valve being of the power type, feeding into a cone loud speaker of matched impedance.

The portable receiver is adaptable for mains operation, and A.C. and D.C. eliminators for this purpose are available at 10 guineas extra.

The outstanding receiver in the Ampion productions is their standard mains-operated set for A.C. supply. It is a five-valve receiver of four stages, the last stage consisting of two super-power valves in parallel, with a 10-watt dissipation. A screen grid H.F. stage is employed, followed by detector and a L.F. stage leading to the power output stage. The set is also designed for use with electrical reproduction of gramophone records, plug and jack being provided for connection with the gramophone pick-up. The receiver strikes a distinctive note because of its compact appearance and extreme neatness. It has the hallmark of careful design and execution which will make a strong appeal to the public.

Another receiver of outstanding merit,

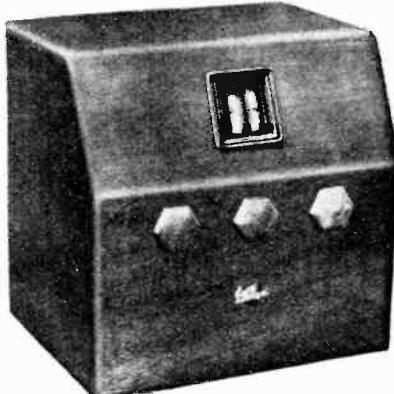
which is also distinctive because of the simplicity of its appearance, is the Marconiphone Model 56, which is also designed to operate from the mains, but this time by the employment of a separate unit. The receiver incorporates three screen grid valves, detector, and a pentode for the output stage. The



Conveniently placed drum controls and all metal cabinet are the outstanding features of the Marconiphone Model 47 mains-operated receiver.

appearance is very pleasing, the set being housed in a mahogany cabinet with tuning by means of two edgewise dials in the centre of the cabinet, tuning being by ganging. Provision for using the receiver for electrical gramophone reproduction is also a feature, whilst a special point of interest is the new type of volume control, independent of tuning.

Another interesting receiver is the Marconiphone Model 47, which is accommodated in a metal cabinet and is designed solely for use with A.C. mains, the entire mains unit being incorporated within the receiver. This receiver consists of one H.F. screen grid valve, detector, and two L.F. stages, and it is a



Marconiphone cabinet set, Model 39, incorporates a screen-grid H.F. stage and a pentode output valve.

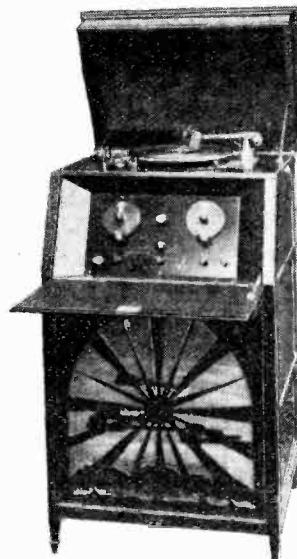
mass-production job, which has made it possible to produce it at a highly competitive price.

Model 39 is another new product of the Marconiphone Co., consisting of screen grid stage, detector, and pentode. Two edge control dials are set together in the sloping panel of the mahogany cabinet; the set can be operated from a mains unit or from batteries. This is a very well

finished receiver, which is bound to be popular, and will be found on Stands 79 to 84.

Just as a year ago the most popular sets were of the four-valve class, now it seems that with the increasing efficiency of valves and general design the outstandingly popular receivers this year are likely to be three-stage sets operating from the mains, with screen grid H.F. valve, and in many cases a pentode output stage. The Igranic Electric Co. will show a new receiver to this specification on their Stands Nos. 161 and 162. The receiver embodies a number of novel features which will be examined with interest. The set is available in various forms of handsome cabinets, and one type incorporates an electric gramophone and a new self-contained frame aerial. Those interested in short-wave receivers will also find two interesting examples of modern short-wave receiver practice exhibited on these stands.

Burndept have always maintained a high reputation for the quality of their



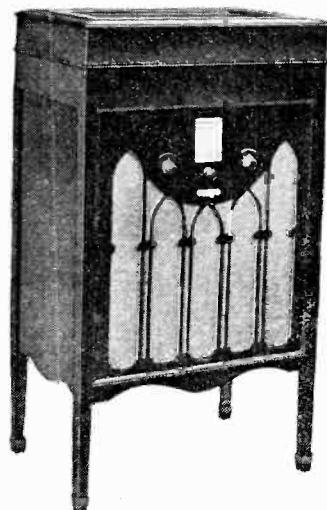
An all-electric radio gramophone set. Three valves are employed, one of which is a screen grid H.F. amplifier. An Igranic product.

products, and this year what will probably be regarded as their outstanding exhibit will be the "Ethogram" All Mains A.C. Radio-Gramophone. The radio amplifier equipment of this instrument is similar to the Burndept A.C. Screened Seven receiver, and consists of two screen grid H.F. stages, anode bend detector, followed by a resistance coupled stage feeding two super-power valves arranged in push-pull as the output stage. The receiver is designed to provide all current and voltages, including grid-bias, from A.C. mains. Tuning is by means of a single drum control, and two additional controls serve; one for volume regulation, whilst the other rotates the frame aerial. The Burndept special "Needle Armature" gramophone pick-up is used, and the equipment is designed so that a reed-driven cone or a moving-coil

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loud speaker can be incorporated according to the choice of the purchaser. An early inspection indicates that other receivers of Burndept production will also be of a very high standard.

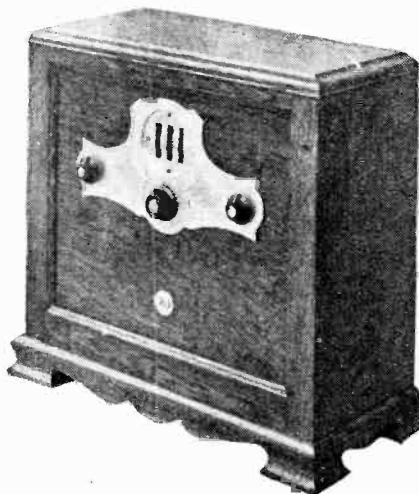
Naturally, one must wait until the opening of the Show before it is possible to attempt to cover, in a review of the



Burndept "Ethogram" A.C. mains-operated radio gramophone. To be found on Stands 144 to 147.

Exhibition, even a small proportion of the apparatus of special merit which Olympia will present. It is only possible at this stage to forecast the general tendency of design by illustration of certain particular sets as good examples of their class.

Kolster-Brandes products, exhibited on Stands 176 to 179, are distinctive in appearance, and will undoubtedly attract attention, particularly on the score of their low price. The All-Mains three-valve receiver is entirely self-

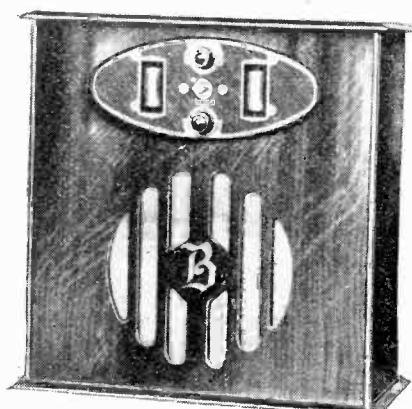


Kolster-Brandes all mains receiver, Type 161. Three valves are used, and it is entirely self-contained.

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contained, so that it can be connected direct to the electric lighting point.

Amongst battery-operated receivers the

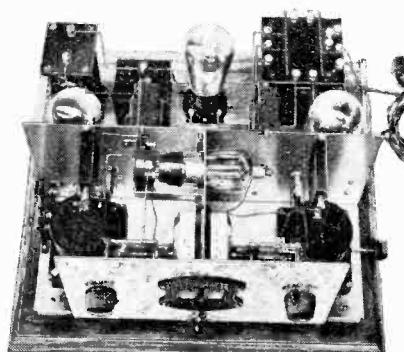


S. G. Brown's kit constructors' 3-valve receiver. A screen-grid H.F. valve is used.

K.B.102 is a screen grid, detector, and pentode set, selling at £9 15s.

Another pleasing example of a three-valve receiver with screen grid H.F. stage will be shown by Messrs. S. G. Brown on Stands 213 to 215. The set is designed particularly with a view to selectivity, in order to make it suitable for the Regional Scheme. The receiver is one intended for home construction, and full details for building are supplied with the parts. Another kit of parts consisting of a three-valve screen grid and pentode output receiver designed to operate from the mains will certainly attract attention.

On Stand No. 63 Messrs. Garnett, Whiteley and Co. are showing their products under the well-known name of

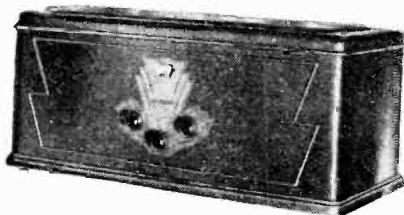


"Lotus" A.C. mains receiver, also supplied in kit form for the home constructor.

"Lotus," and amongst sets it will be of interest to examine their three-valve standard screen grid all-mains receiver with a pentode output stage. A.C. valves are used, and special attention has been paid to selectivity. This receiver is also available in the form of a kit for home construction, everything being in readiness for easy assembly, and full consideration has been given to the question of screening and convenient tuning control.

Kits of parts for home construction certainly appear to have appealed to the manufacturer this year. Cossor's 1930 "Melody Maker" is a constructor's set of outstanding interest which, in anticipation of big sales, is being produced on mass-production methods. The cabinet is pressed steel, handsomely finished to imitate the appearance of leather. The set is available both for mains and battery operation, and those who purchase the battery kit can at any time add the battery eliminator, as sufficient space is provided.

An interesting point in connection with the design is that, realising the difficulties of the home construction of an efficient tuning unit from component parts, the designers have incorporated the



The Cossor 1930 Melody Maker.

tuning condensers, coils, and change-over switch from long to short wave, and the necessary associated screening all within one sealed box, which is supplied as a distinct unit to be treated as one component with external terminals for connection to the other components.

Portable sets will no doubt be more in evidence at this Exhibition than ever before, for certainly the portable set has achieved great popularity with the public during the past few months. But we must never lose sight of the fact that the portable set is still something in the nature of a compromise, manufacturers being very definitely handicapped in designing such receivers, because they have to take



The Lissen portable to be found on Stands 184 to 186. A 5-valve receiver with one dial tuning.

into consideration the question of weight and portability. But, as we know from past reviews in *The Wireless World*, portable sets of marked efficiency are

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being evolved by the British manufacturer.

Amongst new portables may be mentioned the "Lissenola," which is a five-valve receiver with one-dial tuning and providing long- and short-wave reception.



Four valves are used in this Selector trans-portable receiver. The tuned H.F. stage has a screen-grid valve.

An outstanding example of semi-portable, or so-called transportable, receivers is the "Selector Cabinet Portable," which will be seen on Stands Nos. 102 and 104. This is a mahogany cabinet four-valve receiver, for which a remarkable performance is claimed. A screen grid H.F. valve is employed, and calibration charts for each receiver are supplied.

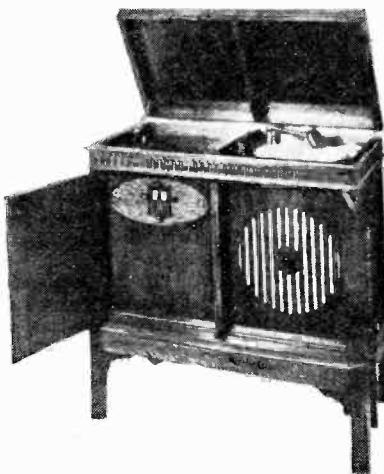
Electrical gramophone reproducers have very definitely taken their place amongst the legitimate products of the radio manufacturer, and we are promised a number of notable examples at Olympia this year. The Symphony Gramophone Radio Co., on Stand 132, will be showing fine examples of radio gramophones, where very special attention has been paid to handsome appearance of design and finish of workmanship, but their star model is undoubtedly



A handsome cabinet houses this "Symphony" de luxe radio gramophone. It includes an electrically-operated gramophone and moving coil loud speaker.

the All-Electric Radio Gramophone *de luxe*, which is a most attractive piece of furniture as well as a radio gramophone. An electric motor drives the turntable; the radio receiver and gramophone amplifier is a unit in itself, mounted within the cabinet on an all-metal chassis and totally enclosed, with the exception of the valves. Indirectly heated valves are employed, and the output is sufficient to provide dance music for a small hall, if necessary. A self-contained frame aerial feeds a screen grid high-frequency stage for radio reception, and the loud speaker is of the moving coil type with a special form of suspension.

The quality of the products of Gambrell Radio, Ltd., has always been of a high order, and amongst the new apparatus which they will be showing this year special interest attaches to the Gambrell radio gramophone, which is designed in two models, operating from direct or alternating current. The turntable is driven by an electric motor and the receiver is a four-valve instrument with screen grid, H.F., and pentode output. Tremendous volume, with excellent

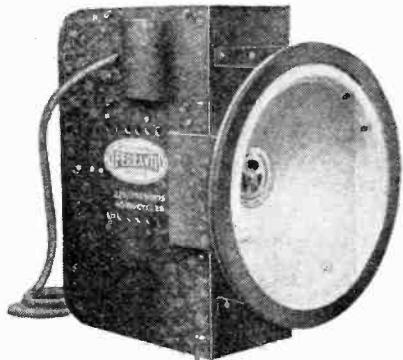


Gambrell's version of an all-electric radio gramophone. Four valves are used, including a screen grid and a pentode. Shown on Stand 62.

quality, is provided, and on the receiver side good selectivity. Both these models can also be fitted with a new device known as the "Novotone," which will be shown at the Exhibition and demonstrated for the first time. The "Novotone" is a special tone compensator invented by Dr. N. W. McLachlan, the special object of which is to compensate for the fact that the gramophone record does not take care of the low or the high frequencies in proper proportion. The effect of the "Novotone" unit is to correct the overall characteristic of the amplifier so as to bring up both high notes and the bass to their proper proportion and so effect a cure for the inherent shortcomings of the gramophone record. The instrument is a noteworthy contribution to the technique of gramophone reproduction by electrical means.

LOUD SPEAKERS.

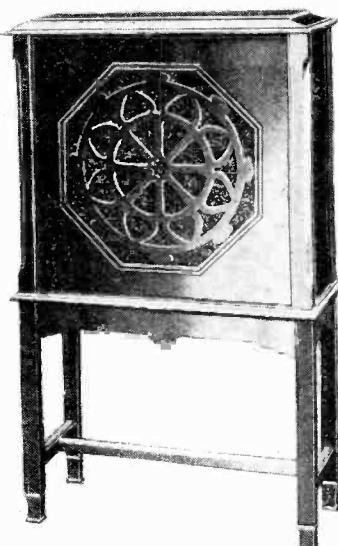
The construction of loud speakers is a new departure for the house of Ferranti, Ltd., but since this firm have had such a wide experience in the design of mains equipment it is perhaps understandable that their energies should be directed to



Ferranti A.C. mains-driven moving coil loud speaker. An input transformer is incorporated.

wards the production of a mains-operated moving coil instrument. Some examples of these will be shown on Stands Nos. 74 and 76. There will be two types, the S.A.1 and the S.D.1; the former is for use on A.C. supply mains of from 200 to 250 volts, 40 to 100 cycles, and incorporates a valve rectifier. The other model is somewhat similar in general construction, but without the rectifying equipment, and is intended for use where the electric supply is of the direct-current nature. At present chassis models only are available, but cabinet assemblies are under consideration.

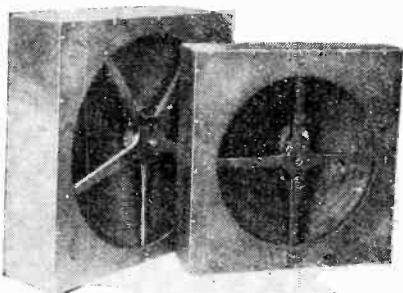
Celestion loud speakers need no introduction in general, but on their stands, Nos. 180 and 183, will be shown some entirely new models this year. This



Celestrola moving coil loud speaker. A new product of Celestion, Ltd.

Show Forecast.—

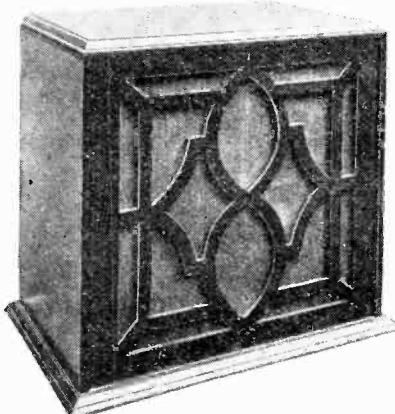
firm, which has in the past specialised in the reed-operated mechanism, has now developed a moving coil type loud speaker, known as the Celestrola. This is supplied for mains excitation of the field coil, or for use with a 6-volt accumulator to meet the requirements of those not having access to the electric supply mains. Mains models are made to suit 110- or 220-volt A.C. supplies, and these incorporate a transformer, rectifier, and input transformer. The D.C. model is made for 110- and 220-volt



Celestion shell case models for fitting into cabinet receivers.

mains, and includes an input transformer. These are built into handsome pedestal cabinets, and can be supplied in oak or mahogany.

The home constructor's requirements are being catered for by the introduction of a range of shell-case reed-type loud speakers fitted with Celestion reinforced diaphragms. These are housed in plain

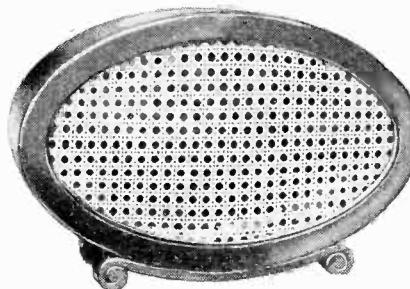


New model Marconiphone moving coil loud speaker with pressed diaphragm.

wooden cases open at the front and supplied with 10in., 11in., 12in., and 14in. diaphragms. A special feature of this year's exhibits is an all-round reduction in prices of their standard models, made possible by the acquisition of a more efficiently equipped factory and a thorough reorganisation of production.

The Marconiphone Co., Ltd., are showing a new model moving-coil loud speaker and two additional reed-operated cone-

type instruments on Stands 79 to 84 inclusive. In the moving coil model the diaphragm is pressed from a fibrous buckram material, and it has been found possible to dispense with the centring

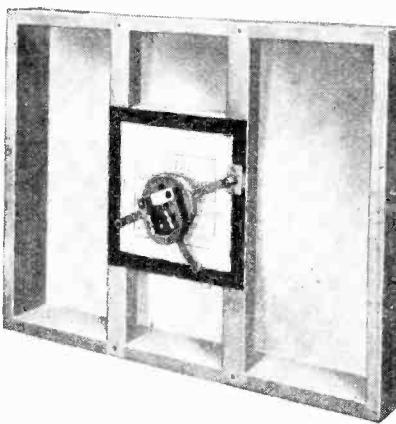


Unorthodox but pleasing design is the feature of the Symphony Gramophone and Radio Co.'s "Oval" loud speaker.

spider fitted to the earlier model. At the forward end of the cone the suspension used follows approved practice. The field coil is wound for 200-250 volts, and requires about 60mA. of current. A unit, fitted with a Marconi U.9 rectifier, is available for use on A.C. supply mains. The instrument is housed in an attractively designed and well-finished mahogany cabinet.

A rather novel and unusual design is adopted by the Symphony Gramophone and Radio Co., Ltd., in their "Oval" loud speaker. The mechanism follows well-tried practice, and consists of a reed-type movement driving a cone diaphragm. The cabinet, however, is oval in shape, the front being acoustically open, but covered by a grill made from woven cane. This is to be exhibited on Stands Nos. 129 and 132.

The use of linen diaphragms for reed-operated-type loud speakers is not new in the literal sense, since these have been in being, but mainly in experimental form, for some time past. The commercially made article, however, is sufficiently recent to justify inclusion in the new season's products. Some good ex-

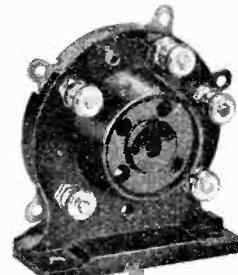


"Ultra Air Chrome" linen diaphragm loud speaker for incorporating in cabinet receivers. A balanced-armature movement is used.

amples of these instruments will be shown on Stand No. 106, the Ultra Electric, Ltd., under the name of Air Chrome loud speakers. Skeleton models, as well as cabinet types, will be exhibited. These instruments are fitted with double linen diaphragms and a balanced armature movement. From the performance curve of this particular design it appears that the response is exceptionally good, and particularly constant between 70 cycles per second and 7,000 cycles, and if this can be maintained in all production models this loud speaker should enjoy well-merited popularity.

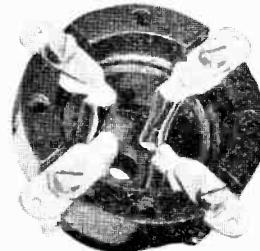
COMPONENTS.

It is difficult at this stage to give anything more than a brief description of the new components that will be seen this year, as the majority of manufacturers



"W.B." Universal 5-pin valve holder. A Whiteley Boneham product to be found on Stand 66.

are mainly concerned with putting the final touches to their principal exhibits. From what can be gleaned, however, it would appear that most of the really new accessories have been developed to meet some special requirement. For example, the advent of the new five-pin A.C. valves has necessitated a special valve-holder, and examples of these will be



"Clix" special low-loss valve holder.

found on the stand of Messrs. Whiteley, Boneham & Co., Ltd. One model, a rigid type, especially designed for 5-pin screen-grid valves, can be mounted to support the valve either vertical to or horizontal to the baseboard. A good electrical contact is assured by the use of expanding leg sockets made from stout nickel silver. An extension of these provides soldering tags, but terminals are fitted also.

An anti-microphonic holder possessing exceptional low loss qualities is to be included in the exhibits of Lectro Linx, Ltd., Stand No. 261. The moulded shell

Wireless World

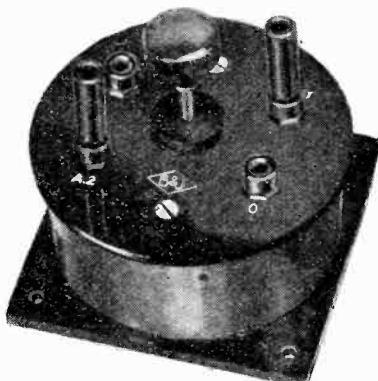
SEPTEMBER 18th, 1929.

Show Forecast.—

is hollow, and the spring sockets are anchored at each end but do not otherwise touch the moulded material. Since the sockets are surrounded by air the capacity effects will be exceptionally low, and, moreover, the leakage paths will be reduced to a minimum.

An addition to the "Belling-Lee" wide range of terminals is an S.G. valve anode connector to completely insulate the top terminal and its connecting wire from adjacent metal work. Its special function is to provide a measure of safety against accidental damage to the H.T. supply, and possibly more delicate components, should the anode connection come loose and trail dangerously among the wires in the set. This useful accessory will be found on Stands Nos. 263 and 264. Here will be found, also, other safety devices, such as a baseboard fuse holder, which consists of a bakelite moulding carrying a cartridge type fuse and two connecting terminals. Those who cannot conveniently incorporate a

culties. An excellent example of this accessory is the "Magnafilter," to be shown on the "Magnum" stand. This piece of apparatus should be connected between the aerial and aerial terminal of the set;

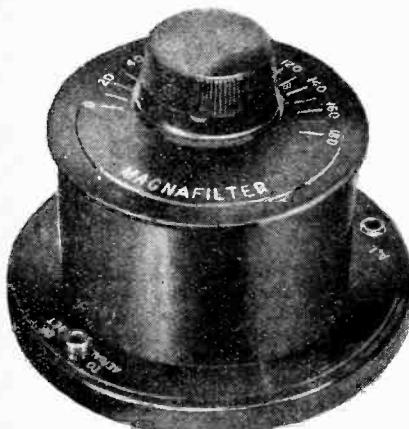


"B. & J." wavetrap; Litz wire is used for the coil.

no alterations, whatsoever, being necessary to the receiver. By its aid a powerful local transmission can be rejected and the alternative programme received free from interference. Wave filters, or rejectors, do not enhance the sensitivity of a set; they merely improve the selectivity under certain conditions.

The B. and J. Wireless Co. will exhibit on Stand No. 233 a wavetrap, which we venture to think will be found highly efficient, since the coil is wound with Litz wire. The aerial should be disconnected from the set and reconnected, by means of a plug, to socket "A₁" or "A₂" on the wavetrap. The "A" socket is then joined to the aerial terminal on the set in the usual manner.

An exhibit that should hold some interest for the portable set user will be



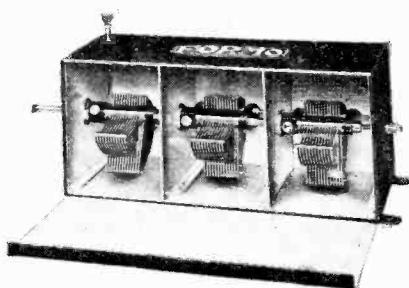
Burne-Jones "Magnafilter" for rejecting undesirable transmissions.

fuse inside the set will find that their particular requirements have been catered for in the form of fuse adaptors which can be fitted to any Belling-Lee wander plug, spade, or pin terminal.

Among the new "Magnum" products—Messrs. Burne-Jones and Co., Ltd., Stand No. 125—will be seen a very interesting volume control. This is known as the "Dissolver," and is in effect a dual volume control. When used in conjunction with an amplifier supplied from two different sources of electrical energy, such as a gramophone pick-up and the detecting portion of a broadcast receiver, for instance, the output from one source can be slowly reduced to zero and the signals from the alternative source gradually brought up to full volume. It could be used, of course, with two gramophone turntables and a similar effect produced.

Many who now enjoy comparative freedom from interference may have a different story to tell when Brookmans Park, and other regional stations, commence operations, but in the majority of cases a rejector will overcome their diffi-

addition to numerous modifications to many of last season's products. A vernier dial with the aperture and scale inclined at an angle of 30° from the perpendicular has been evolved to enable the scale to be read conveniently when operating the set. Those who are particularly keen on experimenting with ganged circuits will be interested in the screened gang condenser units. Dual and triple units are to be shown, and each condenser, which is of the "log" type, is totally enclosed in a separate compartment. Provision is made for adjusting the relative position of the first condenser to correct slight differences in the self capacities of aerial circuit and H.F. circuits, thereby render-



Three-gang screened condenser unit—a Formo product.

ing the ganging of three circuits possible. This correction can be made without opening the screening box.

Messrs. Wilkins and Wright, Ltd., will be showing on Stand No. 115 some examples of ganged condensers. In particular, the "Mite Double Gang" assembly with vernier dial is well worth close examination. Where space is strictly limited these miniature condensers offer a happy solution, since they are compact and take up very little space. There will be displayed, in addition, some specimens of the new "Mite" drum dial condensers, the special feature of which is the large control knob with the aperture for the scale in its centre. A differential reaction condenser, with a capacity of 0.0001 mfd., will be on view also.

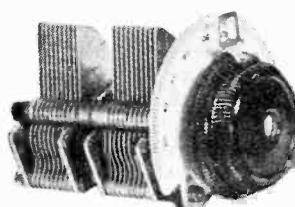
An exceptional display of variable con-



Benjamin Electric Co.'s turntable fitted with short folding legs for outdoor use.

found among the components on Stand 31—Benjamin Electric, Ltd. This is a turntable fitted with folding legs, and enables the set to be raised above ground level when used in the open. Better performance should result, since the frame will have a lower capacity to earth. Rubber buffers are fitted, so that when the legs are folded back the set can be used indoors in the normal manner.

A visit to the Formo Co.'s stand, No. 72, will be well repaid, as a number of new components are to be shown, in

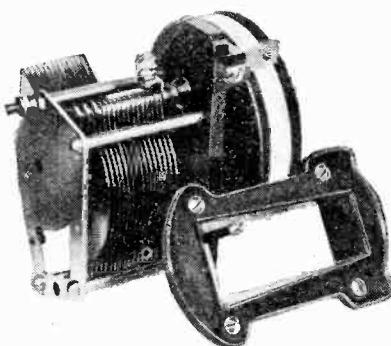


"Utility" dual "Mite" condenser with vernier dial.

densers to meet practically every requirement of the experimenter is provided by Messrs. Wingrove and Rogers, Ltd., on their stands Nos. 128 and 133. The "Polar" two-speed drum control incorporates two 3in. knurled edge drums with

Show Forecast.—

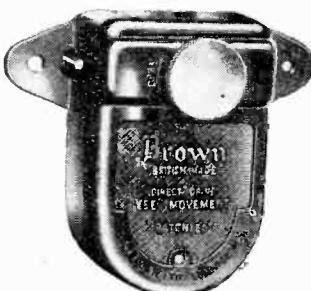
a neat ivorine scale attached to the quick motion drive. It is finished with a handsome escutcheon plate moulded in bakelite, and both right- and left-hand drives



"Polar" drum control condenser with two-speed dial. Right- and left-hand models are available.

are available. Double and triple assemblies will be shown also.

Prominent among the exhibits of Messrs. S. G. Brown, Ltd., on Stands Nos. 213, 214 and 215, will be displayed their "Vee" cone loud speaker units and chassis. Although not entirely new, it is sufficiently recent to attract considerable attention and justify its inclusion in the list of the coming season's new products. One of its principal features is the large electrical input that can be handled before the units show signs of distress. A more recent addition to



The "Vee" loud speaker unit: a product of S. G. Brown, Ltd.

this firm's small components is a "B" type L.F. transformer, which is similar in some respects to the now well-known type "A," but has a lower primary inductance. The ratio is the same, viz., 3.5 to 1.

An opportunity should be found to visit Stand No. 248, where the Telegraph Condenser Co., Ltd., will be exhibiting many diverse types of fixed condensers. We understand that special attention has been given to the production of large capacity H.F. by-pass condensers of the non-inductive type, and having a low A.C. resistance. This is particularly important in modern sets, since an appreciable resistance in the by-pass condenser will off-set many of the advantages conferred by adopting anti-motor-boating measures.

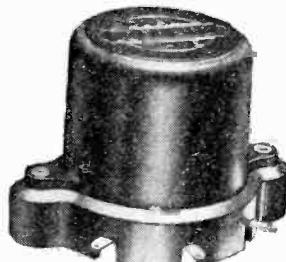
B 39

Some new super-capacity electrolytic condensers will be on view this year. One model, having a capacity of 500 mfd., is designed to withstand a maximum working voltage of 40 D.C., while the 2,000 mfd. type have been entirely redesigned. The leakage current of this model is of the order of 10 milliamps only, and the maximum difference of potential across their terminals must not exceed 12 volts D.C.

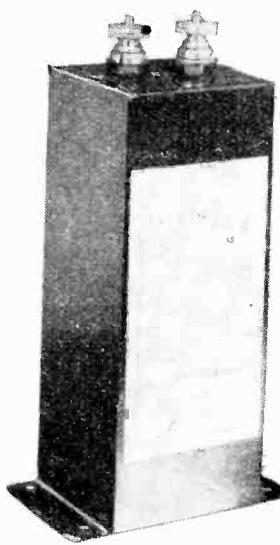
An interesting display of components is promised by the Igranic Co. on their Stands Nos. 161 and 162. Among the new components will be a dual-wave coil unit enclosed in a neat bakelite case with soldering tags protruding from the side of the base. The coils cover both medium and long broadcast wavebands

compensation for the restriction in amplitude of the recordings on the lower notes. Above 6,000 cycles the characteristic shows a sharp fall. Nevertheless, there is an appreciable output at 8,000 cycles.

For the home constructor and experimenter with moving-coil and other type



Igranic dual range coil enclosed in a neat bakelite case.



T.C.C. new 500 mfd. electrolytic condenser.

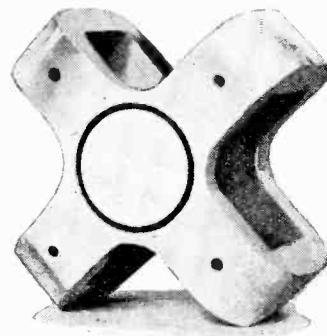
when tuned by a suitable condenser; change from one band to the other being effected by means of a switch. This, however, is not included in the assembly.

An accessory of more than usual interest is the new Burndep "Needle Armature" gramophone pick-up and tone arm, which will be found on Stands 144 to 147. This operates on an entirely new principle. It has been designed having in mind one set of conditions only, showing that those responsible for its being have carefully investigated this matter. The governing factors are: one needle only must be used and the special tone arm is essential if the extraordinarily good characteristics exhibited are to be attained. The natural period of this plays an important part in the output from the pick-up. The general level is of the order of 0.02 volt only, so that rather more than the usual amplification will be required. However, this will be repaid in ample measure, since the variation in the output between 125 cycles per second and 6,000 cycles will be within two decibels either side of the average level. Below 125 cycles the output increases, but this is desirable as a com-

loud speakers, some interest will be found in the exhibits of Messrs. Swift, Levick and Sons, Ltd., on Stand 240. This firm specialise in all kinds of permanent magnet castings, and among their principal exhibits will be a new cross type magnet for moving-coil type speakers. The most interesting feature of the design is that a solid casting is used, with the result that magnetic leakage is reduced to the absolute minimum since there are no joints in the magnetic circuit. It is claimed that a flux density at the gap of between 4,000 and 7,000 lines per square centimetre can be attained, according to the dimensions and weight of the magnet. The gap is accurately machined and tapped holes are provided for attachment of the cone chassis.

ACCUMULATORS AND BATTERY ELIMINATORS.

Although there will be many attractive displays of H.T. and L.T. accumulator batteries to be seen this year, we cannot promise any radical departure from recognised standard practice. This is, perhaps, quite understandable, since accumulator manufacturers had years of



Swift-Levick permanent magnet for home construction of moving-coil speakers.

experience before wireless became an everyday source of entertainment. The Chloride Storage Battery Co., Ltd. (Stands 172 to 175) have, however, intro-

Wireless World

Show Forecast.—

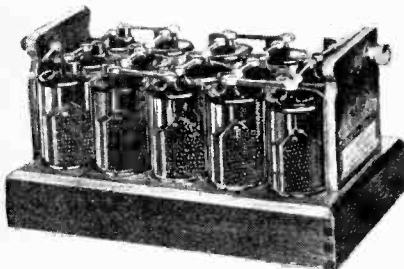
duced a new feature which will be readily appreciated by all users of L.T. cells. Exide low-tension batteries are now fitted with non-interchangeable red and blue terminals. The positive is made octagonal in shape, while the negative remains plain, as hitherto. Thus,



Octagonal positive, and plain negative, terminals are now fitted to all Exide L.T. cells.

these are readily distinguishable in the dark.

The Hart Accumulator Co., Ltd., have augmented their range of H.T. batteries and introduced some 20- and 30-volt H.T. units assembled in wooden crates which can be stacked one above the other. This has been done to meet the requirements of users to whom floor, or table, space is of importance. Tubular glass containers are employed, and both the positive and negative plates have been covered with sheets of perforated ebonite to prevent dislodging of the active material from the grids. In addition, a wide range of L.T. accumulators for stationary and portable work are to be shown on their Stand No. 289.

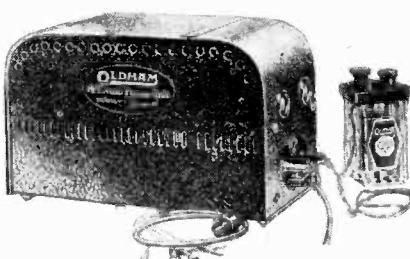


These new Hart H.T. units can be stacked one above the other for conservation of table space.

An opportunity should be made to visit Stands Nos. 68 and 70, Messrs. Oldham & Sons, Ltd., as in addition to a fine show of H.T. and L.T. batteries this firm

have developed a new "H.T. auto-power unit." This consists of a stout metal case with space for an Oldham 120-volt H.T. accumulator in two tiers, and a trickle charger. A four-way cable terminating in a four-pin plug connects the unit to the set, and on withdrawing the plug the cells are automatically put on charge without disturbing the connections on the set. A further improvement in this model takes the form of an additional trickle charger, inside the case, for recharging the L.T. battery also. Westinghouse metal rectifiers are incorporated in these models. Small lamps are fitted to indicate when the cells are on charge. The rear part of the container is removable to allow examination of the cells and "topping-up" when required.

Among the accessories on Stands Nos. 8 to 11—Messrs. E. K. Cole, Ltd.—will be found a range of rectifier units to convert a D.C. battery eliminator into an A.C. mains unit. Since many D.C. supplies are shortly being changed to A.C., this additional piece of apparatus should be found extremely useful. Further-



"Oldham" H.T. auto-power unit with L.T. trickle charger included.

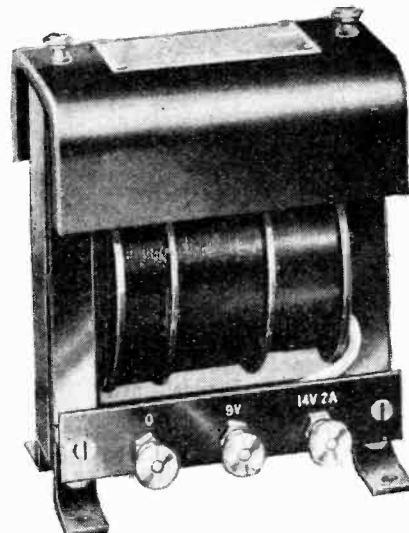
more, these units can be used as trickle chargers for H.T. batteries. A full range of H.T., L.T., and complete battery eliminators will be shown also.

Messrs. Partridge & Mee, Ltd., have made many additions to their range of battery eliminators, but the most interesting exhibit in the accessory section will be a selection of skeleton type eliminators for incorporation in home-constructed sets. Valve rectifiers are employed. In addition there will be on Stand 98 three new mains transformers for use with Westinghouse metal rectifiers. Type 2B is a low voltage model for use in L.T. chargers, and H.T.3 and H.T.4 are the high voltage types designed especially for the Westinghouse H.T.3 and H.T.4 metal rectifiers.

A new P.M. filament transformer giving 4 volts at 5 amps. will be included in the Mullard exhibits this year on Stands 58, 117, and 134 to 137. It has been designed to supply current to the heaters of the new A.C. valves developed by this firm, and will be available in various types suitable for A.C. mains of from 100 to 250 volts.

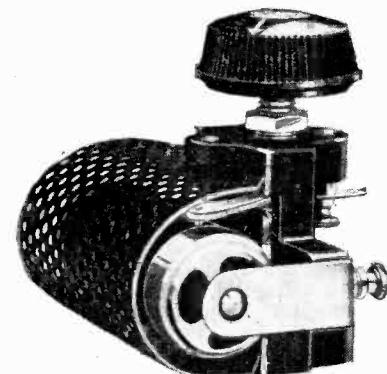
The Varley Co.'s exhibit on Stands 154 and 159 includes many new features. In particular the Multi-volt power transformer, for use with a valve rectifier, and rated at 50 watts, should hold

the interest of the experimentally minded. This single component provides 250+250 volts at 60 mA. for the H.T. supply; 2.5+2.5 volts at 2 amps. for a 5-volt rectifier; 3+3 volts at 2 amps. for the filament of a power output valve; 0.8 volts at 5 amps. and 4 volts at 2 amps. for directly and indirectly heated



Varley multi-volt transformer; a universal voltage provider; it has five separate secondary coils and is rated at 50 watts.

valves. It is wound for A.C. mains of between 40 and 100 cycles and for 100-120 volts or 200-250 volts. Before leaving this stand the range of power potentiometers should be examined. There will be seven types in all, varying from 400 ohms to 50,000 ohms maximum. They are wire-wound and rated to dissipate 25 watts. The resistance bobbin is protected by a shield and is removable from its holder. Thus, values can be changed, if desired, without removing the com-



Varley power potentiometer with removable resistance bobbin.

ponent from the panel. An added refinement is provision for rotating the resistance bobbin and thereby exposing a new track for the slider.

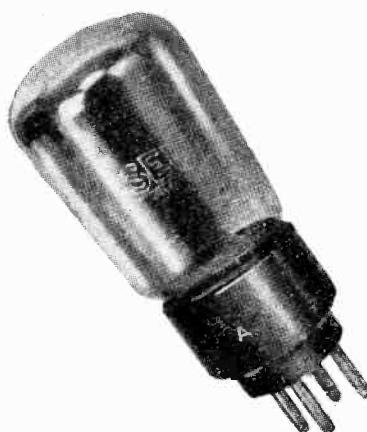
Wireless World

Show Forecast.—

VALVES.

With the latest addition of valves to their already extensive range of radio accessories, it is interesting to record that Lissen, Ltd., now manufacture everything required for wireless reception. The full range consists of eight valves with 2-volt filaments and includes a screen-grid valve and two pentodes, also five triodes. These are the usual H.F., R.C.C. and L.F. types, and two power output valves, the P.220 and P.X.240.

Several new valves will figure among the

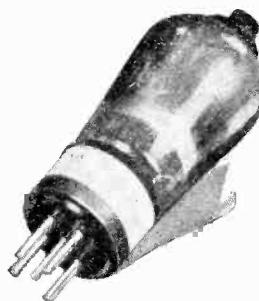


Lissen P.220 small type power amplifying valve.

well-known Mullard P.M. series this year. Of special interest are the new 5-pin A.C. valves fitted with indirectly heated cathodes and consuming 1 amp. at 4 volts. These comprise a screen-grid valve, type S.4V., which possesses the extraordinary amplification factor of 1,000; the A.C. resistance, however, is on the high side, viz., 1.33 megohms. Types 354V, 164V, and 154V all possess mutual conductances of two or over. The 104V is the super-power output valve, and gives an amplification of 10 with an A.C. resistance of 2,850 ohms, the mutual conductance being 3.5 mA. per volt.

Marconi valves have been overhauled and a few new types introduced. A new pentode P.T.240 with an A.C. resistance of 55,000 ohms and an amplification factor of 90 figures in the 2-volt class, while

the 4-volt range has been augmented by pentode P.T.425 also and a screen-grid valve, the S.410. Additions to the 6-volt series include a new screen-grid valve, the

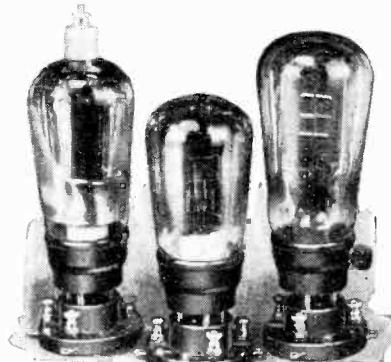


Mullard S.4.V.—a new 5-pin indirectly heated screen-grid valve.

S.610, and the return of the L.S.6A, which was for a time withdrawn. The characteristics of the last valve are A.C. resistance, 1,300 ohms, and amplification factor 3. Its maximum working H.T. is 400 volts. A range of A.C. valves and full- and half-wave rectifiers will be shown on their stands (Nos. 79 to 84).

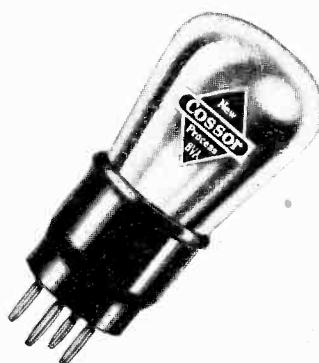
Since these valves appear, also, in the Osram list, they will be exhibited on stands 85 to 90 inclusive.—The General Electric Co., Ltd.

Cosmos, B.T.H. and Ediswan valves are now being marketed by the Edison Swan



Trio of "Mazda" valves. On the left the S.G.215, centre H.210, and right the Pen 230.

Electric Co., Ltd., and specimens of those types which will be retained under the new organisation are to be shown on stands Nos. 148 to 153 inclusive. A new range, under the name of "Mazda," have been introduced, and the 2-volt series were reviewed in this journal in the issue of August 28th last. Full details of the composition of the 4-volt series have not come to hand, but we understand that a new 4-volt pentode is now ready and will be exhibited. A full range of 6-volt valves will be shown, and this will include three power valves, the P.625A, P.625B, and P.P.3/425, the last mentioned having somewhat similar characteristics to the familiar B.T.H. B.12, and will deliver an



The new Cossor valve in the three-electrode series.

undistorted power output of three watts.

A high-voltage half-wave rectifier, U.65/550, and similar to the B.T.H. R.H.I., will be shown, as well as a varied display of A.C. indirectly heated valves.

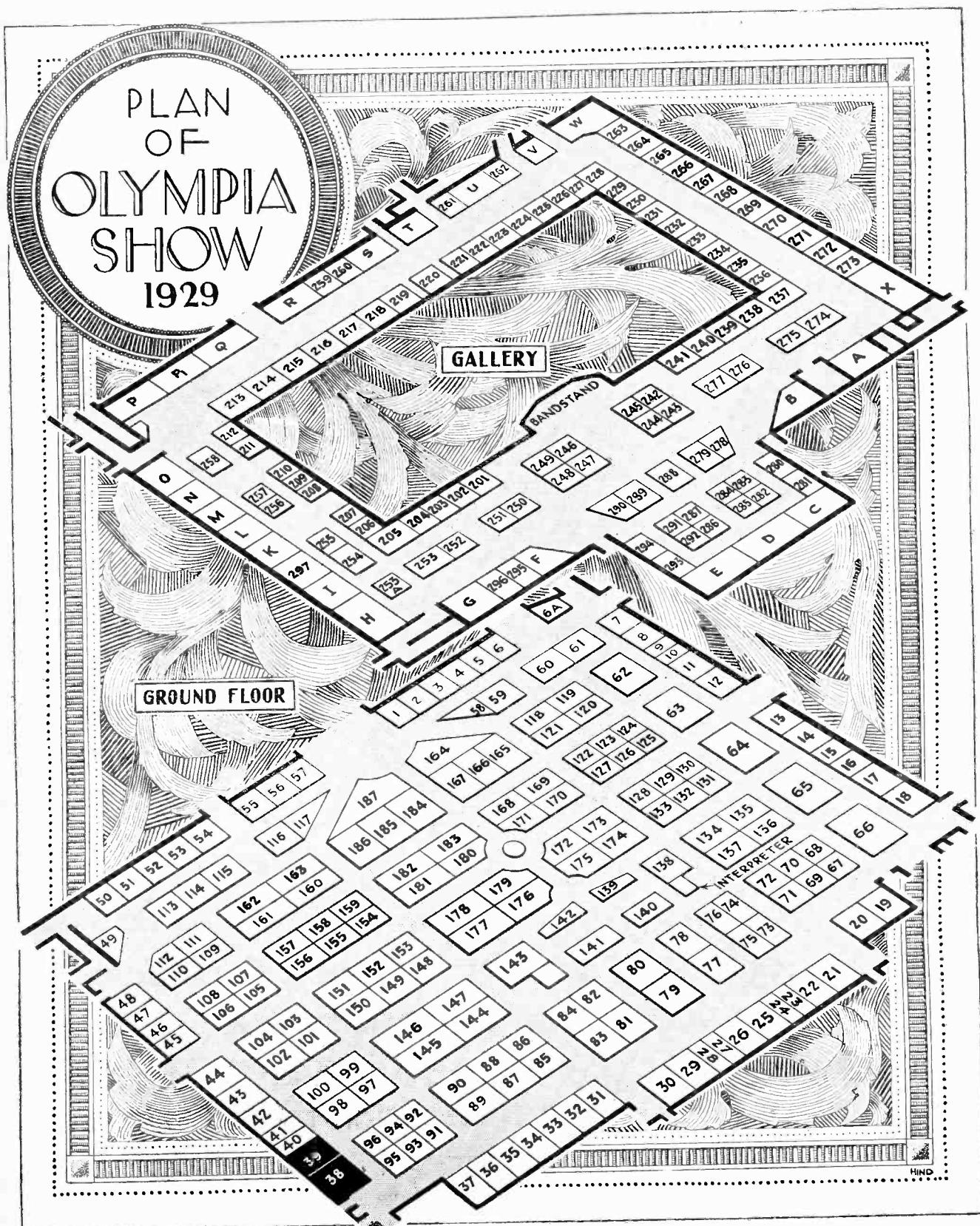
The Cossor series have acquired some interesting additions, which will be shown on Stands 78, 138, 173 and 174. In all, about thirty-five different types will be available for the coming season. The principal new valves are the M.S.G.41, a screen-grid valve, the 41M R.C., 41M H.F., 41M L.F., 41M.P., and 41X.P. All of these are indirectly heated A.C. valves and require 4 volts at 1 amp. for the heater. There will be, also, a full range of half- and full-wave rectifiers operating from 250 volts to 1,200 volts R.M.S. and dissipating from 10 to 65 watts, according to type.

Visit Stands Nos. 38 and 39 and Inspect the following **WIRELESS WORLD RECEIVERS**

"THREE VALVE 'KIT' SET."
"THE RECORD III."

"THE NEW KILO-MAG FOUR."
"THE FOREIGN LISTENER'S FOUR."

The MEGAVOX D.C. ELIMINATOR will also be available for inspection.




EXHIBITORS AT OLYMPIA


FOR PLAN OF STANDS SEE FACING PAGE.

- A**DEY Radio, Ltd., (297)
99, Mortimer St., Regent St., London, W.1.
Aeonic Radio, Ltd., (73)
90, Regent St., London, W.1.
Atalanta, (234)
1-3, Brixton Rd., London, S.W.9.
Automatic Coil Winder & Electrical Equip. Co., Ltd., (220)
Winder House, Rochester Row, London, S.W.1.
B.B.C., (252a)
Savoy Hill, Strand, London, W.C.
B. & J. Wireless Co., (233)
24, Athelstane Mews, Stroud Green Rd., London, N.4.
Baker, A., (23)
89, Selhurst Rd., South Norwood, London, S.E.25.
Bakelite, Ltd., (255)
68, Victoria St., London, S.W.1.
Beaver Electrical Supply Co., (287)
5, Great Chapel St., London, W.1.
Bedford Electrical & Radio Co., Ltd., (45)
22, Campbell Rd., Bedford.
Belling & Lee, Ltd., (263 & 264)
Queensway Works, Ponders End, Middlesex.
Benjamin Electric, Ltd., (31)
Brantwood Works, Tariff Rd., Tottenham, London, N.17.
Bird & Sons, Ltd., Sydney S. (155)
Sarnesfield Rd., Enfield Town.
Bowyer-Lowe Co., Ltd., The (130 & 131)
Radio Works, Letchworth, Herts.
British Ebonite Co., Ltd., (21)
Nightingale Rd., Hanwell, London, W.7.
British General Mig. Co., Ltd., (107)
Brockley Works, Brockley, London, S.E.4.
British Radio Gramophone Co., Ltd., (156 & 157)
77, City Rd., London, E.C.1.
Brown Bros., Ltd., (34 & 35)
Great Eastern St., London, E.C.2.
Brown, Ltd., S. G., (213, 214 & 215)
Western Av., North Acton, London, W.3.
Brownie Wireless Co., of Great Britain, Ltd., (143)
Nelson Street Works, Mornington Crescent, London, N.W.1.
Bulgin & Co., A. F., (295 & 296)
9-11, Cursitor St., Chancery Lane, London, E.C.4.
Bullphone, Ltd., (60)
38, Holywell Lane, London, E.C.2.
Burndep Wireless (1928), Ltd., (144, 145, 146 & 147)
Eastnor House, Blackheath, London, S.E.3.
Burne-Jones & Co., Ltd., (125)
288, Borough High St., London, S.E.1.
Burgoyne Wireless, Ltd., (50 & 51)
34a, York Rd., King's Cross, London, N.1.
Burton, C. F. & H., (36 & 37)
Progress Works, Bernard St., Wallall.
- CARRINGTON Mfg. Co., Ltd.**, (270 & 271)
Cameo Works, Sanderstead Rd., Croydon.
Catesbys, Ltd., (3 & 4)
Tottenham Court Rd., London, W.1.
Celestion, Ltd., (180 & 183)
London Rd., Kingston-on-Thames.
Chloride Electrical Storage Co., Ltd., (172 & 175)
217-229, Shaftesbury Av., London, W.C.
City and General Radio Co., Ltd., (256)
46, Watling St., London, E.C.4.
Clearatron (1927), Ltd., (22)
21, Cumberland St., Birmingham.
Climax Radio Electric, Ltd., (91 & 92)
Haverstock Works, Parkhill Rd., Hampstead, London, N.W.3.
Cole, Ltd., E. K., (8, 9, 10 & 11)
"Ekco" Works, London Rd., Leigh-on-Sea.
Colvern, Ltd., (99)
Mawneys Rd., Romford, Essex.
Columbia Graphophone Co., Ltd., (94 & 96)
92, Clerkenwell Rd., London, E.C.1.
Cook's Wireless Co., Ltd., (223)
C.W.C. Works, Ipswich, Suffolk.
Cossor, Ltd., A. C., (173, 174, 158 & 78)
Cossor House, Highbury Grove, London, N.5.
- D.X. Coils, Ltd.**, (262)
542, Kingsland Rd., London, E.8.
Danipad Rubber Co., Ltd., (219)
5 & 7, Market St., Finsbury, London, E.C.2.
Day, Ltd., Will., (7)
19, Lisle St., London, W.C.2.
De la Rue & Co., Ltd., Thos., (260)
90, Shernall St., Walthamstow, London, E.17.
Dew & Co., A. J., (26, 27 & 28)
33-34, Rathbone Place, London, W.1.
Dibben & Sons, Ltd., Wm., (65 & 15)
80, St. Mary's Rd., Southampton.
Donotone (Regd.) Loud Speaker, The, (268 & 269)
40, Furnival St., London, E.C.4.
Dubilier Condenser Co., (181 & 182)
(1925), Ltd.,
Ducorn Works, Victoria Rd., North Acton, London, W.3.
Dulcetto-Polyphon, Ltd., (278)
2-3, Newman St., London, W.1.
Dunham, C. S., (47 & 48)
Elm Works, Elm Park, 131, Brixton Hill, London, S.W.
Dyson & Co. (Works), Ltd., J., (1)
5, Godwin St., Bradford.
- EAGLE Engineering Co., Ltd.**, (77)
Eagle Works, Warwick.
Eastick & Sons, J. J., (272 & 273)
118, Bunhill Row, London, E.C.1.
East London Rubber Co., (274 & 275)
Great Eastern St., London, E.C.2.
Econasign Co., Ltd., (238)
137, Victoria St., London, S.W.1.
- Edison Bell, Ltd.**, (116)
Edison Bell Works, Glengall Rd., London, S.E.
Edison Swan Elec. Co., Ltd., (148, 149, 150, 151, 152 & 153)
(Metro Vick Supplies, British Thomson-Houston Co., Ltd.)
123, Queen Victoria St., London, E.C.4.
Ellison & Hillman, (29 & 30)
123-5, Albion St., Leeds.
Epoch Radio Mfg. Co., (218)
25, Laurence Pountney Lane, London, E.C.4.
Every Ready Co. (G.B.), Ltd., (139 & 142)
Hercules Place, Holloway, London, N.7.
- FALK Stadelmann & Co., Ltd.**, (279)
83-93, Farringdon Rd., London, E.C.1.
Fellows Mig. Co., Ltd., (32 & 33)
Cumberland Av., Park Royal, London, N.W.
Ferranti, Ltd., (74 & 76)
Hollinwood, Lancs.
Flinders (Wholesale), Ltd., (282)
East Stockwell St., Colchester.
Forno Company, (72)
Crown Works, Cricklewood Lane, London, N.W.
Fuller Accumulator Co. (1926), Ltd., (75)
Woodland Works, Chadwell Heath, Essex.
- GAMAGE, Ltd., A. W.**, (258)
128, Holborn, London, E.C.
Gambrell Radio, Ltd., (62)
Buckingham House, Buckingham St., Strand, London, W.C.2.
Garnett, Whiteley & Co., Ltd., (63)
"Lotus" Works, Broadgreen Rd., Liverpool.
General Electric Co., Ltd., (85, 86, 87, 88, 89 & 90)
Kingsway, London, W.C.2.
Goldsman, J. L., (280)
4, Great Queen St., Kingsway, London, W.C.
Graham & Co., R. F., (230)
45 & 47, Cambridge Rd., Kingston-on-Thames.
Graham Amplion, Ltd., (164 & 187)
25-6, Savile Row, Regent St., London, W.1.
Graham Farish, Ltd., (140 & 141)
17, Masons Hill, Bromley, Kent.
Gramo-Radio Amplifiers, Ltd., (247)
1a, New London St., London, E.C.3.
The Gripco Co. (L. H. Reid & Co.), (227)
32, Victoria St., London, S.W.1.
Grosvenor Battery Co., Ltd., (237)
2-3, White St., Moorgate, London, E.C.2.
- HALCYON Wireless Co., Ltd.**, (168 & 313-319)
313-319, Regent St., London, W.1.
Hardyson Radio, Ltd., (158)
13, Market St., Huddersfield.
Harlie Bros., (277)
Balham Rd., Lower Edmonton, London, N.9.

Wireless World

SEPTEMBER 18th, 1929.

Exhibitors at Olympia.—

- Hart Accumulator Co., Ltd., (289)
35, Marshgate Lane, Stratford,
London, E.15.
Hart Bros. Electrical Mfg. Co., Ltd., (239)
4, Queensway, Ponders End, Mddx.
Hart Collins, Ltd., (49)
38a, Bessborough St., London, S.W.1.
Henderson & Co., Ltd., W. J., (201)
351, Fulham Rd., London, S.W.10.
Hobday Bros., Ltd., (252 & 253)
21-27, Great Eastern St., London,
E.C.2.
Houghton-Butcher (G.B.), Ltd., (242, 243,
38-89, High Holborn, Lon- 244 & 245)
don, W.C.1.
Hunt, Ltd., A. H., (259)
H.A.H. Works, Tunstall Rd.,
Croydon.
Huntry, Norman, (235)
35, Clerkenwell Green, London, E.C.1.

IGRANIC Electric Co., Ltd., (161 & 162)
147, Queen Victoria St., London,
E.C.4.
Iliffe & Sons, Ltd., (38 & 39)
Dorset House, Tudor St., London,
E.C.4.
Inc. Radio Society of Great Britain, (285)
53, Victoria St., London, S.W.1.
Itonia Gramophone, Ltd., (286)
Itonia House, 58, City Rd., London,
E.C.1.

J.R. Wireless Co., (266)
6-8, Rosebery Av., London, E.C.
Jackson Bros., (97)
72, St. Thomas St., London, S.E.1.
Jewel Pen Co., Ltd., (267)
21-22, Great Sutton St., London,
E.C.1.
Junit Mfg. Co., Ltd., (207)
2, Ravenscourt Sq., London, W.6.
"K.N." Electrical Products, Ltd., (254)
5 & 7, Singer St., Tabernacle St.,
Finsbury, London, E.C.2.
Kalisky (Aldgate), Ltd., S., (24 & 25)
75, Aldgate High St., London, E.1.
Kolster-Brandes, Ltd., (176, 177,
Cray Works, Sidcup, Kent. 178 & 179)

LAMPLUGH, Ltd., S. A., (126 & 127)
Kings Rd., Tyseley, Birmingham.
Langham Radio, Ltd., (59)
Exhibition Works, Wembley.
Lectro-Linx, Ltd., (261)
254, Vauxhall Bridge Rd., London,
S.W.1.
Lever (Trix), Ltd., E. J., (211 & 212)
8-9, Clerkenwell Green, London,
E.C.1.
Lissen, Ltd., (184, 185 & 186)
Friars Lane, Richmond, Surrey.
Lithanode Co., Ltd., (232)
190, Queen's Rd., Battersea, London,
S.W.
Lock, Ltd., W. & T., (202 & 203)
St. Peter's Works, Bath.
Lock-Atkinson Wireless, (257)
95, Great Titchfield St., London, W.1.
Loewe Radio Co., Ltd., (291)
4, Fountayne Rd., Tottenham,
London, N.15.
London Electric Stores, Ltd., (293 & 294)
9, St. Martin's St., Leicester Sq.,
London, W.C.

- London Electric Wire Co., & (64)
Smiths, Ltd.,
7, Playhouse Yard, Golden Lane,
London, E.C.1.
London Metal Warehouses, Ltd., (222)
Hill St., Pocock St., Blackfriars,
London, S.E.
London Radio Mfg. Co., Ltd., (112)
Station Rd., Merton Abbey, London,
S.W.19.

M.P.A. Wireless Ltd., (165)
62, Conduit Street, London, W.1.
McMichael, Ltd., L., (101 & 103)
Wexham Rd., Slough.
Mainten Mfg. Co., Ltd., (226)
126, Portland Road, Hove.
Manufacturers Accessories Co., (236)
(1928), Ltd.,
85, Great Eastern Street London,
E.C.2.
Marconiphone (79, 80, 81, 82, 83, & 84)
Co., Ltd.,
210-212, Tottenham Court Rd.,
London, W.1.
Mic Wireless Co., (56)
White Horse Place, Market St.,
Wellingborough.
Montague Radio Inventions (52, 53, & 54)
& Development Co.,
117-119, Regent St., London, W.1.
Mullard Wireless (134, 135, 136,
Service Co., Ltd., 137, 58 & 117)
Mullard House,
Charing Cross Rd., London, W.C.2.

NEW London Electron Wks., Ltd., (67)
East Ham, London, E.6.

OLDHAM & Son, Ltd., (68 & 70)
Denton, Manchester.
Ormond Eng. Co., Ltd., (118 & 121)
Ormond House, Rosebery Av.,
London, E.C.

PANDONA, Ltd., (225)
87-89, Edmund St., Birmingham.
Paroussi, E., (206)
10, Featherstone Buildings London,
W.C.1.
Partridge & Mee, Ltd., (98)
74, New Oxford Street, London,
W.C.1.
Partridge, Wilson & Co., (283)
217a, Loughborough Rd., Leicester.
Perfectavox, Ltd., (114)
Alexandra Works, High St., Yeadon,
near Leeds.
Peto & Radford, (108)
50, Grosvenor Gardens, London,
S.W.1.
Peto Scott Co., Ltd., (42, 43, & 44)
77, City Road, London, E.C.1.
Philips Radio, (169 & 170)
145, Charing Cross Rd., London,
W.C.
Prowse & Co., Ltd., Keith, (228)
159, New Bond St., London, W.1.
Pye Radio, Ltd., (160 & 163)
Paris House, Oxford Circus, London,
W.1.

READY Radio, Ltd., (93)
159, Borough High St., London,
S.E.1.
Radielle Co., Ltd., (2)
18a, Haverstock Hill, Chalk Farm,
London, N.W.3.

Radio Gramophone (292)
Development Co.,
7, St. Peter's Place, Broad St.,
Birmingham.
Radio Instruments, Ltd., (122, 123, & 124)
12, Hyde St., London, W.C.1.
Radio Service (London), Ltd., (204)
105, Torrano Av., Camden Town,
London, N.W.5.
Redfern's Rubber Works, Ltd., (46)
Dawson St., Hyde, Cheshire.
Rees, Mace Mfg. Co., Ltd., (105)
39a, Welbeck St., London, W.1.
Regent Radio Supply Co., (16, 17, & 18)
21, Bartlett's Buildings, London,
E.C.4.
Reproduction, Ltd., (55)
5-7, Dysart St., London, E.C.2.
Rolls-Caydon Sales, (166)
77, Rochester Row, London, S.W.1.
Rooke Bros., Ltd., (119)
55, Cardington St., London, N.W.1.
Royal Radio Co., (121)
4-5, Dorset Mews North, Upper
Gloucester Place, London, N.W.1.

SEL-EZI Wireless Supply (105)
Co., Ltd.,
6, Greek St., London, W.1.
Selectors, Ltd., (102 & 104)
1, Dover St., London, W.1.
Selfridge & Co., Ltd., (208, 209, & 210)
Oxford St., London, W.1.
Siemens Bros. & Co., Ltd., (69 & 71)
Caxton House, Westminster, London,
S.W.
Six-Sixty Radio Co. (288)
(The Electron Co., Ltd.),
122, Charing Cross Rd., London,
W.C.2.
Standard Wet Battery Co., (57)
184, Shaftesbury Av., London, W.C.
Stratton & Co., Ltd., (109)
Balmoral Works, Bromsgrove St.,
Birmingham.
Sun Electrical Co., Ltd., (250 & 251)
118-120, Charing Cross Rd., London,
W.C.
Swift Levick & Sons, Ltd., (240)
Clarence St. Works, Sheffield.
Sylvex, Ltd., (231)
144, Theobalds Rd., London, W.C.1.
Symphony Gramophone & (129 & 132)
Radio Co., Ltd.,
Axtell House, 23-24, Warwick St.,
Regent St., London, W.1.

TELEGRAPH Condenser Co., (248)
Ltd.,
Wales Farm Rd., North Acton,
London, W.3.
Telsen Electric Co., Ltd., (110)
207, Aston Rd., Birmingham.
Tonex Co., The, (265)
Walker St., Blackpool, Lancs.
Trelleborg Ebonite Works, Ltd., (281)
Union Place, Wells St., London,
W.1.
Truphonic Radio, Ltd., (167)
Truphonic House, Hanover Park,
Peckham, London, S.E.
Tulsemere Mfg. Co., (276)
1-7, Dalton St., West Norwood,
London, S.E.27.

Exhibitors at Olympia.—

- Turner & Co., (95)
54, Station Rd., New Southgate,
London, N.11.
- ULTRA** Electric, Ltd., (106)
661, Harrow Rd., London, N.W.10.
- Universal Gramophone & Radio (100, 40
Co., Ltd., & 41)
Ryland Road, Kentish Town,
London, N.W.5.
- VANDERVELL** & Co., Ltd., (120)
C. A.,
Warble Way, Acton, London, W.3.
- Varley (Oliver Pell Control), (154 &
Kingsway House, 103, Kings- 159)
way, London, W.C.
- Volttron Co., Ltd., (217)
Queensway, Ponders End, Middlesex.

D.F. NEEDED.

Don't visit Olympia without your
direction finder—*The Wireless World*.
oooo

PROOF OF THE PUDDING.

For the first time in the history of
British wireless shows it will be possible
at Olympia this year to listen to sets in
operation. Twenty-four soundproof
cabinets will be situated in the gallery.
oooo

PARIS P.T.T.

A new broadcasting station of the
French Post Office, Paris P.T.T.,
has been put into service with a
power of 5 kilowatts. Transmissions
take place daily between 4 and 10 p.m.
oooo

RUSSIA'S LESSON FOR BRITAIN.

The encouragement given to amateur
transmitters by the Soviet Government is
resulting in a big increase in amateur
licences in Russia. The number now exceeds 500.
oooo

BURNDPT REDIVIVUS.

Profits of £15,979 over a period of ten
months ending June 30th, 1929, are re-
corded by Burndpt Wireless (1928),
which is able to pay a dividend at 6 per
cent. per annum—the first return to be
made to the original shareholders.
oooo

THE FARTHEST NORTH!

A Soviet expedition claims the honour of having erected the world's most northerly wireless station. This has been established at Tranquill Bay, Franz Josef Land. The station will be used principally for meteorological reports, operating on a wavelength of 43 metres.
oooo

OLYMPIA SHIPPING EXHIBITION.

Several devices of wireless interest are on view at the 10th Shipping, Engineering and Machinery Exhibition, which opened at Olympia on Thursday last and runs until September 28th. An example of the automatic alarm receiver is shown, and another noteworthy device is the Laryngaphone noise-excluding telephone, which enables conversations to be carried on without interruption from the noisiest engine room. The microphone of the instrument is applied to the neck or cheek of the speaker, being actuated by the vibrations of the vocal chords.

Wireless World

- WARD** & Goldstone, Ltd., (290)
Frederick Rd., Pendleton,
Manchester.
- Watmel** Wireless Co., Ltd., (111)
Imperial Works, High St.,
Edgware, Middlesex.
- Webb Condenser** Co., (284)
42, Hatton Garden, London, E.C.1.
- Westinghouse Brake & Saxby** (13 & 14)
Signal Co., Ltd.,
82, York Rd., King's Cross,
London, N.
- Whiteley, Boneham & Co.**, Ltd., (66)
Nottingham Rd., Mansfield, Notts.
- Whittingham, Smith & Co.**, (113)
"Portadyne" Works, Chase Estate,
Park Royal, London, N.W.
- Wilkins & Wright**, Ltd., (115)
Utility Works, Holyhead Rd.,
Birmingham.
- Williams & Moffat**, Ltd., (229)
Ladypool Rd., Sparkbrook,
Birmingham.
- Wingrove & Rogers**, Ltd., (128 & 133)
Arundel Chambers, 188-9, Strand,
London, W.C.
- The Wireless World**, (38 & 39)
(Iliffe & Sons, Ltd.),
Dorset House, Tudor Street,
London, E.C.4.
- Wright & Weaire**, Ltd., (221)
740, High Rd., Tottenham,
London, N.17.
- YAGERPHONE**, Ltd., (6)
28, Charlotte St., London, E.C.2.

CURRENT TOPICS.

EVER OPEN DOOR.

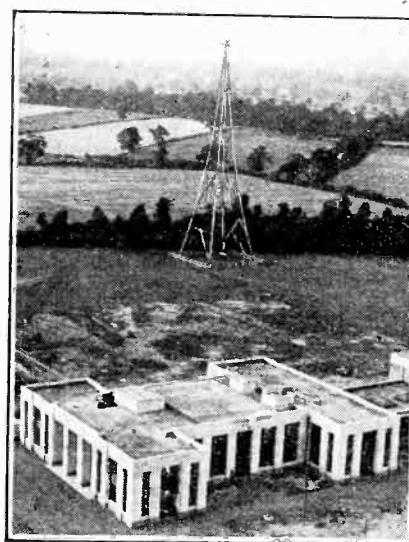
The Transatlantic Telephone services to Canada, U.S.A., Mexico and Cuba are now open continuously day and night.
oooo

WIRELESS DISPLACES PIGEONS.

The American Navy's collection of specially-trained carrier pigeons has been "demobilised" owing to the perfecting of radio communication.
oooo

A CALL FROM MEXICO.

The Treus News Service, of Mexico City, addresses the world in a circular letter requesting all wireless users to pick up their news report broadcast in Morse daily at 9.45 p.m. (G.M.T.) on 16 metres. The power is 20 kilowatts.



A MASTHEAD VIEW of the new London Regional broadcasting station now engaged on nightly tests.

WIRELESS ON GERMAN BUSES.

The suburban bus services of Berlin are to experiment with the introduction of broadcast receivers and loud speakers on buses which take passengers into the surrounding country.
oooo

"INDEPENDENT" SHOW IN PARIS.

Running concurrently with the National Radio Exhibition at Olympia will be the Paris International Wireless Show, extending from September 27th to October 13th. The show is "forbidden ground" to members of the French Radio Manufacturers' Association, the 150 exhibitors consisting of independent firms and foreign manufacturers.
oooo

THE CABLE WIRELESS MERGER.

Imperial and International Communications, Ltd., is the name of the new company which will undertake the wireless and cable traffic work of the cable-wireless merger. The manufacturing side of the merger will be under the control of Cable and Wireless, Ltd., The two organisations will have capital interests exceeding £53,000,000.
oooo

TRANSMISSIONS ON 7 CENTIMETRES.

Experiments in transmission on wavelengths as short as 7.12 and 19 centimetres have recently been conducted by Professor Protov, of the Soviet State Laboratory at Nijni-Novgorod. According to the Russian radio journals, Prof. Protov's signals have been heard clearly at distances of several thousand miles with a transmission power of only 20 watts.
oooo

ATTACK ON FRENCH RADIO FIRMS.

The popularity of three- and four-valve sets in Great Britain and Germany has provoked a discussion in France as to why that country still favours "super-ssets" of the six-, seven- and eight-valve variety, writes our Paris correspondent. The widely-held view that multi-valve sets are necessary in view of the lack of good broadcasting stations is contested by "Petit Radio," a semi-official organ of the Post Office, which assigns a commercial cause to the existing "stagnation," alleging that manufacturers continue to

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produce complex receivers to induce the public to pay high prices in the belief that simple sets are worthless.

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MOTOR CO. INVADES RADIO FIELD.

According to a New York report, General Motors Corporation intends to retail radio goods by arrangement with the Radio Corporation of America.

NIGHTINGALE TELLS THE WORLD.

An enterprising member of the staff of PCJ, Hilversum, was opening the studio window to admit fresh air at the end of a recent programme, when he heard the full-throated song of a nightingale singing not far away. Taking in the situation immediately, he ran to the microphone and announced in six different languages that PCJ was about to broad-

cast the bird's song. The microphone was silently wheeled to the window, and for some time five continents heard the nightingale singing. World-wide reports received by Philips Lamps, Ltd., showed the broadcast was one of the most perfect of its kind ever attempted.

PCJ now transmits on a wavelength of 31.4 metres, and with a power of 24 kW. on Thursdays, Fridays and Saturdays.

TELEVISION FROM 2LO.

Baird Synchronising System Described.

NEgotiations which have been in progress for more than a year between the Post Office, the B.B.C., and the Baird Television Development Co., Ltd., have now culminated in the introduction of an experimental service. "In granting these facilities," states the B.B.C., "in which the public can, if they so desire, take part, neither the Postmaster-General nor the B.B.C. accept any responsibility for the quality of the transmission or the results obtained." No such words of caution can stay the activities of the radio enthusiast who has long looked forward to television as a fascinating field of experiment, and to whom almost any results, however crude, would be of interest and would amply repay for the time and trouble expended in investigating the possibilities. Nothing could be more unfortunate than the fact that the coming transmissions are to take place between 11.0 and 11.30 a.m. daily, Saturdays and Sundays excepted. Such a schedule will prove so serious a setback to amateur activity that the outcome by way of gauging the public attitude towards its innovation will be at the least misleading.

There are many difficulties, however, which stand in the way of a universal interest in television broadcast. Foremost is the absence of receiving apparatus, while the secrecy, perhaps wisely enforced, which has surrounded the Baird system has rendered it impossible for the amateur to throw in his support by way of proceeding with the making up of suitable experimental gear. For more than a quarter of a century inventors have applied themselves to the problems of television, and in every case they have encountered an insurmountable barrier in the devising of means for synchronising the rotating parts at transmitter and receiver. None of the systems of which details have been disclosed has shown a solution to the problem, and a cloud of prejudice has descended upon the Baird apparatus in the absence of technical details of the method of synchronising to be used. It is in respect of the synchronising gear that the public's judgment on the success of the system would be based. Demonstrations in themselves are not entirely satisfying, as the conditions may be very different from those under which the apparatus is to be finally used.

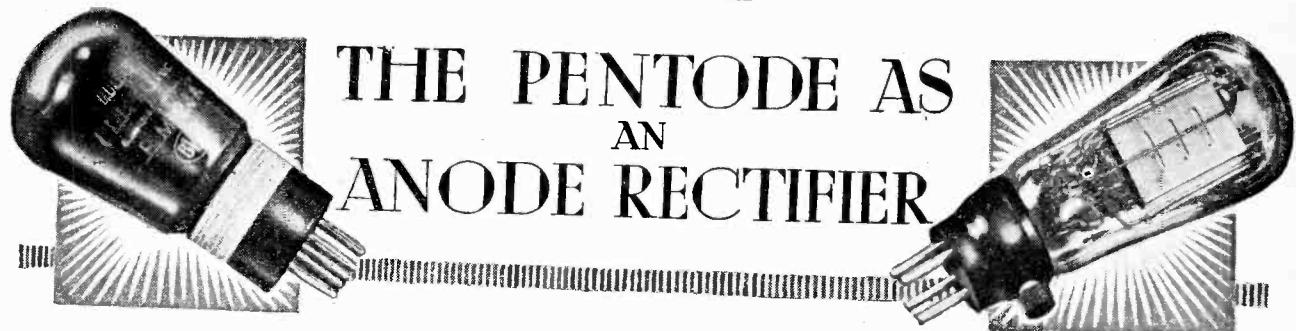
Phonic Wheel Inter-line Synchronising.

Now that the apparatus is about to be available to the public we are able to describe the method of synchronising fitted to the Baird equipments. The aim is to provide for the rotation of a disc with a degree of constancy that after long periods of running must possess no cumulative error. In the Baird

apparatus we find that this aim is accomplished by the phonic wheel method. A toothed wheel is mounted on the motor shaft which, in rotating before an electromagnet, allows of the passage of the teeth past the magnet poles in unison with interposed current impulses sent out by the transmitting equipment. A standard of picture analysis has been decided upon whereby the image is built up by the assembly of thirty transverse lines. Each line is a travelling light spot of varying intensity, and it is between each traverse or each line of the picture that the synchronising signal takes charge of the rotating toothed wheel. This method has been referred to as "inter-line synchronising" in this journal, wherein it was first described.¹ Baird apparatus adopts a synchronising signal in the form of a break in the continuity of the current forming the picture. It will be seen that the teeth of the wheel can pass unrestricted before the poles of the electromagnet only in the absence of a picture forming current. In the simple form of receiver the rectified signals, obtained in a manner similar to that adopted in picture reception, are passed to a neon lamp together with the synchronising magnet, these two components being series connected. It is stated that the receiving disc is arranged to run slightly slower than the analyser at the transmitter, so that the phonic motor actually accelerates the motor drive, so bringing the disc into step on the completion of each line or each traverse of the picture. A thirty-hole disc, therefore, requires a toothed wheel carrying thirty poles. Neon tubes for use with television receivers and capable of working with the potentials normally available from D.C. mains eliminators are used in the Baird equipment.

Although laboratory demonstrations of the apparatus have been witnessed by many readers, a few facts as to the results may help others to clearly appreciate the degree of success at present obtainable. The image is viewed through a magnifier and possesses a slight, yet not tiring, flicker. Good brilliance is obtained, but with an excessive contrast between light and shade. A sitter at the transmitter is at once recognised, and his expressions considerably enhance his words which come from an adjoining loud speaker. With a little concentration one can note the time from a normal watch. Letters running past the transmitter in the manner of an advertising sign are clear cut and easily followed. These results, it is stated, will be obtainable on home equipments working on the broadcast service.

¹ *The Wireless World*, July 3rd, 1929, p. 8.



THE PENTODE AS AN ANODE RECTIFIER

High Sensitivity and Large Output.

By A. L. M. SOWERBY, M.Sc.

IN the instructions issued with the Mullard P.M.22 valve (2-volt pentode) there is included the warning: "This valve should be used only in the output stage of a receiver and not in intermediate stages." It will, of course, be realised that this instruction is a direct challenge to all right-minded experimenters to find out what kind of a performance the valve will put up in other directions. In view of the many difficulties that arise in connection with the detector valve of a receiver, and of the fact that the use of the pentode has already been suggested as a possible cure for some of these troubles,¹ the present article is devoted to its behaviour in that direction, and includes a number of measurements made in endeavouring to estimate its worth for that purpose.

Detector stages in which the valve rectifies by virtue of the bend in its grid volts anode current character-

always one of high amplification factor, and hence also of high A.C. resistance.

It is not possible, unless the requirements of quality in reproduction of music are to be thrown overboard altogether, to use a valve of this type to precede a transformer in the circuit of Fig. 2, for the naturally high A.C. resistance of the valve is raised to even higher values by the application of the negative grid-bias used to adjust it for rectification. With the adoption of the transformer we are therefore compelled to employ a valve of different type altogether, choosing one that, with the grid-bias required for rectification, will have, under working conditions, an A.C. resistance somewhere near that which gives the best compromise between effective amplification and quality of reproduction. In practice, and with a first-class transformer, this condition is found to be met by choosing a valve of nominal A.C. resistance about 10,000 ohms or a little less, and with as high an amplification factor as so low a resistance will permit. The detector stage resulting from this combination of valve and transformer is not particularly sensitive to small signal inputs, but will accept, without overloading, a much larger input than can be applied to the resistance-coupled detector. When this input is available a much greater output of rectified signals can be obtained, and for this reason this style of design is in many cases the better alternative.

Sensitivity to Small Inputs.

The A.C. resistance of the P.M.22 is some 65,000 ohms, which brings it into the class of valves suitable for use as a rectifier when followed by a resistance; as its amplification factor is 82 one would expect it to be a sensitive rectifier, responding well to quite small inputs of signals, for the general rule is that the higher the amplification factor of the valve the smaller the signal-voltage required to enable it to give an L.F. output of reasonable magnitude and good quality. Following up this idea, the performance of the P.M.22 as an anode rectifier was investigated, the operating conditions being varied to a considerable extent in different experiments.

In studying the capabilities of a valve for any particular purpose its characteristic curves must serve as the starting-point. In the case of the pentode the curves are considerably complicated by the presence

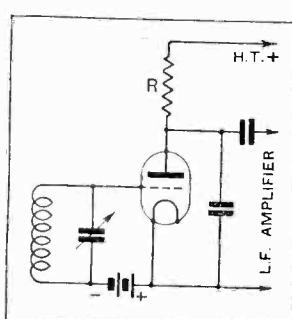


Fig. 1.—Resistance-coupled detector. Uses a high-resistance valve, and is sensitive to weak signals, but cannot deal with really strong signals.

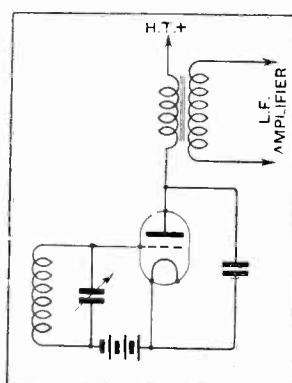


Fig. 2.—Transformer-coupled detector. Uses a low-resistance valve, is insensitive to weak signals, but rectifies strong signals very efficiently.

teristic (anode bend rectification) may be divided into two distinct classes. First, there is the older design in which the anode circuit of the valve is completed through a resistance as in Fig. 1. The outstanding feature of this circuit is its high sensitivity to small signal inputs, with the usual corollary that it will not accept a large input unless it is supplied with an unusually high anode voltage. The valve used is

¹ The Wireless World, May 22nd, 1929, page 527.

The Pentode as an Anode Rectifier.

of one more electrode than is present in the ordinary triode—one more *accessible* electrode, that is to say. A triode provides a family of curves, each representing the plate current corresponding to a number of different plate voltages at a fixed value of grid voltage; with the pentode one requires, for the fullest information, a complete family of this kind for every different auxiliary grid ("terminal") voltage. Such a complete set of pentode curves would fill at least three pages of *The Wireless World*, which amply accounts for the fact that the full set has not yet been published; nor do they accompany this article.

The plate current of the pentode is controlled by three factors: the voltage applied to the plate itself.

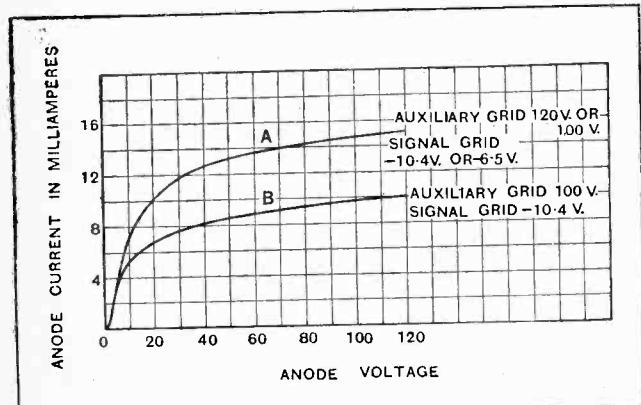


Fig. 3—Anode voltage/anode current curves of Mullard 2-volt pentode P.M.22.

the grid-bias in use, and the voltage on the auxiliary grid. Of these three factors the plate voltage is the least important, and has the smallest effect in deciding the magnitude of the plate current, as can be seen by comparing the two curves of Fig. 3. Curve A is the plate voltage/plate current curve of the P.M.22 valve with a grid-bias of 10.4 volts and with 120 volts on the auxiliary grid. It will at once be noticed that for anode voltages greater than about 50 the change in plate current brought about by altering the plate voltage is only a small proportion of the total current.

Curve B shows the same relationship with 100 volts instead of 120 volts on the auxiliary grid, and with the inner (signal) grid at the same potential as in curve A. The vertical distance between the two curves is seen to be large, showing the considerable influence of the auxiliary grid voltage on the magnitude of the plate current. Expressing it numerically, one can deduce from the two curves that one additional volt on the auxiliary grid has as great an effect in increasing the plate current as some ten extra volts on the anode itself. This is an exact parallel to an ordinary valve of amplification factor 10, where a grid voltage change of one volt would alter the plate current to the same extent as a plate voltage change of ten volts. We may say, in fact, that the amplification factor between auxiliary grid and plate in the P.M.22 is ten.

The inner grid of the pentode exercises an even greater

effect on the plate current than does the auxiliary grid. When obtaining the results plotted in the curves of Fig. 3 it was found that by changing the potential of the inner grid from its original value of 10.4 volts to 6.5, curve B could be shifted up to coincide exactly with curve A, the auxiliary grid being still kept at 100 volts. Thus a change of 3.9 volts on the inner grid is equivalent, so far as plate current is concerned, to a change of 20 volts on the auxiliary grid.

Effect of the Auxiliary Grid.

Let us see what bearing these facts have upon the suitability of the pentode as an anode rectifier coupled by a resistance, as in Fig. 1, to the succeeding valve. When a triode is used in this circuit it is so adjusted that there is a standing plate current of some 10 to 50 microamps. (1 microamp. = 1/1000 milliamp.) When signals arrive the mean effective grid voltage is raised, resulting in an increase of plate current. As the plate current increases the voltage dropped across the resistance in the plate circuit also increases, leaving less of the battery voltage available at the anode of the valve itself. In this way the anode current is prevented from rising to as large a value as it would attain if this compensating influence were not at work, for in the triode the anode voltage plays a large part in determining the plate current. In the pentode, as we have already seen, the influence of anode voltage is very much smaller, so that we might expect the change in plate current due to the arrival of a signal to be greater than with a triode. In other words, the pentode should give, for the same high-frequency input, a greater output than an ordinary valve can provide. and should, therefore, excel in sensitivity to weak signals while still being able, if necessary, to handle stronger ones without distortion.

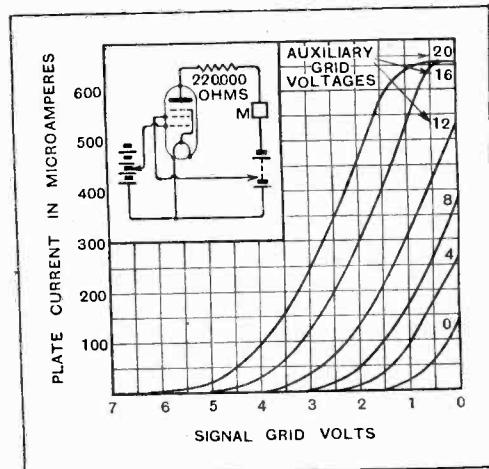


Fig. 4.—Variation of plate current with grid volts for a number of different auxiliary grid voltages. Observe "saturation" towards the top of the curves for 16 or 20 volts on the auxiliary grid.

In order to gain an idea of the best conditions under which to operate the valve as a rectifier, the anode-voltage-anode-current curves of Fig. 3 are not very helpful. A much better indication can be obtained by examining the curves found by plotting grid voltage against

The Pentode as an Anode Rectifier.—

anode current for a constant anode voltage and various values of auxiliary grid voltage. A family of such curves, all taken with a 220,000 ohm resistance in the plate circuit and an anode battery voltage of 145 is given in Figs. 4 and 5.

From a consideration of these curves some rather interesting points emerge. In the first place it is clear that for rectification the valve must be set so as to have an initial plate current, before signals are applied, in the neighbourhood of 20 to 30 microamps. with

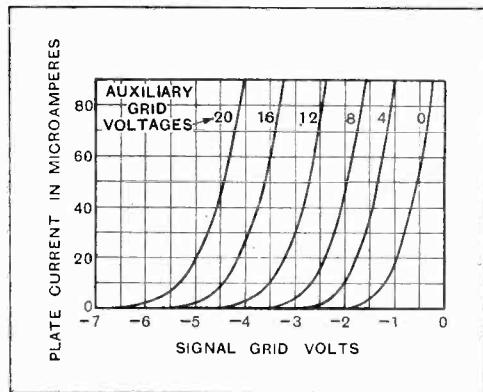


Fig. 5.—The lower end of the curve of Fig. 4 on a larger scale. The bottom bend is more sharply defined when a lower auxiliary grid voltage is used.

the anode resistance used, while from the point of view of obtaining rectification it does not much matter what combination of auxiliary grid voltage and grid-bias is chosen.

Factors Limiting Output.

The peak voltage that the valve can handle is limited in two different ways, depending on the operating conditions. If the auxiliary grid voltage and the grid-bias are both low, as in the curves to the right of Fig. 4, a large grid-swing impressed upon the valve will cause grid current to flow. In recognition of this fact the curves have not been carried into the region of positive grid potentials, since in that region grid current flows, and the curves, though they can be drawn, cannot be used in practice. In the two left-hand curves of Fig. 4 another limitation peculiar to the pentode makes its appearance. These two curves turn over sharply to the horizontal while still in the region of negative grid potentials. The current reached at the top of the curves is that which the anode battery voltage can drive through the anode resistance, and corresponds to zero voltage at the anode of the valve itself. If an attempt were made to use these curves right up to the line of zero, grid voltage distortion of an extremely unpleasant character would arise as soon as the horizontal part was entered upon. The maximum peak voltage that the valve can accommodate with the circuit conditions chosen is thus about 3 volts.

In Fig. 5 the lower portions of the same curves are repeated in order to show the character of the bottom bend upon which the process of rectification depends. On the larger scale it becomes evident that the bend

in the curve is sharper at the right-hand end of the series of curves than at the left. For the reception of strong signals a grid-bias of some five volts or more would be chosen in order to ensure that grid current should not flow and that the whole of the straight part of the curve should be available without distortion arising. The comparative-bluntness of the bend would make no appreciable difference to the efficiency of rectification for strong signals. In receiving weak signals, on the other hand, very noticeably greater sensitivity can be attained by taking advantage of the sharper bend in the curves at the right of the diagram, using a bias of from 1 to 1½ volts, and adjusting the voltage on the auxiliary grid for the loudest signals on a weak station. With this setting a strong signal would produce overloading of a very audible variety.

In order to obtain further data on the performance of the pentode as a rectifier, a further series of measurements was undertaken. In these high-frequency voltages of known magnitude were applied between inner grid and filament of the valve, and the change in plate current due to rectification was measured. For these experiments a comparatively low value of

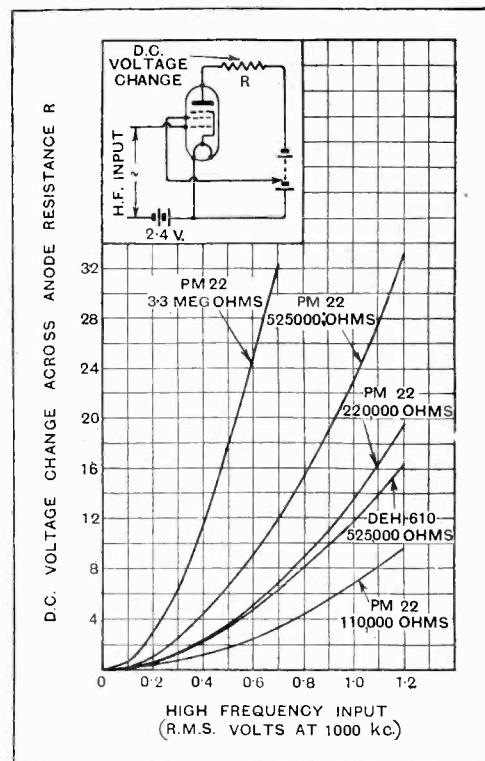


Fig. 6.—Relation between H.F. carrier voltage and D.C. voltage change across R. The steeper the curve the more sensitive the rectifier.

grid-bias was employed, as the measurements were designed as a test of sensitivity. The high-frequency input ranged up to about 1½ volts r.m.s., at a wavelength of approximately 300 metres. The arrangement of the apparatus was such that the voltage was not affected by connecting the pentode across the source.

The Pentode as an Anode Rectifier.—

The results are summarised in Fig. 6, in which the change in voltage across the anode resistance, obtained by multiplying the change in plate current by the value of the resistance through which it flowed, is plotted against high-frequency input. For comparison the results given by a sensitive high-resistance triode rectifier is also included.

Effect of Anode Resistance on Sensitivity.

The sensitivity of the pentode as rectifier, whether for large or small inputs, is seen to increase very rapidly as the anode resistance is raised from low to high values. This effect is present also in the case of triodes, but the gain in sensitivity achieved by choosing an anode resistance of the order of megohms is very much greater with the pentode. In either case, of course, the extra sensitivity is only attained at the cost of some loss of the highest musical notes. Comparing the pentode with the triode (a D.E.H.610 valve, $\mu=40$, $R_a=60,000$ ohms) it is seen that the pentode, with an anode resistance of a quarter of a megohm, gives slightly greater sensitivity than the D.E.H.610 with half a megohm, while if the P.M.22 is used with

half a megohm in its plate circuit it provides signals nearly twice as loud as the triode. In using a pentode in this way one is therefore enabled to make a more than usually satisfactory compromise between the rival claims of sensitivity, which necessitates a high value of anode resistance, and full reproduction of the high musical notes, which are inclined to vanish if the resistance is made too high.

The attention of those engaged in laboratory work is specially directed to the extremely high sensitivity to very small inputs that is attainable when using an anode resistance of the order of 3 megohms. As rectifier in a valve voltmeter of the two-stage type described in various text-books² it will respond to high-frequency voltages of less than half the amplitude of the smallest which a triode can detect.

Further data, dealing more particularly with the points that arise when incorporating the pentode in a receiver in the capacity of detector, will be given in the second part of this article.

(To be concluded.)

² See, for example, Hund's "Hochfrequenzmesstechnik," 2nd Edition, page 150; or *J. Sci. Instruments*, 3, p. 342 (1926).

TRANSMITTERS' NOTES AND QUERIES.

Belgian Amateurs.

The Belgian Postal Authorities have notified amateur transmitters in that country that the international prefix ON must be used with their call-signs as from August 1st.

It may be remembered that in our issue of May 22nd last we noted that some Belgian amateurs were unwilling to use this official prefix, preferring to remain faithful to the old EB.

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Call-signs for Uruguay.

Amateur transmitters in Uruguay use the international prefix CX, and their call-signs are allocated according to the various geographical departments. Thus, 1AA-9CZ are reserved for the Department of Montevideo, 1DA-9DZ to Canelones, 1EA-9EZ to San Jose, 1FA-9FZ to Colonia, 1GA-9GZ to Soriano, 1HA-9HZ to Rio Negro, 1IA-9IZ to Paysandu, 1JA-9JZ to Salto, 1KA-9KZ to Artigas, 1LA-9LZ to Florida, 1MA-9MZ to Flores, 1NA-9NZ to Durazno, 1OA-9OZ to Tacuarembó, 1PA-9PZ to Rivera, 1RA-9RZ to Maldonado, 1SA-9SZ to Lavalleja, 1TA-9TZ to Rocha, 1UA-9UZ to Treinta y Tres, 1VA-9VZ to Cerro Largo, while portable stations are distinguished by the call-signs 1ZA-9ZZ.

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The New Berne Lists.

We have now received from the International Bureau of the Telegraphic Union

a copy of the Alphabetical List of Call-signs, which completes the set of volumes comprising the new "Berne List." We find we were misinformed when we stated, in our note on September 4th, that this list would contain the call-signs of all stations included in the five main lists, as it appears that those of broadcasting stations are omitted.

There should not be any great difficulty in determining to which list of particulars any individual call-sign refers, as the three-letter signs relate to land stations with a few exceptions where four-letter signs are still retained, in which case the name of the station is followed by FX, indicating that it is not a ship station (e.g., CRAF, Melange, Angola, FX). There may, however, be some confusion between Fixed and Land Stations (Part I) and Stations Performing Special Services (Part II). D.F. stations and Radio Beacons are distinguished by the words "Gonio" and "Phare" respectively, but in a few cases there is nothing to indicate whether the particulars of a station will be found in Part I or Part II (e.g., IQW, Ancona, is found among the Italian Meteorological Stations in Part II, but not among the Fixed Stations in Part I).

Ship stations are easily distinguished by having four-letter call-signs, and aircraft stations by their five-letter calls.

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QRA Wanted.

XAUSAZ.

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Changes of Address.

G2AX C. S. Bradley, 91, Shirley Road, Shirley, Croydon.

2AZL W. Paylor, 25, Acre Crescent, Middleton, Leeds.

CLUB NEWS.

Clubs and the Regional Scheme.

One outcome of the regional broadcasting scheme will probably be the need for more wireless clubs to assist the "ordinary listener" to obtain the best results that the B.B.C. can give him, incidentally stimulating in him a desire to approach wireless as a fascinating hobby. The majority of clubs are now discussing plans for the winter session, and it is interesting to note that several are making it their duty to attack the oscillation bugbear.

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Non-Broadcasting Questions.

The Hackney Radio and Physical Society has resumed its meetings at the Electricity Showrooms, Lower Clapton Road, E.5, and a syllabus is in preparation. On September 30th Mr. Cole will lecture on the uses of valves and circuits otherwise than for broadcast reception.

Hon. Secretary: Mr. G. E. Sandy, 48, Melrose Avenue, Wimbledon Park, S.W.

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Meetings Twice Weekly.

The Kentish Town and District Radio Society resumed meetings on Tuesday last, September 17th, at the Carlton Road School, Kentish Town, under the chairmanship of Mr. Hembury (G8AY). New members are cordially welcomed, and full particulars regarding the Society can be obtained from the Hon. Secretary, Mr. A. H. Sartain, 40, Harrington Street, Regents Park, N.W. Meetings are held on Tuesdays and Fridays at 8 p.m.

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Constructing a Club Set.

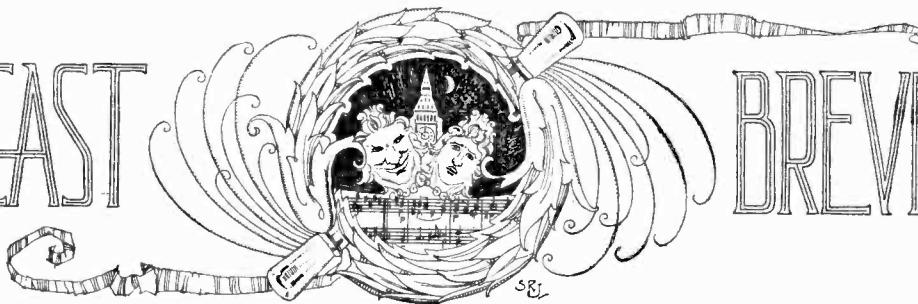
The construction of a screen-grid set is occupying the members of the Slade Radio Society (Birmingham), and some interesting and enjoyable evenings are being spent in producing a set which shall be worthy of the Society. In the near future a direction-finding test is to be held in the open air, a suitable venue for the transmission having been chosen by an "independent" person unattached to the Society.

A party of members will visit the Olympia Radio Exhibition on September 28th. Such has been the demand for membership of the party that only a few vacancies now remain.

Full particulars regarding the Society's activities can be obtained from the Hon. Secretary, 52, St. Thomas Road, Slade Road, Birmingham.

BROADCAST

BREVITIES



By Our Special Correspondent.

Television Tests from 2LO.—Farewell to GNF.—Winter Wavelength Checking.**A Television Debut.**

The Baird television broadcasts which are to be given daily from 2LO, beginning on September 30th, will, of course, be restricted to the transmission of images, no simultaneous broadcasting of speech being possible on a single frequency.

It is noteworthy that the Postmaster-General and the B.B.C. disclaim all responsibility for the results obtained; it would have been more surprising, however, if either party had declared otherwise. The transmissions are purely experimental, and at the moment it is only fair to the Baird Company to regard them as such.

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Another Spark Set to Go.

A philosopher has said that we never consciously perform an action, pleasant or unpleasant, for the last time, without a pang of regret. So it is quite likely that even those who have spent years in cursing the shrill note of GNF, North Foreland, will regain their freedom with a sigh when the station changes to ICW in about two months' time.

The sparking of GNF has probably been the first Morse signal heard by thousands of listeners in S.E. England when tuning their first wireless receiver.

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Thermometer Control in Algeria?

Have you heard an occasional heterodyne on 2LO in the last week or two? The engineers at Keston place the blame on an old offender, Algiers, which ought to be transmitting on 351 metres, but seems to have developed a habit of swinging up and down the frequency scale in tune with the thermometer.

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A Question of Power.

Talking of Keston, I hear that the move to the new receiving headquarters at Tatsfield is temporarily held up owing to a delay in the completion of the electrical power supply. It is expected, however, that the transfer will take place before the excitements of winter wireless begin, when wavelength checking becomes a really serious matter. It is generally conceded that the summer months have not severely tested the Prague Plan, but it seems more than likely that the increased radiation possible in winter will disclose some painful clashes.

B 5x

Face-lifting and Broadcast Reception.

Listeners in the Oxford Street district may suffer in more than one respect when Brookman's Park supersedes 2LO. In addition to loss of signal strength it is extremely probable that they will also discover a babel of extraneous noises which were formerly overwhelmed through the proximity of a 3 kW transmitter. Electric lifts abound in the district; in fact, almost every building in the locality possesses at least one of these "mush" makers. And isn't Oxford Street the home of the electric masseurs and face-lifters?

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"Journey's End."

In obtaining permission to broadcast that epic war play, "Journey's End," on Armistice Day, the B.B.C. creates a precedent in that the play will be performed

at the studio microphone while simultaneously running at a London theatre. The author, Mr. R. C. Sherriff, will himself make the slight alterations necessary for the broadcast version and will collaborate with Howard Rose in its production.

"Journey's End" will be broadcast from all stations except 5GB, but including the Empire short-wave station 5SW.

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Winter Symphony Concerts.

On October 12th the B.B.C. opens the 1929-30 season of Symphony Concerts in the Queen's Hall. Twenty-three concerts will be given, of which two (those on October 12th and November 1st) will be contributions to Sir Thomas Beecham's Delius Festival. Other conductors during the series will include Sir Henry Wood, Sir Landon Ronald, Hermann Scherchen, Franz von Hoesslin and Ernest Ansermet.

The National Chorus—a good test for the loud speaker!—will be heard in three choral concerts, and there will be many well-known soloists. All the concerts will be broadcast.

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Commonly Speaking.

From a correspondent of the B.B.C. in the Argentine:—

"Your transmissions are vulgarly received on 3 lamps."

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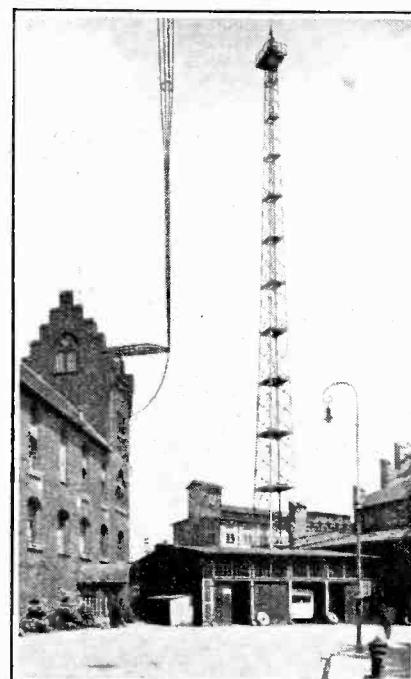
Short Plays from 2LO.

Two short plays will be heard by listeners to 2LO on September 27th. The first, "Wind Up," is by J. Jefferson Farjeon. The second, entitled "The Split in the Cabinet," adapted from the story by Stephen Leacock, is by V. C. Clinton Baddeley.

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Gael Warning.

The chief event of the Gaelic year in Scotland—the National Gaelic Mod—has come to be regarded as a regular source for broadcast relays. For the past three years extracts from one or other of the concerts of the Mod have been relayed. This year a portion of the prize-winners' concert on October 4th is to be relayed through Dundee from Perth for broadcast from all Scottish stations. In this programme listeners should have an opportunity of hearing some of the finest Gaelic musicians of the country.



MÜNSTER. An unusual view of the German relay station with its imposing lead-in. Münster transmits on 234 metres.

Eckersley's Baby



A Visit to "London Regional."

THE natal cry which shook the European ether and inaugurated the British regional scheme in the early hours of Monday last emanated from a station which, to judge from appearances, must mark a new standard of achievement in the annals of the B.B.C. To the eye of the visitor the Brookman's Park Twin Regional Station presents a spectacle of extraordinary symmetry, the almost severe buildings standing like a Druid circle in the centre of a small plateau and exactly midway between the two pairs of 200ft. lattice masts.

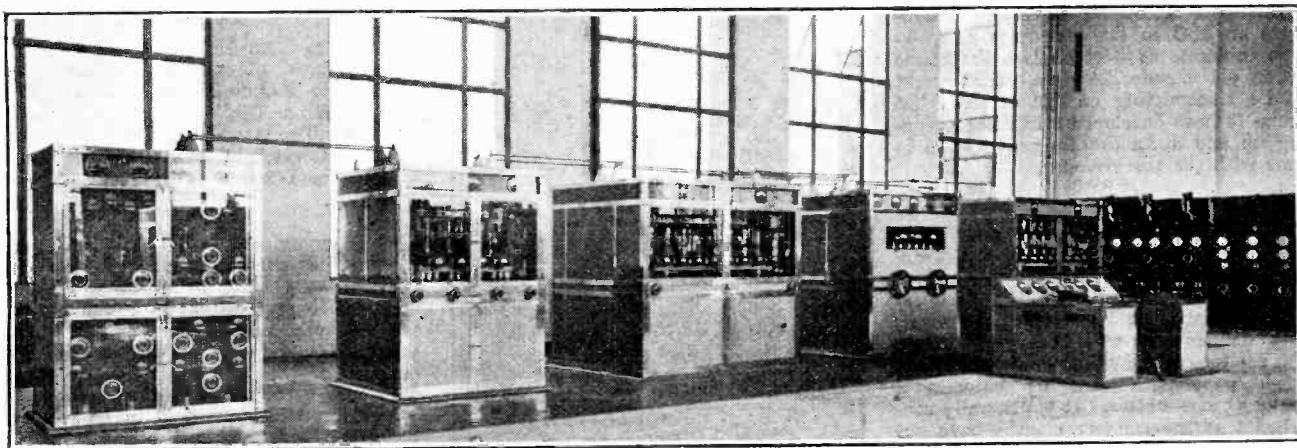
Entering the buildings at the east end, we find ourselves in the power house. Power is derived from Diesel generating plants. These machines, which run at 300 revolutions per minute, provide 300 h.p., giving an output of 2,700 amperes at 230 volts. It is interesting to note that precautions have been taken to prevent the transmission of vibration to the valve equipment by mounting each of the generating plants on a concrete bed which is independent of the foundations of the building.

The use of a D.C. supply may be criticised, but its adoption makes possible the use of a floating accumulator battery capable of providing power to one transmitter in the event of engine failure.

Passing from the generator and battery rooms we find all the necessary machines for generating anode and filament current not only for the main transmitting valves, but for the auxiliary, oscillating and modulating equipment.

Progress in Generator Design.

A type of generator which marks progress in the design of machines of this class is in use, and is the product of the English Electrical Company. The armature is entirely insulated from its spindle, is built in two sections, and fitted with four commutators. By this means a potential of 12,000 volts is obtainable from a single machine. There are three of these H.T. machines, each generating 160 kW. and direct coupled to orthodox D.C. motors driven from the motor generator sets already referred to.



One of the twin transmitters at Brookman's Park. On the extreme left are the drive oscillator and separator. Next is the modulating unit. This is followed by two banks of valves used for aerial excitation, and between them is the aerial tuning equipment, which connects through the feeders to the additional tuning inductances situated at the foot of the aerial and midway between the masts.

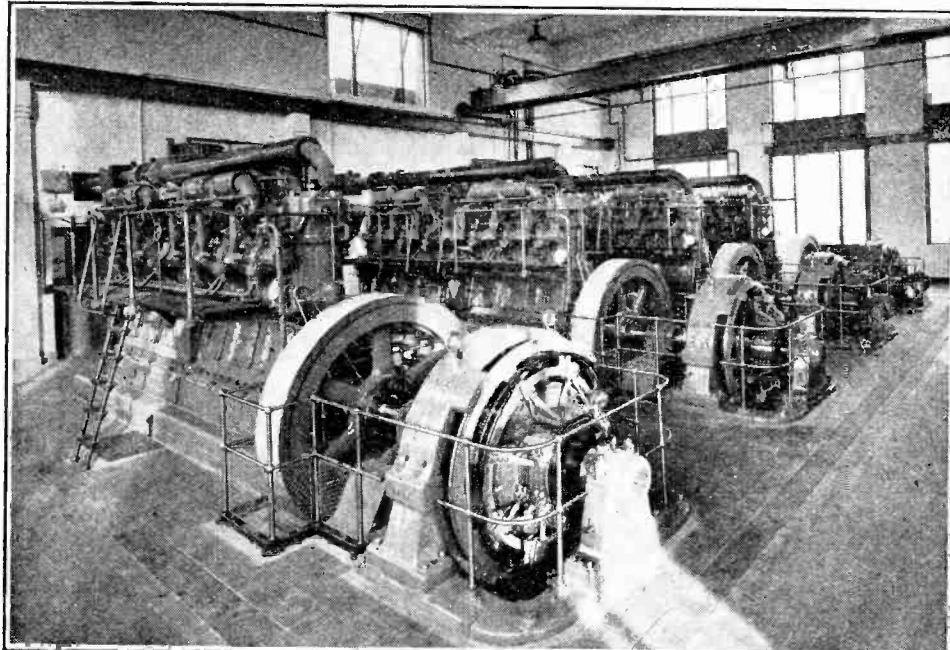
Eckersley's Baby.—

As readers already know, the station is doubly equipped for the purpose of transmitting two programmes simultaneously on two wavelengths. Two of the three motor generators will thus be used together, the third being a spare for emergency use. Accommodated alongside the H.T. machines are three L.T. generators each with an output of 1,300 amps. at voltages from 15 to 30. These machines, as well as those used for various anode voltages, grid biasing, etc., are in triplicate, so that in every case there is a standby generator.

The main hall of the building is taken up with the transmitting equipment. Facing each other along the two sides are two identical transmitters each arranged to handle a separate programme through its own aerial system. The circuit adopted is similar to that employed at Daventry 5GB and consists of an oscillator (which can, if necessary, be fork controlled) which governs the lower power modulated oscillator through an intermediate tuned circuit called the separator. This arrangement prevents fluctuation of frequency within small limits.

The aerial is excited from two banks of eight water-cooled valves which are in opposite phase across the tuning inductance. A tuned feeder system couples the aerial with the transmitter, the necessary apparatus for tuning being housed in a small building immediately beneath the centre of the aerial.

A notable feature is the provision of means for switching over to a spare valve in all parts of the apparatus where a single valve is used, the breakdown of which would interrupt the working of the station. By merely turning a key switch the spare valve is



General view of the power house. A sound insulating channel surrounds the foundations of the machines.

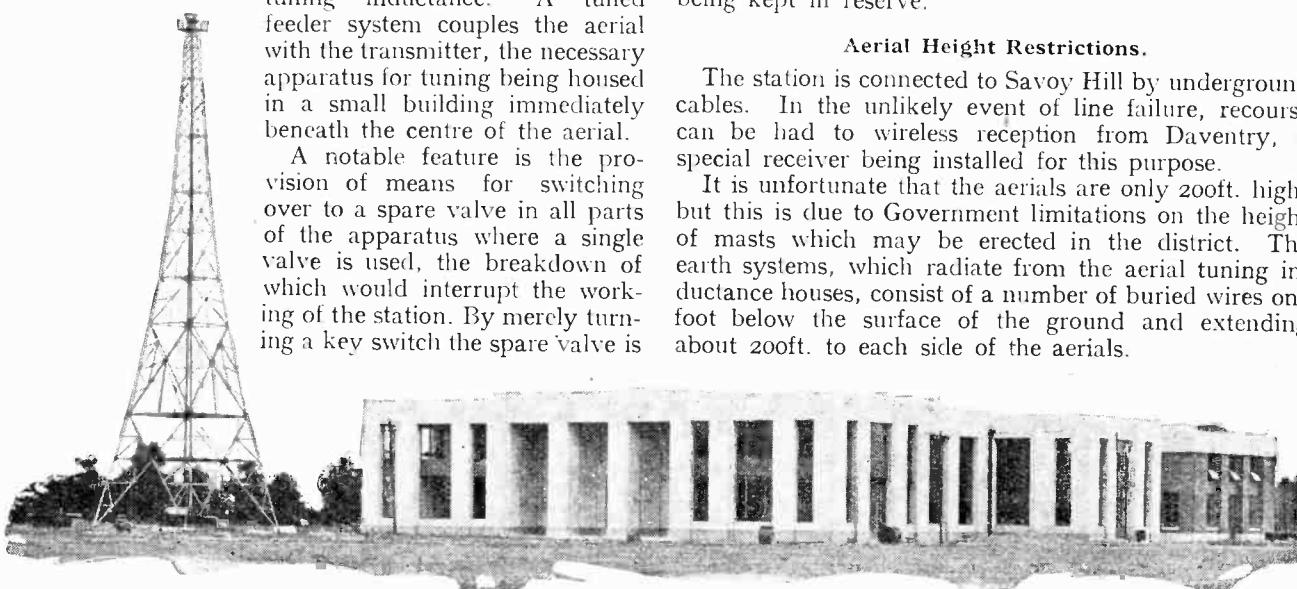
thrown into circuit. Precautions have also been taken in connection with the paralleling of the main oscillating valves to prevent circulating currents, and by an arrangement of chokes each valve functions independently of its partners.

As already explained, modulation is at low power, i.e., the modulation is supplied to the intermediate oscillator. Each transmitter normally delivers 30 kW. to its aerial. It is believed that almost full power is being used during the present tests, a small amount being kept in reserve.

Aerial Height Restrictions.

The station is connected to Savoy Hill by underground cables. In the unlikely event of line failure, recourse can be had to wireless reception from Daventry, a special receiver being installed for this purpose.

It is unfortunate that the aerials are only 200ft. high, but this is due to Government limitations on the height of masts which may be erected in the district. The earth systems, which radiate from the aerial tuning inductance houses, consist of a number of buried wires one foot below the surface of the ground and extending about 200ft. to each side of the aerials.



This view, taken from the south-west, shows the extreme simplicity in the design of the station buildings.

The Design of A.C. Mains Sets

Details of a Typical Three-valve A.C. Set.

By W. T. COCKING.

(Concluded from page 238 of the previous issue.)

THE rectifier is the next question, and on this point the writer is at variance with most other people. Nowadays anode bend is always recommended for quality, and is particularly recommended for A.C. mains receivers. With regard to the latter, it is usually said that grid rectification is dangerous from the point of view of hum; for, as the grid is only earthed, as far as low-frequency currents are concerned, through a very high resistance, it is liable to pick up hum. Though this is true in theory, it has been found no more difficult to use grid than anode rectification; neither gives hum, nor is either more likely to pick up hum than the other. That, at least, has been the writer's experience.

Advantages of Grid Rectification.

With regard to quality the writer prefers a grid detector because he believes that under modern broadcasting conditions it gives better quality. Modern broadcasting is much more deeply modulated than that of a few years ago, and anode bend is increasingly inefficient as the percentage modulation grows, while the grid rectifier does not appear to be so badly affected. In the writer's opinion, the only real fault of the grid detector is the load it places on its grid circuit, but if only a small positive potential, or, in the case of some A.C. valves in which grid current flows even when the grid is negative, no grid potential, is applied, this damping is greatly reduced. If little or no bias is used, the quality is distinctly improved by using a small grid condenser, about 0.001 mfd.

If anode bend rectification is used, the negative bias cannot be obtained from the voltage drop across a resistance in the H.T. return lead; for with an anode rectifier the anode current is dependent upon the strength of the incoming signal. It can, however, be obtained from the anode feed potentiometer, as shown in Fig. 3; the formula for calculating the resistance of R is the same as for an L.F. stage, except that the value used for the current will not be the anode current of the rectifier, but the current flowing through the

resistance which forms the arm of the potentiometer nearest the H.T. return lead.

Finally, care should be taken in the disposition of the components, although this is not critical if the power unit is built in a separate box from the set and placed at some distance from it. If, however, the whole apparatus is built into one cabinet, care will be necessary; in fact, at first it is unwise to screw down any of the transformers, as it will probably be necessary to rotate them to find the position of minimum hum. A carefully built set will work as well as one built in two sections, but the transformer positions are critical, even if they are quite a distance apart.

Suggestions for a Three-valve A.C. Set.

In Fig. 4 is shown the circuit diagram of the writer's receiver and power unit, which has been in use for several months, and which has proved so satisfactory that he would now never go back to batteries. It was designed in accordance with the principles outlined in this article; there is no H.F. stage, as it was intended for use on London and 5GB only, but a stage could easily be added, as in Fig. 5, where the biasing arrangements should be carefully noted. The current flowing through the resistance R, which provides the bias, is not only the anode current of the screened valve, but also the screen current and the anode current of the detector. That is, the total current through R is the anode current of the first valve, plus the screen current,

plus the anode current of the detector, and this value must be used when calculating the required resistance of R. In practice it would probably be best to use a variable wire-wound resistance, when the actual value of the grid bias could be adjusted while the set was working.

Filament Hum.

The indirectly heated screened valves have remarkable characteristics, and will give a greater H.F. stage gain than any other valves; an attempt, however, to heat the filament of an ordinary battery type screen-

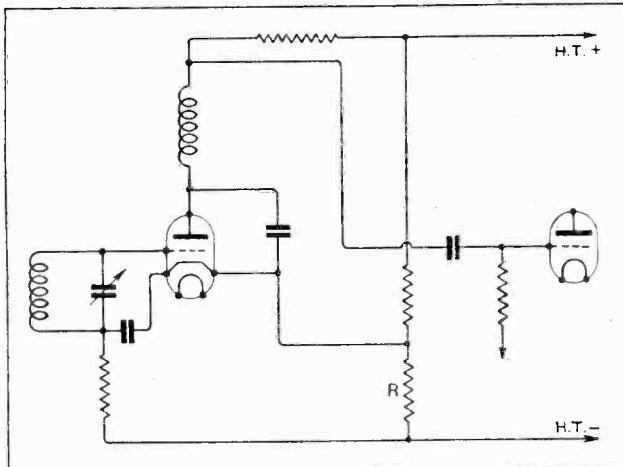


Fig. 3.—With an indirectly heated anode bend detector valve "free" grid bias can be obtained from an anode feed potentiometer, one arm of which is shown as R.

The Design of A.C. Mains Sets.—

grid valve with A.C. was a failure owing to hum. The reason for this hum is rather interesting, for it is obtained even when the H.F. couplings will not pass low-frequency currents, but it is only obtained when the set is tuned in to a station. At first sight it appears impossible for there to be hum with such a circuit, but in reality the A.C. current heating the filament causes the anode current to vary at the same frequency, and modulates the carrier of the incoming signal with a 50-cycle note; this, of course, is rectified and amplified by the low-frequency stages. This suggests a

enables much greater amplification to be obtained, but it also enables better quality to be obtained without loss of amplification as compared with a battery set. For example, with a transformer-coupled L.F. amplifier, using a battery type valve of 20,000 ohms A.C. resistance, the stage amplification will usually be about 60, but if a mains valve of the same resistance is substituted the amplification will be doubled. On the other hand, if a mains valve of about 10,000 ohms be used, the amplification will be the same as with a 20,000-ohm battery valve, but the quality will be much better. The reproduction of both bass and treble will be im-

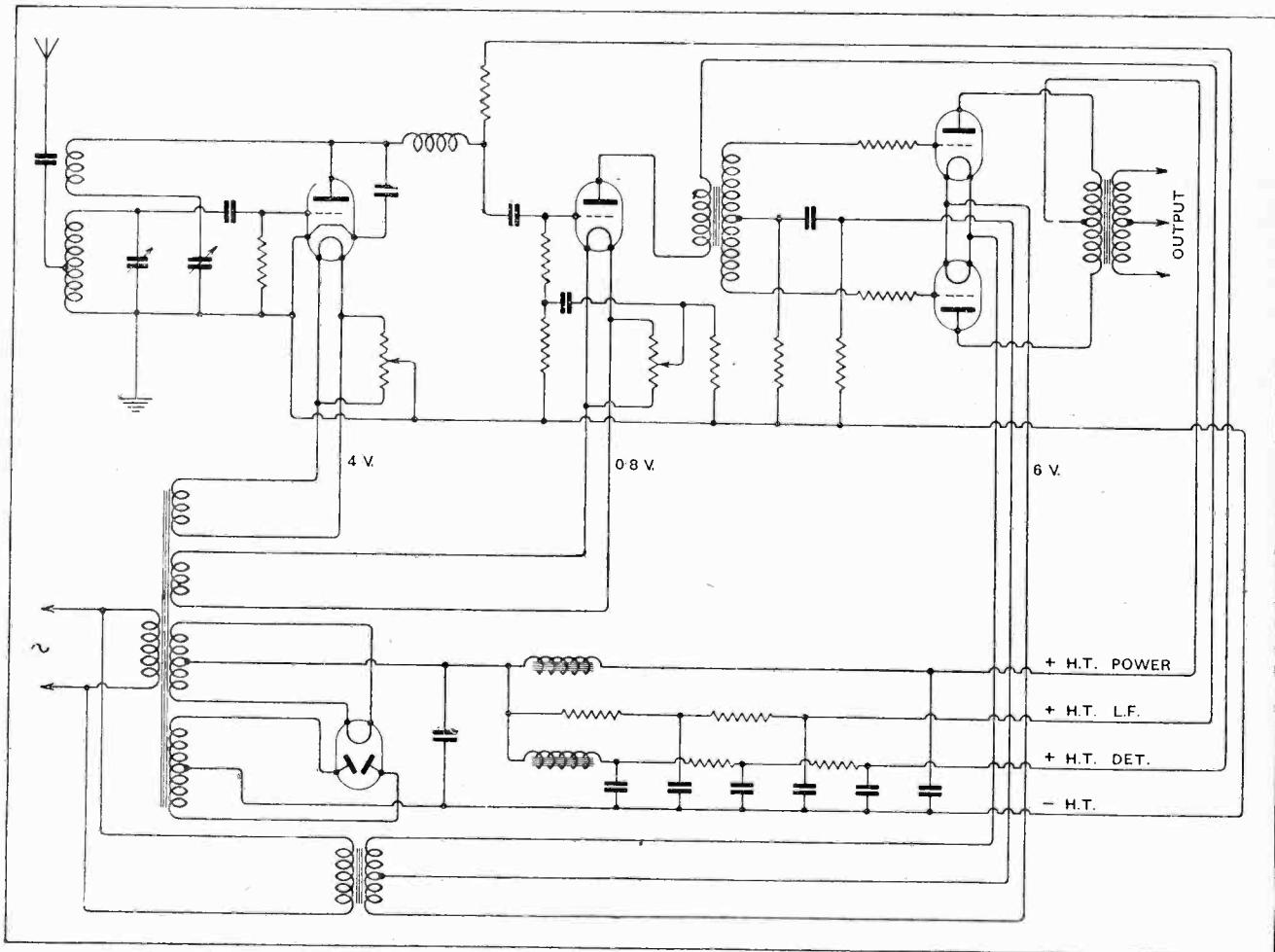


Fig. 4.—Circuit details of a complete three-valve receiver entirely operated from A.C. mains. An H.F. stage is not used as the receiver was primarily intended for the reception of 2LO and 5GB.

remedy; if the low-frequency stages will not amplify a 50-cycle note, an ordinary valve can be used for the high-frequency stage, but it is a poor way out, for the bass notes in the transmission will be cut off also. It is only useful in cheap sets or where much bass is not wanted.

While it is true that the results with a mains set are better than those with one operated from batteries, the improvement is not necessarily in the form of increased amplification. The higher mutual conductance (usually double) of valves of the indirectly heated cathode type

proved by the use of a lower resistance valve, and, in addition, it will reduce the risk of distortion due to overloading.

In the H.F. amplifier, too, it is not always advisable to try to obtain the very utmost in the way of amplification. It is sometimes very tempting to try to obtain an amplification of 300 or so from an indirectly heated screened grid valve, but when the questions of selectivity and quality are considered, it may be found that it is better to sacrifice some of this high amplification. With any set the higher the amplification the greater

The Design of A.C. Mains Sets.—

will be the selectivity required; the usual circuits for high amplification are no more selective than a neutralised amplifier where the stage gain is only about 40. It is not generally realised that the high-note loss in an amplifier using very low loss coils may reach the alarming figure of 90 per cent.! By means of a special circuit, using an A.C. mains valve, it is possible to reduce this loss to only 10 per cent., and still obtain, with no reduction in the selectivity, a stage amplification of 60, which is as high as that obtained with an ordinary battery screened grid valve.

In view of this it is the writer's opinion that the greatest satisfaction will be obtained from a mains set if the questions of quality and selectivity are made the

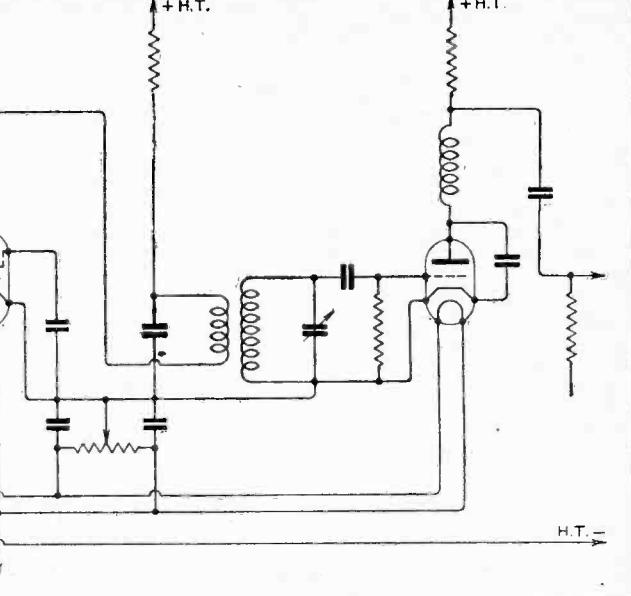


Fig. 5.—Suggested connections for an H.F. amplifier in which grid, anode, filament and screen obtain their working potentials from A.C. mains.

prime considerations, while mains hum need not be feared if the above precautions are carried out.

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.

AMATEUR STATUS?

Sir,—May I be permitted to say a few words about this "Amateur Status" business?

Mr. T. P. Allen in his letter says that he had not previously heard of the A.B.R.S.!

How many amateurs could say that they had never heard of the R.S.G.B.? I venture to say—not one. Surely this in itself proves that the R.S.G.B. is the official amateur society of this country.

In reading through many foreign amateur radio journals one invariably sees the R.S.G.B. mentioned, but I, personally, have never seen any mention of the A.B.R.S.! Why?

Remarks have also been made about the R.S.G.B. being a "London Society." All I can say about this is: one only has to go to the annual convention of the R.S.G.B. to prove this statement to be utterly ridiculous.

I live forty miles from London, but I can say that the R.S.G.B. have always helped me in every possible way, and have always replied to my letters *by return of post!*

Further, its membership is increasing daily, and I am certain that amateurs would not join if they felt a better society existed. I, with many others, consider it an honour to be a member of the R.S.G.B.!

Before closing I should like to say a few words about "This QSL Business."

Mr. Ashton J. Cooper and others regard the exchanging and collecting of QSL cards as "a foolish idea."

I very heartily disagree!

I certainly have no patience with "the wall-paper type of collector," but I have always considered that when one works a station it is part of his duty as an operator of a private station to confirm every 'contact made.'

If it were not for QSLs, what should we have to prove that we have worked certain stations or countries?

They alone form a very helpful log, and also form a bond of friendship between the two stations.

I send a QSL to every station worked, British or Continental, and, further, if another fellow takes the trouble to send me a report on my signals, he gets my card and thanks, always, in return.

I do not operate my station just to collect cards—far from it—but I feel that after working a station it is up to me to see that he gets a further report and confirmation of our QSO.

I would add that only 75 per cent. of the stations who receive my cards send me theirs. I am pleased to say, however, that nearly every G station QSLs, sometimes *via* R.S.G.B.!

Has the A.B.R.S. a QSL service? I have never heard of it.

In closing, may I, through the columns of your valued journal, wish the R.S.G.B. further success, and thank you for publishing such interesting articles and letters?

JAMES N. ROE.

Sir,—There are to-day a large number of amateurs engaged in carrying out experiments of an important nature, and they do this by getting in touch with another amateur who reports on their signals. Thus every new amateur means another station to help with these experiments.

Those who hear their "bleatings and croaks" think that they are talking utter rot, whereas they are probably experimenting with duplex telephony or crystal control.

People who don't know all this ought not to criticise amateurs. Do not suppress them, but rather give them every assistance possible, and they will amply repay, by the result of their experiments, any assistance given to them.

B.R.S.260.

READERS'

PROBLEMS.

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

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

A Source of Lost Energy.

From several recent articles I gather that it is good practice to determine experimentally the number of primary turns of H.F. transformers used with S.G. valves. It is therefore proposed to adopt a sectional form of winding with more sections of fewer turns than those used in "The Wireless World" designs—and to short-circuit any sections that are found, on trial, to be superfluous. I take it that this will be better than a tapped primary, with its dead-end effects?

J. T. S.

We would strongly dissuade you from adopting your proposed scheme. The practice of short-circuiting sections of coils wound in the manner described is seldom permissible nowadays, and then only in cases where the various sections are adequately spaced, with this object in view. It is an axiom in H.F. transformer design that all the primary turns shall be tightly coupled to the secondary, and if a section is short-circuited a considerable amount of energy will be absorbed from the latter coil.

We agree that it is highly desirable to adjust the primary winding so as to suit the characteristics of the S.G. valve in use, and also the particular needs of the user. Adjustment is best made by removing superfluous turns, but, if you prefer it, there is little reason why a tapped winding should not be used, particularly if the number of "dead" turns is small.

.....

How It Works.

Will you please give me a few words of explanation as to the working of the "free" grid bias scheme included in the "Foreign Listener's Four"? I am thinking of making up a set on similar lines (but with a single H.F. stage), and should like to understand this part of the circuit fully before beginning operations.

T. F. A.

This free grid bias scheme is not difficult to understand. If you study the circuit diagram of the receiver in question, it will be apparent that the cathode lead of each valve requiring a negative bias is joined to the common H.T. negative bus bar through a small resistance; the anode current of the valve must consequently flow through this resistance, producing a voltage drop which is applied to the grid circuit.

The matter will perhaps be made more

clear by referring to Fig. 1, which shows the essentials of a single-valve circuit, without extraneous complications. It should be observed that the grid return lead must be joined to the negative H.T.

voltage difference existing across the ends of the bias resistance will automatically rise, providing more grid negative.

.....

Look to Grid Bias.

I have just noticed that signals increase in strength very noticeably when the H.T. plug feeding the detector valve of my "Everyman Four" is removed from the battery. This increase, however, is only momentary, as signals soon die away altogether unless the plug is replaced.

The general performance of the set is not as good as formerly; is the above symptom of any help to you in forming an opinion as to what may be wrong?

L. G. B.

It seems probable that the negative bias applied to the detector valve is somewhat less than it should be, and that better rectification is taking place when the applied anode voltage has dropped considerably (through discharge of the bypass condenser).

It is quite possible that the anode resistance has changed in value; this is more likely to be the case if you are using a grid leak type of resistor in this part of the circuit.

.....

An American Set.

My five-valve set, of American manufacture, has "power" valves in the two H.F. stages. Do you consider that it would be worth while replacing these with modern "H.F." valves? My object is to increase range: selectivity is already quite adequate for this district.

S. R. F.

The majority of American "2 H.F." sets of a few years ago included neutralised transformers designed for valves of some 8,000 ohms impedance. The primary windings were small, and we consider that results would be disappointing were you to make the proposed change.

It is just possible that H.F. magnification could be appreciably increased—perhaps doubled—by using modern high-efficiency valves of the type sold for anode bend detection ("D" or "D.E.L." type). The impedance of these valves is about right, but we hesitate to recommend them to you definitely, for the reason that the balancing and screening arrangements of the set may well be inadequate to cope with the increased amplification available. More sensitivity is useless unless it is accompanied by stability.

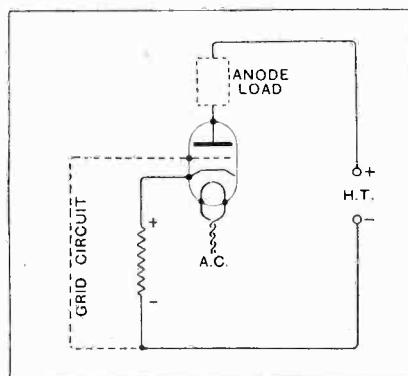


Fig. 1.—Simplified diagram showing principle of "free" grid bias.

lead in order to take advantage of the difference of potential across the resistance, which, incidentally, is always shunted by a large condenser providing a low-reactance return path for H.F. or L.F., as the case may be.

Not the least of the advantages of this method lies in the fact that it is more or less self-adjusting to variations in anode voltage; if this voltage (and consequently current) is increased, the

RULES.

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

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

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

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

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

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

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

Modified Hum-proof Eliminator.

I should like to make up the Hum-proof D.C. Eliminator, as described in "The Wireless World" for August 28th, for use with my Kilo-Mag. Four, but as I do not wish to apply more than the specified maximum voltage of 150 to my output valve, have come to the conclusion that it should be possible, in the interests of economy, to dispense with some of the output feeds, and to supply all the anodes with the voltage mentioned, on providing a potentiometer as described for the two screening grids.

If you approve of this, will you please let me have a circuit diagram of the eliminator, modified to suit my requirements? F. N.

As you suggest, the set will work well with a common anode voltage of about 150, and, unless you wish to apply a pressure in excess of this to the output valve, it is possible to effect an economy by simplifying the eliminator, particularly as in this case there is no need to use the various parallel feed circuits for decoupling.

The modified circuit diagram is given in Fig. 2; R_1 is a voltage-absorbing resistance, of which the value will depend on the current taken by your valves and on mains voltage, and must be determined

Spacing Between Coils.

The practice of winding medium- and long-wave transformers on the same former, exemplified in several recent "Wireless World" designs, appeals to me, but no design on these lines has yet been published that satisfies my own requirements; this is probably because I intend to use, for my new set, a screening box rather smaller than usual, and am consequently forced to reduce the dimensions of my coils.

The point on which I specially need information is concerning the minimum spacing between the two sets of windings. The majority of published designs show a clear $1\frac{1}{4}$ in. or more. Is it permissible to reduce this appreciably? H. M. W.

Generally speaking, the medium- and long-wave coils should have a clear spacing of between 1 in. and $1\frac{1}{2}$ in. The greater dimension is applicable to the more ambitious type of coupling.

From the fact that you propose to use a smaller screening box than usual, it is inferred that no attempt is being made to obtain the maximum possible H.F. stage gain, and so we consider that an inch spacing will be ample, especially as your transformers are to have a smaller diameter than usual.

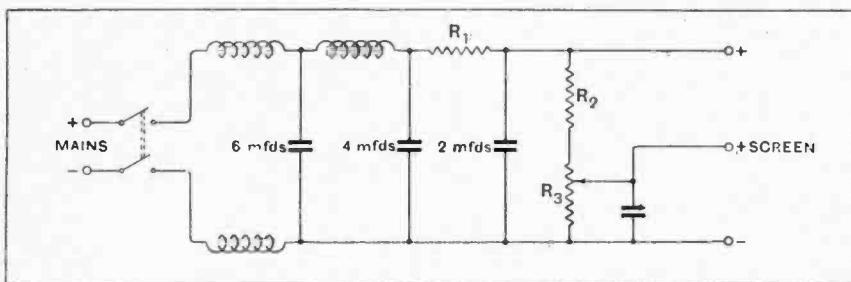


Fig. 2.—Simplified circuit of Hum-proof D.C. Eliminator giving a single H.T. voltage with a supplementary screen-grid supply.

by calculation; 4,000 or 5,000 ohms is likely to be about right. R_2 and R_3 are the two elements of the screening grid potentiometer, and may have the value allotted to them in the original article.

○○○○

Switching Neutralised H.F. Amplifiers.

I notice that waveband switching is but seldom included in circuits with neutralised three-electrode H.F. valves, although it is almost universal in "S.G." sets. Is there any basic reason why this switching should not be as successful in the former class of receiver? N. H. M.

Switching of the circuits associated with a three-electrode H.F. amplifier can be carried out quite successfully, and need not introduce much loss—certainly not more than 10 per cent. in voltage amplification—but, due to the need for changing over the neutralising arrangements, connections are much more complicated. This is particularly true when attempts are made to attain high efficiency on both medium and long wavebands.

A Continuous Waverange

Almost without exception, sets designed for broadcast reception cover the wavelengths between, roughly, 250 and 600 metres and 900 and 2,000 metres. It happens that I particularly wish to receive transmissions on about 800 metres; can you refer me to a published design that does not "miss" this intermediate wavelength? T. D. S.

As a matter of fact, it is by no means difficult to design a receiver to cover the entire waveband without a gap from about 250 to 2,000 metres in two steps; indeed, more than one set described in this journal will do so, and the majority will tune to 800 metres on the long-wave setting. Unfortunately, this wavelength is received with the tuning condensers near their minimum capacity, and consequently selectivity is poor.

It may be added that, almost without exception, those sets with 0.0003 mfd. tuning condensers described in this journal may be made to cover the com-

plete band specified by substituting 0.0005 mfd. If you adopt this plan, however, it would be well slightly to reduce the inductance of the long-wave coils.

We suggest that you should write to us again, giving full particulars of the type of set required.

○○○○

Threshold Howling.

My short-wave set is fairly satisfactory, but suffers from one disability about which I am seeking your advice. On increasing reaction gradually, a point is reached where violent L.F. oscillation is produced; this seems to occur just before the detector valve goes into H.F. oscillation.

Apart from the fact that, apparently, it is impossible to increase sensitivity (by reaction) to the fullest possible extent, the effect is extremely annoying when wearing headphones. Can you suggest a cure? A. A. D.

This effect, known as threshold howling, is well known, and is, indeed, one of the bugbears of short-wave reception. In the first place, you should observe the fullest possible precautions against passing H.F. energy into the L.F. amplifier. Attention to this matter will often effect a cure, but if it does not, we suggest that you should increase the value of the detector grid leak—even up to 10 megohms—and also fit a detector potentiometer, so that the positive voltage applied to the grid may be reduced to the smallest value consistent with good rectification.

○○○○

Visual Indication of Wavelength.

I have been considering the making of a modulated valve wavemeter, but it occurs to me that this complication is unnecessary now that I have fitted a low-reading milliammeter in the anode circuit of the bottom bend detector included in my set. Is it not a fact that the radiation of a simple heterodyne wavemeter, when picked up by the receiver, will produce a deflection of the meter, resonance being indicated by maximum current reading?

L. H. A.

Your statement is quite correct, and, indeed, it is possible to get a more accurate reading by visual than by aural means. For your purpose, a simple oscillator valve, with a calibrated tuning scale, will be perfectly adequate.

ARE YOU A GOOD JUDGE OF WIRELESS APPARATUS ?

Vote for your choice of the outstanding exhibit at the Olympia Show and qualify for the £50 cash prize offered by
The Wireless World.

SEE PAGE 268.

The Wireless AND RADIO REVIEW

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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.

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WHY NOT COMPETITIVE PROGRAMMES?

THE Regional Scheme is under way and its introduction marks the first definite stage towards the provision of alternative programmes throughout the country. The public has never been really satisfied that the programmes hitherto have been all that they might have been, and the Regional Scheme of alternative transmissions is likely to receive a warm welcome because of the choice which it will provide. But it still seems doubtful whether a real contrast in the programmes can be provided so long as both programmes are compiled by the same organisation.

The B.B.C., through their stations, have a monopoly for the transmission of broadcast programmes, and we have always contended that it is right and proper that there should not be a division of control of the stations conducting broadcasting in this country amongst separate broadcasting organisations, as exists, for instance, in America. The technical difficulties in the way of distribution of programmes would be enormously increased if the arrangements ceased to remain in the hands of

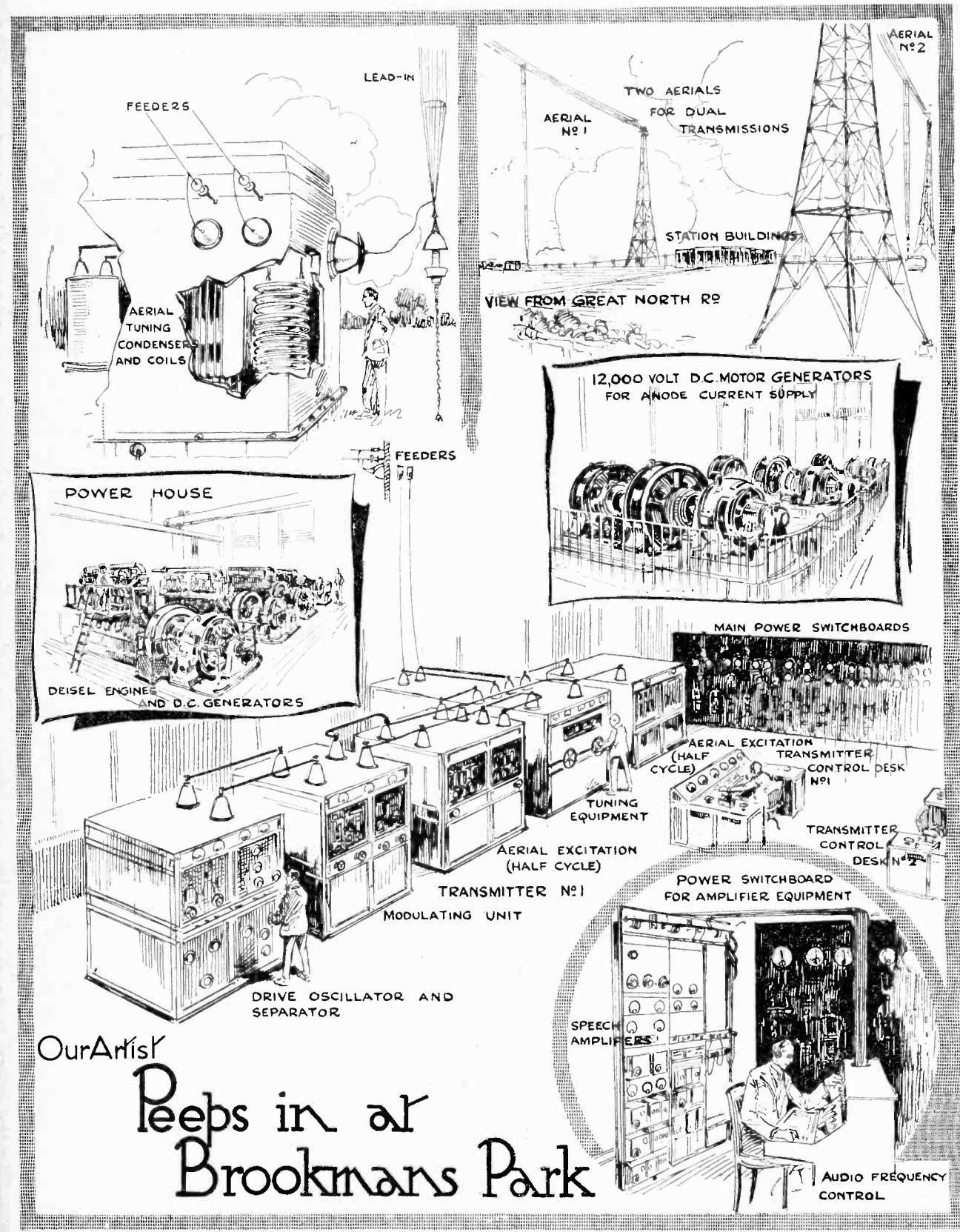
one authority. But when we come to look into the question of the compilation of the programmes themselves, it would seem to us that the desirability of a single organisation no longer exists. With two programmes throughout the country, what objections are there to two separate and distinct organisations to conduct the alternative programmes?

Two Separate Programme Boards.

If we could arrange for two separate programme organisations within the B.B.C. to be set up we should arrive at a stage where there was definite competition between the two organisations to vie with one another in a competitive spirit. But it would seem that it would be possible to extend this idea still further. By now the sum of money available for expenditure on programmes can be approximately estimated in advance, and this sum, divided into two equal parts, is the amount available for expenditure on the alternative programmes. If the Government were to invite, through the B.B.C., tenders for the supply of programme matter, is it not conceivable that offers would be forthcoming which would insure for the public a better choice than is likely to be available so long as the compilation of both programmes remains under the same control? The B.B.C. would, of course, be entitled to retain their special features of educational broadcast, and so forth, and would exercise, as they do at present, a censorship over all the matter to be broadcast.

Any such drastic change in the general arrangements could not, of course, be put into force until the conclusion of the present guaranteed term of office of the B.B.C., but there would seem to be no obstacle to the immediate separation of the compilation of the alternative programmes by constituting two independent and competitive programme organising staffs within the present B.B.C. organisation, and it would probably not be long before a healthy rivalry between the two departments would do much to insure for the public a very much better choice than the programmes could otherwise be expected to provide.

It may be argued that such an arrangement would mean an expensive duplication of staff at the B.B.C. which would not be justified by results, but as we visualise the scheme the duplication would only occur in the constitution of the Programme Boards; all the machinery of programme preparation could remain as one organisation as at present, and time would be allotted for those special types of transmissions now specially arranged by the B.B.C., and they would be common to both the alternative programmes.



Our Artist

Peeps in at
Brookmans Park

OF all the problems that arise in connection with the reception of wireless signals, there is none that is more fascinating, or that has been attacked in a greater diversity of ways, than that of the satisfactory amplification of the original high-frequency currents derived from the aerial. Its fascination arises partly from the fact that the use of effective high-frequency amplification affords the only really satisfactory means of receiving signals from a distance, and partly from the very considerable difficulties that the evolution of a really satisfactory high-frequency amplifier has presented.

In the early days of broadcasting, the coupling between the valve amplifying at high frequency and the detector was usually a simple tuned coil, employed in the tuned anode circuit of Fig. 1. So long as coils of high resistance were used, and the aerial was connected directly to the grid of the valve to provide additional damping, this arrangement gave quite appreciable amplification, so that signal strength was much better than could be obtained by connecting the detector directly to the aerial. It was soon found, however, that by employing a better coil, combined with a more satisfactory mode of coupling the aerial to it, a receiver without the high-frequency stage, but having reaction to take its place, gave equally good signals from distant stations.

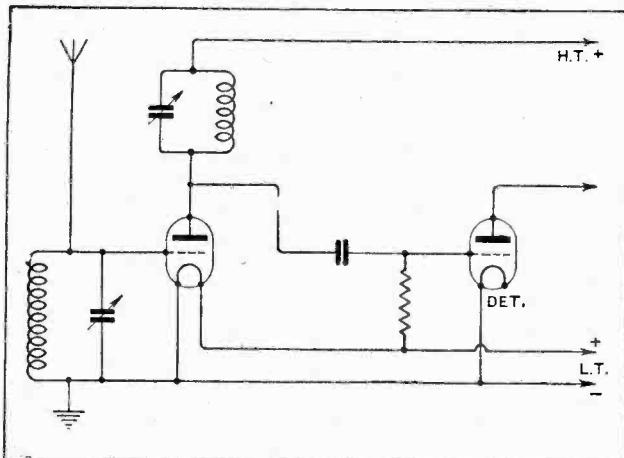


Fig. 1.—The old tuned-anode circuit. The arrangement is inherently unstable for the reasons given in the text, but with high-resistance coils and heavy aerial damping, it can be used.

The Passing of the Neutralised Triode

The Principles of the Screen-grid Valve Simply Explained.

By A. L. M. SOWERBY, M.Sc.

chiefly due to a cause which has been the main stumbling-block in the way of producing efficient high-frequency amplifiers at all stages of their development. If we consider the valve of Fig. 2, and remember that the grid is being made alternately more positive and more negative than the filament by the application of the high-frequency voltage derived from the aerial, we can follow out quite simply the process by which the unwanted oscillation is set up. At any moment when the grid is made positive by the received signals, it attracts a larger number of electrons than usual through its meshes, and passes them on to the plate, which is thereby made momentarily more negative. Since plate and grid, together with the leads running up to them through the valve, are in quite close proximity to one another, this momentary excess of electrons on the plate reacts upon the grid, repelling electrons out from it and so making it even more positive than could be accounted for by the signals alone.

When the signal voltage reverses, as it does every millionth of a second or less, and makes the grid negative, the flow of electrons from filament to plate is momentarily checked, so that the plate becomes temporarily more positive. The same thing happens again;

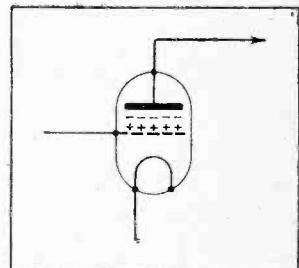


Fig. 2.—Showing how reaction through the valve takes place in the circuit of Fig. 1. When the plate is instantaneously made more negative by the signals, it induces a positive charge on the grid which tends to set up oscillation.

The Passing of the Neutralised Triode.—

the positive charge on the plate attracts more electrons into the grid from the external circuit, once again enhancing the effect of the signals. Thus at every moment the proximity of the plate increases the signal voltage on the grid, with the result that, if not checked in some way, the signal voltage rapidly builds up to the largest value that the limitations of the valve will permit, no matter how small it might have been originally. This is the condition known to everyone as oscillation, which precludes entirely the satisfactory reception of speech and music.

Systems of Neutralisation.

There are two known ways of avoiding this effect. The first, and the one which has held sway until very recently, is to provide artificially another pair of neighbouring conductors, equal in effective size to the grid and plate of the valve and their leads, and to connect one of them to the grid. The other is supplied with a voltage which is always positive when that on the plate is negative, and *vice versa*, so that electrons are attracted to the grid through this auxiliary circuit to the same extent as they are repelled by the plate. The two effects thus cancel, and the voltage on the plate has, on the whole, no reflex action on the grid.

This scheme is known as neutralisation, and the "two conductors forming the "dummy valve" are made up in the familiar form of the neutralising condenser, which is made adjustable in capacity so that it can be made to match any valve. The reverse voltage required may be produced by any one of half a dozen different circuits, of which two samples are shown in Fig. 3. These, although they look different, are practically equivalent, for both depend on the fact that if a coil is earthed at its centre and supplied with high-

frequency currents, the two opposite ends will at any moment be at equal and opposite potentials. The choice between a transformer and a circuit of the tuned anode type is a matter depending on the characteristics of the valve and the tuned circuit, and is concerned solely with the most efficient transfer of energy from the valve to the tuned coil.

Neutralised circuits built up on these or similar lines provide the only practicable method of obtaining good

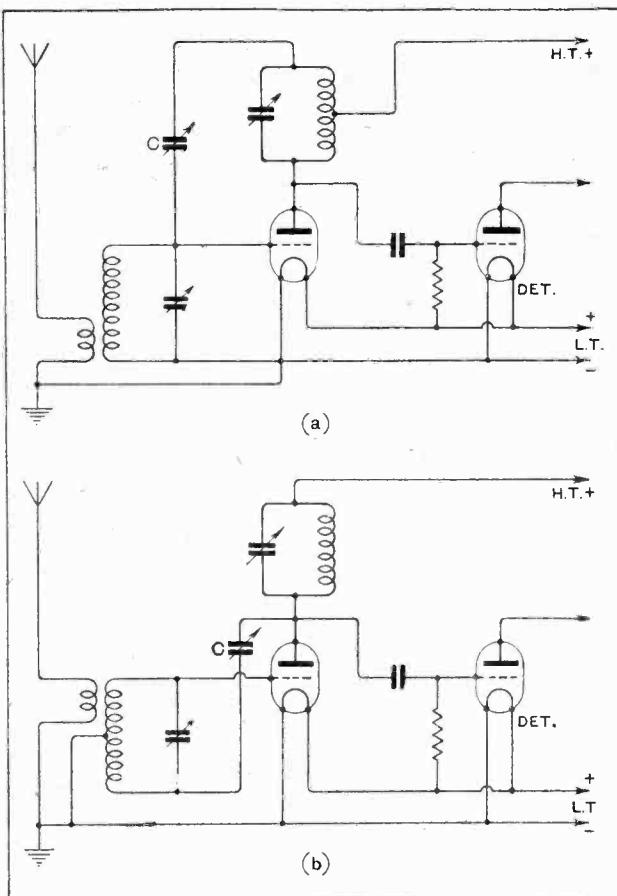
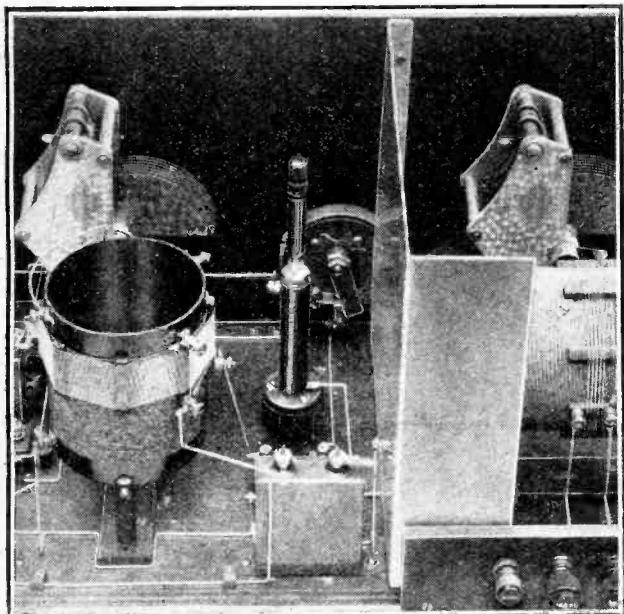


Fig. 3.—Neutralised circuits. Two modifications of Fig. 1 in which the reflex action of plate upon grid is balanced out. In (a) the voltage is reversed before being fed through C, and in (b) after passing through C.



A section of a well-known receiver in which the retro-action from plate to grid is balanced out on the lines of Fig. 3, by an auxiliary winding and a small condenser.

amplification from an ordinary valve, and so have very deservedly held the field for some years. With carefully chosen coils, an amplification of about sixty-five times in one stage can be attained, though to reach this figure involves a good deal of skill and knowledge on the part of the designer of the set, together with care and a conscientious obedience to instructions on the part of the constructor. A much less efficient stage, amplifying only some twenty times at most, has been widely regarded as highly satisfactory.

In extenuation of this modest aspiration, it must be remembered that the valve is only one of many paths by which amplified energy in the plate circuit can be fed back into the grid circuit to cause oscillation, and neutralisation can therefore only be fully effective if all these other paths are also closed. The chief of

The Passing of the Neutralised Triode.—

These is due to the coils and the wires connected to them, which can transmit energy to one another in a way not so very different from that by which signals from a transmitter are picked up by a frame aerial. The only real cure for this lies in enclosing one or both tuned circuits, together with all leads which carry high-frequency currents, in a closed metal screening box, so that they cannot indulge in unauthorised transmission and reception. The expense of this proceeding has led to the design of many receivers in which amplification is kept down to so low a figure that this complete screening is not essential to stability.

It has been stated that there are two ways of avoiding the reaction of plate upon grid that causes oscillation, but so far we have only described one method, in which the fundamental effect is left untouched, while its results are balanced out. In Fig. 4 there is shown a repetition of Fig. 2, with the addition of an extra electrode between grid and plate. If this extra electrode is left connected to nothing, the plate, at a moment when the signals have made it more positive than usual, will attract electrons to the upper side as shown in the figure at (a). Since these electrons must come from somewhere, and there is no possible source but the extra electrode itself, this results in its under side becoming positive. The grid is then made more negative in exactly the same way as in the simpler case of Fig. 2, and with exactly the same unpleasant results.

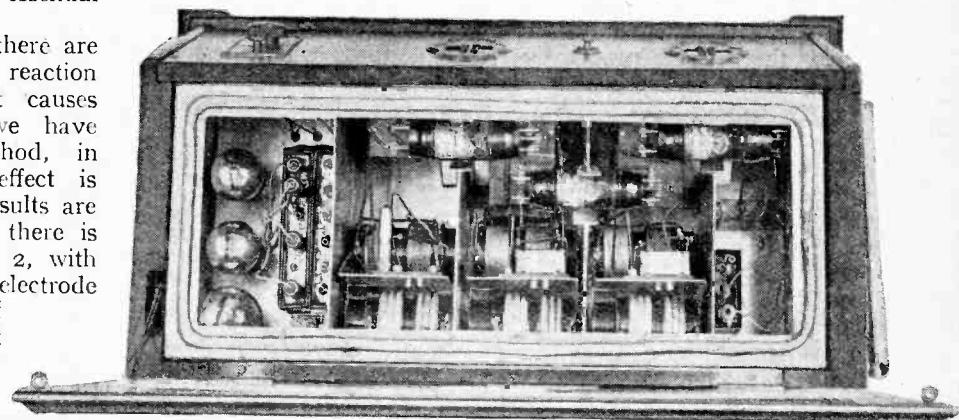
But if the extra electrode is earthed, as at (b), we find a very different state of affairs. Once again the plate, momentarily made more positive by the signals,

attracts electrons to the upper side of the extra electrode, but the electrons no longer have to come from its lower side, for the whole earth is now available as a possible source. No positive charge, therefore, appears on that side of the extra electrode which is next to the grid, and the latter is therefore completely unaffected by any momentary charge that the plate may acquire.

This is the principle upon which the screen-grid valve is built, the extra electrode being the screening grid interposed between grid and plate. It is necessary, of course, to

ensure that not only the electrodes themselves, but also the leads running to them, shall be screened from one another, which is accomplished in practice by putting the valve through a hole in a metal screen and having grid and plate leads out through opposite ends of the bulb. The screening grid, together with these extra precautions, removes almost completely the reflex action of the plate upon the grid.

Nothing has so far been said about the structure of the screening grid, but in discussing its action it was tacitly assumed that it was a sheet of metal completely cutting off the grid from the plate. While this would



A commercial receiver incorporating three screen-grid H.F. stages. Expensive, but of superlative performance, a receiver of this type is only made commercially possible by the screen-grid valve.

undoubtedly be effective in preventing the plate from influencing the grid, and so in eliminating unwanted oscillation, a valve so made would hardly be satisfactory, for electrons from the filament would not be able to reach the plate at all! It is necessary, in consequence, to make the screen in the form of a perforated sheet or a fine gauze of wire through the meshes of which electrons can pass. By this compromise the perfection of the screening is marred to some extent, and a trifling amount of energy can be fed back, though not usually enough to set up oscillation.

Effect of Screen on Valve Characteristics.

The screening grid is, in practice, not earthed directly, but through a large condenser, so that although high-frequency potentials cannot appear upon it, it can be raised to any desired d.c. potential. This arrangement offers the opportunity of utilising the screening grid for a second purpose in addition to that of preventing oscillation, for it is found that if it is connected to a tapping on the H.T. battery the characteristics of the valve are made very much better than those of an ordinary triode.

It is not difficult to see how this happens.¹ If we ignore the plate of the valve for a moment and think of the other three electrodes only, we have in effect an ordinary triode with the characteristics of a good member of its class. Variations in the H.T. voltage

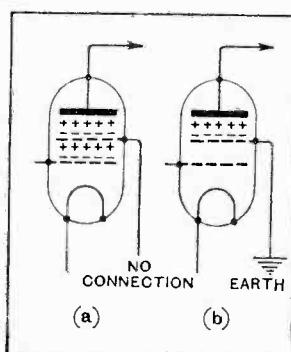


Fig. 4.—Effect of interposing a screen between plate and grid. In (a) the screen is not earthed and therefore fails to isolate plate and grid as the distribution of charges shows. In (b) no charge appears on the lower side of the earthed screen so that the grid is unaffected by charges on the plate (compare Fig. 2).

¹ For the mode of presentation here adopted, the writer is indebted to "The Shielded Four-electrode Valve," by Capt. Round.

The Passing of the Neutralised Triode.

on the screening grid, which is acting as the plate, will alter anode current in the usual way, so that the valve impedance will not be very high. Variations in grid voltage will produce a change in plate current of the magnitude normally found with triodes.

If now we put on the plate a voltage that is about double that on the screening grid, electrons previously stopping at the screening grid will be pulled through its meshes to the plate, so that a current will make its appearance in the plate circuit at the expense of that in the screening-grid circuit. Owing, however, to the screening effect of the screening grid, the plate will only be able to divert electrons to itself at the last moment, when they have practically reached the screening grid, so that changes in plate voltage will have hardly any effect on the plate current. This is merely another way of saying that the A.C. resistance of the valve is high. But—and here is the point—the grid can still control the current flowing through the valve to the same extent that it did when the plate was out of use, so that the mutual conductance of the valve is unchanged. Since mutual conductance is the ratio of

amplification factor to A.C. resistance, and the latter has been raised enormously while keeping the ratio constant, it follows that the amplification factor of the valve has also been enormously raised. The usual figure for a screen-grid valve is 200, as against the normal 40 of a high-amplification triode with a lower mutual conductance.

Thus the introduction of the screening grid, besides removing at its very source the chief cause of unwanted oscillation, has the further result of making it possible to attain greater amplification from the stage than was possible with the neutralised triode.

In the earliest screen-grid valves the screening was imperfect enough to permit oscillation to make its appearance as soon as the amplification of the stage was raised to about two-thirds of the maximum attainable from an ordinary valve neutralised; so that these valves offered no real advantage over the neutralised triode. In the latest models, however, the screening is much more nearly perfect, so that very high amplification can be reached before the tiny residual feed-back through the valve causes oscillation. Simultaneously, the characteristics have been improved, so that this high amplification can be realised quite readily in a practical receiver without any of the circuit complications associated with the neutralised triode.

The best of the 2-volt screen-grid valves can now

provide, in quite an everyday set, an amplification of 120 times in a single stage with complete stability, while if special precautions are taken to minimise losses in the tuned circuits an amplification of over 200 times can be reached before magnification, by out-running the effectiveness of the internal screening, causes the old trouble of spontaneous oscillation to recur. In any set aiming at such high amplification as this it is of

course quite necessary to isolate grid and plate circuits completely by enclosing one or both of them in a metal screening-box with a very well-fitting lid and soldered seams.

In conclusion, it is only fitting to draw attention once more to the vast strides that have been made since the original introduction of the screen-grid valve just two years ago, and to emphasise the fact that the neutralised triode, which served us so well for so long a time, and which gallantly held its own against the screen-grid valve in its early days, is now very definitely outclassed by its younger rival.

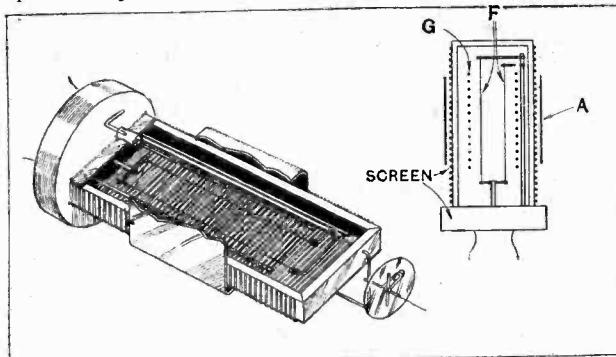


Fig. 5.—The arrangement of the electrodes inside a typical screen-grid valve. The inner or working grid G surrounds the filament F, the anode A being mounted outside the screen grid.

HOWLERS FROM DAVENTRY PROGRAMMES.

THE French versions of the Daventry programmes appearing in *L'Antenne* and other Paris papers are often funny, but have surpassed themselves in the last few weeks.

Misprints in English titles are, of course, frequent, and occasionally inspired (as, for example, the "Dank-Holiday" overture). One would have expected, however, that so well known an item as Ravel's "Ma Mère l'Oie" might have been recognised by the French translator, and not left as "Suite de Mère Goose"; or that the "Chant du Canot sur le Volga" might have got back into its normal French form; or that someone might have noticed that "Handel et la Harpe" is not a translation of "Handel and the Harpsichord." And the "third form" flavour of "Je suis toujours en amour

avec vous" comes as a surprise in a French paper!

However, these are minor delights, as is also the (quite excusable) "Handel sur la Plage." A higher level is reached with (July 24th) Tchaikovsky's "La Beauté du Sleeping"; for the benefit of those whose French is classical it should be added that a "sleeping" (fondly believed, of course, to be the English expression!) is French for "sleeping-car," so that one feels that this suite should be hooked on behind the "Pacific 231."

And finally, "Bague, Cloches, Bague," an item in the 7.30 London and Daventry concert of August 3rd. Sceptics (though no one would ever have dared to invent this!) may see *L'Antenne* of Sunday, July 28th, page 724.

TO the manufacturer of complete receivers the present-day need for extensive screening has probably been a blessing in disguise, as it has naturally inclined his mind towards the metal chassis plan of construction, of which so many successful examples will be seen at Olympia. The amateur sees the matter from an entirely different viewpoint: factory methods are obviously impossible for him, and, handy as he may be with his tools, sheet metal working is generally found to be beyond the scope of the home workshop.

Difficulties in the way of the constructor are gradually being smoothed away, but in any case he must reconcile himself to the fact that the sensitivity of his H.F. amplifier will be largely dependent on the effective isolation of each grid and plate circuit. Designers of screen-grid valves have played their part nobly by reducing internal inter-electrode capacity almost to vanishing point; it cannot be too strongly emphasised that their efforts are wasted unless those who use the valves take all possible precautions against unwanted external couplings.

There is another aspect of the screening problem apart from its application to H.F. amplification. If we are to have twin high-power stations a not inconsiderable percentage of the population of this country will find themselves so situated geographically that it will be a difficult matter to receive even one transmission without interference. In localities where the strength

of incoming signals is greatly in excess of requirements it will clearly be an extravagance (for local alternative programme reception) to use H.F. amplifying valves, and in many cases a comparatively simple arrangement of tuned cascade filters, involving no maintenance cost, will be found to fill the bill admirably. Here is another application for screening: if the apparatus is to be disposed in a reasonably small space, fairly thorough isolation of individual circuits is found to be necessary.

Reverting to the question of screened H.F. amplifiers, it would perhaps be well to devote a few words to the proper method of distributing components among the various compartments.

The skeleton circuit

diagram of two high-frequency stages followed by a detector, given in Fig. 1, should serve as a guide to generally accepted practice in this matter. It should be observed that the H.F. valves themselves are external to the boxes in conformity with the usual arrangement where a considerable stage gain is anticipated: it is important that they should be so mounted that the plate and grid connecting leads should not exceed an inch or so in length. The conventional valve shield—virtually an extension of the internal screening—is recommended, but more or less as a safety measure; if the layout is carefully planned it adds but little to the maximum amplification attainable.

Aerial Circuit Screening.

It may be pointed out that it is by no means essential in every case to enclose the components associated with the first (or input) grid circuit; indeed, where a frame aerial is used as a collector it is obviously impossible to do so. If this circuit is unscreened still greater care must be taken to prevent feed-back from the output end of the set, and in consequence, it is advised that it should receive the same attention as the remaining grid circuits when circumstances permit. A reduction in direct pick-up is sometimes urged as a further reason for screening the aerial-grid coil and condenser, although it is to be doubted if this is valid.

In laying out a screened set there is a very natural tendency to overlook H.F. currents in the detector anode circuit and to be lulled into a false sense of security because, say, an H.F. by-pass condenser is connected directly between the plate and filament. Even if considerably more elaborate precautions than this are observed it is still necessary to look on the

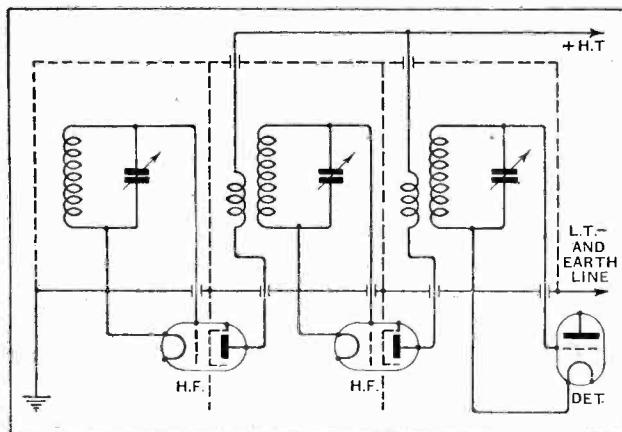
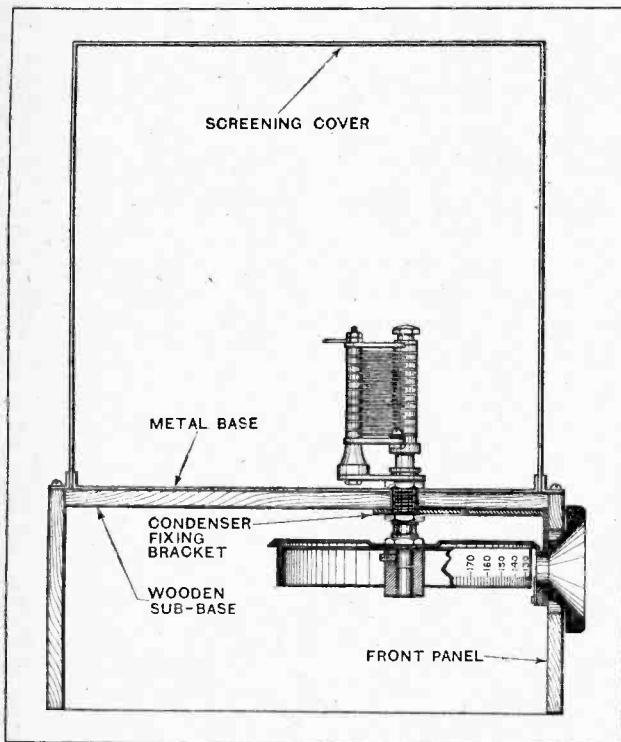


Fig. 1.—Circuit diagram of "2-H.F." receiver (omitting non-essentials) showing disposal of components in the screening compartments, which are indicated by dotted lines.

Screening Problems.—

entire anode circuit as a potential source of danger; without going to the length of recommending that it should be separately screened, it is advised that the components and wiring should be disposed so that



Method of mounting variable condenser with drum dial and friction drive in a "Wireless World" type of screening cabinet. The condenser is a new "Utility" product; the scale reading is visible through an aperture in the operating knob.

they do not "couple" with any of the other H.F. circuits.

Leakage at Joints in the Screen.

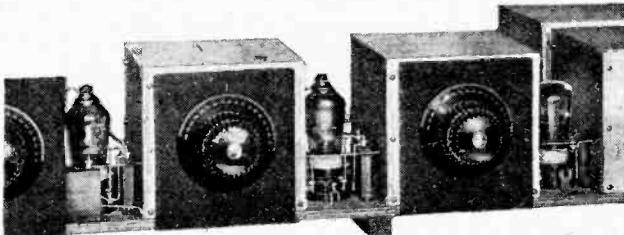
Poor joints in screening boxes are a constant source of trouble; for instance, a set of conditions may be encountered where a shielded receiver is lacking in stability when an ill-fitting metal lid is in position, but is quite free from self-oscillation when the cover is entirely removed. This suggests that inadequate screening in certain positions can be worse than no screening at all, but, to prevent the formation of a wrong impression in the reader's mind, one should go on to say that, if overall H.F. magnification of the set under discussion is increased, a state of affairs will be reached where stability is unattainable until the lid is altered so that it makes a satisfactory electrical seal.

It would hardly be exaggeration to say that the pro-

gress of amateur radio during the past year has been hampered by difficulties more or less closely associated with screening problems. It is unfair to ask the manufacturer to produce, at prices within everyone's reach, different types of container for an almost infinite variety of sets, but we can fairly hope to see a range of perhaps three standardised sizes capable of accommodating any ordinary receiver. The type of metal cabinet suggested by the *The Wireless World* Technical Staff, and used for the "Kilo-Mag Four," was found to be suitable without any alteration as to dimensions for the "Record III." The writer has the Editor's permission to say that a four-valve receiver, to be described in the near future, and from which great things are confidently expected, will be housed in an exactly similar container. All this would seem to prove definitely that there is no insuperable difficulty in the way of using the same type and size of cabinet for a diversity of sets—always provided that the original basic design is so planned that the designer's style is not unduly cramped. *The Wireless World* cabinets certainly fill this requirement, and, modified by manufacturers to meet the exigencies of commercial production, it is likely that they will provide an almost complete solution of the screening problem. Their reception up to the present time has certainly been most encouraging.

Condenser Dials.

The variable condensers of each receiver built in this type of cabinet have been operated through a thumb-controlled dial. Those wireless users who profess an objection to this method of tuning may be interested to know that this disability—from their point of view—may be overcome by fitting a condenser of the pattern having a drum dial, and driven through a friction reduction gear by a panel knob. A component on these lines is the new "Utility"; perhaps the Olympia Show



A modification of the conventional method of screening, in which H.F. valves are mounted between spaced metal boxes. This spacing increases the effectiveness of shielding, particularly if the box joints are not completely closed.

will disclose others capable of being fitted in a similar way. The provision of a 4in. dial should enable the condenser to be mounted in a cabinet with a projecting base. A condenser of this sort should be easy to fit, but, of course, it will almost always be necessary to insulate the spindle and bush from the metal base.

When you Visit
OLYMPIA

CALL AT STANDS 38 and 39, where recent
"Wireless World" sets are on view.

Broadcast Brevities

By Our Special Correspondent.

Public Demonstrations of Television.—Brookman's Park on Trial.—Pacifying Scotland.

Where to See Television.

"And how shall we receive television?" is a legitimate question in view of the fact that the first tests from a B.B.C. station are to begin on Monday next, September 30th. In order to lose no opportunity of enabling Olympia visitors to view the results, the Television Development Company are installing a demonstration receiver in a building opposite the Exhibition entrance, and the test transmissions will be received here daily from 11 to 11.30 a.m. I understand that similar equipment will also be in operation at Selfridges and possibly at another well-known store. The first transmissions will consist of cinematograph films.

The B.B.C. wish it to be clearly understood that they are in no way concerned with the demonstrations beyond supplying the necessary transmitting station. Mr. Baird, therefore, has a free hand.

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Savoy Hill's Single Thought.

It is not often that the whole staff at Savoy Hill deigns to interest itself in the technical side of the Corporation's activities. During the past week, however, the whole battalion—musicians, programme compilers, porters, announcers—have been asking one question: "How are the Brookman's Park transmissions being received?" But the engineers, delighted though they may be at having roused the sickle interest of the layman, are cautious in their replies. They realise, as "Satisfied, Wanstead," may not, that a single transmission after broadcasting hours is no test of a regional scheme.

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"London Regional" on Trial.

On the whole, the reports are gratifying, but, as I ventured to prophesy, there are some grumbles. From Pimlico comes the rebuke: "Very faint—not worth paying the licence," while Paddington, with more restraint, says: "Weaker." It will interest listeners in both these districts to know that a resident at Brookman's Park is full of praise for the Regional Scheme because a crystal set gives him excellent volume on a loud speaker. (Pimlico will be comforted by reflecting that Brookman's Park will be no place for wireless reception when London Regional No. 2 starts up.)

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The Satisfied South.

Satisfaction with the signal strength of the new station is most marked in dis-

tricts which are poorly served by the Oxford Street transmitter. In the East, Leytonstone and Mile End are both highly delighted, while the same feeling is expressed in the southern suburbs. Purley registers a definite improvement, while a correspondent in Guildford tells me that he must undoubtedly shorten his aerial to prevent overloading!

It is encouraging to hear from Welwyn, only six miles from the regional station, that while excellent quality is obtainable on a screen-grid three-valve set with frame aerial, there is little difficulty in cutting out signals when required.

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Too Many Programmes?

With the prospect opening up before us of programmes on every side to suit every mood, it is disturbing to learn from South Africa that listeners are growing dissatisfied with broadcasting because there is too much of it. It is feared that too plentiful a supply sharpens the critical faculties of the listener to a degree which becomes unpleasant from the broadcaster's point of view. One journal, which seems to have the interest of the broadcaster at

heart, urges a reduction of broadcasting hours, in the belief that the programmes would thereby be improved. Or would the result merely be the blunting of that cursed critical faculty?

Whichever way we look at it, there can be no doubt that the British regional scheme will enormously increase the burdens of the programme compilers.

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Scotland Distrusts the Regional Scheme.

We have heard so much about the centralisation of programme effort under the regional scheme that it is hardly surprising that many areas in which local patriotism is strongly marked are beginning to eye the whole scheme with suspicion. Scotland particularly is concerned lest the victory of the trouser over the kilt be repeated in the realm of broadcasting by an unwholesome preponderance of "English" talent.

To allay all feeling of this kind, the Scottish Regional Director, Mr. D. Cleghorn Thomson, will broadcast from all Scottish stations on Tuesday, October 8th, explaining that the development of Scottish endeavour in music and drama will be more fully catered for under the regional scheme than ever before. It is to be hoped that, so far as is reasonable, the same policy will be observed in other parts of the country.

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Play by "G.B.S."

Lovers of Shawian drama should note in their broadcast diary that Shaw's play, "Captain Brassbound's Conversion," is to be given from 21.0, 5XX, and other stations on October 16th.

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America's "Cathedral" Studios.

A correct studio "atmosphere" has always been regarded in America as a vital necessity to the sensitive broadcast artiste, and many ingenious architectural devices have been employed to obtain various effects such as the "Palm Court" and the "Terraced Garden." Now Dr. M. Luckiesh, described as Cleveland's "lighting wizard," has devised a system of illumination for the National Broadcasting Company of America, which can transform any studio into a cathedral or a severe Roman forum by the turn of a switch.

The effects are obtained by concealed lights and cunningly designed shadows which give the studio walls the appearance of receding or advancing according to the requirements of the producer.

FUTURE FEATURES.

London and Daventry.
SEPTEMBER 29TH.—Harvest Festival Service from St. Giles' Church, Stoke Poges.

OCTOBER 1ST.—Excerpts from Queen's Hall Promenade Concert.

OCTOBER 2ND.—First General Assembly of Re-United Church of Scotland, 8.30 p.m. from Edinburgh.

OCTOBER 4TH.—"The World We Listen In," a miniature revue by Holt Marwell.

Daventry Exp. (5GB).

SEPTEMBER 20TH.—Programme of Oratorio.
SEPTEMBER 30TH.—Queen's Hall Promenade Concert—Wagner.

OCTOBER 2ND.—Queen's Hall Promenade Concert—Brahms.

OCTOBER 4TH.—"Made in Brummagem," written by Graham Squiers, composed by George Barker, Fred Cecil, and Shirley Goodall.

Cardiff.

SEPTEMBER 30TH.—A West Country Programme.

Manchester.

SEPTEMBER 30TH.—Works by Gustav Holst.

OCTOBER 5TH.—"Calais to Dover," a farce by Gertrude S. Jennings.

Newcastle.

OCTOBER 1ST.—Local Opera.

Glasgow.

OCTOBER 1ST.—"Barbara Grows Up," a play by G. J. Hamblen.

Aberdeen.

OCTOBER 4TH.—Light Orchestral Concert.

Belfast.

OCTOBER 4TH.—A Programme of Coleridge-Taylor's Music.

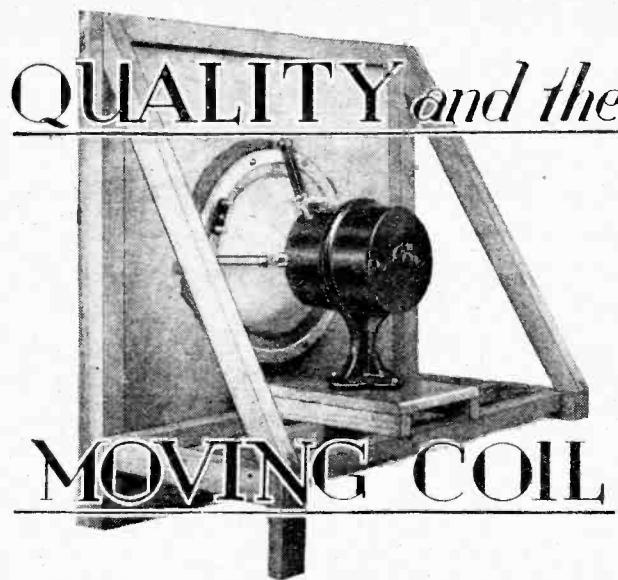
UNQUALIFIED statements are inevitable when facts are to be recorded briefly. The points set out here are, however, not merely opinions but carry with them the endorsement of practical proof with experience dating back to the time when a commercial moving-coil loud speaker was unobtainable. Some of the results have been found by trial and error, and others are the proof of prediction, yet all are in agreement with theoretical reasoning.

To construct a set suitable for giving good quality reproduction with a moving-coil loud speaker, together with long-range reception, is the ambition of many an enthusiast. Eventually he learns that range and quality do not walk hand in hand. Long-range reception demands a generous H.F. amplifier, which, in collecting the distant signal, gathers atmospherics and heterodyning, the low-frequency vibrations of the former and the high-pitched whistles of the latter being particularly well produced by the moving-coil speaker. Such background noise cannot be tolerated. Selectivity is an essential to sensitivity, and to such an extent must it be introduced that the higher audio-frequencies carried by the side

bands are lost. Experience clearly proves that both leaky grid detection and reaction must be avoided, but these aids to sensitivity are not wanted with a local station receiver.

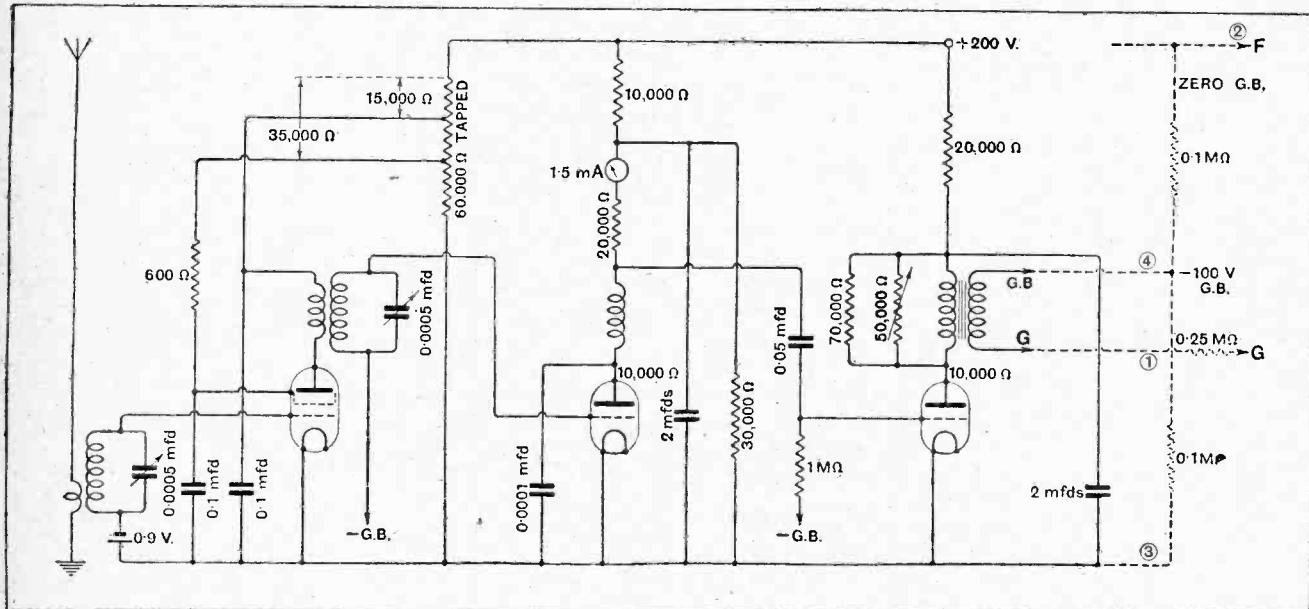
An electric light supply is essential for the adoption of the output amplifier circuits given here; indeed, we must admit that without mains it is difficult to fulfil the requirements of quality reception. A 200-volt D.C. or rectified A.C. supply is needed to operate the three-valve receiver shown. No attempt is made at high stage gain in this receiver—in fact, rather the reverse is aimed at. It is scarcely necessary in this particular instance to use a complete screening box for the H.F. stage, a screen separating the apparatus of the grid circuit from that of the anode circuit

being all that is necessary. Special low-loss coils are unnecessary, and moderately flat tuning is desirable. Input is controlled by adjusting the aerial turns, while a ratio of about 1 to 4 for the H.F. transformer will suit most valves, at the same time avoiding oscillation troubles. The use of an L.F. valve as an anode bend detector is also advisable. True, such a valve is very inefficient, but overloading of the subsequent stages must



Some Facts on Obtaining the Best Reproduction.

By F. H. HAYNES.

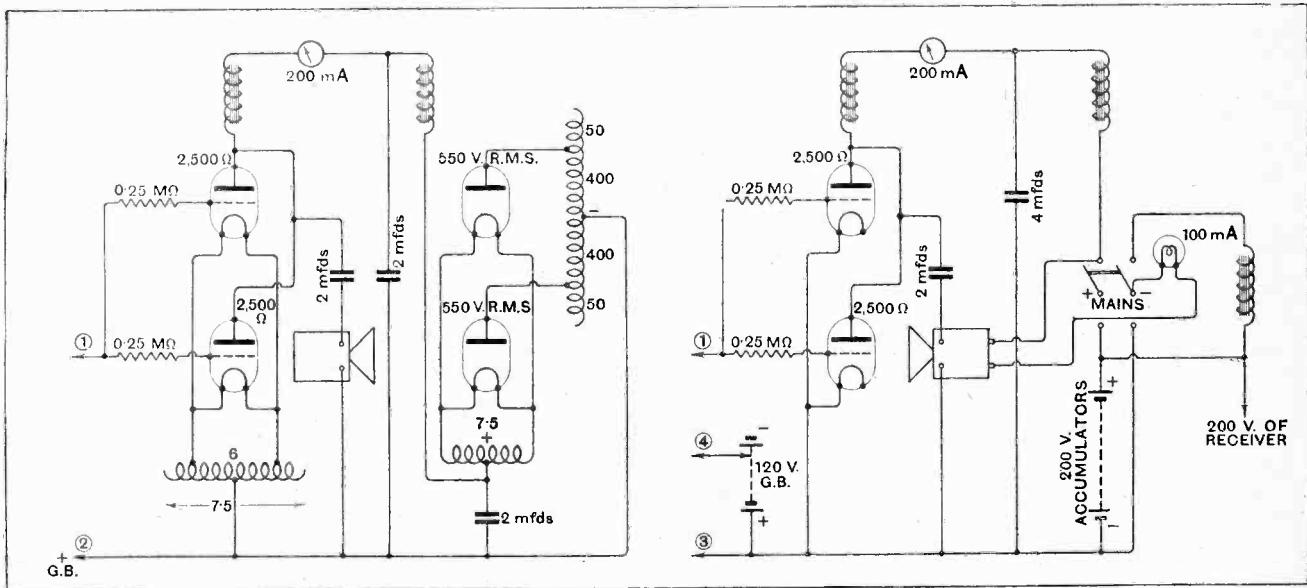


The milliammeter in the anode of the detector is a comparative measure of signal strength. Assuming a fixed figure for percentage modulation with a given valve and grid bias, overloading of the subsequent stages is avoided by assessing a maximum meter reading determined by aural test or with the aid of microammeter and milliammeter in the grid and anode circuits of the output.

Quality and the Moving Coil.—

be carefully guarded against, while our aim is to preserve the upper frequencies. Such a low impedance valve might be followed by a special transformer coupling, yet

put to suit the early valves is wasteful. To create an unnecessarily high anode voltage so as to provide, in the case of A.C. supply, a "free grid bias," impairs the life of the rectifier, and to obtain the 100 volts unloaded



Output stage for use with A.C. supply. Grid bias is derived from the amplifier feeding the earlier stages. A separate arc rectifier energises the field magnet, neither smoothing nor floating accumulator being necessary.

Output stage for use with D.C. supply. An H.T. accumulator is charged from the mains and serves the earlier valves while it becomes series connected with the supply for feeding the output stage.

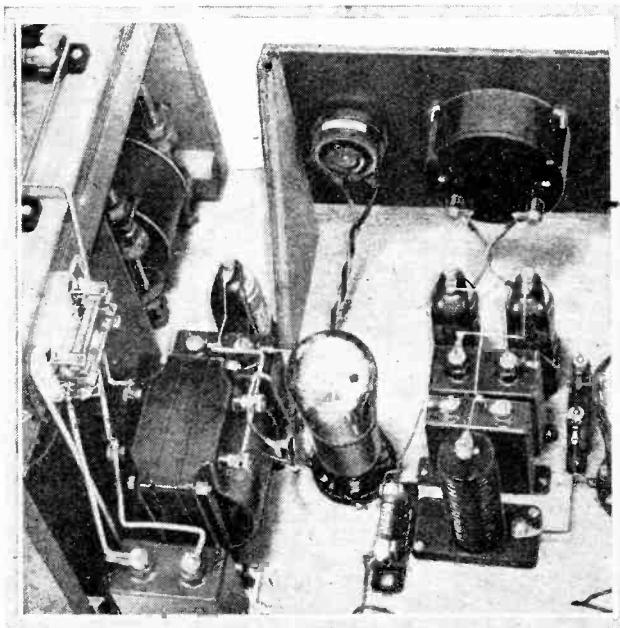
if the bass frequencies are to be preserved resistance coupling has much to recommend it. An unusually low value of anode resistance effectively avoids high-note loss. This anode bend detector valve is fed from a potentiometer as an alternative to a voltage dropping resistance because the anode current becomes several times greater on the tuning-in of the carrier.

A transformer-coupled stage follows the resistance coupled detector. The transformer, which should be selected with caution, should have quite a low ratio. Volume is initially controlled by adjusting the aerial turns, but as it is undesirable to reduce the input to the detector below certain limits, a second volume control is arranged as a by-pass shunt to the transformer primary. The output amplifier should be treated entirely apart from the preceding stages.

To break down the high anode voltage of the out-

putting potential is not an economy with A.C. A separate rectifier should be employed for the early valves, use being made of this potential as shown in the diagrams for biasing the output stage. The high voltage mains circuits for D.C. and A.C. supply will be found self-explanatory.

Choke feed output as compared with the transformer prevents the signal currents from circulating through the H.T. supply. An output transformer is often the cause of distortion, while the only advantages it can bring are those of a more compact moving coil, and hence a smaller gap, and a reduction in the effect of capacity introduced by long extension leads. Generous gap width matters little if we have mains, and consequently plenty of energising current. At the same time, the need for a centring device is avoided. Many output chokes are far too meagre, and when passing the heavy D.C. anode current



Layout of the apparatus associated with the detector, showing the post-detector volume control and the milliammeter which serves as a measure of signal strength.

Quality and the Moving Coil.—

do not maintain a sufficiently high impedance at very low frequency.

A moving coil possessing the number of turns for "maximum undistorted power output" will render the speaker too sensitive for ordinary room conditions, while valve impedance must be high compared with that of the coil to render the total circuit impedance reasonably constant with change of frequency, the varying coil impedance being swamped by that of the valve. This does not mean that we must go out of our way and use high-impedance output valves or avoid the use of valves in parallel. We need a coil that is as light as possible and, all things considered, a winding of some 700 to 800 turns, 2in. in diameter, will suit the output amplifier shown in the diagrams. The more the turns the greater the falling-off of the frequencies at the upper and lower ends of the scale. The reasons for this are obvious in that the impedance of an inductance increases with frequency, while the back voltage set up by the generous excursion of the moving coil at the low frequencies also causes a reduction in the value of the alternating current. This latter condition cannot be remedied by weakening the field, for in order to produce the same signal output we

should then require a coil of more turns, possessing increased inductance, and having, incidentally, a greater D.C. resistance and weight. It is therefore apparent that we need maximum flux density across the gap for quality reception. Thus, to weaken the field is unsatisfactory as a volume control, while it is equally unwise to shunt the moving coil with a variable resistance. A reduction in the plate circuit impedance due to shunting the coil may cause an output valve previously correctly adjusted to run into grid current and suffer from the troubles of overloading. To connect a resistance in series with the moving coil of such a high value effectively to cut down volume, while swamping the effects of the changes of coil impedance, is not recommended, and the only correct method is, of course, to reduce the grid swing applied to the output stage by the volume controls provided. A marked weakening of the bass results when volume control is attempted by the process of detuning. A rattling effect in moving-coil reception is more often due to overloading of the output valve than to a mechanical vibration in the loud speaker itself. Cotton-wool lightly packed between the centre pole and the moving coil will temporarily remedy the distortion due to poor centring without introducing buzzing or chattering noises.

WE WANT YOUR VOTE.

Every Reader Should Participate.

WE have already announced in previous issues the details of the Olympia Show Competition which *The Wireless World* is again arranging this year in connection with the Annual Radio Exhibition, and we wish to impress upon every reader individually that we want his vote to ensure that the results of the ballot are truly representative of the views of our readers as a whole.

It is really quite a simple matter to complete the entry form, which is to be found amongst the advertisement pages of this issue, and will appear also in our issue of next week. Every visitor to the Exhibition goes there, we believe, having in mind as one of the objects of his visit to form his own personal opinion as to what is the outstanding feature of the Show, and what are the best products in every class of apparatus exhibited. We ask every reader to pass on to us his choice by completing the Competition entry form.

Classification of Exhibits.

For convenience, we have divided up the exhibits into the following classes:

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

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

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

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

(5) Loud speakers of all types. (6) Valves.

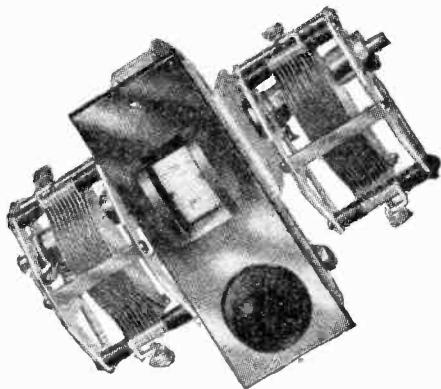
(7) Other apparatus not classified above; also component parts such as transformers, condensers, tuning coils, resistances, etc.

How to Enter.

The completed entry forms need not be sent to us until after the appearance of our issue of next week, to be dated October 2nd, but should reach us not later than Monday, October 7th. At our Stands, Nos. 38 and 39 on the ground floor of Olympia, letter-boxes are provided to receive completed entry forms from those who prefer to hand them in in this way instead of posting them.

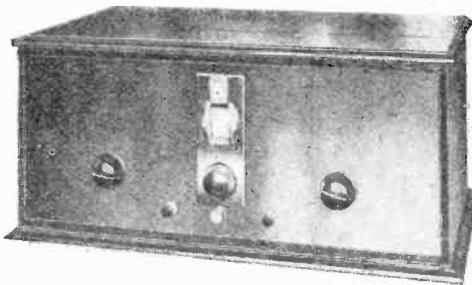
Naturally those readers who are able to visit the Olympia Exhibition will be able to arrive at their decisions in the choice of apparatus in the various sections with the least difficulty, as they will see the apparatus at first-hand for themselves, but for those who may not be able to get to Olympia the competition is still open, and the three Show Numbers of *The Wireless World* may be expected to provide ample information to guide them in their choice.

We remind our readers that *The Wireless World* is offering £100 in prizes in connection with the competition, the first prize of £50 to be awarded 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 classes, whilst in addition second, third, fourth, and fifth prizes to a total value of a further £50, in the form of vouchers for the purchase of apparatus, will be presented.



Drum Dial Gang
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Britain's Greatest Radio Receiver

Precision Instruments were essential for the Mullard Orgola Receiver — Britain's Greatest Radio Receiver — and J.B. Condensers were chosen. That wonderful smoothness of tuning; that precision accuracy; that best in manufacture; that embodiment of all that is skill and most up-to-date in Condenser design—these are the features that found J.B. Condensers a place in this Great Receiver.

Build the Mullard Orgola Receiver yourself and midst a host of other wonderful features enjoy that real efficiency of tuning made possible by J.B. Condensers.

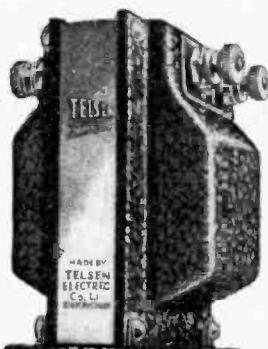
STAND 97
NATIONAL RADIO EXHIBITION
OLYMPIA
September 23rd—October 3rd, 1929

Advt. of Jackson Bros., 72, St. Thomas' Street, London, S.E.1. Telephone: Hop 1837.



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Ratios $\frac{5}{3}$ — $\frac{1}{1}$ Ratios $\frac{5}{3}$ — $\frac{1}{1}$

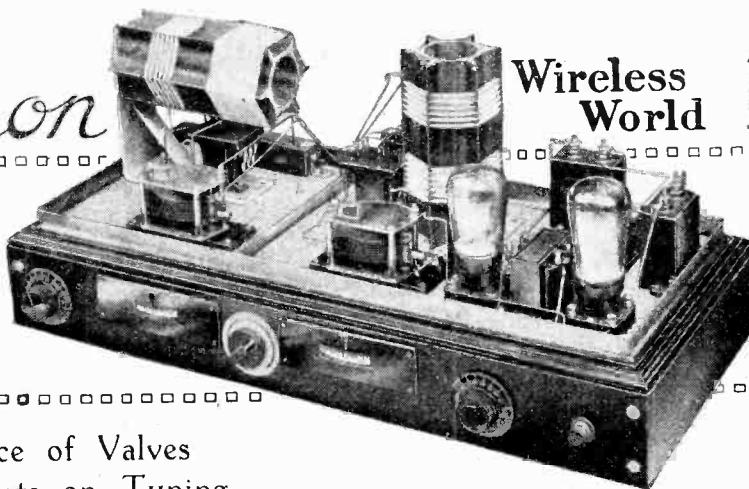
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*Notes on
the*



Wireless
World

KIT SET

Choice of Valves and Hints on Tuning.

In last week's article dealing with the circuit principle and the construction and wiring of the "Kit Set," considerations of space prevented the inclusion of dimensions relating to the special metal cabinet. The drawing given below is schematic and gives the leading dimensions only, such details as strengthening fillets in the corners of the wood base being left to the discretion of the individual. The fitting of the condenser dials will be greatly simplified if the front edge of the base is made detachable. Special attention should be devoted to the electrical seal between the bottom edges of the screening

cover and the metal tray in the base. The method suggested in the issue of this journal for July 24th will give good results, provided the clearances are small, while the type of seal evolved by Messrs. Rutherford and Co., Ltd., who made the original cabinet for this set, has given every satisfaction. The appearance of this cabinet may be judged from the accompanying photograph.

Coming now to the question of suitable valves, we will commence with a decision to concentrate on 2-volt valves only. In the first place, the idea of a 2-volt filament circuit is in keeping with kit set tradition, but this would not deter us from giving precedence to 4- or 6-volt valves if it were thought that these would give vastly better results. As a matter of fact, some of the best screen-grid valves at present available are to be found in the 2-volt series, the detector bias is capable of much finer adjustment when using a 2-volt filament circuit, and modern 2-volt power and super-power valves are capable of giving more undistorted volume than can be used in the average room. At one time the output valve was the weak link in the 2-volt range of valves, and many people still express a preference for the 6-volt series, though their requirements in the matter of volume may be quite modest. When it is mentioned that the "Kit Set" has been running a

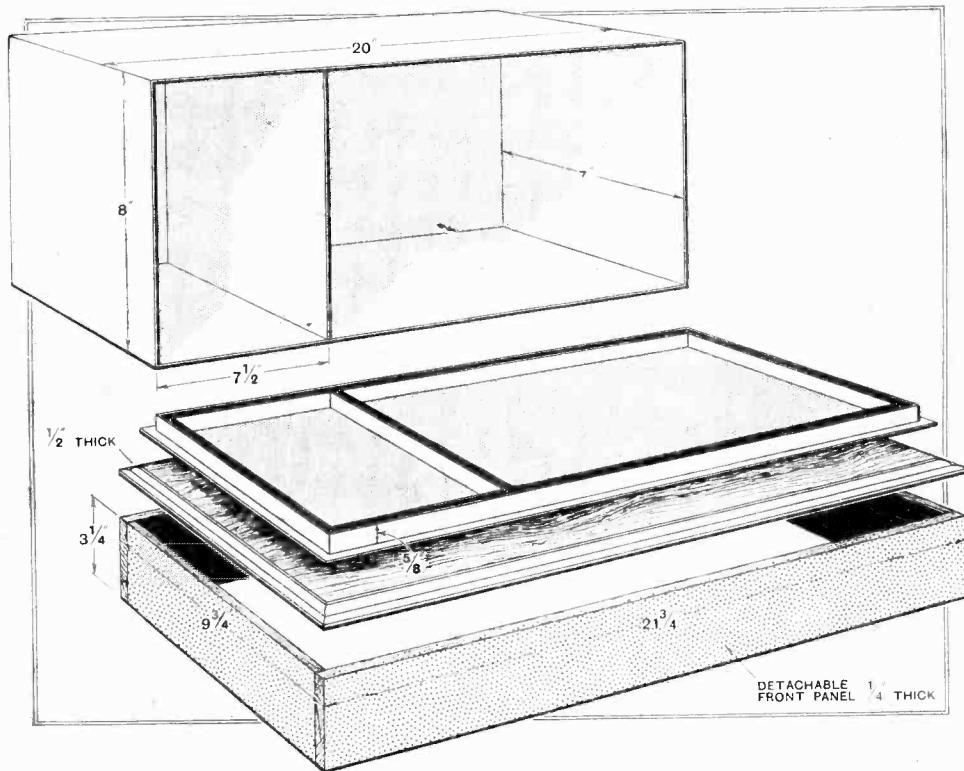


Fig. 1.—Leading dimensions of the metal cabinet. A good electrical seal between the cover and the metal tray is essential. The plinth is constructed of wood and should be provided with a detachable front panel.

Notes on The Wireless World Kit Set.—

moving-coil loud speaker to capacity during the last few days with a "240" super-power valve in the last stage, it may be taken that such a prejudice is not founded in fact.

The ratio of the H.F. transformer permits considerable latitude in the choice of a screen-grid valve, and good results will be obtained with any valve with a nominal A.C. resistance of, say, 200,000 to 250,000

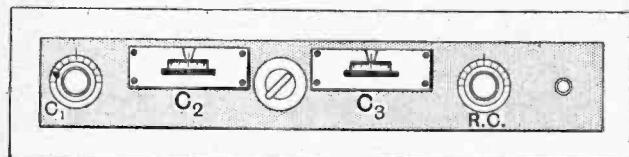


Fig. 2.—Key to the tuning controls. The on-and-off switch is on the extreme right, while the volume control rheostat is situated between the main tuning dials C_2 and C_3 .

ohms, and amplification factor 200 to 250. Generally speaking, valves with an A.C. resistance above these figures will give greater selectivity at the expense of range, while below 200,000 ohms amplification will be increased at the expense of selectivity. Most modern S.G. valves are adequately screened, but if the valve chosen does not possess a low residual plate-grid capacity, instability will result. The upper limit for this capacity may be set at 0.02 micro-mfd.

The detector should be of the familiar "H.L." type with an A.C. resistance of about 20,000 ohms and an amplification factor of 20. A wide choice is presented by the valve makers, and generally speaking, the valve with the highest mutual conductance will give best results.

The type of output valve will depend on the volume required by the individual, and the battery power at his disposal. The first two valves will account for about 6mA. of H.T. current at 120 volts. An ordinary 2-volt "power" output valve with a 0.15 or 0.2 amp. filament and an A.C. resistance of 4,000 or 5,000 ohms will account for a further 6 or 8 mA., bringing the total up to 12 or 14 mA. This combination will satisfy most people, but a "super-power" valve with a 0.4 amp. filament and A.C. resistance of 2,000-2,500 ohms will give "moving-coil" volume for a total anode current for the set of 16 to 20 mA.

It is worth while to experiment with the setting of the potentiometer tapping (R_2 in the circuit and wiring diagrams of the original article) for on this adjustment depends not only the efficiency of the detector, but also

the smoothness of reaction control. Most valves require a positive setting, but with valves in which grid current starts fairly early a terminal nearer the negative filament connection should give best results.

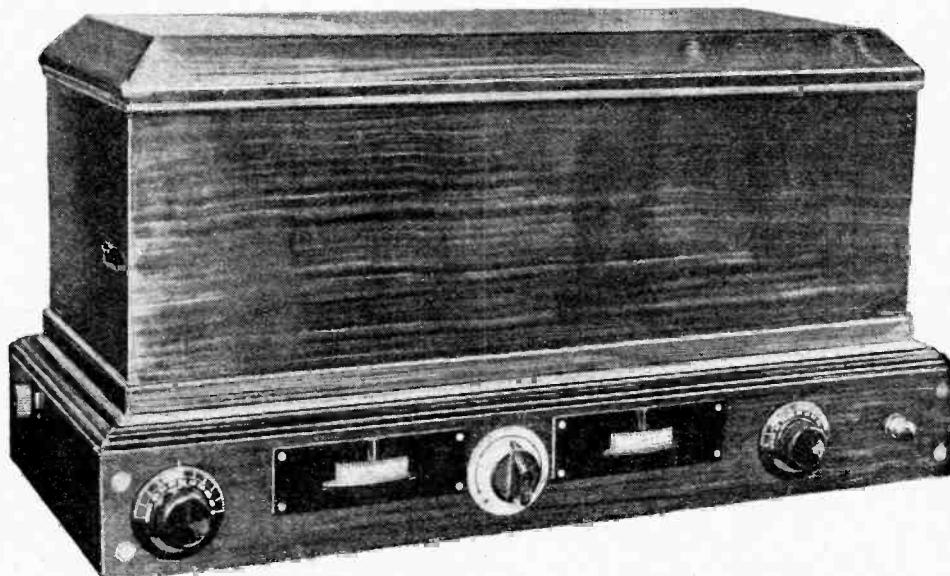
Further experiments with the tappings on the secondary circuit coils confirm the second turn on the medium-wave coil and the fifth turn on the long-wave section as the best settings for general use. They give an ample margin of selectivity for the Regional Scheme without in any way affecting the range of the set.

The prospect of four tuning controls may seem, at first sight, somewhat formidable, and, in fact, it is useless to expect results if the dials are twiddled at random. Success lies in systematic routine movements of the controls based on a proper understanding of the function of each dial.

Sequence of Tuning.

The tuning condenser C_2 (left-hand main tuning dial) is the keystone of tuning system. This condenser tunes the secondary (grid) coil of the coupled aerial circuit, and its setting is unaffected by alterations in the adjustments of other dials on the panel. It is for this reason that the scale readings of this condenser have been used in preparing the calibration chart in Fig. 3. The reader is strongly recommended to use a similar curve for his own receiver, starting with a few points for prominent stations and adding points as new stations are received.

Next in importance to condenser C_2 is the aerial tuning condenser C_1 (Fig. 2), controlled by the small dial on the extreme left of the panel. Leaving C_2 set, rotate C_1 until resonance with C_2 is indicated by a faint hiss in the



General view of the complete receiver. The metal cover is finished to resemble mahogany, and is practically indistinguishable from French polished wood.

loud speaker. Now bring C_3 , the H.F. transformer condenser controlled by the right-hand main dial, into tune with the first two circuits and increase volume of means of the reaction condenser R.C. (small subsidiary dial on right), remembering that any alteration in the reaction setting will necessitate readjustment of the H.F. trans-

Notes on The Wireless World Kit Set.—

former circuit C_3 . That, *in extenso*, is the complete process of tuning. It may sound complicated, but is essentially simple when epitomised into the following rule:—

When searching for stations divide the controls into two groups, "Aerial (C_1) and Secondary (C_2)" and "H.F. (C_3) and Reaction (R.C.)." Always keep C_1 and C_2 in step when moving across the wavelength scale and then tune in to the " $C_1 - C_2$ " group with C_3 and R.C. as with a simple reacting detector set.

The foregoing applies to the reception of distant stations. When tuning to the local station the quality can be modified to suit individual taste by varying the degree of reaction and experimenting with one or more of the circuits slightly off tune. Here the volume control rheostat can be brought into play with advantage. When using the Mazda S.G.215 valve in the first stage it was observed that the filament was somewhat "sluggish"; in other words, unless the rheostat was turned slowly the desired setting was easily overshot.

Selectivity and Range.

With regard to the range obtainable, the calibration curve speaks for itself. All these stations were logged at loud speaker strength on a 50ft. aerial at a place $1\frac{1}{2}$ miles from 2LO, where interference from electrical machinery is unusually severe. The following facts will indicate the degree of selectivity to be expected. On long waves Königswusterhausen (1,635 metres) was received clear of Daventry 5XX and Radio Paris, the two nearest stations on either side. On medium waves Frankfurt (390 metres) and Naples (332 metres) could be received without a trace of background from 2LO, while the volume from Toulouse (381 metres) was such that the slight background from 2LO did not interfere with the enjoyment of the French programme.

Knowing the adverse conditions under which these tests were carried out, we put forward this receiver with confidence for use in any part of the country.

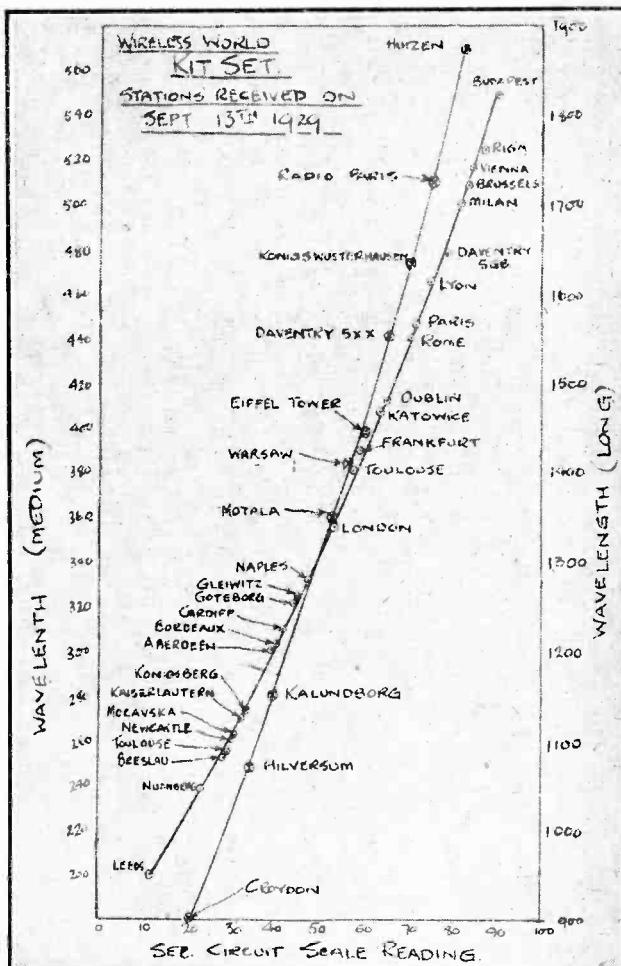


Fig. 3.—Stations received during the course of a single evening on a 50-ft. aerial $1\frac{1}{2}$ miles from 2LO, using a Mazda S.G.215 valve in the first stage.

NEGATIVE RESISTANCE.**The Explanation of a**

MANY users of receivers embodying a screen-grid valve in the high-frequency stage must have noticed that if the H.T. + connection is broken at the conclusion of a transmission, the receiver emits a feeble little squeak before subsiding into silence. It is quite a harmless phenomenon, but it may have puzzled others as much as it did the writer when he first came across it.

The cause is simple enough once it is pointed out. On breaking the H.T. + lead the anode voltage is not instantly reduced to zero, because there are large reservoir condensers which continue to supply a steadily falling voltage for a very appreciable fraction of a second. As the voltage on the anode of the screen-grid valve falls, it passes through a value a little lower than that by which the screening grid, by its separate connection to the battery, is still maintained. But it is well known that the screen-grid valve has a negative

resistance when the voltage on the anode is a little lower than that on the screening grid, which implies that any coil connected in its plate circuit will be set into oscillation at the frequency to which it happens to be tuned.

In this way the plate circuit of the valve oscillates for an instant, and, heterodyning the station to which the set is tuned, causes the squeak. The squeak is faint because all the other valves in the set have a ridiculously low anode voltage at the moment when the oscillation occurs, while still being biased to suit the full voltage. They therefore hardly amplify at all.

Normally, when we say "a valve is oscillating," we mean that there are oscillations in its grid circuit. In the present case, although it is the first valve of the set that is causing the oscillations, they are entirely restricted to its plate circuit, so that the oscillations cannot be radiated by the aerial or cause offence to other listeners.

A. L. M. S.

CURRENT TOPICS

Events of the Week in Brief Review.

"WIRELESS WORLD" AT OLYMPIA.

To avoid the rush, visit *The Wireless World* Olympia stands, Nos. 38 and 39, as early as you can. The "W.W." receivers on view include "Three Valve 'Kit' Set," "The New Kilo-Mag Four," "The Record III," and "The Foreign Listener's Four." In addition, "The Hum-Proof D.C. Eliminator" is available for inspection.

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THINK OF A NUMBER.

The Daily Mirror is offering radio equipment to the value of £200 in prizes for successful forecasts of attendances at the National Radio Exhibition.

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ALL-ELECTRIC SHOW IN PARIS.

Like the British Radio Exhibition, the Paris Salon, organised by the French Radio Manufacturers, and to be held in October, will take rank as an "all-mains" show. It is expected, writes our Paris correspondent, that all-electric sets will be the main feature.

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RADIO AT SHIPPING EXHIBITION.

Visitors to the National Radio Exhibition at Olympia will find several devices of wireless interest at the Shipping, Engineering, and Machinery Exhibition, which runs concurrently in the Main Hall, Olympia, until Saturday next, September 28th. An example of the automatic alarm receiver is on view, besides other marine wireless apparatus.

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WHY ALGIERS HETERODYNES.

Radio-Algeria has recently been accused of heterodyning 2LO. Apart from the proximity of wavelength (Algeria works on 351 metres), the trouble may be due to the fact that the new transmitter at Algeria provides an aerial power of 12 kW. The makers, who also equipped Radio-Paris, have adopted the system of modulation at low power as used by the new B.B.C. regional station.

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SETS ON APPROVAL.

Radio dealers in the United States are waking up to the fact that the "sets on approval" business requires a good deal of watchfulness. The discovery has been made that many listeners make a practice of "joy riding," securing a set for the stipulated month's trial, afterwards returning it as unsatisfactory. By patronising a sufficient number of manufacturers in this way, a listener can enjoy free broadcast reception for many months.

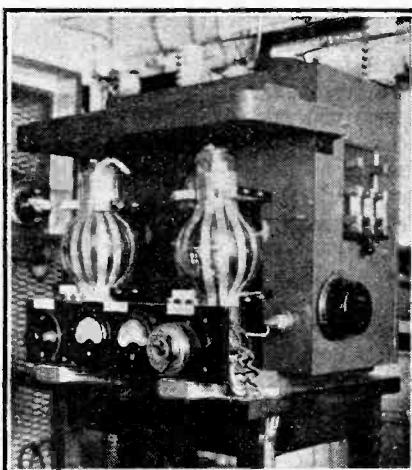
WHAT HAPPENED NEXT?

True story from New York:—
Station Director: This is WJZ.
Voice on 'Phone: What's that?
S.D.: This is WJZ.
V.O.P.: Sorry, can't get you. Would you spell it?

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120 KILOWATTER FOR PARIS?

Paris, which is already overstocked with broadcasting stations, is threatened with a new arrival in October—"Radio Banlieue"—which, it is stated, will work on 120 kilowatts "at the start"! One trembles to imagine what power will be developed when Radio Banlieue really "gets going."



"WHILE YOU WAIT." A new Marconi short-wave transmitter which can be attached to an existing set, using the same H.T. supply. It is on view at the Olympia Shipping Exhibition.

A COMPLIMENT TO WIRELESS OPERATORS.

Except on occasions of shipwreck, wireless operators receive few bouquets, but a tribute to their accuracy and efficiency is contained in the annual report of the director of the Meteorological Office. It is stated that, although all messages relating to weather are sent in figure code, and frequently during the busiest periods, in 4,476 reports, each consisting of eight groups of five figures, transmitted during the year, Atlantic operators made only two mistakes in every 1,000 figures.

A BRAZEN SPECIMEN.

A "pirate" fined at Mistley, near Ipswich, was detected through having lodged a complaint with the B.B.C. regarding local oscillation.

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ROOM FOR DEVELOPMENT.

Lithuanian Post Office returns show that there is one broadcast receiver to every 220 persons. Kovno, the capital, with a population of 195,000, contains only 1,279 wireless sets.

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THREE-YEAR WIRELESS COURSE.

A three-year course in Radio Communication is included in the syllabus of the Northampton Polytechnic, St. John Street, London, E.C.1. A free prospectus can be obtained on application.

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WIRELESS OPERATORS' UNION.

Mr. T. J. O'Donnell has been appointed general secretary of the Association of Wireless and Cable Telegraphists in succession to the late Mr. E. R. Tuck. Mr. O'Donnell has been secretary of the marine section since 1920.

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PROGRAMMES FROM ICELAND.

The Iceland Government has signed a contract with the Marconi Company for the construction of a new high-power broadcasting station at Reykjavic, the capital of the country. The transmitter will have an aerial power of 15 kW., and special circuits will be incorporated to enable it to be used for telegraphic transmission, as well as broadcasting. The work is to be completed in time for the thousand years' anniversary of the discovery of the island, to be celebrated next June.

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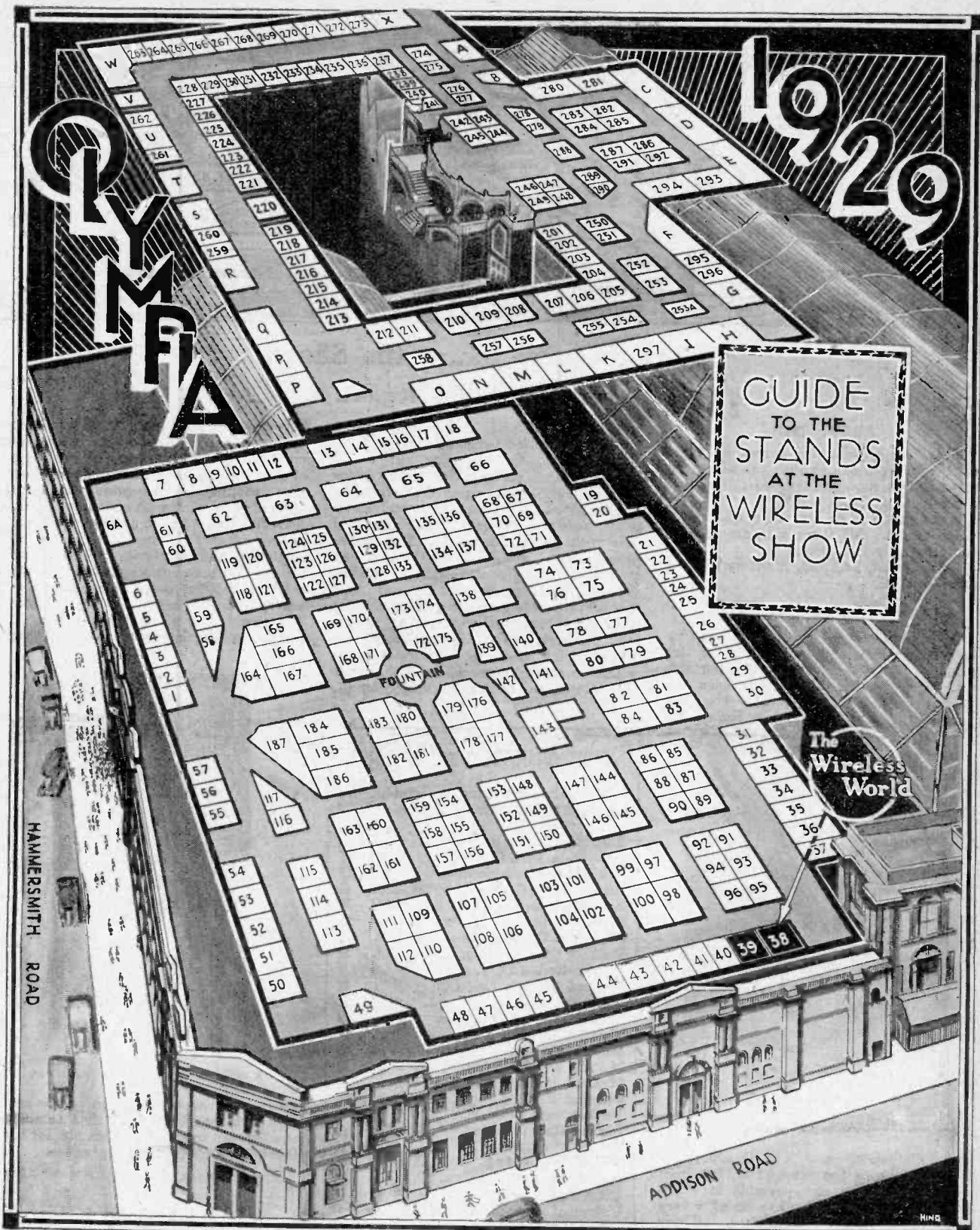
HOPE SPRINGS ETERNAL.

A rather startling contribution to the controversy regarding the question of erecting steel pylons on the South Downs for the conveyance of electric power is contained in a letter in the correspondence columns of our esteemed contemporary, *The Sussex Daily News*. The writer says: "The question is, which is better—to put up with disfigurement for a number of years for the immediate gain of cheaper electricity for rural districts, or wait until this can be obtained at a still further reduction in price, owing to the great save of the capital costs of pylons and cables, which will be obsolete as soon as wireless can be used?"

SEPTEMBER 25th, 1929.

Wireless
World

311





What to Look for at the Show.

A Stand-to-Stand Report.

ADEY. (297)

This firm are showing several portable sets, with from one to four valves, stated to embody a new principle of tuning and a new circuit arrangement.

A special feature is made of the 2-valve model. All these sets are sold at comparatively low prices.

Adey Radio, Ltd., 99, Mortimer Street, London, W.1.

AEONIC. (73)

A comprehensive programme in receivers has been embarked upon for this season. The well-known suit-case portable set, selling at 16 guineas, has been improved in detail. It contains the conventional two H.F. triodes linked by



Aeonic two-valve all-mains receiver.

aperiodic couplings. The transportable Five, selling at the same price, has been retained, while a new portable in which the selectivity is claimed to be of a very high order has been introduced. There is a single screen-grid valve, followed by a detector and two L.F. amplifiers. The

valves are carefully biased to keep the anode consumption below 10 mA.

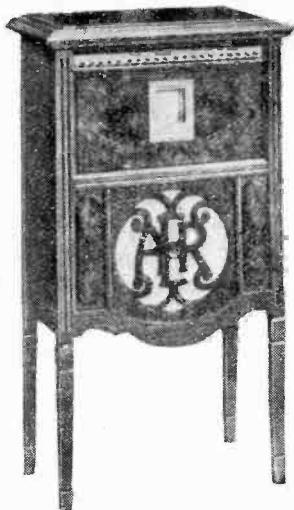
Selling at the popular price of £12 15s. an all-mains cabinet receiver for external aerial and earth is available. For those who want a more powerful output there is also a mains-driven screen-grid four with one-dial control. Two radio-gramophones are marketed; one, an ambitious equipment entirely mains-driven, including a moving coil loud speaker; the other, a more modest machine with a self-contained receiver and a cone loud speaker. The 20-push-button receiver selling at 35 guineas contains an ingenious arrangement whereby the selection of various stations is effected by the

key-operation of twenty semi-fixed mica-dielectric tuning condensers which can individually be pre-set to the wavelength of any station. In order that the selectivity should be adequate, a super-heterodyne circuit with six valves is used. As a frequency-mixer, a double-grid valve of the neutralised space charge type is employed, and band-pass filters are used instead of a tuned-grid circuit. The intermediate amplifier contains two screen-grid valves and the frequency is 650 metres. The single L.F. valve is a pentode. A novel accessory attached to each Aeonic

AUDITION ROOMS AT OLYMPIA

The following firms are conducting demonstrations in the Gallery :—

	Room
Bakers Selhurst Radio	L
Bowyer-Lowe Co., Ltd.	W
British Thomson-Houston Co., Ltd.	U
British Radio Gramophone Co., Ltd.	G
Brownie Wireless Co. of G.B., Ltd.	X
Celestion, Ltd.	C
Columbia Graphophone Co., Ltd.	N
Dubilier Condenser Co. (1925), Ltd.	R
Edison Bell, Ltd.	S
General Electric Co., Ltd.	K
Graham Amplion, Ltd.	E
Igranic Electric Co., Ltd.	Pi
Kolster-Brändes, Ltd.	H
Marconiphone Co., Ltd.	D
M.P.A. Wireless, Ltd.	O
Mullard Radio Valve Co., Ltd.	T
Ormond Engineering Co., Ltd.	M
Perfectavox, Ltd.	V
Philips Radio	A
Pye Radio, Ltd.	B
Reproduction, Ltd.	Q
Rooke Bros., Ltd.	P
Ultra Electric, Ltd.	F
Universal Gramophone & Radio Co., Ltd.	I



Aeonic 20-push-button receiver.

set is an alarm watch which can be set to ring at a pre-determined time to remind the listener to switch on his set for some favourite item in the programme.

Aeonic Radio, Ltd., 90, Regent Street, W.1.

AMPLION. (164 & 187)

Complete Amplion receivers, now shown for the first time, will naturally be

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examined with more than common interest. The following description applies primarily to the battery-fed model, although all the sets are of similar design.

The receiver is built on a cast aluminium chassis, and is enclosed in a metal cabinet finished in a dark and unobtrusive colour intended to harmonise with most schemes of furnishing. It employs a screen-grid H.F. valve and leaky grid detector with reaction, followed by resistance- and transformer-coupled note magnifiers. Automatic grid bias is provided for the first three valves, and there is elaborate H.F. filtering (screened in a separate metal box) between detector and L.F. amplifier.

Volume control is effected by varying aerial coupling by the swinging coil method, and provision is made for reducing input to a very low value if desired. The set is "decoupled" in a most thorough manner, and should be quite immune from troubles brought about by high-resistance batteries. It has two edgewise turning dials arranged side by side so that they can be operated simultaneously; both scales are calibrated in wavelengths.

Provision is made for connecting a pick-up across the first L.F. grid circuit. This device is inserted in such a way that one side of it is at earth potential, and advantage is taken of this by fitting a flexible pick-up lead having a braided metal covering.

The A.C. model is similar in essentials, but is fitted with A.C. valves in the first three stages and parallel P.625's at the output end. The built-in power unit includes a Westinghouse metal rectifier.

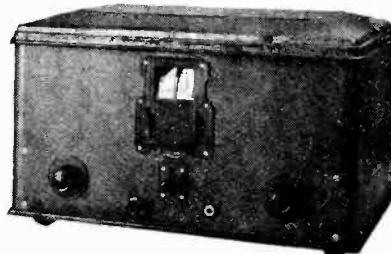
A radio-gramophone, including a similar receiver, is also produced.

control of volume may be distributed over a large part of the resistance scale.

An insensitive type of pick-up, intended for cases where considerable amplification is available, but where the device must be operated at a distance from the amplifier, is also manufactured. Its windings are of low resistance, and consequently the disturbing effect of capacity in long leads will not be evident.

Amplion receivers and loud speakers are demonstrated at 9, Macrise Road, near Olympia.

Graham Amplion, Ltd., 25 26, Savile Row, London, W.1.



The New Amplion receiver.

ATLANTA. (234)

Apart from the Atlanta screwdriver, already well known to readers, this firm are exhibiting several other devices.

The Atlanta chuck is a handy holder for such small tools as taps and reamers; it is supplied with three collets to accommodate tool shanks up to 1in. diameter. It is rotated by turning the knurled collar; the knob remains stationary in the palm of the operator's hand.

Every amateur mechanic—and even the professional—knows how difficult it is to drill a hole diametrically through round

**AUTOMATIC COIL WINDER & ELEC.
EQUIPMENT CO. (220)**

An ingenious coil-winder machine is being exhibited which will not only measure and cut the wire to a predetermined length, but also will insert insulating material between each layer during the process of winding. A great deal of interest will undoubtedly attach to this machine, which is the outcome of many years of experiment.

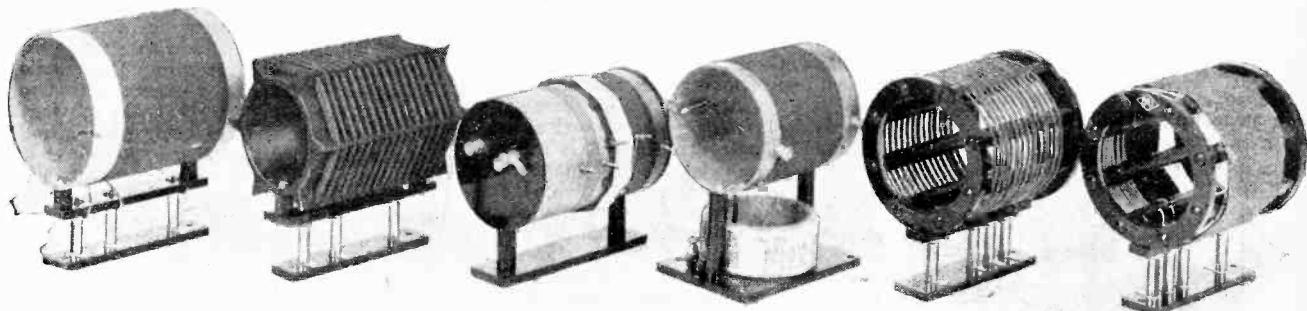
An entirely new model of a hand machine will interest the manufacturer, the retailer and the repairer alike, as the price is small compared with that of the automatic production. It will wind up to 3,000 revolutions per minute. There are other winders capable of working at 6,000 revolutions per minute. The Avometer, the well-known all-purpose meter, which will measure all ranges of volts, amps, and ohms likely to be met with in receiver technique is exploited by this company.

Another exhibit is the Slektun inductance coils which have, for this type of winding, a comparatively low high-frequency resistance.

Automatic Coil Winder and Electrical Equipment Co., Ltd., Winder House, Rochester Row, S.W.1

B. & J. (233)

The activities of this firm are almost entirely devoted to the production of tuning coils and in particular the coils that are specified and the various designs put forward for the home constructor. On a rough count there are no fewer than fifteen different types of coils, all beautifully finished so that the set builder can be assured of success in following a design by purchasing these ready-made coils. It will interest the set constructor to peruse



Specimen B. & J. coils for use in the making up of sets described in the "Wireless World."

Turning to loud speakers, we find that the Amplion "Lion" cabinet models are considerably reduced in price, and that a new "Standard Cabinet Cone" with balanced armature movement has been introduced. This model has provision for adjusting the impedance of its windings to suit different valves.

The new Amplion pick-up is supplied either as a unit or with tone arm or volume control. The latter gadget operates on the potentiometer principle, and has an extra resistance (which may be short-circuited if required), so that the

metal or ebonite rod. The Atlanta drilling jig makes the task easy. This simple device consists of a pair of steel blocks, with cross V-section grooves, held together by a pair of dowel pins. It has a guide for the drill.

A handy tool-set for the radio constructor is also produced. It comprises a soldering-iron, hammer, files, two pairs of pliers, scriber, and centre punch, all mounted by spring clips in a wooden rack, and costs 12s. 6d.

Atlanta, 1-3, Brixton Road, London, S.W.9.

a list obtainable at this stand setting out the many types of coils used in the construction of the receiving sets described in the various journals. In the majority of cases, and particularly is this true of highly efficient receivers, the performance of the set is entirely dependent upon the care which has been exercised in making the coils. Prices which appear to be reasonable are asked for the coils, and the service of supplying them removes an unavoidable weak link in the presenting of designs which are intended to entail only the assembly of components. Screens and

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screening boxes also form part of this exhibit. As a guide to price, a set of coils for the "Screened Grid Regional" receiver is 35s. For the "Foreign Listener's Four" (broadcast band) 30s., and for the "New Kilo-Mag Four" (covering both ranges) 45s.

To cater for those listeners whose sets prove insufficiently selective with the starting of the Brookmans Park transmission, the B. and J. wavetrap has been introduced. Its selective low-loss coil is Litz wound.

B. and J. Wireless Co., Athelstone Mews, Strand Green Road, London, N.4.

BAKELITE. (255)

While the many interesting mouldings to be seen at this stand illustrate the considerable advance the application of bakelite is making in the radio industry, one does not expect to find any conspicuous new developments. The new bakelite laminated sheet is of interest to every set maker as an alternative to the materials commonly used for radio panels. Apart from good appearance its principal merit is durability.

Bakelite, Ltd., 68, Victoria Street, London, S.W.1.

BEAVER. (287)

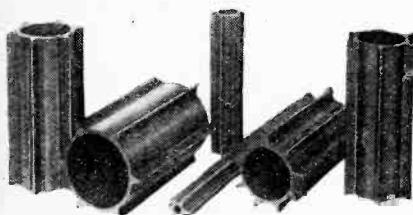
This firm factors the best known products of the more important radio manufacturers. Attention, in general, is being given to portable sets, and in particular to the Celebro five-valve receiver. This is contained within a suit-case and finished in solid hide, and sells at 12 guineas, or in blue rexine at £12. The conventional circuit containing two aperiodically coupled H.F. valves and a regenerative grid detector is employed.

A wide range of components is also to be seen on this stand.

Beaver Electrical Supply Co., 5, Great Chapel Street, W.1.

BECOL (BRITISH EBONITE CO.). (21)

The modern H.F. amplifier with single stage gains up to 500 times depends for its efficiency as much upon the design of



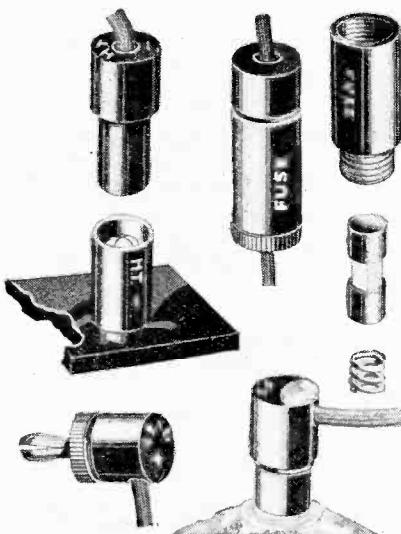
A range of Becol ribbed ebonite formers.

the tuned circuit as upon the characteristics of the valve. The desiderata for the optimum length and diameter of winding to produce an inductance of high dynamic resistance have been well understood for the last few years, but it has not been so well appreciated until lately that a winding mostly surrounded by air, such as results from the use of a ribbed ebonite former, has a very low high-frequency resistance indeed. Further-

more, the dielectric losses in good ebonite are small. For these reasons the 3in. and 4in. ribbed low-loss formers being exhibited merit attention, for with a Litz stranded conductor tuning coils can be wound to a dynamic resistance of over 300,000 ohms.

Ebonite sheet in matt, polished, and mahogany-grained finishes, is being shown together with rods, tubes and mouldings of various sizes.

British Ebonite Co., Ltd., Nightingale Road, Hanwell, W.7.



Belling Lee connectors for use in H.T. leads, grid bias and the anodes of S.G. valves.

BEETHOVEN (MONTAGUE RADIO INVENTIONS). (52-54)

Five models form the range of the Beethoven sets. There are three portables, two of four valves and one of five; one of the former having two H.F. stages, including a screened valve and a pentode output. This model is arranged so that it can be readily adapted for mains operation. A mains-operated combined radio receiver and electrically reproducing gramophone housed in an attractive pedestal cabinet is shown. It is produced, as standard, in walnut to harmonise with modern furnishing, but may be obtained in a wide variety of period designs. Radio reception is provided by an enclosed frame aerial followed by two H.F. stages, including a screened valve, a detector, and two L.F. stages. In the output are two parallel connected valves. The loud speaker is of the moving coil type. A pilot lamp on the operating panel indicates the switching on of the set. Long-range reception is claimed for the radio receiver.

Montague Radio Inventions and Development Co., Ltd., 117-119, Regent Street, London, W.1.

BELLING-LEE. (263 & 264)

The products shown cover a definite field which embraces all forms of devices

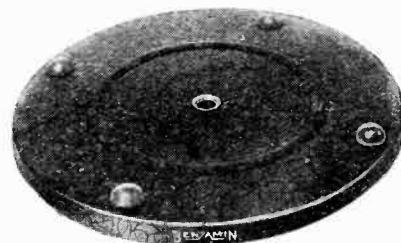
needed for making the terminal connections to wireless apparatus. Apart, therefore, from the well-known Belling-Lee bakelite shrouded terminals we find at the stand H.T. and grid battery connectors, spade terminals and connectors carrying fuses. Orthodox designs have been departed from, and careful thought has been given to ensure that the connectors meet all practical requirements. Thus we find that the battery wafer plugs are very much shorter than formerly. This modification renders them particularly suited to the conditions met with in portable set construction where very little space is available above the H.T. and grid batteries. Another refinement is the bringing out of the wire connector from the side of the insulating piece so as to avoid an acute turn which may eventually lead to breakage, while the exposed flat top conspicuously carries the marking. There are no side screws on any of the connectors, neither is there need for the use of a screwdriver when fixing the lead. Frayed ends are also avoided. An important development is the substitution of "D" section hard-drawn prongs in place of the old method of saw cutting a circular pin. By this means plugs are easily inserted, hold tight, and make reliable connection. Plugs and sockets are available for the jointing of flexible leads, and are so arranged with the aid of a sleeve that no metal parts are exposed when a connector is drawn apart. The same refinement is to be found in a range of wader plugs intended particularly for use in the construction of battery eliminators. These plugs are available for internal fuses. These are glass mounted and arranged to be readily replaceable. A new departure is to be found in spade terminals, where in place of the plain metal connector formerly used we now find a spring clip.

Of particular interest is a press-on anode connector for use with screen-grid valves. The lead carrying the anode voltage terminates on a connector that is entirely shrouded, so that the obvious danger of this H.T. carrying wire falling into contact with other apparatus is avoided. By using this connector the risk of burning out valve filaments when the L.T. switch is open and the valve is being changed is entirely obviated.

Belling and Lee, Ltd., Queensway Works, Ponders End, Middlesex.

BENJAMIN. (31)

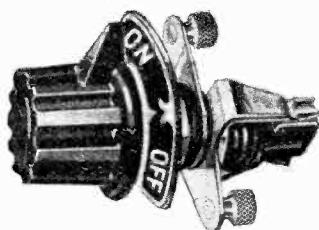
Benjamin activities largely centre around the production of bakelite valve-



Benjamin turntable. It is fitted with collapsible feet on the underside.

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holders. The range is extended to meet modern requirements and new Benjamin types are available to suit indirectly heated and pentode valves. In addition



Benjamin rotary switch.

to the present type of plunger switch there is now a new rotary type. It has a snap action and is secured with one-hole fixing which carries an "on" and "off" indicating plate.

A turntable no less than 9in. in diameter is a new introduction. A unique refinement is the fitting of collapsible feet, which, not being required for indoor use, are folded inwards beneath the turntable, yet their adoption is almost essential when elevating a receiver used out of doors. The price is 7s. 6d.

Benjamin Electric Co., Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17.

BOWYER-LOWE. (130 & 131)

A newcomer to the range of Bowyer-Lowe receivers is a five-valve transportable. It is of the vertical type with tuning panel in a recessed compartment above the loud speaker grille. Tuning is by single dial, two other controls being for wavechange and volume. The price is £16 16s.

A popular Bowyer-Lowe receiver of last season, the "Pentovox-Three" employs a screen-grid H.F. stage with a pentode output. In addition to the two reduction geared tuning controls provision is made for the use of reaction.



Bowyer-Lowe Pentovox Three.

Including valves, H.T. and grid bias batteries, and four-volt L.T. accumulator, the price is £11 13s. 6d.

The already well known receivers, the "Vox Populi 3" and the "Screened 4," are now available with mains equipment permitting of their use with either A.C. or D.C. supply.

The Bowyer-Lowe Co., Ltd., Radio Works, Letchworth, Herts.

BRITISH GENERAL MFG. CO. (107)

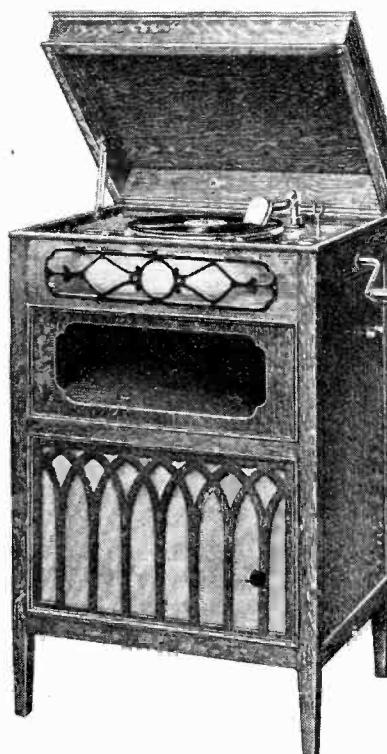
An aerial tuning unit for the 220-2,000-

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metre waveband, which proved popular during last season, has been slightly modified and reduced in price from 18s. 6d. to 14s. 6d. A three-valve battery-operated receiver for outside aerial and earth with enclosed loud speaker is a new exhibit selling at £15.

The "Midget" transformer will prove useful in portable sets and where space is a consideration. Bakelite mouldings, which form part of the exhibit, are now manufactured by this firm.

British General Mfg. Co., Ltd., Brockley Works, Brockley, S.E.4.



The "Adaptogram" pedestal cabinet.

BRITISH RADIO GRAMOPHONE CO. (156 & 157)

The British Radio Gramophone Co. are specialists in combined wireless and gramophone sets, but also produce apparatus for radio without a record turntable. An example of this is the Craigwell Model 12, which is a self-contained detector-L.F. set requiring only the addition of an external aerial and earth.

The Adaptogram is a gramophone-style cabinet fitted with a Garrard spring motor and turntable and space for any receiver of average dimensions. It is, of course, intended for those who wish to adapt their sets for gramophone work in a tidy manner, without straggling wires between set and batteries and between turntable and set.

The Craigwell Radio Gramophone, Model 37, is typical of the less-complex type of instrument of this class. Designed for an external aerial and earth and battery feed, it includes a three-valve detector-L.F. set, a built-in double

inen diaphragm loud speaker, Garrard double-spring motor, and a B.T.H. pick-up. The instrument is supplied in oak or mahogany cabinet, and is of reasonable size—22in. wide, 19in. deep, and 41in. high. A mains-driven model is available.

The more ambitious and expensive radio gramophones designed for mains supply are fitted with parallel output valves and a moving coil loud speaker to the purchaser's choice. Swinging frame aerials are built into the side doors, and, where desired, electrically driven turntables are fitted.

A 4-valve portable, with a tuned H.F. stage (screen-grid valve) has just been introduced. This new model is of particularly clean design, and includes what is, apparently, most effective screening.

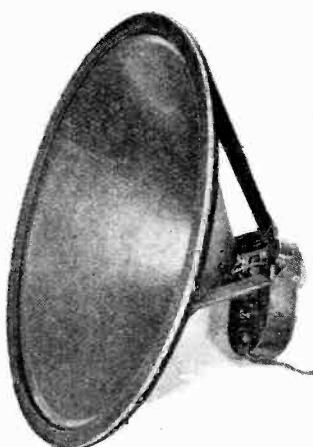
The British Radio Gramophone Co., Ltd., 77, City Road, London, E.C.1.

BROWN. (213-215)

In a demonstration of the new Vee reed-driven cone unit the output from two LS5A valves in parallel having about 50-volts grid swing failed to cause distress from overloading. From this it will be clear that the power-handling capacity of this unit is well above the average, which is explained when a study of the shape of the reed and pole pieces is made. Normally the magnetic pull on the reed varies as the square of the distance between the reed and pole-piece. In the Vee reed the angle of approach relative to the pole is not direct, but is a trigonometrical component, therefore the reed can be set nearer to the pole and yet have a bigger amplitude of movement without collapsing.

The reed is mounted on a double phosphor bronze suspension, giving ample flexibility, and the drive is direct rather than radial. The price of the unit is 25s.

The new "Duplex" loud speakers, of which there are three models, contain the Vee unit and cones of various diameters. The latter have a special construction, in that the cone is straight-sided at the centre but towards the periphery there are strengthening corrugations and the expansion is logarithmic. It is claimed



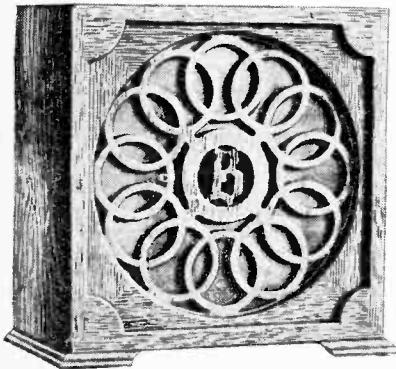
The Vee unit complete with cone chassis by S. G. Brown.

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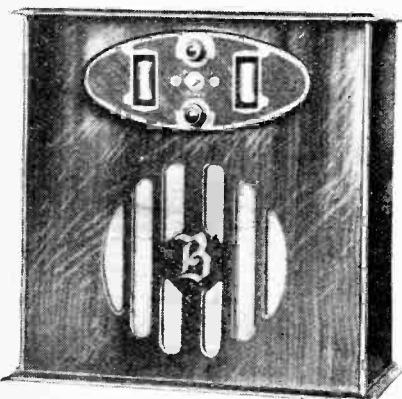
that this design assists "shock absorption." The V.10 Duplex speaker with 10in. cone in a well-finished mahogany or oak cabinet sells at £5 10s.

A kit set for battery operation, in which simplicity of construction has been made a fine art, is available at £12, including self-contained loud speaker but excluding valves and batteries. Another constructors' set, suitable for operation from A.C. mains, is priced at £20.



The new Brown Duplex loud speaker with the Vee unit.

The A.C. eliminator for this receiver is also put out in the form of parts for home construction, and is designed in accordance with accepted modern practice for the feed of the three valves, which are respectively screen-grid, regenerative leaky-grid detector, and power output. There is a type B set which has a cabinet of different shape, not containing a loud speaker, but with ample room for H.T., L.T., and grid bias batteries. The tuning inductances used conform to *The Wireless World* practice and are wound on 3in. ribbed formers, and careful attention has been paid to the optimum ratio of diameter to winding length. It would be difficult to make a mistake in assembling the Kit receiver in the five distinct stages which are explained on coloured charts. The wooden baseboard has the shape of each component marked on it, and successive stages of assembly are associated with



A self-contained Kit set by S. G. Brown. A screened-valve H.F. stage is included.

different coloured leads. There are only seventeen wires to connect, and even the necessary tools are provided.

A handsome screen, resembling a fire screen, has been specially designed for use with the Vee unit and cone chassis (the latter sells at 15s.); it stands 2ft. 7in. high, and can be purchased for 42s.

The type "A" L.F. transformer, with an inductance of 200 henrys and a uniform curve from about 40 to 5,000 cycles, is retained in the 1930 programme, whilst a new smaller model—type "B"—with an inductance of 54 henrys at 1 mA. costs 17s. 6d.

There are four moving coil loud speakers: model A, for accumulator field excitation, consuming $\frac{1}{2}$ ampere at 6 volts, is £9, including input transformer. Model B, sells at £6 17s. 6d. without transformer. Model C, wound with a field for D.C. mains, is £7 12s. 6d., and the necessary input transformer for the low-resistance speech coil is £1. The fourth model has a permanent magnet.

S. G. Brown, Ltd., Western Avenue, North Acton, W.3.

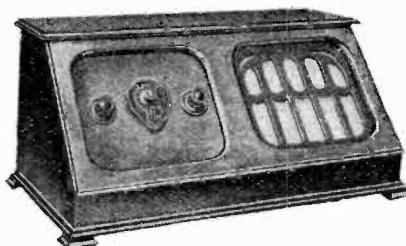
BROWN BROS. (34 & 35)

Although this stand is principally of trade interest in that a complete range of receiving sets by the leading manufacturers is to be found, considerable interest attaches to the extensive variety of accumulator charging equipments which have been brought together. One cannot do better than examine the various types of plant being shown here when interested in the problem of battery charging on a commercial basis.

Brown Bros., Ltd., Brown's Buildings, Great Eastern Street, London, E.C.2.

BROWNIE. (143)

Two new Brownie receivers are now seen for the first time. They might be



Brownie Dominion Console.

described as attractive sets, admirably suited to typical home requirements and offered at popular prices. The "Dominion III" is a detector with reaction followed by two L.F. transformer-coupled stages. The sloping front panel carries slow motion dials, and the cabinet is mahogany. A useful feature is the provision of a battery compartment. The price without valves is £5 17s. 6d. The other new model is the "Dominion Console," which includes a self-contained loud speaker as well as batteries. The price is £9 without valves.

Brownie Wireless exhibit in addition to wireless components, a crystal set, which

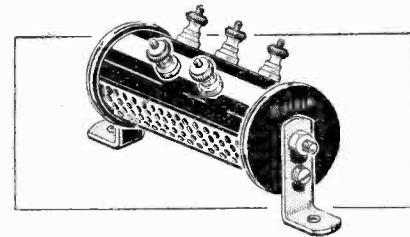
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indicates that this form of reception is by no means dead, and particularly is this observation true now that a high-power transmission is available for London listeners.

Brownie Wireless Co. of Great Britain, Ltd., Nelson Street Works, Mornington Crescent, London, N.W.1.

BULGIN & CO. (295 & 296)

A comprehensive range of components under the trade names of "Decko," "Deckorem," and "Bulgin," is being put on the market for this season.



Bulgin heavy duty tapped resistance.

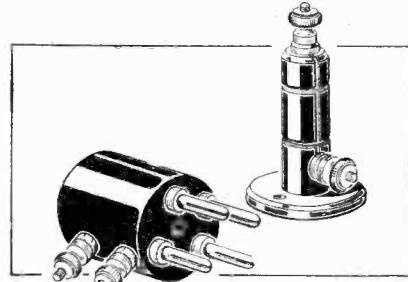
New baseboard-mounting decoupling resistances for screen-grid valves having resistances of 600, 1,000 and 2,000 ohms, should have extensive application now that stage amplifications of 100 or 200 times are the rule rather than the exception. These resistances have terminal connectors, are non-inductively wound, and sell at 1s. 6d. each.

For experimenters and dealers alike, a valve-holder in which the anode connector is broken and the ends are brought out to two terminals for the series connection of a milliammeter, should prove useful for testing plate current.

For inclusion in eliminators where plate currents up to 25 mA. have to be handled, there is a series of tapped heavy-duty wire-wound resistances, covering the range 1,000 to 100,000 ohms—the prices varying from 9s. 6d. to 12s. 6d. The small heat dissipation that may take place is assisted by the air-cooled frames, which are a standard fitting on every model.

A panel-mounting tell-tale lamp, fitted behind a ruby lens which only projects $\frac{3}{8}$ in., is a new component, as is also a frame aerial spacer for the home constructor. A set of four of these, made in bakelite and having ten slots, sells for 1s. 3d.

Among the many hundreds of com



On the left is the Bulgin valve-holder with split anode connection; on the right is a non-inductively wound 600-ohm decoupling resistance.

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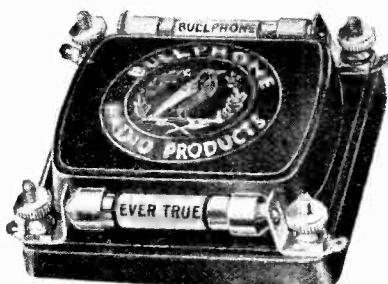
ponents listed by this company, mention may be made of the shock-proof mains connectors, flash-lamp fuses of especial value in metal oxide rectifiers, a high-frequency choke, and a heavy-duty potential divider.

A. F. Bulgin and Co., 9-11, Cursitor Street, Chancery Lane, E.C.4.

BULLPHONE. (60)

The loud speakers produced by this firm are retained, and a range of components has been introduced. These include a dual range coil wound on a ribbed bakelite former. Two aerial tapings are provided, and the unit is handy for mounting on a baseboard behind a panel. It has a push-pull switch operated by a control rod adjustable as to length. Plug-in aerial and anode coils, of which the windings seem to be well-proportioned, are also exhibited.

An R.C. unit in a neat bakelite case is also shown; the resistances and condenser have normal values, the former being of the grid leak type. Other products are L.F. transformers, fixed



Bullphone R.C. unit.

condensers, grid leaks, valve-holders and a neat binocular choke with a small external field, selling at 4s.

Bullphone, Ltd., 38, Holywell Lane, Great Eastern Street, London, E.C.1.

BURGOYNE. (50 & 51)

Three Burgoyne receivers are shown. First there is the "Pentode" model, which has for some while been the standard Burgoyne portable receiver. It is referred to as a "straight five," and comprises two triode H.F. stages, valve detector, and two L.F. stages, the output being a pentode. Faithful musical reproduction is claimed for this set, the loud speaker being a Burgoyne product. High grade components are used in its construction, and the H.T. battery consumption has been adjusted to about 7.5 mA. At a small extra cost a rejector is fitted to facilitate the cutting out of a local station. Supplied in a genuine hide case the price is £19 19s., inclusive of royalties.

Next there is a four-valve model, the Burgoyne "Screened Four" de luxe, which is seen for the first time at the exhibition. The H.F. stage is a screen-grid amplifier, followed by detector valve, resistance-coupled L.F. stage, and transformer to pentode output. The two tuning condensers are operated by edgewise drum controls, arranged to

give quick and slow motion simultaneously on both condensers. In addition to the use of reaction as a volume control a potentiometer is also provided for this purpose. The two wave ranges are obtained by a three-position switch, which includes the "off" position. The loud speaker unit is new and



The Burgoyne S.G. de Luxe.

has been specially designed for this receiver. H.T. consumption is 8.5 mA. A good feature is the inclusion of a calibration chart which, incidentally, shows the actual settings for over sixty stations. The case is of dark blue crocodile hide with nickel-plated fittings. Panels and grille are of polished walnut. The price complete is £25 4s.

Lastly, there is a mains-operated set which is indicative in its design of the trend in portable receiver construction. It is an entirely self-contained four-valve set, utilising the new indirectly heated valves.

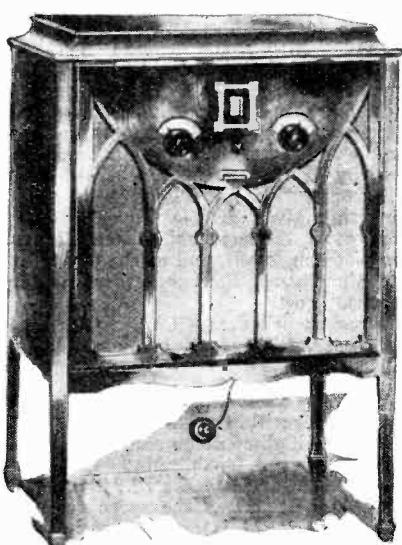
Burgoyne Wireless, Ltd., 34A, York Road, King's Cross, London, N.1.



New Burndepot screened portable.

BURNDEPT. (144-147)

The new "A.C.7" is from every aspect an interesting example of modern receiver design. Mounted in an upright pedestal cabinet with built-in loud speaker and frame aerial, it includes two screen-grid H.F. stages, anode bend detector, resistance-coupled to the first L.F. amplifier, which is followed by a pair of push-pull output valves. The seventh valve is a rectifier for H.T. supply; grid bias is provided through a Westinghouse metal rectifier. The three tuning condensers are operated by a single control, a "trimming" condenser being connected across the frame for final adjustment. The tuning dial is calibrated directly in wavelengths, and there is a four-position switch providing for reception of three wavebands (from 200 metres upwards) or for gramophone reproduction. Construction is on the metal chassis principle.



The Burndepot A.C.7.

Frame aerial and loud speaker (the latter is of the double stretched linen diaphragm type) are built up as a unit, and can be swung through about 65 degrees by rotation of a knob mounted in an external position.

Indirectly heated valves are used in the earlier stages, with directly heated triodes (P.625a) in the output sockets. A radio gramophone of similar design is manufactured.

The "Universal Screened Five," a table model receiver for general requirements, comprises a single H.F. stage, grid detection with reaction, followed by resistance- and transformer-coupled L.F. stages with push-pull output. Extreme sensitivity has been aimed at in the design, which includes such features as a three-position selectivity switch, three wave ranges, and a pre-detection volume control. An output milliammeter is fitted as an extra refinement. This set is supplied either for battery or A.C. mains feed.

The new "Screened Portable" is a

Stand-to-Stand Report.—

redesigned version of its well-known prototype. All valves are now completely enclosed, and their new arrangement is particularly economical in space. The receiver proper is built on an aluminium sheet frame, and a considerable improvement in sensitivity is claimed. As in the case of the "A.C.7," a linen diaphragm loud speaker, made under Air-Chrome licence, is included. A 118-volt H.T. battery of greater capacity than formerly is now fitted.

A new pick-up, of the type in which the needle acts as the armature, has just been produced. Minimum record wear, elimination of needle scratch, and extreme compactness are features of this new device, which can be supplied with a separate volume-control unit.

All the principal Burndep components are retained, with, in several instances, improvements in detail. For instance, the inductance of the H.F. choke is now raised to 150 millihenrys, without any increase in self-capacity.

The "Air-Chrome" loud speakers already mentioned are now sold as separate instruments. A table model, with a diaphragm measuring 14in. square, is priced at £4 4s.; there is also a large console instrument having a diaphragm of 18in. by 23in.

Demonstrations of Burndep apparatus are being given at the Olympia Motor Showrooms, Hammersmith Road (opposite Addison Road), and at the new West End showrooms, Roxburghe House, 283, Regent Street.

Burndep Wireless (1928), Ltd., Eastnor House, Blackheath, London, S.E.3.

BURTON. (36 & 37)

A leading exhibit of this firm is a new type of logarithmic condenser, of very small overall dimensions and with an exceptionally good finish. Made in capacities of 0.0003 and 0.0005 mfd., it is priced at 6s. and 6s. 3d. The space occupied behind the panel is approximately 2½in. by 2in. A cheaper and somewhat larger model, with aluminium end plates, is also shown. All Burton condensers have cone bearings, and the feature of an adjustable "hand brake" is retained.

Edgewise condensers are often more

adaptions of components intended to be operated by the conventional knob and dial; this statement cannot be applied to the new Burton semi-gang condensers, of which the parts are clearly designed for their special purpose. The assembly consists of two condensers, with the direct drive drums arranged side by side so that both can be operated simultaneously by a single finger. Fine individual control is effected through a second pair of discs mounted outside the main drums. The aperture disclosing the scales is arranged at an angle suitable for easy reading. Single condensers on the same plan are also manufactured.

An L.F. transformer is a new product of this firm. Made in ratios of 5:1 and 3:1, it is mounted in a brown bakelite case, and has a heavy stalloy core, the laminations being "stepped" so as to provide the maximum amount of core to the bobbin on which the windings are carried. The price of this component is 10s. 6d.

A complete range of anti-capacity switches with from 1 to 5 poles, has just been produced. The design follows well-tried and proved practice. Other new components are binocular and single chokes, priced respectively at 5s. 9d. and 3s. 9d.

Several complete receivers have been introduced. The "Empire Three," a detector-L.F. combination in a wooden cabinet, sells at an exceptionally low price, considering its good finish and appearance. Another set, fitted with a switch for changing-over to gramophone reproduction, embodies an H.F.-detector-L.F. three-valve circuit, with screen-grid high-frequency valve. There is also an all-mains det.-L.F. three-valve set in which indirectly heated valves are used.

C. L. and H. Burton, Progress Works, Bernard Street, Walsall.

C.A.V. (120)

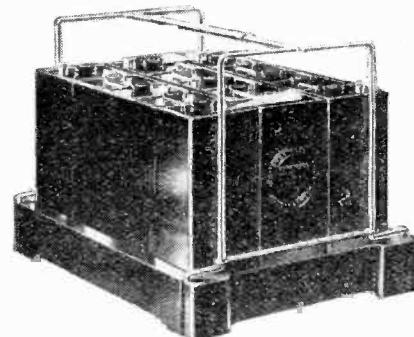
A very complete range of high- and low-tension accumulators are being exhibited. For portable sets there is being shown an "all-position" jellied-acid battery from which the egress of drops of acid is impossible. All parts of the plates are always surrounded by electrolyte, a condition which is not always pos-

sible with free acid. The jellied-acid is not a solid mass but has a cohesive honeycomb structure which ensures free distribution of the gases. Above the



New "M" type 10-volt H.T. accumulator unit (C.A.V.).

plates is placed a glass wool absorbent pad, which arrests acid spray, feeds the electrolyte with moisture, and confines the jellied-acid to the surface of the plates. To keep the pad thoroughly moist a little distilled water should be added about once a month. Size for size the ampere-hour capacity of these cells is no less than that in the free acid type, for no separate acid trap compartment is necessary.



C.A.V. high-tension battery built from "M" units.

The new "M" type H.T. accumulators in 10 volt units are so shaped as to ensure an air space when they are grouped side by side or in tiers to make up a high-voltage battery. The cell containers are moulded in an acid-proof material used in car batteries. There are three capacities available, namely, 2,500, 5,000 and 10,000 mA. hours, priced respectively at 5s., 6s. 3d., and 12s. per 10-volt unit, or 18s. 9d., 23s. 3d. and 42s. per 30-volt unit.

The A.C.M. type mass-plate cell, which has proved very popular, is being shown again at this exhibition. The cells have extra heavy plates, which are specially designed to give small discharges over long periods, and are, therefore, particularly suitable for operating low consumption valves. They can be left without attention for periods of several months without detriment. A 2-volt cell of 20 amp. hours sells at 4s. 6d. As an alternative to celluloid containers, the 2-volt



C.A.V. all-position jellied-acid cells for portable sets.

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range of Acton glass accumulators are to be recommended. The plates are not of the mass type, and are suitable for large discharges. A cell with an actual capacity of 60 ampere-hours is marketed at 15s. 6d.

There are accumulators on this stand for every wireless purpose.

C. A. Vandervell and Co., Ltd., Warble Way, Acton, W.S.

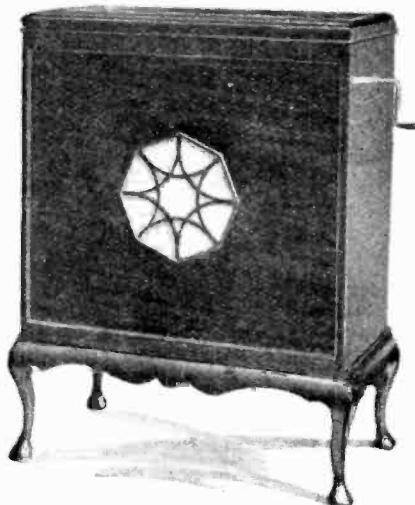
C.W.C. (COOK'S WIRELESS CO.). (223)

Receivers both of the portable and cabinet type, also a radio-gramophone, are to be seen on this stand. The C.W.C. cabinet transportable receiver has an internal pivoted frame aerial, so that for orientation the whole set does not have to be moved. Including royalty, batteries, and all accessories, this self-contained four-valve screen-grid receiver sells at £31 10s.

The C.W.C. 5-valve portable set is one of the smallest on the market—its dimensions being 15in. x 15in. x 7½in. A horizontal panel at the top ensures that undue stooping is not required when operating the set on the ground. The price complete is £22 10s.

There is a popular 5-valve portable receiver conforming to more conventional layout and dimensions at £16 10s. complete, and a range of 2-, 3-, and 4-valve cabinet receivers from £5 5s. to £16 5s. The 4-valve radio-gramophone being shown is self-contained with enclosed frame aerial and batteries, whilst the gramophone motor is spring-driven. The circuit incorporates the well-tried combination of tetrode-triode-pentode. The price is £45.

Cook's Wireless Co., Ltd., C.W.C. Works, Ipswich, Suffolk.



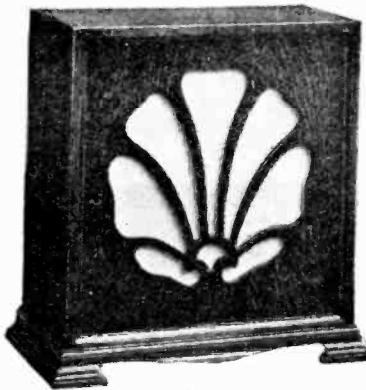
Radio gramophone with screen-grid and pentode valves manufactured by C. W. Cook's Wireless Co.

CAMCO (CARRINGTON MFG. CO.). (270 & 271)

Cabinets of every description for outside aerial sets, portable sets, and loud speakers are exhibited on this stand.

D 9

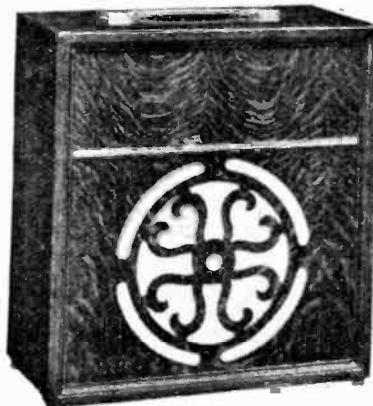
The "Master" cabinet accommodating panels measuring 21in. x 7in. or 18in. x 7in. is especially suitable for an all-mains receiver. The lid is hinged, there is a loud speaker compartment which will take most of the popular cone chassis, and there is room for an eliminator. It should be mentioned that this cabinet is suitable for the Osram and Mullard Kit sets.



A loud speaker cabinet by Camco.

The "Popular" pedestal cabinets, for panels measuring 18in. x 7in. or 21in. x 7in., are well finished and will harmonise with the furniture in a living room; they can be supplied in finished oak or mahogany. The lid is hinged, the baseboard (supplied) is 10in. deep, and there is a separate battery compartment with removable flap; the overall height is 34in., and the price £4 10s. For those desiring to construct their own portable set a special cabinet is marketed with overall dimensions of 18in. x 17in. x 7½in., accommodating a panel of 16in. x 7in., with an actual opening of 12in. x 4½in. A 12in. cone can be used concealed behind a 9in. fret backed with silk. A removable ply frame is included to carry the aerial and batteries. The price in oak is 48s.

A suit-case to house a portable set is priced at 45s. The lid contains an ornamental grille to hide the loud speaker, and a removable frame for the enclosed



Camco carrier cabinet for home-contractors.

aerial is provided. There are a number of cabinets for moving-coil loud speakers and radio-gramophones, and a new American-type cabinet for panels of 18in. x 7in. at 18s.

Carrington Mfg. Co., Ltd., Cameo Works, Sanderstead Road, Croydon.

CATESBYS. (3 & 4)

Among a number of receivers the four-valve screen-grid portable merits attention. Built into a suit-case covered with a material of blue waterproof with crocodile finish, this set is marketed at 16 guineas complete; it is extremely light, weighing only 25 lb. Particular attention has been paid to the screening of the H.F. valve, the general circuit and layout of which conforms to the latest accepted practice. The four-valve pedestal receiver containing a screen-grid H.F. valve is of the self-contained type but designed to work with an external aerial and earth. A cone speaker is built into the cabinet, and a hinged door at the back gives access to batteries and valves or to the eliminator if mains are available. The price is 14 guineas.

Catesbys, Ltd., Tottenham Court Road, W.1.



Catesbys' super screened-grid suit-case receiver.

CELESTION. (180 & 183)

The enviable reputation gained by this firm is well maintained in this season's range of loud speakers. The "C" series have been reduced in price. The following prices are current for speakers housed in oak cabinets: C.10, £3 15s.; C.12, £5 12s. 6d.; C.14, £1 11s.; C.24, £20.

The Celestion Woodroffe pick-up, well known to readers, is still being marketed at £4 4s.

The new "Z" loud speakers retain the reinforced diaphragm, but have a new electro-magnetic movement which, it is claimed, gives an even wider frequency response than former models. The two speakers of this class are designated "Z.20" and "Z.25"; the first-mentioned has a resistance of 750 ohms, the size of the cabinet is 19½in. x 18½in. x 8½in., and the price in oak £7 15s. The more ambitious model has the same resistance, but

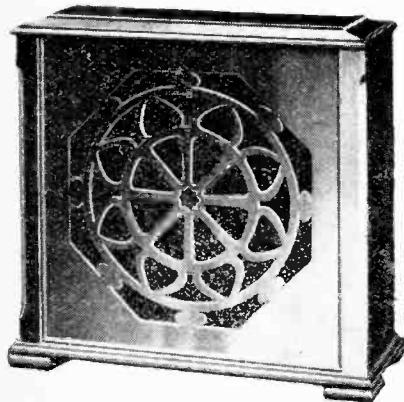
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measures 24in. x 24in. x 14in., and is priced at £15.

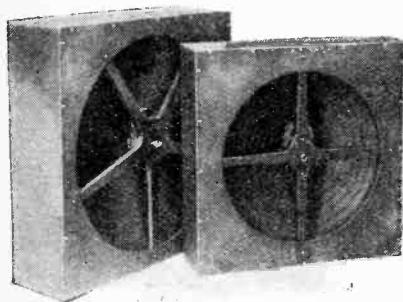
A new "Celestroda" moving coil speaker has been introduced for this season. Its acoustic output is adequate for talking film work, but with a modest input a highly satisfactory performance can



The new Celestion Z.20 loud speaker.

be had for home use. Housed in an oak cabinet with a field wound for a 6-volt D.C. supply and a speech coil connected to a transformer and filter, there is a model at £24.

For A.C. mains there is a speaker complete with mains transformer, rectifier, speech transformer, and filter for £25 10s., whilst for D.C. mains the price is £24 12s. 6d. The speech coil in each case is centred by three flexible metal strips,



Celestion shell case speakers for home constructors.

which allow axial, but no lateral movement. Home constructors who require speakers to fit into existing cabinets can now obtain shell case speakers fitted into plain stained boxes. The Z.10b model, with a 10in. diaphragm, costs £3 5s., while a variety with a 14in. diaphragm (Z.14b) costs £5 17s. 6d. This type has front adjustment, and the models designated C.10, C.12, C.14, "Shell," have back adjustment.

Celestion, Ltd., London Road, Kingston-on-Thames.

CITY & GENERAL RADIO CO. (256)

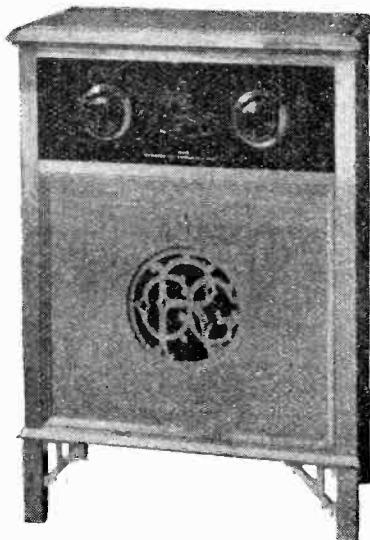
One of the most ambitious pieces of apparatus produced by this firm is an all-electric Cinema Amplifier. This is an electric gramophone, fitted with two turn-

tables and fading device. The turntables are electrically driven.

An all-mains radio gramophone is also manufactured, both in A.C. and D.C. models. This instrument is also fitted with an electric motor.

Among other sets there is a three valve H.F.-det.-L.F. mains set, and a receiver on "kit set" lines, stated to include all the best features of the most popular receivers, which sells at 9 guineas, complete with valves and royalty. Components of the highest grade are used.

An attractive pedestal cabinet, with space for a loud speaker and batteries, and priced at £2 10s., is also exhibited. It should be suitable for accommodating any conventional three-valve set of average dimensions.



City pedestal cabinet.

This firm are retail agents for wireless apparatus of every kind.

City and General Radio Co., Ltd., 46, Farring Street, London, E.C.4.

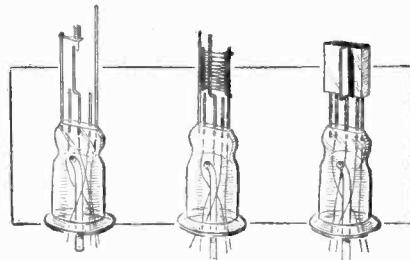


City Super Three.

CLEARTRON. (22)

Thoriated filaments with a fairly high current consumption have been replaced throughout by the more modern and economical coated filament in all types of valves produced by this firm, with the result that the great majority consume only 0.1 amp. Exceptions are the super-power varieties, but in no case does rated filament current exceed 0.25 amp. The construction and method of assembly of the electrodes have similarly undergone modification and all the valves are enclosed in pipeless bulbs. Leading-out wires from the electrodes are connected to the pins without soldering.

The 610 L.F. should be a particularly useful valve, with an impedance of 8,000 ohms and an amplification factor of 14—characteristics that should make it suitable even for the difficult task of bottom



Electrode assembly of new Cleartron valves.

bend rectification preceding transformer coupling. This valve has counterparts in the two- and four-volt ranges, although, as is natural, their "figures of merit" show a slight falling off. The 210 H.F., with a two-volt filament and impedance and voltage factor of, respectively, 20,000 ohms and 18, would appear to be a useful valve for grid circuit detection or neutralised H.F. amplification. Power and super-power valves are available in all filament ratings at the price of 6s. 6d.; the ordinary types cost 5s.

Cleartron (1927), Ltd., 21, Cumberland Street, Birmingham.

CLIMAX. (91 & 92)

D.C. and A.C. battery eliminators of entirely new design are the principal items of interest among this season's



Climax A.C. mains unit.

Climax products. Constant output is obtained on the intermediate voltages by means of a potential divider, which is an entirely satisfactory method when combined with resistances to prevent inter-stage coupling. H.F. and L.F. chokes, wire-wound resistances, and potential dividers are the principal Climax components.

Climax Radio Electric, Ltd., Haverstock Works, Parkhill Road, Hampstead, London, N.W.3.

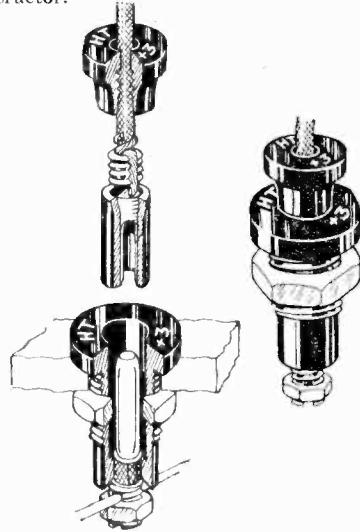
CLIX (LECTROLINX). (261)

Under the name "Clix" we find at this stand every variety of connector, many types having been specially designed to suit exacting requirements.

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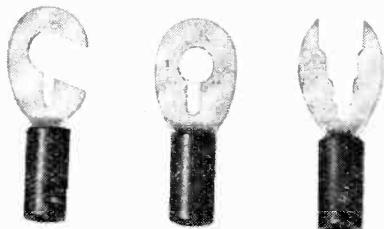
Of particular interest at the present time, by way of its suitability for mains-operated sets, is the new "All-in" plug and socket. Its principal merits include the complete insulation of all conducting parts, so that it can, in fact, be mounted in a metal panel. Both panel and connector portions carry indicating markings. Its flexible lead is easily terminated, and the plug and socket connector are of a reliable type. No metal parts are exposed when the plug is withdrawn. A wide variety of spade and plug connectors to be found at this stand are of interest to the set user as well as the set constructor.



Clix sockets in which no metal parts are exposed.

A new product is a low-loss valve holder in which the spring connections are mounted round a hollow bakelite shell. An interesting spring-jawed connector is used which will make reliable contact in spite of variation in valve pin spacing. Each of the four connectors is a single piece right to the point of connecting the lead.

Lectroline, Ltd., 253, Vauxhall Bridge Road, London, S.W.1.

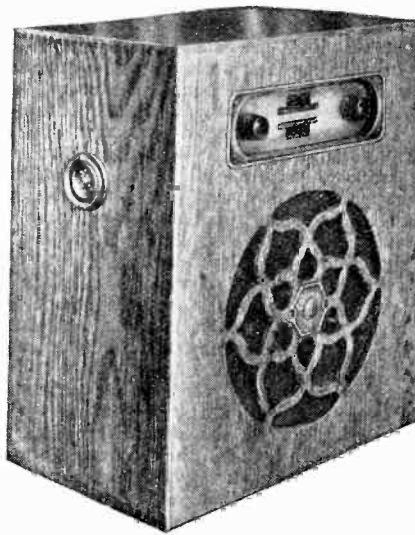


Specimen Clix battery connectors. (Lectroline.)

COLUMBIA. (94 & 96)

The radio products of this well-known gramophone company are entirely new, and the designs adopted clearly indicate the trend in modern commercial practice. Both as to circuit principle and external

finish the two models shown depart in many details from the majority of sets. For instance, the Columbia Radio Table



Columbia table model type, 304.

Model No. 304 incorporates three screen-grid stages, and by this means adequate selectivity is combined with a high degree of amplification. The problems of distortion by side-band cut-off can, of course, receive careful consideration when designing a selective three H.F. stage amplifier. Following such generous amplification, it is possible to fully load an anode bend detector even with distant station transmissions. Resistance coupling is adopted between detector and output valve. It should be mentioned that this entirely self-contained receiver is supplied for either D.C. or A.C. mains operation, so that the super-power output valve can be readily supplied with the high anode voltage of 200. The set is designed for use with an elevated aerial, but it is obvious that with such a high degree of H.F. amplification and the consequent extreme sensitivity obtained that good reception will be obtained without the aid of an aerial. For indoor use a wire 10ft. to 20ft. in length is suggested. Tuning is virtually by single knob control, though a fine adjustment is provided for critically adjusting the set to bring up a weak transmission. The wavelength ranges covered are 230-550 metres and 1,000-2,000 metres. An important feature is the calibration of the tuning drum in actual wavelengths, and provision is made for marking the settings of stations received. The A.C. model makes use of the Westinghouse rectifier. In either mahogany or walnut finish this self-contained set is priced at £33.

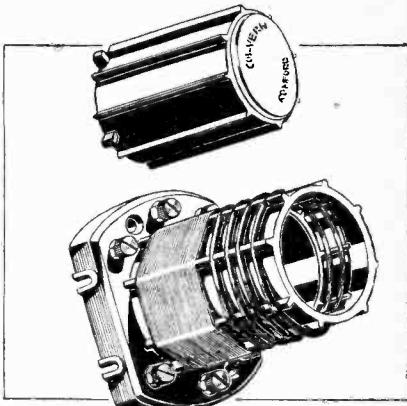
Included in the range of new Columbia sets is a five-valve portable. An important feature of this receiver is the readiness with which it can be adapted for mains operation. No alteration to the set is necessary, the batteries being left in position in the receiver. The same valves are used for both battery or mains drive, whether D.C. or A.C. Five triode

valves are used, arranged as two H.F. and two L.F. stages. Separate frame aerials are employed for long- and short-wave bands. Tuning is by horizontal thumb-operated controls. Reaction is only associated with the first valve, and therefore has the effect of sharpening the tuning without affecting the aperiodic circuits which follow. Leaky grid detection is adopted owing to its great sensitivity to a weak signal, while the L.F. stages are transformer coupled. A generous power valve is used for the output. It is stated that the loud speaker has been specially designed to suit the conditions of the output circuit. The valve platform is strip connected, thus largely obviating the use of soldered connections, which experience has shown to often be the cause of failure in portable sets. In polished oak cabinet with all accessories and turntable the price is £17 17s. D.C. and A.C. battery power units for use with this set are available at £10 10s.

Columbia Graphophone Co., Ltd., 92, Clerkenwell Road, London, E.C.1.

COLVERN. (99)

"Colvern Coils for Every Modern Radio Circuit," is a claim that is well substantiated by the wide variety of tuning inductances exhibited at this stand. Set constructors for the past three or four years have utilised Colvern interchangeable formers in the making up of coils to suit their special requirements, and as a result there are so many varieties that it is impossible to enumerate them here. The basis of all Colvern coils is a light and well finished bakelite former, ribbed in the case of broadcast band coils and slotted to accommodate the large number of turns required for long-wave tuning.



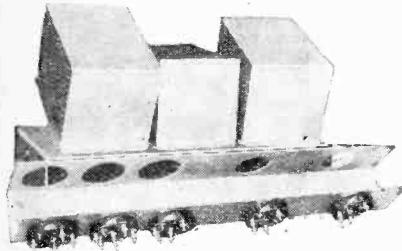
The new Colvern two-range coil. It can be fitted with either a rotatable reaction coupling or a fixed internal primary winding.

Mention need only be made here of the new products. The home constructor will find a new form of tuning coil, by the use of which set construction becomes much simplified. On a single compact former are both long- and short-wave windings, the long-wave coil being section wound and arranged at a suitable distance from the broadcast band coil so that it may be short-circuited. While

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like their predecessors these coils may carry a primary or reaction winding, it is to be noted that a rotor has now been introduced within the coil former to permit of a variable coupling. Such an arrangement possesses many advantages.



Colvern screening equipment.

Used as a variable aerial coupling a control of selectivity is readily provided, and in this respect this new rotor carrying coil is particularly suited to the requirements of London listeners, who may now need an adjustment to regulate selectivity. Another application is that of variable reaction coupling, and no longer is it necessary, as with a fixed reaction winding to experimentally adjust the reaction turns in order to produce a smooth reaction control. The rotor is a thin bakelite former, ribbed and slotted, and is carried between a pair of spring contacts. Provision is made for adjusting the position of the coil within the former so that it may couple to the best advantage with the long- and short-wave circuits. This new coil and rotor will find many applications in radio receiver design and sells at 8s. 6d. Another component of particular interest is a dual-range H.F. transformer, specially suited as an H.F. intervalve coupling for the screened valve. It embodies an inset to the standard former so that the primary winding is tightly coupled to the secondary. The price is 12s. 6d.

Colvern receiving sets are displayed for the first time, and herein is the evidence of an extension of activities from component to set manufacture built upon a foundation of a competitive interest in amateur set construction. Consequently, many refinements are to be found in the sets. The "Sirius Alpha" is a four-valve mains-operated receiver

embodying two screen-grid H.F. stages, indirectly heated detector, followed by power-pentode output. The eliminator is incorporated and makes use of a valve rectifier with full-wave rectification. Assembly is carried out on an all-metal chassis and the stages are completely screened by being totally and separately enclosed in metal boxes. In order that adequate power output can be obtained without overloading a potential of 300 volts is adopted. Volume control is associated with the aerial circuit, so that in cutting down the volume overloading of all valves throughout the receiver is at the same time avoided. As a strong signal is usually an interfering one, the volume control is so arranged that as it is brought into operation the selectivity is improved. This set is one-dial operated, the several tuned circuits being ganged by means of horizontal dials arranged beneath the tuning compartments. It is interesting to note the thoroughness of the screening, even to that of separating the various valves.

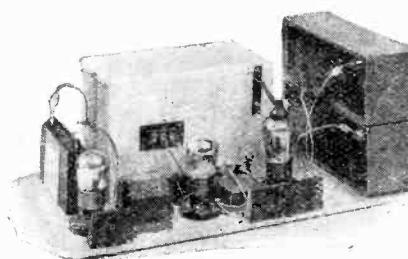
Special screening compartments that have been developed in the construction of the "Sirius" sets are also shown separately. These have been slightly modified to render them suitable for the requirements of the home constructor.

Colvern, Ltd., Mawneys Road, Romford, Essex.

COSSOR. (78, 138, 173, & 174)

The vague description "easy-to-build" is capable of latitude in its interpretation. This observation, however, can be no more truly applied than it is to the new Cossor Melody Maker. Experience is not required in the assembling of components, but it is in the wiring up of a receiver that not only is much work involved, but in addition to the danger of a faulty connection the actual arrangement of the wiring may seriously impair the performance. Particularly is this comment true as regards H.F. equipment, and it is for this reason that an entirely new method of set construction is to be found in this season's Cossor set. Here the entire H.F. equipment is built as a unit, and thus the difficult wiring associated with a tuned aerial and H.F. intervalve coupling is avoided. The tuning condensers are gauged so as to give true one-dial control. This H.F. unit is of convenient

and compact dimensions, and it is to be noted that the screening is rendered particularly effective by tightly bonding the joints with rivets, while complete screening is provided between the tuned aerial and H.F. circuits. Every detail appears to have been carefully planned, the number of components having been reduced to only ten, which when assembled on the oak-faced ply baseboard are connected together with twenty wires. There are no soldered connections. The simple layout adopted produces a chassis form of construction so that the entire equipment may be placed into an attractive metal cabinet on the front of which is an escutcheon plate exposing the three controls and the tuning scale. A point of detail, but one of importance when good finish is the aim, is the entire avoidance of exposed screw-heads. Even the grub screws on the controls are not to be seen. Another detail is the avoidance of terminals, while unsightly battery leads are avoided by giving space to the H.T. battery within the metal cabinet. All components have been specially constructed even to the plug connectors. The price of the complete kit including the latest type Cossor valves together with the handsome cabinet finished in blue lacquer and with oxidised silver escutcheon is £8 15s. An A.C. mains model built on similar lines is also available, and costs £15.



1930 Cossor Melody Maker. The H.F. and tuning components are supplied as an assembled unit.

A complete two-valve all-mains set is also shown. It is specially suited to the conditions which will exist when the new B.B.C. Regional Scheme comes into operation. The price is £10 10s. This two-valve receiver is also available associated with the loud speaker, the operating panel being exposed beneath a hinged cover lid. The external appearance is thus that of an attractive loud speaker requiring no external or additional accessories. It is a well-finished equipment, and is priced £14 14s.

Cossor valves are too well known to require detailed comment here. The range includes no fewer than thirty-five types, and is made up of indirectly and battery-heated valves, and includes pentodes. In each of the 2-, 4- and 6-volt classes there are six types, the S.G., R.C., H.F., L.F., P., and X.P. The filament current is in most cases 0.1 ampere, but is necessarily increased to 0.2 and 0.3 ampere in respect of certain of the lower voltage valves of the P. and X.P. types. All Cossor S.G. valves have an amplification factor of 200



The chassis of the Colvern Sirius receiver with screening boxes removed.

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with an A.C. resistance of 200,000, and should therefore give a single stage amplification of over 70 when used with a stable H.F. interstage coupling. The indirectly heated screen-grid valve

three-hole fixing of Cyldon condensers, but when required three-hole fixing bushes and screws can be supplied. The 0.0005 mfd. "Junilog" condenser is priced at 8s. 9d.

This same type of condenser is being incorporated in a new type of twin condenser, and in this respect its small diameter plates are particularly suited to the requirements of ganging as compared with plates of generous sweep where a slight displacement would considerably alter capacity. Overall dimensions have been cut down to a minimum. The price of this twin model, the Junior "Synchromate," is 30s., complete with bakelite drum dials, fixing screws and escutcheon plate.

Sydney S. Bird and Sons, Ltd., "Cyldon" Works, Sarnesfield Road, Enfield Town, Middlesex.

DANIPAD. (219)

Besides a full range of cut ebonite panels with various surfaces, there is exhibited ebonite tubing, ribbed low-loss formers, rod and wedge rod in many varieties. Complete coils for popular Kit sets are manufactured, as well as H.F. chokes, ultra short-wave inductances, and dual-range coils with base switching. There are coil holders, neutralising condensers, wavetraps and switches, and bakelised formers up to 7in. in diameter. There are, in fact, very few wireless components required by the amateur that are not stocked by this company.

Danipad Rubber Co., Ltd., 5 and 7, Market Street, Finsbury, E.C.2.

DAVENSET (PARTRIDGE, WILSON & CO.). (283)

This firm are manufacturers of several different types of battery chargers, intended mainly for the use of wireless dealers, garages, etc.; H.T. and L.T. models are available, and gas-filled valves, giving full-wave rectification, are employed. These instruments are economical in first cost and upkeep.

A transportable receiver is also shown. This instrument is on fairly conventional lines, and includes Mullard "Permacore" transformers and a Celestion loud speaker. Differential control of reaction is embodied in its design.

There is also a "Conversion Kit," intended for use in converting existing battery sets for A.C. mains operation. It comprises a power transformer with an adjustable primary suitable for mains voltages between 200 and 250, and also centre-tapped L.T. windings giving, respectively, 4 and 5 volts. A smoothing choke is included in this "kit."

The "Grippleshell" adjustable bracket, manufactured by this firm, is now supplied in several types. This useful fitting is designed to act as an aerial wire guide in positions where it would otherwise be difficult—or even impossible—to avoid earthing the wire to the eaves, corners, chimneys, or other parts of a building. It carries a heavy porcelain shell insulator at one end.

Partridge, Wilson and Co., Loughborough Road, Leicester.



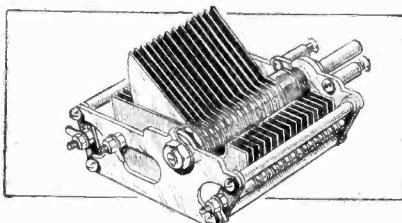
A new departure in self-contained set design—the Cossor two-valve mains receiver.

M.S.G.41 is capable of giving an H.F. stage gain of probably double this figure.

A. C. Cossor, Ltd., Cossor House, Highbury Grove, London, N.5.

CYLDON (SYDNEY S. BIRD & SONS). (155)

In view of the ease with which H.F. amplification may be obtained by the use of a screen-grid valve there is an increase in the building of sets embodying Tuned H.F. stages. If bulky construction is to be avoided it is essential that as little space as possible shall be taken up by the tuning condenser. Appreciating this requirement Sydney S. Bird and Sons have introduced a new model, the "Cyldon Junilog." The overall dimensions and the sweep of this type of condenser are particularly small, the length being 2½in., and the width with vanes fully extended only 3½in. This compactness has compelled a departure from the usual



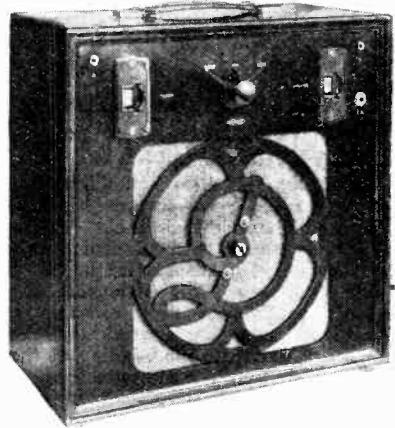
Cyldon Junilog condenser.

DAY. (7)

For the dance hall, restaurant, or cinema, a powerful sound-reproducing instrument is being exhibited which is provided with three turntables and gramophone pick-ups. To obtain special "effects" it is possible to superimpose the outputs of two or three records, and this is aided by differential volume control. The gramophone motors are electrically driven, and all high and low tension current is derived from a motor generator housed in the base. As an emergency supply in the event of the failure of the mains, a set of H.T. accumulators is available. Assuming a B.O.T. power unit at 2d., the total running cost per hour is under 1d., and it is claimed that the gramophone pick-up causes so little wear that records running for several hours a day last for six months. There is a "Musikon" moving-coil loud speaker.

This company also factors the better-known radio components on the market.

Will Day, Ltd., 19, Lisle Street, W.C.2.



Davaset transportable.

DE LA RUE. (260)

Manufacturers of mouldings and moulded materials for radio purposes.

Thos. De La Rue and Co., Ltd., 90, Shernhall Street, Walthamstow, London, E.17.

DEW. (26-28)

The apparatus shown is described as "a complete show in miniature," and represents a selected range of sets, components and accessories of particular interest to the radio dealer.

A. J. Dew and Co., 33-34, Rathbone Place, London, W.1.

DIBBEN. (15 & 65)

The chief products of this company are receivers and loud speakers. The Monarch-Three type S.G.T. set contains the well-tried combination of screen-grid valve followed by a leaky grid detector and power valve; the price is 7 guineas (royalties extra).

A similar receiver, but incorporating A.C. equipment for all-mains drive, is marketed at 16 guineas (excluding royal-

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ties). The Monarch-Three type T.S. contains a detector and two L.F. valves and an enclosed Amplion loud speaker; it is retailed at 7 guineas (excluding royalties). Another receiver, having a similar layout but housed in rather a larger and more elaborate cabinet in Jacobean style, includes a large balanced-armature speaker, and is capable of delivering a generous undistorted output.

There are several loud speakers contained in attractive cabinets. The Monarch-Boudoir speaker, for instance, embodying a two-pole unit, sells at 2 guineas, and a rather larger speaker with balanced armature movement recommended for large rooms or dance halls is priced at 6 guineas; this is called the "Cromwell Royal" model.

Wm. Dibben and Sons, Ltd., 80, St. Mary's Road, Southampton.

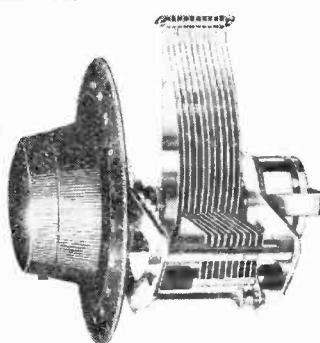
DONOTONE. (268 & 269)

The Super-Donotone loud speaker, which is the chief exhibit this year, is housed within a circular cabinet having a drum 18in. in diameter and a depth of 12in. There is a series of 32 tuned gongs, each responding to its own note and a diaphragm of special composition. The price, in mahogany or oak, is 10 guineas.

The Donotone (Reyd.) Loud Speaker, 40, Furnival Street, E.C.4.

DUBILIER. (181 & 182)

Condensers for every conceivable position in a radio receiver are being exhibited. The well-known K.C. variable condenser with and without drum control, and the midget condensers of 0.0001 and 0.0002 mfd. are being retained. This season's programme also contains the toroid coils embracing a wave-range from 22 to 2,000 metres; the winding of these coils is such that there is practically no external field, with the obvious corollary that there is an absence of unwanted direct pick-up from a nearby powerful transmission.

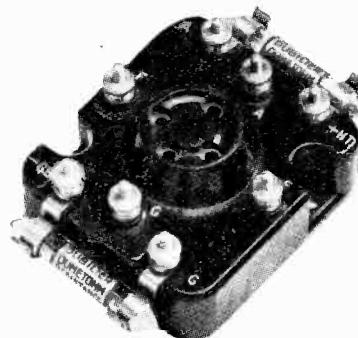


Dubilier K-C condenser.

The R.C. coupling unit combined with valve-holder is useful where economy of space in a receiver calls for consideration. Complete with two Dumetohm resistances the price is 7s. A point worth noting is that the valve-holder may be used for the valve which precedes or follows the resistance stage in the unit. There are four high-frequency chokes; the first choke of this series is primarily in-

tended to be connected in the anode circuit of the detector valve where its function is to prevent the passage of radio-frequency currents into the L.F. amplifier. It should not be used on wavelengths below 100 metres. Type 40 has a higher inductance and will, therefore, act as a more efficient impedance at the higher wavelengths. Type A.C. is specially designed for aperiodic coupling in H.F. amplifiers. There is also a short-wave choke known as type S.W.

For low-tension eliminators there is a series of dry electrolytic condensers, and for H.T. eliminators the tapped condenser block, many examples of which are made by this company, is likely to be more widely adopted in view of the advantages it confers with regard to cheapness, simplicity in wiring, and compactness.



Complete R.C.C. stage—a Dubilier product.

Paper-dielectric condensers of 2 mfd. capacity, with wider and wider application as all-mains sets become more extensively used, are available tested at 2,500 volts D.C. downwards. The price of the model tested at 400 volts D.C., for instance, is 3s. 6d. This condenser has a working voltage of 200. The low power factor of mica-dielectric condensers for decoupling in screen-grid circuits is becoming appreciated by amateurs. Condensers of this type, with capacity values of 0.01 mfd. to 0.05 mfd., marketed from 4s. to 5s. 6d., should therefore be of interest.

A range of dry batteries is included for this season; these are made in single and treble capacities. The smaller 99-volt battery with grid bias tappings sells at 11s. 9d., while the 100-volt battery of the heavy-duty type is priced at 22s.

Besides the Westminster portable radiogramophone which is now well known there is a new all-electric 3-valve screen-grid receiver available for D.C. or A.C. selling at £25. Both aerial and H.F. inductances are separately tuned. The reaction control is ingenious, as it automatically changes the reaction coupling for long and medium waves.

A D.C. eliminator made to the specification of *The Wireless World* "Hum-Proof D.C. Eliminator" is on this stand.

Dubilier Condenser Co. (1925), Ltd., Ducor Works, Victoria Road, North Acton, W.3.

DULCETTO-POLYPHON. (278)

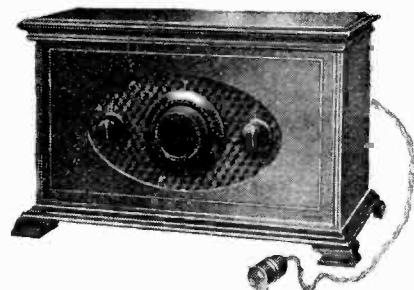
Manufacturers and factors of gramo-

phones, records and accessories as well as radio apparatus.

Dulcetto-Polyphon, Ltd., 2 and 3, Newman Street, Oxford Street, London, W.1.

DUNHAM. (47 & 48)

Battery- and mains-fed receivers are the chief exhibits of this company. The



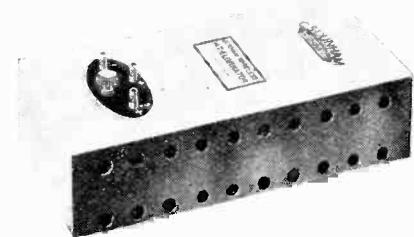
The Dunham "Simplicity-Two" Receiver.

"Simplicity-Two" set is housed in an attractive cabinet with an oval panel on which the tuning dial and capacity control of reaction is arranged. Wave-range switching is provided. Complete with valves and royalties the price is £6 10s. This set, adapted for all-mains operation, sells at 13 guineas complete, while a three-valve model is marketed at 21 guineas. For those who wish to have these sets in more elaborate furniture there is a series of pedestal "Simplicity" receivers in which a Symphony cone loud speaker is fitted. Battery or eliminator compartments are provided, and the only external leads besides those connected to the mains, where these are available, are to the earth and aerial.

The Portable-Five, selling at 17 guineas, has two aperiodically coupled H.F. stages and the conventional regenerative leaky-grid detector. There is a balanced-armature cone speaker, and careful biasing of the valves results in a total anode consumption of only 8 mA. In the transportable set a point of interest is the provision of means whereby the accumulator can be charged *in situ* if supply mains are available. A home-charger containing a dry metal-oxide rectifier is being shown for 2-, 4-, or 6-volt accumulators. The price is 50s.

A frame-aerial supported on a ball-bearing turntable is a useful component for those desiring really good selectivity in the neighbourhood of a powerful station. The change-over from short to long waves is effected by a switch, and the price is 2 guineas.

C. S. Dunham, Elm Works, Elm Park, 131, Brixton Hill, S.W.



Dunham H.T. eliminator.

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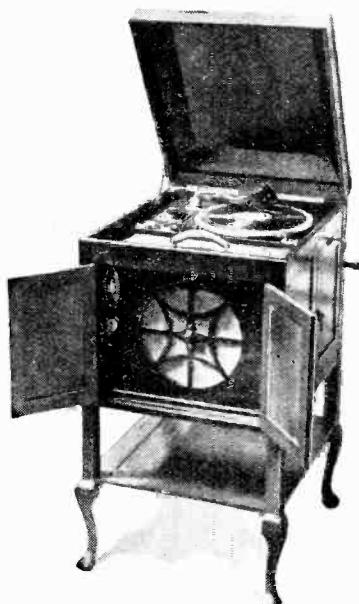
D.X. COILS. (262)

H.F. chokes for both baseboard and clip-in mounting are shown. A new product is the D.X. Dual-Range Tuner using coils of the standard plug-in type. Short-wave coils, L.F. intervalve transformers, as well as a new "D.X." tone arm are included in the exhibits.

D.X. Coils, Ltd., 542, Kingsland Road, London, E.8.

EAGLE ENGINEERING CO. (77)

A new way of using the portable set is disclosed on this stand. The Eagle Engineering Co. has produced an upright cabinet with a spring motor-driven gramophone turntable, pick-up, and volume control. Space is provided to accommodate a standard "Warwick Portable Five" receiver in the front of the



Warwick radio gramophone.

cabinet. The set, which is already fitted with a pick-up socket, can thus be used either for radio or gramophone reproduction in the home, or can be removed from the cabinet and taken out of doors at a moment's notice.

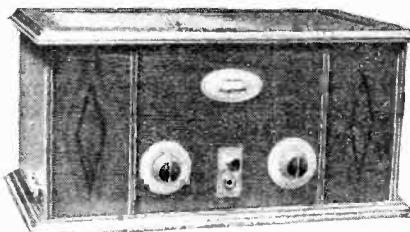
The "Warwick II" is a simple but apparently effective 2-valve det.-L.F. set sold at a low price. The front panel is attractively finished in imitation of oak by a new photographic process. Provision is made for using a pentode in the L.F. position when desired, and there is ample space in the cabinet for accommodation of the necessary batteries.

Apart from the Warwick Portable Five already mentioned, there is another neat five-valve portable of the suitcase type in which several interesting features are included. Controls are arranged inside the lid, which cannot be closed until the main switch is set at "off."

An inexpensive aerial tuner is also manufactured. This component has a rotatable reaction coil and a phosphor-

bronze ball switch for changing inductance.

The Eagle Engineering Co., Ltd., Eagle Works, Warwick.



Warwick two-valve receiver.

EAST LONDON RUBBER CO. (274 & 275)

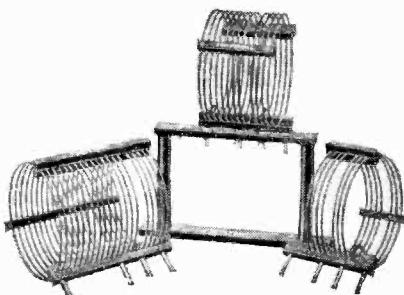
This company factors the more important wireless components and sets. A very comprehensive display of portable, transportable, and all-mains receivers is to be seen on their stand. When a visit is made to a factor's stand this year the preponderance of batteryless receivers is most marked, and is a sign of the changing times.

East London Rubber Co., Great Eastern Street, E.C.2.

EDDYSTONE (STRATTON & CO.). (109)

The three-valve short-wave home constructors' set is produced this year in improved form. It comprises a screen-grid H.F. valve with choke input from the aerial, a grid detector with reaction, and a single L.F. stage.

A new complete four-valve short-wave set has been introduced. It is similar to the three-valve arrangement, but has two L.F. stages (choke- and transformer-coupled). It is interesting to note that a parallel vernier condenser is connected across the tuning condenser, thus reverting to a practice applied to broadcast sets several years ago. It is stated that this has proved itself to be more satisfactory than the use of a tuning condenser with a very high reduction gear ratio. Complete decoupling is included in this set, which,



Eddystone short-wave coils.

by the way, has provision for a pick-up, and so should be particularly attractive for overseas users, for whom, indeed, it is largely intended. A special export model is supplied in a teak case. Special

care has been taken to render the set suitable for use in tropical climates.

A new three-valve short-wave set in a crackle-finished metal case has just been introduced.

There is also a range of inductances for small-power transmitters, and a useful astatic short-wave choke.

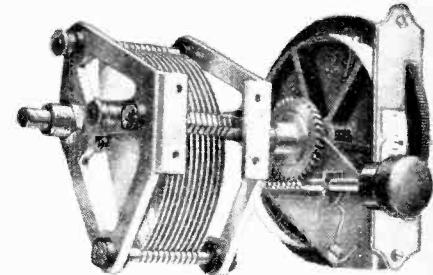
It should be noted that sets of coils for broadcast reception can be supplied with the Eddystone sets.

Kits of parts for the construction of double circular stretched diaphragm loud speakers are also exhibited; two sizes are available. The kits include plywood frames, cloth, rubber beading, varnish, and full instructions. The completed instrument is suitable for operation with an Ormond or Blue Spot unit.

Stratton and Co., Ltd., Balmoral Works, Bromsgrove Street, Birmingham.

EDISON BELL. (116)

In view of the wide experience of its manufacturers, the Edison Bell all-mains radio-gramophone is certain to be examined with considerable interest. Its five valves are arranged as H.F. amplifier, detector, and two stages of L.F. magnification, with parallel valves in the output position. An external aerial and earth are used, and there are two tuning controls, operated by edgewise dials. Models for A.C. and D.C. mains are available.



Edison Bell drum dial condenser.

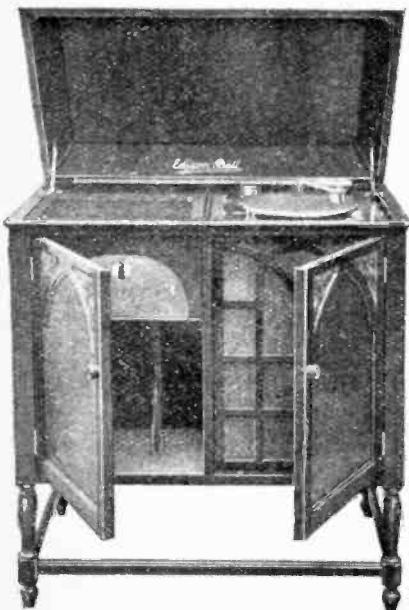
Volume control is effected by a potentiometer device whereby the output from the detector to the L.F. amplifier may be critically regulated. There is also an extra resistance control across the pick-up; this is, of course, inoperative when receiving radio signals.

The loud speaker is of the moving coil type, and special claims are made as to its sensitivity: it is connected to the output end of the set through a transformer.

An electric turntable motor is included, and there is also a scratch filter circuit. A battery model radio gramophone is also manufactured; its circuit arrangement comprises an S.G. high-frequency amplifier, detector, and pentode output valve. There are two tuning controls with reaction, and the frame aerial, built into the back of the cabinet, can be rotated through a knob protruding through the top panel. Provision is made for using the gramophone with an ordinary sound-box and built-in horn, should the batteries fail.

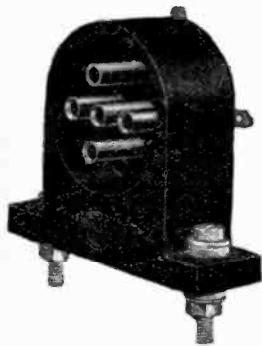
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Another set, of a type which should become popular, is the "Maison Screened Grid Three." The feature of this set is a built-in frame aerial, although external aerial and earth connections can be added if desired. As the set includes a loud speaker and space for batteries, it is entirely self-contained.



Edison Bell radio gramophone.

The new Edison Bell Plaque loud speaker is intended for suspension from the picture rail, and thus occupies a minimum of useful space; it is supplied with an oxydised chain and hanger, and is of the cone type.



Edison Bell valve-holder.

New components include a variable resistance of the graphite track type, with a maximum value of 0.5 megohm. Contact is made with the track through a German silver ball. In the design of the new loud speaker drive unit especial pains have been taken to devise a reed movement free from undesirable resonances; the unit is intended to operate with a cone diaphragm. There are also new thumb-control condensers with knob vernier, reaction condensers, and useful valve-

holders (suitable for the new valves) which have rubber shock-absorbing insulation.

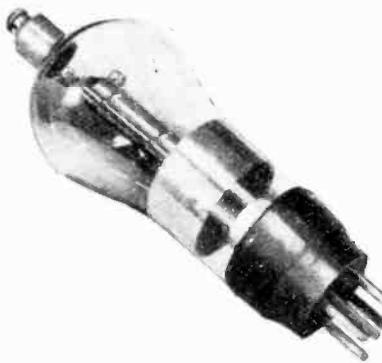
Edison Bell, Ltd., Edison Bell Works, Glengall Road, London, S.E.

EDISWAN. (148 & 153)

(Incorporating Metro-Vick Supplies & British Thomson-Houston Co., Ltd.)

Under a new arrangement, the Edison Swan Co. are marketing the radio products of the Metro-Vick supplies and B.T.-H. companies.

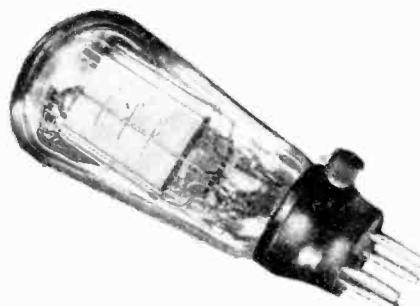
The well-known Cosmos valves, having the short-path characteristic, have been improved in design and are now known as Mazda valves. The large resources of the three companies have been pooled and the new complete range of 2-, 4-, and 6-volt valves is the product of their combined research and manufacturing experience. The Mazda series of valves also



The new improved Mazda AC/SG screened valve with 5-pin base having a central contact. (Ediswan.)

includes a number of the better-known B.T.-H. and Ediswan valves, having modified constants and new names. The most striking advance is probably in the 2-volt series, where mutual conductances up to nearly 4 mA./volt in battery-heated valves are obtained; such figures with filament consumptions well under one watt are remarkable, and, indeed, vie with the most efficient 6-volt valves, consuming greater filament currents.

The H.L.210, with an amplification factor of 26, and a mutual conductance of 1.25, will make a good neutralised H.F. amplifier, as well as an L-G detector. The P.240—a power valve—which will handle about 24 volts grid swing, has an A.C. resistance of 1,900 ohms, and an amplification factor of 7, giving a slope of



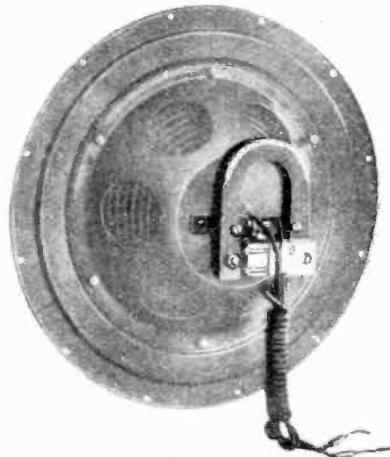
Mazda 230-Pentode valve (Ediswan).

5.7. There are two pentodes—the 230 Pen. and the 425 Pen.—having high mutual conductances and "earthed" grids connected to the control grids instead of the filaments to prevent the burning out of all the valves in a receiver, should the outer grid touch the plate.



Ediswan transportable receiver for A.C. mains.

The battery-fed screened valve—the 215 S.G.—which has been fully described in the pages of this journal, has an A.C. resistance of 270,000 ohms and an amplification factor of 300, and the all-important anode-grid capacity is only 0.005 micro-mfd.—an extremely low figure allowing a theoretical stage amplification of no less than 150 to 160, with tuned anode coupling, without neutralisation, provided the



Ediswan reed-movement attached to cone assembly.

screening in the set is carried out with meticulous care.

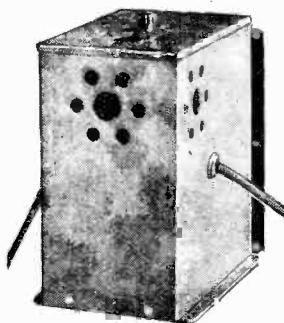
The Mazda A.C./S.G. valve, an improved edition of the valve which is more familiar to our readers as the Cosmos A.C./S., has a five-pin base with a central contact, an amplification factor of 1,200, and a mutual conductance of 2. The duplex screening grid reduces the inter-electrode capacity to the very low figure of 0.0045 cms., so that the unneutralised tuned anode stage gain can be nearly 250 before instability begins to set in.

About a year ago the best screen-grid

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valve available would only give a maximum stage amplification of about 80 unneutralised. The AC/HL and AC/P valves have indirectly heated cathodes and replaces our old friends, the AC/G and AC/R valves, whilst the AC/P1 is a super-power output valve capable of delivering 1,000 milliwatts undistorted A.C. output. There are four rectifying valves, three are of the half-wave type, and three have equipotential 4-volt cathodes, thus allowing interchangeability of the heater transformers.

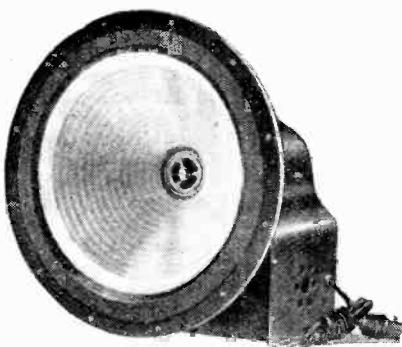
To the flat-dweller, a batteryless, all-mains portable receiver will be of interest. Selling at 30 guineas, this set contains a balanced-armature cone loud speaker and four Mazda A.C. valves. The H.F. valve is an AC/SG, followed by two AC/HL valves and an AC/P. An enclosed elimin-



The R-K rectifier unit for moving coil loud speakers (Ediswan).

ator supplies the H.T. and L.T. voltages and contains a UU60/250 full-wave rectifying valve. A small door at the side of the cabinet covers the control panel, on which there is provision for a gramophone pick-up and exterior aerial and earth.

In the new 3-valve all-electric A.C. and D.C. sets, selling at 20 guineas, there is a welcome departure from conventional layout; the controls are set on a sloping panel at an angle that makes for easy manipulation. The following valves are used : AC/SG, AC/HL, and 425-Pentode, and an elaborate screening scheme prevents unwanted interaction. Access can only be had to the various components after the mains supply is automatically cut off by an interlocking safety device. A variable



Senior R-K loud speaker unit with field current rectifier included (marketed by Ediswan).

loose-coupled aerial circuit not only assists in obtaining adequate selectivity, but also acts as a volume control.

To match the pentode to different loud speakers, a variable choke-feed output is employed. The A.C. consumption is one unit of electricity for 35 hours' running.

In the D.C. model the loud speaker is isolated by two condensers, and the aerial is at earth potential as regards D.C., to prevent complications when the positive lead of the lighting supply is earthed.

There are also 3- and 4-valve battery receivers, in which the "elastic" aerial selectivity unit can be added if desired. A new Ediswan balanced-armature cone unit, having a particularly light armature, sells at 15s., and a reinforced corrugated cone assembly for mounting on a baffle-board is now on the market at 12s. 6d.

Added to the well-known range of B.T.-H. "R.K." moving-coil loud speakers, there is a senior self-contained unit with rectifier, thus providing its own source of field excitation. A separate rectifier unit for field excitation sells at £4 4s.; it is fitted with a transformer, smoothing condenser, and full-wave rectifying valve. A complete range of Metro-Vick eliminators is being shown.

Edison Swan Electric Co., Ltd., 1a, Newman Street, London, W.1.

ELEX (J. J. EASTICK & SONS). (272 & 273)

Besides distributing the radio components of all well-known radio manufacturers, this firm makes a series of standardised plugs and sockets, and among other small metal parts, a treble-duty terminal. A vertical hole drilled in the terminal screw-head takes the standard Elex T.14 plug or wander-plug. The under-surface of the terminal head when screwed down will hold a spade connection, whilst a horizontal hole through the centre of the terminal provides for the pin type of connector or the end of a wire. The threaded shank is slotted to take a sub-panel wire, thus dispensing with soldering. There are no fewer than 40 indicating tops to these terminals, which sell at 4½d. each.

For portable sets where the space is extremely limited the Elex midget wander plug, having the very minimum of dimensions, should prove useful.

J. J. Eastick and Sons, 118, Bunhill Row, E.C.1.

EFESCAPHONE (FALK, STADELMANN & CO.). (279)

New screen-grid receivers for both battery and mains operation have been introduced since last year. The older models have been improved in details of construction and in the matter of appearance.

A portable suit-case type of set with tuned H.F. amplification (S.G. valve), detector, and two L.F. stages, has recently been produced. This is in addition to a more conventional five-valve self-contained set, with aperiodic H.F. amplification, which is shown in both suitcase and upright transportable form.

All the eliminators made by this firm have been brought up to date by the

provision of means whereby screening grid voltage can be critically adjusted. In addition, a new mains unit, for use with indirectly heated valves, is exhibited. This instrument provides both anode current and low-tension A.C. for the heaters.



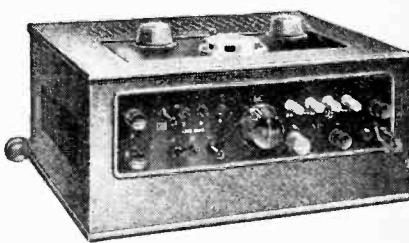
Falk Stadelmann portable.

Another new product is a cone loud speaker employing a novel method of construction, which is made in several types.

Falk Stadelmann and Co., Ltd., Efesca Electrical Works, 83 to 93, Farringdon Road, London, E.C.1.

EKCO (E. K. COLE). (8-11)

Battery eliminators as well as mains-operated receivers are the specialised products of E. K. Cole, Ltd. In considering the wide variety of apparatus displayed it is as well to adopt a useful classification introduced by the makers. Thus eliminators are divided into three classes, referred to respectively as the ten, twenty and sixty milliamperes range. In each of the three classes there are several models giving various voltage outputs and embracing both A.C. and D.C. supply. It is explained that the various voltages obtained are produced by separate resistances as against the somewhat uncertain practice of using a common potential divider. All rectifiers are of the Westinghouse type excepting two auxiliary units which are intended for attaching to a D.C. eliminator, and in which case the rectifier is a Philips valve. Metal containers are used in every instance except-



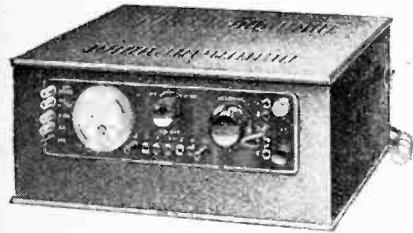
Ekco H.T. and L.T. eliminator for use with D.C. supply.

Wireless World

Stand-to-Stand Report.—

ing, of course, complete receiving sets, while precautions are taken in the arrangement of the terminals to render it impossible for the user to receive a shock. In the 10 mA. range is a D.C. eliminator, which at 17s. 6d. costs little more than the dry battery which it replaces. It has, however, only a single voltage tapping of 120. Two other models are included in the ten mA. range, and these are for use with A.C. and D.C. supply, and have two voltage outputs, estimated at 60 volts 20 mA. and 120 volts 10 mA.

It is probable that the 20 mA. range includes eliminators more particularly meet-



Ekco H.T. and L.T. eliminator for A.C. supply.

ing popular requirements. Both A.C. and D.C. models include three voltage outputs, for in addition to the 60- and 120-volt connectors there is a 60- to 80-volt potential arranged to suit the requirements of screen-grid valves. Advancing in the range but under the 20 mA. heading there are models in which the 60-volt output is replaced by a continuously variable potential of 0 to 120 with current output on this terminal up to 6 mA.

Five and six voltage outputs are provided in the A.C. and D.C. models of the 60 mA. series. To take a particular instrument, the A.C. model 5T.60 gives an S.G. voltage of 60 to 80, two independently variable outputs of 0 to 120, a fixed potential of 120 to 150 depending on the load taken, which may be up to 16 mA., and a power output up to 200 volts which falls to 150 when loaded to 50 mA. The price of this model is £10 10s., and a corresponding instrument for use with D.C. supply is £4 15s.

The problem of obtaining H.T., L.T. and grid bias from D.C. or A.C. mains has been undertaken, and four models are shown by the use of which a receiver becomes entirely mains operated. The D.C. model CI.A is a generous outfit provided with four H.T. potentials with

an output up to 60 mA. and an L.T. supply up to 0.6 ampere, together with grid-biasing potentials up to 21 volts. It is emphasised that no alteration is necessary to the existing receiver. A corresponding A.C. model, it is interesting to note, is not designed on the assumption that special or indirectly heated valves are to be used in the receiving set. The L.T. output is 1 ampere, and it is stated that the use of this unit involves no more complication than the batteries which it replaces.

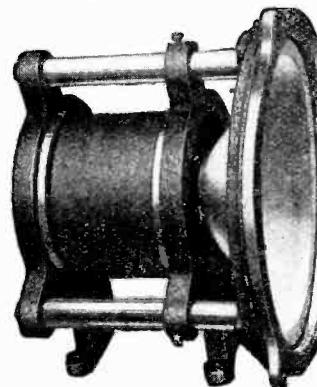
Mains-operated receiving sets are also to be seen. The designs are unique, and do not follow popular radio practice. A two-valve set, the P.2, meets the requirements of a large body of listeners by way of providing "trouble-free" reception from a local station. The output valve is a pentode, the P.M.24, while the D.C. model makes use of the F.M.4DX as a first stage valve, and in the A.C. model the valve is the A.C/G. It is stated that this receiver is specially selective, while the degree of selectivity can be varied in order to suit the set to local conditions. A three-valve model, the SGP3, is provided with a screen-grid H.F. stage as well as pentode output. Single-control tuning is arranged, and a compensating control enables maximum results to be obtained with aerials of different dimensions. The three-valve model for either A.C. or D.C. supply is priced at £21. Both the two- and three-valve models cover the wave ranges 2/500 metres and 1,000/2,000 metres.

E. K. Cole, Ltd., "Ekco" Works, London Road, Leigh-on-Sea, Essex.

ELLISON & HILLMAN. (29 & 39)

As wholesale stockists this firm displays a representative selection of the coming season's equipments.

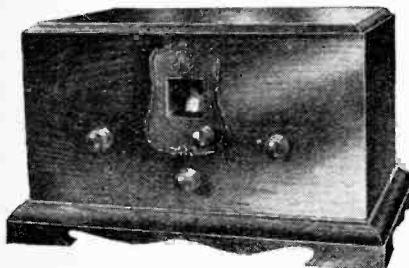
Ellison and Hillman, 123-125, Albion Street, Leeds.



Epoch permanent magnet moving coil loud speaker.

EPOCH. (218)

Fourteen different types of moving coil loud speakers, together with many cabinet models, ranging in price from £2 10s. to £9 5s. are exhibited. Interest in the moving coil type of loud speaker still continues to gain ground, while its recent innovation in the cinema firmly establishes its superior merit. Cinema and public address types are included in



Ekco all-mains receiver. Type P.2.

SEPTEMBER 25th, 1929.

the Epoch range, while for the more modest requirements of the home there is a permanent magnet model.

A.C. mains transformers and smoothing chokes are now produced in addition to loud speakers, while a scratch filter unit for use with a gramophone pick-up is a new component of interest.

Epoch Radio Manufacturing Co., Ltd., 3, Farringdon Avenue (near Ludgate Circus), London, E.C.4.

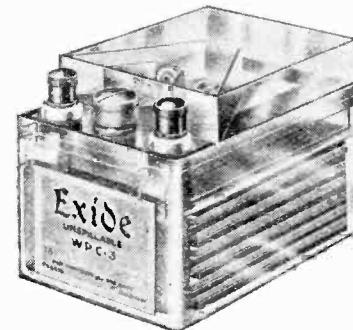
EVER READY. (139 & 142)

In addition to all types of batteries representative of the application of dry cells to radio purposes, we find both H.T. L.T. accumulators. Testing voltmeters suitable for the examination of H.T. and L.T. batteries are included.

Ever Ready Co. (G.B.), Ltd., Hercules Place, Holloway, London, N.7.

EXIDE. (172 & 175)

An entirely new H.T. battery, the Exide type WY10, is included among the wide variety of Exide products. This battery has been specially introduced for use with the generous amplifier,



Specimen Exide battery for use with portable sets.

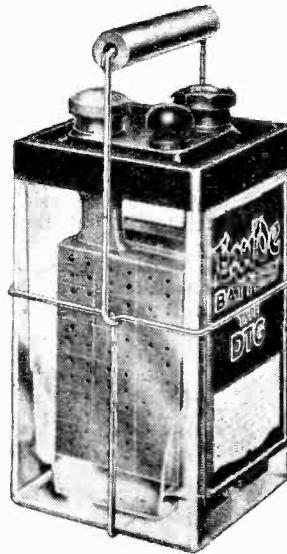
such as the ambitious moving coil equipment, public address apparatus, and talking picture installation. The considerable thickness of the plates is a noteworthy feature, and it is obvious that the cells are intended to withstand hard usage. Non-interchangeable terminals are provided. The new terminal design is an interesting feature of this season's batteries, and while red and blue colourings are used the positives are in addition made octagonal and can therefore be readily distinguished in the dark. Another feature is the introduction of the ebonite moulded lid with all Exide cells, which are in glass containers. This permits of the moulding of the plate pillars into the lid so that they cannot possibly work loose, while absolutely eliminating acid creepage on to the terminals.

A speciality has been made of batteries for portable sets. There are many types, all fitted with an acid trap arrangement, rendering them proof against the spilling of acid even under the most severe conditions of shaking or tipping.

The DTG type cell is well known, though it is not always appreciated that this cell has been specially constructed

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so as to withstand long periods on open circuit. This class of cell is referred to as the "Mass" type, and it is claimed that such cells can be left without attention for long periods and suffer no detriment.



Exide "Mass" type cell. Dissimilar terminals form a new feature.

ment. The internal resistance is low and the voltage remains steady. Grid biasing batteries (types WJG and WHG) are also shown and consist of five small cells with two-volt tappings, and these also are designed to withstand long use on open circuit.

Included in the display is a selection of loose plates, separators, and other cell components illustrating the construction and technical details of the many and varied types of Exide cells to be found on the battery market.

The Chloride Electrical Storage Co., Ltd., 217-229, Shaftesbury Avenue, London, W.C.2.



The Popular Faradex Five.

FARADEX (ROOKE BROS.). (119)

Three types of Faradex portable receivers are shown. The Faradex Portable Five is a suitcase model, which in solid leather case of antique finish is priced at £16 16s. A distinctive feature is the provision for the use of a gramophone pick-up. A less expensive model, the Popular Five, is offered at the low price of £14 14s. There is a new four-valve portable in which the H.F. stage incorporates a screen-grid valve. This is a high-grade set, selling at £18 18s.

An interesting form of H.T. eliminator is shown, together with a wide range of Faradex components. The eliminator is unique, in that it employs a special form of chemical rectifier known as the Chromal.

Rooke Bros., Ltd., 55, Cardington Street, London, N.W.1.

FELLOWS. (32 & 33)

There are eight receivers in the programme for this season. The "Regal Three" contains a Mullard screen-grid H.F. valve, followed by detector and pentode output, and sells at £21 10s., including high-tension battery, Exide two-volt 100-amp.-hour accumulator, and cone speaker.

The "Regal Four" employs anode bend detection, and has two L.F. valves, but does not include a pentode; the price is £24 15s.

There are four receivers in the "Little Giant" series, ranging in price from £11 5s. to £14, and a very complete equipment is included. There is also a new set entirely operated from A.C. mains.

A five-valve portable set listed at £15 in imitation leather, and £22 in real leather, is a newcomer this season, as is also a cabinet speaker claimed to respond to an exceptionally wide musical range.

Fellows Mfg. Co., Ltd., Cumberland Avenue, Park Royal, N.W.

FERRANTI. (74 & 76)

One cannot help feeling at times that the extreme care a manufacturer may have taken to make a particular component as perfect as possible may be of no avail when combined with another component of inferior performance. It is in this respect that one often views the adoption of specially designed interstage couplings when the output stage and its associated loud speaker so often possess serious defects. Considerable importance attaches therefore to the introduction by Ferranti of a moving-coil loud speaker. Most of those technical points appreciated by the amateur are found to be present in this new instrument. A flux density of 11,000 lines per sq. cm. is obtained across the gap with a consumption of 23 watts in the field coil, and this, in turn, may be derived from an A.C. rectifier taking 35 watts from the mains. This high current consumption, which is insignificant when dealing with mains supply, is of first importance by way of producing the highest possible flux density. A valve rectifier, the U.8.

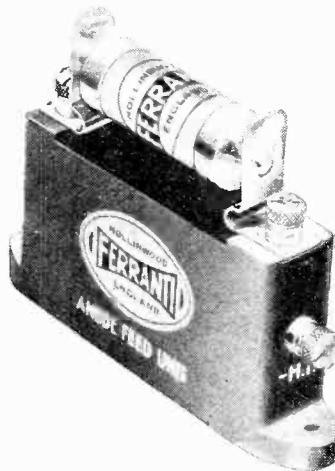
is built into the mounting of the loud speaker so that it becomes an entirely self-contained unit. Supple centring is adopted with a large diameter coil, while a leather mounting, used because of its lasting properties, supports the cone.



Ferranti moving-coil loud speaker for use with A.C. supply.

Complete with rectifying equipment for use with A.C. supply, the loud speaker is priced at £10. The D.C. model, with similar external mounting, costs £6 10s.

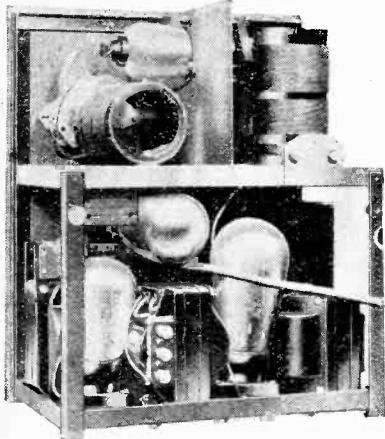
Another new feature is the anode feed units, which form a compact combination of anode feed resistance and by-pass condenser. Their purpose is that of preventing interstage coupling as well as regulating the several anode voltages required in a receiver. It will be remembered that Ferranti were largely responsible for the introduction of the anode feed arrangement as a preventative of oscillation trouble, and in connection with the use of these new units a pamphlet has been produced showing typical circuit arrangements. A triple unit combining three resistances with three condensers is also produced, and when necessary this can be connected as a potentiometer, by which means a reduced potential will remain constant in spite of a change of current.



The new Ferranti anode feed unit.

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A new trickle charger, the type T.C.5, gives an output of 1 ampere at 2, 4, 6 or 9 volts, the 9-volt tapping being provided for use with certain moving-coil loud speakers, which will not take their full rated field current when operated from a rectifier owing to the high inductance of the magnet winding. The price is £4 7s. 6d. Another new rectifier is one of the Westinghouse type, giving the generous output of 6 amperes at 6 volts.



Interior view of the Ferranti mains receiver.

The urgent demand for a high inductance output choke is met by the new Ferranti type B.5. It is larger than its predecessors, and is listed at 27s. 6d. The resistance is only 40 ohms, and it will carry currents up to 160 mA.

This year marks the introduction of Ferranti radio receivers. This new venture carries with it the high reputation which has been built up in the production of the special Ferranti components of the past and the considerable guidance that has been so much in evidence in the various Ferranti technical publications. Only one type of set is shown. It is an A.C. mains set with two indirectly heated valves, a screened valve being used in the H.F. stage. The H.T. supply is obtained through a valve rectifier, Osram type U.5. The front panel carries two tuning controls, the scales being viewed

through recessed apertures. A plunger switch changes the wave range, while the front panel carries, in addition, a volume control and an "on" and "off" switch. A generous refinement is the inclusion of an output transformer with winding suitable for high or low resistance loud speakers. Like other Ferranti eliminator equipment, the mains supply is disconnected on removing the receiver from its containing cabinet. The price is £25

A new and interesting form of radio switch is now available as a component. Single and double pole models are supplied with various numbers of contact studs. The principle is that of compressed springs moving between parallel plates which carry the contact studs. That these switches are used in Ferranti meters indicates the absence of variation in contact resistance. Prices range from 2s. 6d. to 6s.

The range of Ferranti meters has been extended, particularly as regards the instruments using metal rectifiers and thermo couples.

Ferranti, Ltd., Hollinwood, Lancs.

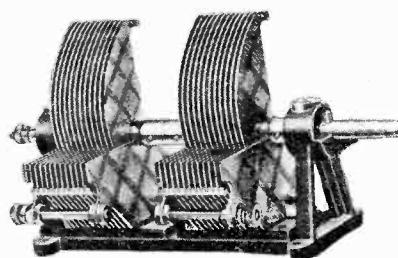
FLINDERS. (282)

This stand is of special interest to retailers in the Eastern counties and carries a selection of the latest radio apparatus.

Flinders (Wholesale), Ltd., East Stockwell Street, Colchester, Essex.

FORMO. (72)

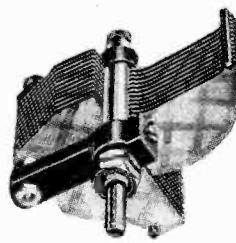
Variable condensers predominate in the Formo exhibit. They are exceptionally low in cost, yet compare as regards technical attractiveness with their more expensive competitors. The log condenser, "1930," which is available in four capacity ranges between 0.00015 and 0.0005



Formo 1930 Dual Gang condenser.

mfd., is priced at 4s. 6d. The scrutinising amateur may well see fit to examine this component, and he will find difficulty in noticing any point calling for adverse comment. The fixed plates are securely held in a slotted brass bar, to which also are secured the bakelite end pieces used to support the spindle and its bearings. A merit of the condenser is its extreme rigidity in spite of its apparently light construction. Connection with the end terminal is positive and carries through to the moving plates by a braided pigtail connector in a hollow spindle. A readily accessible friction adjustment is a useful feature, permitting of a smooth move-

ment. Modelled on similar lines there is a reaction condenser with a capacity of 0.0002 mfd., priced as low as 2s. 9d. This also has the internal pigtail connector. A real attempt at the successful gauging of condensers is to be found in the "1930" dual-gang model. In this instance a rigid cast bracket supports the bearings, while the stators, which are first secured to substantial slotted brass pieces are in turn carried on bakelite mouldings. These ganged condensers follow a logarithmic scale, and it is claimed that the capacity change followed by the sections is as close as 4 per cent. A further development is the screened ganged condenser unit, consisting of three totally separated units. In order that gauging may conform to close limits it is essential to exclude all external stray capacities as well as to protect the plates from mechanical injury.



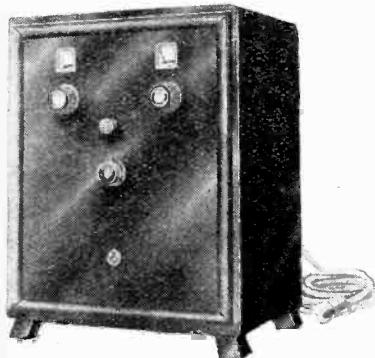
Formo 1930 Log condenser.

In spite of the complete capacity screening between the units the triple ganged condenser is compact and may be readily associated with the other totally screened equipment of the tuned stages. An adjustment is provided which permits of rotating the stator of one of the units so as to compensate for added capacity which is introduced when the condenser is associated with an aerial circuit. A component of interest to the home constructor is the new and inexpensive vernier dial. An examination of this dial shows it to be free from backlash and of robust construction. The scale is tilted to an angle of 30° from the vertical, thereby permitting of a convenient unobstructed view. Other well-known Formo components are to be seen at the stand including L.F. intervalve couplings, tuning coils and bases, valve holders, short-wave tuning condensers, as well as the Formo-Densor, which is intended for use as a neutralising or reaction condenser.

Formo Company (Arthur Preen and Co., Ltd.), Crown Works, Cricklewood Lane, London, N.W.2.

G.E.C. (85-90)

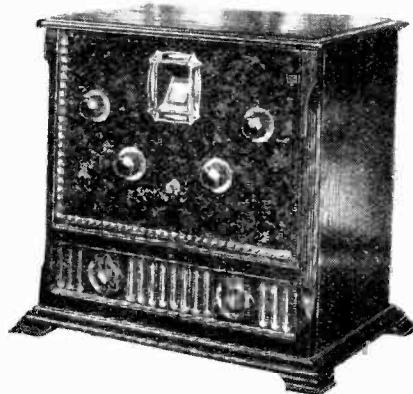
There are no fewer than seven entirely new Gecophone receiving sets exhibited which, as well as being built around the latest types of Osram valves, embody many new and novel features. Selected as an outstanding receiver from among the exhibits is the three-valve A.C. mains model type B.C.3030. It is of the cabinet variety with mottled front panel at the centre of which is exposed an inclined tuning indicator. On switching on the mains this dial is illuminated by a pilot lamp.



Ferranti mains receiver.

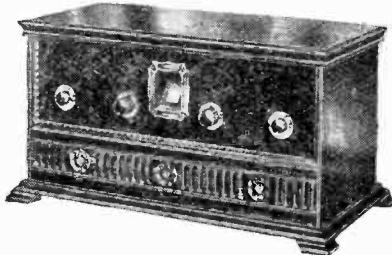
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Single knob tuning is provided, a twin condenser being ganged to the indicator. The dial carries three sets of figures, (a) a scale calibration of 0 to 100, occupying the centre, (b) to the left a broadcast band wavelength scale, and (c) to the right a wavelength calibration for the high-wave range. The scales are marked at



Gecophone three-valve set for battery operation.

intervals of 50 metres, an arrangement which not only simplifies tuning, but assists in the identification of stations. The circuit embodies the use of a screen-grid H.F. stage, and follows a generous power output valve, the use of the latter being possible by using a relatively high voltage H.T. eliminator. Three aerial connections are provided to permit of an adjustment of selectivity. A good feature is the provision of a choke filter output circuit. An interesting detail is the inclusion of an earthing lead in the flexible connector which attaches to the mains. Sensitivity and selectivity combined with high quality reproduction are claimed for this set. The cabinet measures 21in. x 11in. x 12½in. The price is £25.



Gecophone three-valve A.C. mains set.

Another three-valve set has been designed for use where A.C. mains are not available, yet in order to avoid the unsightly connecting cords provision is made for housing the batteries within the cabinets. The approximate dimensions are 16½in. x 15½in. x 12½in. The circuit principle and operating devices closely follow the model B.C.3030. The output valve supplied is D.E.P.240, and provision is made for accommodating a pentode (P.T.240).

D 21

Another new three-valve set is a short-wave receiver. Its circuit departs from the orthodox in that a screened valve precedes the detector, and this, it is understood, enables the set to oscillate easily on all wavebands irrespective of the length of the aerial with an avoidance of "blind" spots. A degree of amplification is claimed for the H.F. stage. The case is entirely of metal, and measures 14in. x 8½in. x 8¾in. There are two tuning condensers, although a modification by way of increased vane spacing has been introduced. Plug-in coils cover a wave range of 14 to 100 metres, while additional coils could be supplied for broadcast wavelengths.

A four-valve screen grid portable (type B.C.2950/2), stated to be capable of receiving thirty stations when used in London and with a guarantee of twenty-five stations at good loud speaker strength, is of first importance. Two tuning dials are used, though it is pointed out that operation is quite simple, two dials being an essential to the provision of a high degree of selectivity. Good quality reproduction is assured by the use of a generous output valve—the Osram P.240.



Gecophone four-valve screen grid table model.

The case is of waterproof fabric with imitation leather finish and antique red or Cambridge blue in colour. Incorporating a similar circuit and general layout as this portable set there is a four-valve screen-grid table cabinet model in mahogany. Among portables also is an all-electric screen-grid four. It must be admitted that by the use of eliminator equipment better performance, particularly as regards quality, can be obtained as compared with the battery-operated portable. The extensive range of sets also includes a two-valve all-electric receiver. The detector valve, a D.8, is followed by a super-power valve, the P.625A. The eliminator includes a valve rectifier. The price is £15.

Possessors of last year's G.E.C. kit set will be gratified to note that the New Osram Music Magnet embodies but few modifications. It is said that the new coils slightly improve both sensitivity and selectivity. Mechanically the gauged condenser is, perhaps, an improvement on the old type, being more rigid and having a

smoother drive. There is an improved intervalve transformer, while the fixed condensers are slightly altered in design to facilitate fixing. The price of the kit complete with Osram valves and cabinet, an addition since last year, is £9.



The new G.E.C. "Stork" cone loud speaker.

Mains power units incorporating valve rectifiers, various attractive types of loud speakers, including a moving coil model, as well as many valves possessing remarkable characteristics are all new introductions at this year's Exhibition. In particular there is the PT.625, a 6-volt super-power pentode. With a working anode voltage of 250 it combines an amplification factor of 80 and an impedance of 43,000 ohms. Additions to the range of A.C. operated valves are the M.S4 (screen grid), M.H4, M.IIL4 and M.L4. It is significant to note that the grid to anode capacity of the M.S4 is probably the lowest on record, being no more than 0.0045 micro-mfd. It is this figure that governs the maximum stable amplification obtainable.

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

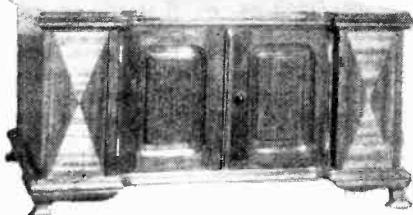
GAMAGE. (258)

Portable sets, loud speakers, and accessories of well-known manufacture are represented at this stand.

A. W. Gamage, Ltd., 128, Holborn, London, E.C.

GAMBRELL. (62)

This firm are showing a number of all-electric sets, models with from two valves upwards being produced. The newest type is a transportable with built-in frame aerial; in fact, a self-contained set, except for an external



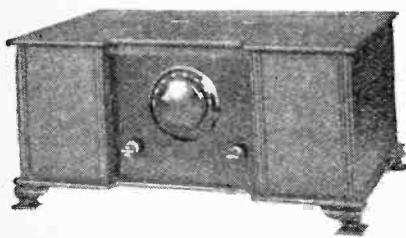
Gambrell All-Electric Four.

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connection to the mains (either A.C. or D.C.). The A.C. version makes use of indirectly heated valves—screen-grid H.F. amplifier, grid detector, and pentode output. A metal rectifier is connected in a voltage-doubling circuit. Provision is made for the addition of a pick-up.

Perhaps one of the most intriguing features of the show is the Gambrell "Novotone," a tone-regulating and correcting device due to Dr. N. W. McLachlan, which can be connected to any electrical gramophone-reproducing apparatus. All too often tone-control devices work only with the help of a good deal of imagination on the part of the user. Not so the "Novotone"; the



Gambrell All-Electric Two.

writer has had an opportunity of hearing it in operation, and can vouch for the fact that it does what it is intended to do, namely, compensates for the usual falling-off in the output of the average pick-up—and sometimes of the amplifier—at the lower and upper ends of the frequency scale. Quite apart from any possible shortcomings of the reproducing apparatus, it is inherent to the process of recording that, as the width of groove must be restricted, the lowest audible frequencies cannot be reproduced at full strength unless some form of artificial aid is invoked; this aid, it is claimed, is supplied by the "Novotone," and, unless the writer's ear is greatly at fault, with complete justification. Further, the reproduction of most kinds of music is noticeably brightened by the inclusion of the device, showing its effectiveness at the other end of the register.

The "Novotone" is included in the new Gambrell Radio Gramophone, which is exhibited and demonstrated.

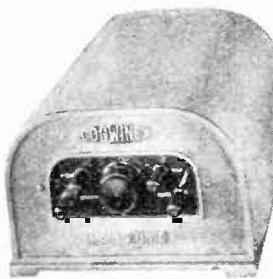
Gambrell Radio, Ltd., Buckingham House, Buckingham Street, Strand, London, W.C.2.

GODWINEX (J. DYSON & CO.). (1)

A complete range of eliminators, both for D.C. and A.C. mains, is the principal feature of this stand. Models with valve and Westinghouse metal rectifiers are available, and the requirements of the screen-grid valve have been taken into account by the provision of a critically-adjustable output up to 80 volts.

A number of complete receivers are shown. The Screened Grid Portable (H.F., detector, 2 L.F.) is contained in an oak case of suitcase pattern, and is priced at £22. There is also a five-valve transportable model in upright cabinet.

The Godwinex All-Mains three-valve set is provided with a gramophone pick-up connector. An ambitious piece of apparatus is the new All-Electric Radio Gramophone, which embodies such



A typical Godwinex eliminator.

refinements as an electric turntable motor with an automatic stop coming into operation at the end of each record. The price of this instrument is £50, inclusive of royalty.

J. Dyson and Co., Ltd., 5 and 7, Godwin Street, Bradford.



Godwinex suit-case portable.

GOLDSMAN. (280)

This firm is exhibiting two radio-gramophones, both of which are mains-driven, and fitted with indirectly-heated valves. There is also a transportable all-electric radio receiver, which includes a frame aerial and loud speaker. This instrument is completely self-contained except for a connection to the A.C. mains. A battery-operated portable receiver is also shown.

J. L. Goldsmann, 100, High Holborn, London, W.C.2.

GOLTONE (WARD & GOLDSTONE). (290)

A display of various wires used in radio work, including flexibles and aerial wire, is made by this firm. They also exhibit various forms of battery-charging

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apparatus and plug-in coils designed for various popular sets. H.T. battery eliminators, for both A.C. and D.C. mains, are manufactured in various types, at prices of from a guinea upwards. These instruments are also sold in the form of kits of parts for the home constructor. Components on show include H.F. transformers, H.T. batteries, choke coils, fixed condensers, etc.

Ward & Goldstone, Ltd., Frederick Road, Pendleton, Manchester.

GRAHAM. (230)

The chief products of this company are small turned metal components, such as valve pins, valve sockets, plugs, etc. The Norbex valve sockets for flush panel mounting are nickel-plated and well finished. The type with a closed end and coned lug enables all wiring to be clipped on prior to soldering, and is of great assistance where contacts have to be made in inaccessible positions.

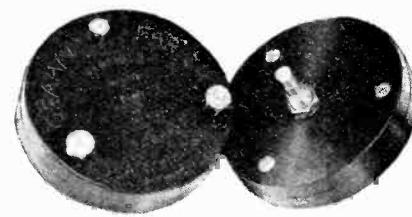
Another type having a long open end, which is threaded and provided with a screw, requires no soldering. For mounting valve sockets on wooden or metal panels, red or black erinoid bushes can be supplied at 1s. 3d. dozen.

R. F. Graham & Co., 45 & 47, Cambridge Road, Kingston-on-Thames.

GRAHAM-FARISH. (140 & 141)

New products introduced by this firm include an H.F. choke with an uneven form of winding divided into a number of graduated sections. It is designed to clip into a standard resistance holder.

An extremely compact condenser with bakelised material between the vanes is also shown. This is in addition to the "Microficient" solid-dielectric condenser, which has been available for some time. This latter component is now supplied in a modified form, with a "dead" spindle and bush, in order that it may be mounted direct on a metal panel. A vernier dial for this condenser is available in an unusual style; the indicator dial is mounted behind the aperture of an escutcheon plate which is secured to the panel.



Graham Farish bakelite-dielectric condenser.

All the well-known components produced by this firm, such as Ohmite resistances, R.C. units, bakelite-enclosed fixed condensers, etc., are retained.

Graham Farish, Ltd., Masons Hill, Bromley, Kent.

GRAMO-RADIO AMPLIFIERS. (247)

All the apparatus shown by this firm, whether for gramophone, radio or cinema work, embodies a distinctly unconven-

Stand-to-Stand Report.—

tional system of L.F. amplification. The intervalve couplings consist of a kind of air-cored transformer wound with high-resistance wire, with a small condenser bridging the primary and secondary coils.

The list of models exhibited is headed by the "Olympic" Gramo-Radio receiver, which derives all its current from the mains. It is supplied in cabinets of oak, mahogany, burr walnut, or Japanese lacquer, at prices varying between £95 and £115. An electric gramophone, suitable for restaurants, clubs, etc., is also supplied; this model is similarly energised from the mains.

There are also two five-valve receivers, one of which is mains driven. Amplifiers for talking films, as already installed in a number of cinema theatres, are shown.

The C.A.C. low-frequency coupler is available as a separate unit for inclusion in home-constructed sets, in the form of two or three-stage amplifiers at prices from 35s. to £5. These units are compact, the three-stage model, which, incidentally, is supplied, if desired, with 5-pin sockets for A.G.C. valves, occupies a baseboard space of but $5\frac{1}{2}$ in. \times $4\frac{1}{2}$ in., and weighs only 10 ozs. Readers will be able to judge of the effectiveness of this device, as it is being demonstrated in showrooms in the premises of the Olympia Motor Co., Hammersmith Bd., facing the Exhibition entrance.

Gromo Radio Amplifiers, Ltd., 1a, New London Street, London, E.C.3.

GRIPSO (L. H. REID & CO.). (227)

This stand is devoted to the display of small fittings, such as earthing clips, spade ends, and wander plugs. The Gripso on-off switch, with revolving dial showing through an aperture, will be familiar to many readers; it is now being produced in multi-pole form.

L. H. Reid and Co., 32, Victoria Street, London, S.W.1.

GROSVENOR. (237)

On this stand is to be found a comprehensive range of high-tension dry batteries. The chief feature exhibited is a series of batteries specially constructed for portable sets. A number of well-known manufacturers are now fitting them as standard equipment.

Grosvenor Battery Co., Ltd., 2-3, White Street, Moorgate, E.C.2.

HALCYON. (168 & 171)

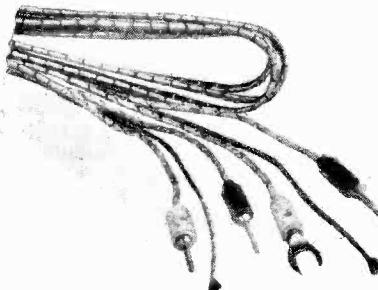
The products of this firm—portable receivers exclusively—remain substantially unchanged since they were described in *The Wireless World Portable* issue. There has, however, been an all-round reduction in price; for example, the "Cabinet Five" now costs 32 guineas, and the "Screened Grid Four" is priced at 28 guineas. Specimens of the various models are on view.

The Halcyon Wireless Co., Ltd., Canberra House, 313-319, Regent St., London, W.1.

Wireless World

HARBROS (HART BROS.). (239)

The exhibits on this stand include many forms of flexibles such as are required for the connecting up of radio receivers and extension equipment. Known as "Harbros Easyfix," is a useful braided twin conductor possessing reasonably low capacity between the two leads and which can readily be attached around



Harbros battery cable.

walls and skirting boards. It is useful for a number of radio purposes, and in particular loud speaker extensions as well as for remote control circuits. Well-finished multi-lead battery cables are also shown providing a tidy form of connection between the receiving set and source of current.

Hart Bros. Electrical Manufacturing Co., Ltd., Queensway, Ponders End, Middlesex.

HARDYSON. (158)

A range of five receivers and radio gramophones is available. The "Standard" model, selling at 35 guineas, has three valves—detector and two L.F.—and there is provision for a gramophone pick-up. There are two tuning controls, the loud speaker is self-contained, and the set contains means for all-mains operation either from D.C. or A.C.

The "Queen Anne Table Grand," selling at 37 guineas, embodies four valves, the first being an S.G. valve, followed by a regenerative leaky grid detector and two L.F. valves. There is provision for a gramophone pick-up, and the receiver derives its current from either D.C. or A.C. mains. The Screened-Four battery radio gramophone has the same circuit as the last receiver, but no means is provided for deriving current from the mains.

The *De Luxe Screened-Five*, selling at 70 guineas, is an elaborate equipment for A.C. mains, and contains a moving coil speaker.

Hardyson Radio, Ltd., 13, Market Street, Huddersfield.

HARLIE. (277)

Three types of high-class radio gramophone are shown. They are entirely self-contained. The "Orchestral" is a generous and attractive installation suitable for hotel use, and selling at £152 10s. This set is mains-operated, whether A.C. or D.C., and it is understood that the output stage comprises L.S.5a valves in push-pull. Slightly less ambitious, but equally attractive, models fitted with almost similar electrical equipment are the "Salon" (£138 10s.) and the "Cham-

ber" (£118). Complete moving-coil loud speakers, with windings for accumulator or D.C. mains, are available at £3 10s. The Harlie pick-up and tone arm is a new component. A folding swivel joint on the end of the arm is a novel and useful feature, permitting of the removal of the pick-up from the record. Complete with a weight adjustment and self-contained volume control, the price is £1 17s. The Volustat, another new component, is a continuously variable resistance having a power-dropping rating of 10 watts.

Hart Bros., Balham Road, Edmonton, London, N.9.

HART ACCUMULATORS. (289)

There are a large number of listeners who prefer a source of high-tension supply of negligible internal resistance to avoid all the complications of back-coupling, and employ high-tension accumulators, even though they have electric lighting in their houses. To these, and owners of sets who have not electric light, the wide range of high-tension accumulators will appeal. The "RAO" type have a capacity of 1,250 milliampere-hours. The containers are moulded glass boxes, the lids are of ebonite, and the plates, having a complete envelope of perforated ebonite preventing the dislodging of active material, are worthy of attention.

The "Raydax" type, having a capacity of 3,000 mA. hours, is useful where heavy consumption power valves are used.



Hart 10-volt H.T. accumulator unit.

For anode currents of 100 mA. and upwards the "Beamex" cells with a capacity of 10,000 mA. hours are available. With large differences of potential between terminals, surface leakage and corrosion can be serious with H.T. cells; it is thus of interest to find that this company has paid special attention to these points, and not only provides effective inter-cell insulation, but also uses a special terminal alloy, not containing brass, which entirely resists the action of acid.

For portable sets there is an unspillable L.T. accumulator designed to operate in two positions. For tropical climates, or under conditions where change of temperature may be an important factor, the "MEZ" L.T. cells in ebonite containers are recommended.

On this stand can be seen accumul-

Wireless World

HENDERSON. (201)

Among this firm's exhibits will be found a new receiver designated the "U" two-valve portable. A Mullard loud speaker is included, and the dimensions are $8\frac{3}{4}$ in. $\times 12$ in. $\times 8$ in., the total weight being only $19\frac{1}{2}$ lb. This portable sells at 11 guineas.

Other portable receivers include type "T" retailing at 17 guineas, and type "S" at 25 guineas; they both contain five valves.

There are also various components, such as H.F. chokes and switches, and a complete range of eliminators. The latter include H.T. units for both D.C. and A.C., the D.C. model retailing at the low figure of 29s. 6d. The A.C. models, incorporating Westinghouse metal rectifier, range in price from £4 10s. to £7 10s.

A radio gramophone is also being shown.

H. J. Henderson & Co., Ltd., 351, Fulham Road, S.W.10.

HOBDAY. (252 & 253)

Acting as distributors for the trade, this company is exhibiting a comprehensive range of the new season's components and accessories.

Besides the products of other firms, they have a number of interesting components of their own. These include dry batteries, switches, chokes and ebonite.

Hobday Bros., Ltd., 21-27, Great Eastern Street, E.C.2.

HOUGHTON-BUTCHER. (242-245)

Here the radio dealer will find arranged a selected number of new lines, those, in fact, which in Houghtons' opinion are going to prove the most popular of the coming season.

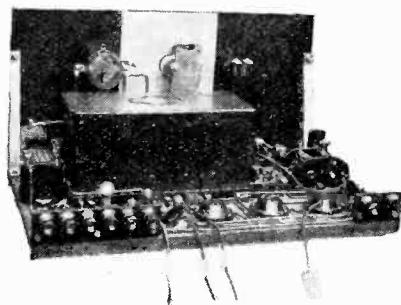
Houghton Butcher (Great Britain), Ltd., 88-89, High Holborn, London, W.C.1.

IGRANIC. (161 & 162)

As it is representative of typical modern practice in the design of a receiver intended for the requirements of the average wireless user, the new "A.C.3" will perhaps be considered to be the most interesting Igranic exhibit. Three indirectly-heated A.C. valves, functioning normally as screen-grid H.F. amplifier, detector and pentode L.F. magnifier, are used, while in each model provision is made for gramophone reproduction by a switching arrangement whereby the pick-up is automatically connected across detector grid and filament, with appropriate negative bias—which, by the way, is obtained from a battery, although L.T. and H.T. current are derived from the mains, the latter through a U.5 double wave rectifying valve. The set is supplied in three distinct models: Table, Bureau, and Radio-Gramophone, the first-mentioned being intended for operation with an open aerial, while the other two are provided with built-in non-directional frame aerials. Both these models have Igranic Patent cone loud speakers housed in the base of their cabinets and operated by a balanced armature unit of particularly workmanlike design.

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The circuit arrangement is fairly conventional, but it is observed that complete decoupling of the anode circuits is included, and that a choke-filter output device is provided. Metal enters largely



Igranic short-wave superheterodyne.

into the construction of the set, as the various units and screens are assembled on a frame of L-section aluminium.

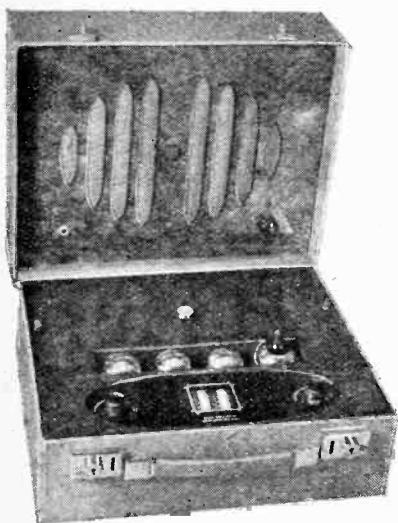
Another entirely new set is the "Neutrosonic" Short Wave Receiver, a compact and distinctly promising short-wave version of the well-known "Neutrosonic Seven" (which, by the way, is produced this year in a new type of cabinet with built-in moving coil loud speaker). The short-wave superheterodyne, covering the band between 12.5 and 70 metres, has a total of six valves, including a signal-



Hart unspillable accumulator for portables.

HART COLLINS. (49)

The principal exhibits are the "Passport" portable receivers. The four-valve screen-grid model in leather attaché case sells at £21 5s. complete, and the more ambitious *de luxe* model at £23 10s. The latter is contained within a cabinet of solid walnut, and is fitted with a Celestion loud speaker. Particular attention has been paid to the total anode consumption, which is under 10 mA. Provision is made in both models for the connection of an external loud speaker,

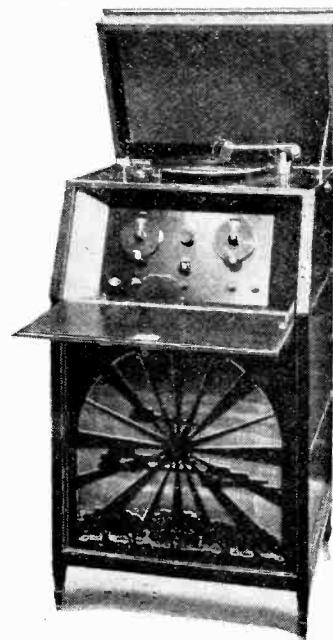


The Hart Collins "Passport" receiver—
a screen grid portable.

and, if desired, a Fultograph wireless picture receiver can be attached.

In the programme for this season there are all-mains receivers.

Hart Collins, Ltd., 38a, Bessborough Street, S.W.1.

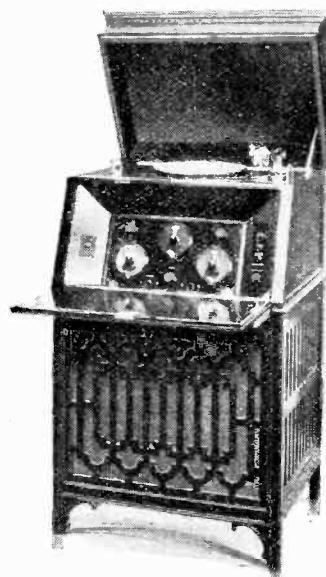


Igranic A.C. Three radio gramophone.

frequency amplifier before the detector. As choke aerial input and an autodyne oscillator circuit are employed, there is but one tuning control. Considering its possibilities, the price of this receiver (£23 without valves or batteries) may fairly be considered as exceptionally low.

Stand-to-Stand Report.—

Turning to components, we find that a new range of double-waveband coils has been produced. There are three distinct types : aerial coil (or tuned anode), neutralised H.F. transformer and screen-grid H.F. transformer. Each is mounted in a neat moulded bakelite case, and is intended to be used with a simple on-off switch for waveband changing. Provision for reaction is included in each case. Regarding the screen-grid H.F. transformer, it is stated that the primary impedance is designed to match the average present-day valve. In order to



Igranic Neutrosonic Seven: cabinet model.

simplify wave-changing, a fixed primary is used; it is carefully disposed in order to afford the best possible compromise between ideal conditions on both wavebands, with a slight bias in favour of the medium waves, where maximum efficiency is most needed.

Although it is not, strictly speaking, a new product, mention should be made of the Igranic Transverse Current Microphone, described in our Manchester Show Report last year. This component seems to be finding an increasingly wide field of usefulness in connection with public address and other work of a similar nature.

All the well-known Igranic components are retained, with, in several instances, minor alterations and improvements in design.

The Igranic Electric Co., Ltd., Elstow Works, Bedford.

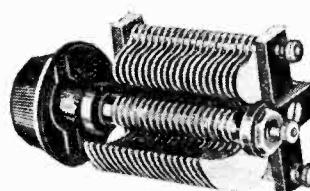
ITONIA. (286)

In addition to various radio receivers and accessories of leading makes, a portable receiver, a product of this company, is also shown. This set, the Autocrat Portable Five, is fitted with an Air Chrome loud speaker, a type in which a double diaphragm is used, and which is separately exhibited on the stand.

Itonia Gramophones, Ltd., Itonia House, 58, City Road, London, E.C.1.

J.B. (JACKSON BROS.). (97)

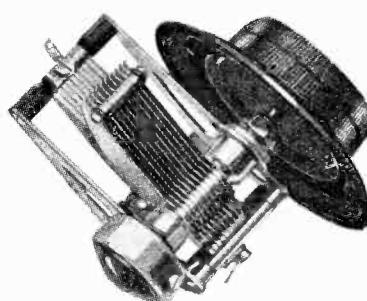
This firm now produces such an extensive range of variable condensers that it is impossible to enumerate, let alone to describe, all the various types. In view of the present vogue for condensers of small physical dimensions—brought about by the need for economising space in screening compartments, and also to



J.B. Midget condenser.

the demands of the portable set builder—attention will be focused on the new "Tiny" pattern. These little condensers are supplied with knob, pointer and scale, have an 8:1 reduction gear, and are provided with a ball bearing and pigtail connector. The 0.0005 mfd. model costs 10s. complete.

The Universal Log Condenser is a high-grade product, and one need hardly say more than that it is a real engineering job. Both vanes and frame are of hard brass. The steel centre spindle is adjustable as to its length, so the component should be handy for mounting in unconventional ways—as, for instance, in screening cabinets of the type lately described in this journal. Lugs are fitted so that the condenser may be mounted on the baseboard.



J.B. slow-motion condenser.

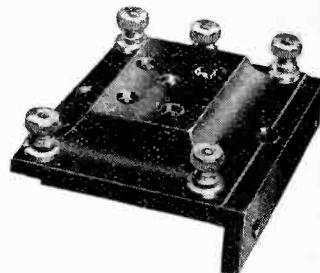
Several different patterns of edgewise drum dials (both direct and slow-motion) are exhibited. In particular a double-drum gauged unit, with single operating knob, has been produced and is specified for use in the new Mullard "Orgola" receiver. Special short-wave condensers, in capacities of 0.0001 mfd., 0.00015 mfd., and 0.00025 mfd., have phosphor-bronze balls in their bearings and increased air spacing between the vanes.

Jackson Bros., 72, St. Thomas Street, London, S.E.1.

JUNIT. (207)

A neat universal valve-holder is being shown. Having five sockets, one of which is central, screen-grid valves, triodes, and the new type of pentode can be accommodated. Provision is made for vertical or horizontal fixing. The special spring clip into which the valve legs fit is so designed that it makes positive contact along three surfaces of each valve leg. The valve-holder, having a bridge structure, enables the wiring when required to be carried underneath. A vertical terminal strip mount, with horizontal fixing ledge to prevent the possibility of splitting the wood of the baseboard, is also to be seen on this stand.

Junit Manufacturing Co., Ltd., 2, Ravenscourt Square, W.6.



Junit 5-pin valve-holder for vertical or horizontal mounting.

"K.N." ELECTRICAL PRODUCTS. (254)

This firm specialise in the manufacture of wireless receivers for the trade, and exhibit a number of sets to show their capabilities in this direction. There is a neat H.F.-det.-2.L.F. suit-case type of portable with a tuned H.F. coupling which embodies a metal chassis construction, also a complete portable radiogramophone with a more or less conventional two-stage H.F. amplifier followed by a detector and two L.F. stages. The "Cube" model is particularly compact. A three-valve all-mains receiver is also shown.

"K.N." cabinet cone loud speakers include an auxiliary balancing mechanism in their drive units, and are manufactured in various types.

"K.N." Electrical Products, Ltd., 5 and 7, Singer Street, Tabernacle Street, Finsbury, E.C.2.

KABILOK (W. T. LOCK). (202 & 203)

A fine display of cabinets, of almost every imaginable type, is made on these stands. Not only are there containers for sets and radio gramophones, but also for loud speakers, of both the moving coil variety and the reed-driven type. The constructor is catered for by the provision of special models suitable for use in assembling cone loud speakers with the help of the popular drive units.

A pedestal gramophone cabinet, suitable for accommodating a typical "kit" set, has just been produced. It provides space for the set itself, and also for motor, turntable, and batteries or eliminator. A loud speaker can be built into the lower compartment.

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Table cabinets for all the well-known "kit" sets are exhibited, including one for the "transportable" version of the Mullard S.G.P.

W. and T. Lock, Ltd., St. Peter's Works, Bath.



Lock gramophone cabinet for kit sets.

KALISKY. (24 & 25)

This firm is showing a range of their own products, sold under the trade name of "Sopranist," such as accumulators and transformers, etc., as well as a number of proprietary sets, loud speakers and components, for which they are agents.

S. Kalisky (Aldgate), Ltd., 75, Aldgate High Street, London, E.C.3.

KEITH PROWSE. (228)

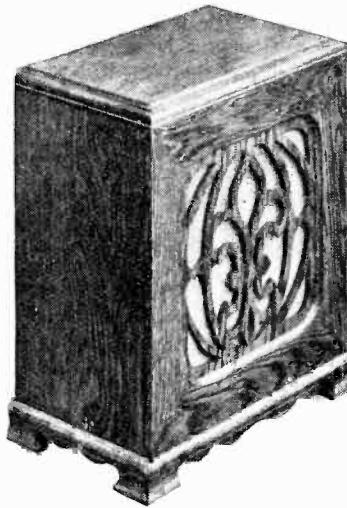
On this stand is displayed a representative range of portable and cabinet receivers, including those made by Burndept, Aeonic, Truphonie, McMichael and Halcyon.

Keith Prowse and Co., Ltd., 159, New Bond Street, W.1.

KOLSTER-BRANDES. (176-179)

This company has embarked upon the manufacture on a large scale of popular-priced receivers. As an instance of a well-designed receiver conforming to the latest practice, mention should first be made of the K.B.102 set, which sells complete with valves and royalties, at £9 15s. A screen-grid H.F. amplifier is followed by a leaky grid detector, which, in turn, is followed by pentode output. Accurate tuning is facilitated by drum

controls and vernier adjustment. The K.B.161 set is entirely mains-driven, and, although the circuit is similar to the K.B.102, greater selectivity is got by the use of a double-tuned circuit, together



The K.B.72 balanced-armature speaker by Kolster-Brandes.

with a reaction condenser. To prevent overloading of the last valve a volume control is included. The receiver, ready to plug into A.C. mains, is £17 10s. complete.

A battery-fed model, having the same circuit and provided with a gramophone pick-up jack, sells at £10 15s. The K-B suit-case portable set, having a balanced armature cone speaker in the lid, is priced at 18 guineas. There are four valves, the first being an S.G. valve, and the last two being linked by L.F. transformers. The aerial and inter-stage inductances are tuned by thumb dials with vernier adjustments.

A radio-gramophone, designed to operate from A.C. supply mains, con-



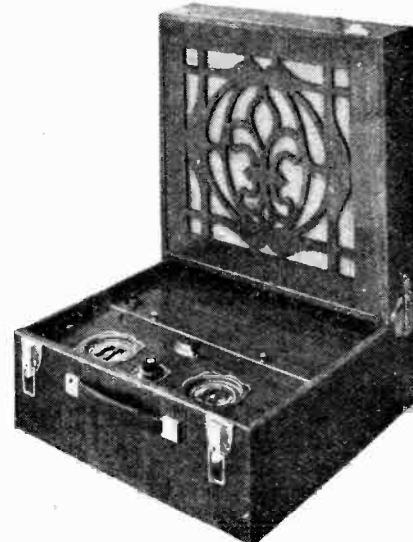
The K.B.151 Dynamic speaker made by Kolster-Brandes.

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tains a three-valve set substantially the same in design as the K.B.161 receiver. There is also included a spring-driven motor, capable of playing three records at one winding, and a K.B.131 pick-up. The K.B. electric gramophone contains a two-stage L.F. amplifier, the first valve of which has an indirectly heated cathode; this is coupled to two output valves in parallel. A liberal smoothing equipment follows the full-wave rectifying valve. A K.B. gramophone pick-up, a moving coil speaker, and electric motor with 12in. turntable, are included. The whole equipment, which is capable of giving sufficient volume for a small hall, is thus A.C. mains-operated.

The well-known Brandeset 3A and 3B receivers and the Ellipticon cone loud speaker are being retained for the new season, as are also the Brandes accumulators.

Kolster-Brandes, Ltd., Cray Works, Sidcup, Kent.



Kolster-Brandes 4-valve screen-grid portable.

L.E.S. (LONDON ELECTRIC STORES). (293 & 294)

Radio wholesalers and distributors. It should be noted that the name of this company has been changed to "L.E.S. Distributors, Ltd.," taking effect from September 23rd.

L.E.S. Distributors, Ltd., 9, St. Martin's Street, Leicester Square, London, W.C.2.

LAMPLUGH. (126 & 127)

The buying of a receiver in an elaborate and expensive container may fairly be considered an extravagance when one has standing idle a cabinet or other piece of furniture suitable for housing the apparatus. No doubt many potential wireless users are so situated, and, to cater for them, this firm has introduced "Chassirad" receivers—complete sets, but with no containers other than the metal cases in which they are built. The first is an

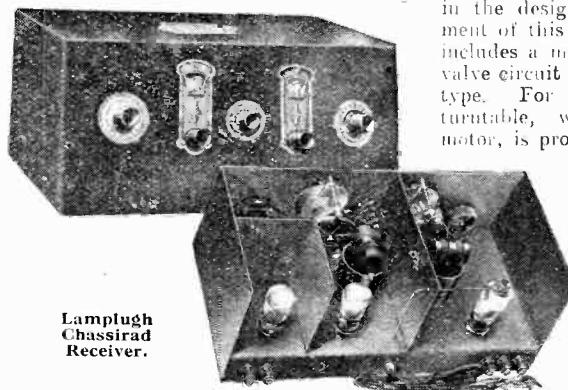
Stand-to-Stand Report.—

H.F.-det.-L.F. combination, including such modern refinements as waveband switching, separate reaction windings for each waveband, and complete screening. The metal casing of this set is complete, and is finished in an improved form of "crackle" enamel; actually, many would consider it good enough to use without any camouflage. The second set is a three-valve outfit (det.-2 L.F.) similarly built on a metal chassis, with only the valves exposed. Both these sets are excellent samples of modern manufacturing practice.

The "Silver Ghost" is a good-looking receiver embodying the same circuit arrangement as the "Chassirad," but mounted either in a table cabinet or on a console pedestal with built-in loud speaker.

Two-and three-valve all-mains sets are also exhibited. Both these models are fitted with provision for connecting a pick-up.

A radio-gramophone with a three-valve det.-L.F. combination has just been introduced. A B.T.H. pick-up is fitted as standard, and the set is provided with a volume control in the L.F. coupling, which is consequently effective both for gramophone and wireless reproduction.



Lamplugh
Chassirad
Receiver.

There are also a range of components, including eliminators for A.C. and D.C. supplies.

*S. A. Lamplugh, Ltd., King's Road,
Tysley, Birmingham.*

LANGHAM. (59)

"The Langham Blue" is a five-valve portable set with two choke-coupled H.F. stages, followed by regenerative leaky-grid detector and two L.F. stages, which are resistance- and transformer-coupled respectively. The total anode consumption is under 9 mA. Provision is made for the use of a gramophone pick-up, and the receiver in a case covered with blue leather cloth sells at 18 guineas (including royalties).

The "Popular Five" sells at the low figure of 16 guineas, and has a single tuning control of the vernier drum type. Waveband switching and a separate volume control are provided.

Langham Radio, Ltd., Exhibition Works, Wembley.



The Langham-Blue portable receiver.

LAW (LOCK-ATKINSON). (257)

An exhibit of screens and screening boxes, including several designs specified in this journal, is a feature of this stand. "Kilo-Mag Four" coils are also shown.

The LAW radio-gramophone is an interesting example of extreme compactness in the design of a dual-purpose instrument of this class. On the radio side, it includes a more or less conventional five-valve circuit in a container of the suitcase type. For gramophone reproduction, a turntable, with Garrard double-spring motor, is provided, together with a pick-up on a pivoted arm, which is neatly arranged to fold back into the lid when not in use. A Celestion loud speaker is fitted to this model. The set is nicely finished, the case being covered in antique hide with oxidised silver fittings. Batteries and gramophone motor are stored in a separate compartment to which access is easily obtained by opening an extra lid in the base.

cabinet radio-gramophone, which is so arranged that it can be supplied with the necessary equipment for operation from the mains.

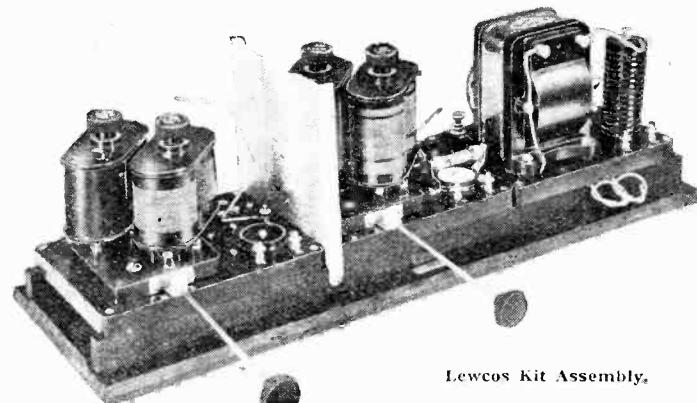
Lock Atkinson Wireless, 95, Great Titchfield Street, London, W.I.

LEWCOS (LONDON ELECTRIC WIRE CO. & SMITHS). (64)

"From the copper ingot to the complete set" would not be a bad slogan to apply to the new "Three-valve Kit Assembly" produced by this well-known firm of wire manufacturers. Actually, some slight qualification would be necessary, as the set as supplied is not quite complete, requiring merely the addition of some form of container, three variable condensers, and an on-off switch. It is intended that the receiver shall be housed in an existing piece of furniture or in an American style cabinet of conventional design.

An entirely novel method of construction has been adopted in this set, which comprises a screen-grid H.F. valve, transformer-coupled to a grid detector with reaction, which is linked by the new "Lewcos" I.F. transformer to a single output valve. The three valve units—H.F., detector, and L.F.—are mounted on bakelite baseboards, which include spring-suspended valve holders and also carry mouldings for accommodating the coils, which are of the fieldless binocular type, long- and medium-wave inductances being mounted side-by-side. Waveband switching is quite unorthodox, as the coil bases are moved bodily through push-rods; connection to the various points is made through springy contacts on the undersides of the bases, which engage with corresponding studs on the chassis.

Provision is made, by means of a metal strap, to effect the necessary filament circuit modifications for using either directly heated battery valves or indirectly heated A.C. valves. Where maximum range and volume is desired, a pentode may be fitted in the output socket. It is no exaggeration to say that the set can be wired up to give signals in a few minutes, as all



Lewcos Kit Assembly.

Several other portable and transportable sets are shown, including a cheaper model at 14 guineas. There is also a large

the internal connections have already been made.

It is generally admitted that the ab-

Stand-to-Stand Report.—

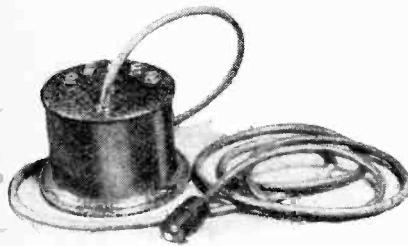
sorption type of wavetrap, if properly designed, is the most satisfactory instrument of its kind; those who find difficulty in eliminating a powerful local station will be interested in a new piece of apparatus, designed to fit on the aerial-grid coil of an existing set, which is shown for the first time. The capacity-inductance ratio of the absorbing circuit has been well chosen; the condenser, of the semi-variable type, is of comparatively large capacity, and is mounted on top of a moulding carrying a litz wire coil. The range of usefulness of this neat little gadget is limited by the fact that it cannot easily be coupled to every type of coil, but, with a little ingenuity on the part of the user, it should be adaptable to a large number of sets.

Mention has already been made of the new "Lewcos" L.F. transformer; this component, which has a 5 : 1 step-up ratio, is designed with an eye to the popular type of set in which a grid detector (with or without a preceding H.F. amplifier) is followed by a single L.F. stage.

It would be quite impossible, in the space available, even to give a bare list of the wide range of coils and H.F. transformers on this stand, but mention should be made of a new dual-range binocular coil mounted on a base with built-in switch, and of a new plug-in inductance coil with three tappings led out to terminals disposed round the casing.

It is hardly necessary to add that specimens of every conceivable type of wire applicable to the radio art are on view.

The London Electric Wire Co., and Smiths, Ltd., Church Road, Leyton, London, E.10.



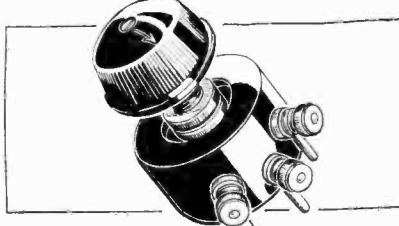
A D.C. eliminator at a popular price, made by Lissen.

LISSEN. (184-186)

Included among the products for this season are two D.C. eliminators selling at popular prices. To the keen student who follows the latest accepted practice these units should prove of special interest. After the usual choke-condenser smoothing circuit, potentiometer-feed for screen current is provided by means of fixed series resistances in type A model, and by a continuously variable wire wound resistance in type B. The latter unit also contains a variable control for detector plate voltage—a desirable refinement with leaky-grid rectification. Series feeds are used for the other two H.T. positive tappings, which deliver a total of 12mA.

The units are housed in neat circular bakelite mouldings about 4in. in diameter,

and the space around the components is filled with wax to prevent derangement should the eliminator be dropped. Type A sells at 27s. 6d., and type B at 39s. 6d.



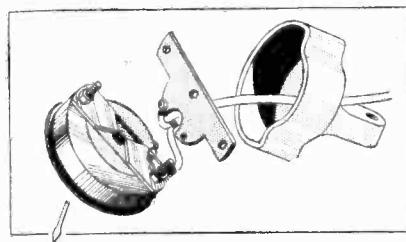
Lissen volume control with rocking plate contact.

It is understood that the wire-wound variable resistances referred to, which are only about 1½in. in diameter, will be available separately; the fine wire resistance element is wound on a circular former to which contact is made by an ingenious flexible metal rocking plate, so that there is no rubbing action.

For grid circuits where there is no D.C. component a new potentiometer volume control is available. The same rocking plate form of contact is used, but the resistance element of 500,000 ohms is not wire-wound. For radio-frequency or gramophone pick-up circuits this component should have considerable appeal at 4s. 6d.

A new gramophone pick-up, contained in a bakelite moulding, is of distinctly interesting construction. A spear-point needle is used, held by a rubber washer, and is limited in axial movement by the diverging blades of the spear-head, while the end of the needle remote from the point is free to move in the small gap between two large V-shaped pole pieces. The needle, which thus becomes the armature, is the only moving part; the price is 30s.

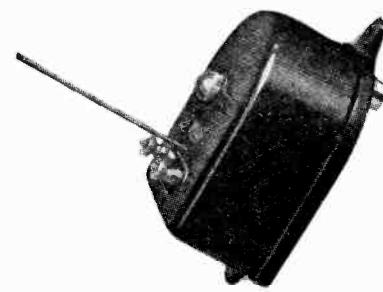
A new range of eight two-volt valves, including two pentodes and a screen-grid valve, are now on the market. The screened valve—called the S.G.215—has an amplification factor of 180, an A.C. resistance of 200,000 ohms, and a mutual conductance of 0.9 mA. per volt. The super-power pentode—the P.T.240—has an A.C. resistance of 22,500 ohms and an amplification factor of 45, giving a slope of 2 mA. per volt. As an indication of the grid swing that the valve will accept at 100 volts on both anode and screen the recommended grid bias is 7½ volts negative.



The Lissen pick-up in which the spear-point needle is the armature.

There are no fewer than twelve radio-gramophones, ranging in price from £30 to £49 12s. 6d., the less expensive models are battery-fed and the more elaborate machines are equipped with A.C. or D.C. eliminators and moving coil loud speakers. Where the design includes mains equipment an electric gramophone motor can be incorporated for a small extra charge.

An interesting feature in connection with the five-valve Lissenola portable set selling at £16 16s. is the extremely low total H.T. consumption of 8 mA. This is brought about by careful attention to the negative biasing potentials of the two 3-electrode H.F. valves, as well as that applied to the L.F. valves.



Balance-armature cone unit—a Lissen product.

Among a host of other components are H.T. and L.T. accumulators, cone units, and a Combinator which allows the rapid construction of an R.C.C. unit from fixed condensers and resistances. The super-transformer, selling at 19s., and the S.G.3 kit receiver, well known to readers, are still contained in the programme for 1930.

Lissen, Ltd., Friars Lane, Richmond, Surrey.

LITHANODE. (232)

A new range of Lithanode L.T. accumulator batteries in glass cases are shown for the first time. These include the special plates used in the other products of the firm, and are sold at relatively low prices. A special high-capacity battery, suitable for withstanding the demand of, say, a big amplifier with a number of L.S.5 type valves, and at the same time feeding a moving coil loud speaker magnet winding, is another new product.

A number of single unspillable cells, with ampere-hour capacities up to 40, are exhibited. These are of the type so widely used for portable sets.

On this stand is also exhibited the Metropolis portable set, embodying a very unusual supersonic heterodyne circuit. A total of five valves is employed, including two of the screen-grid type, two triodes, and a pentode in the output position. Both weight and overall dimensions are below the average.

The Lithanode Co., Ltd., 190, Queen's Road, Battersea, London, S.W.8.

LOEWE. (291)

Particular interest attaches to the Loewe exhibit in view of the application of the well-known Loewe multiple valve to the design of popular receiving sets. A local station receiver (type O.E.333) is

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virtually a three-valve receiver, comprising a detector valve with two resistance-coupled L.F. stages. The receiver contains tuning coils and variable condenser together with a lever pattern "on" and "off" switch, while terminals are avoided by the provision of battery connecting leads. The aerial circuit is loose-coupled and is therefore particularly selective, and the arrangement of interchangeable coils permits of the reception of Daventry 5XX. An anode voltage of 90 is specified and an L.T. supply at 4 volts.

Although of very similar external appearance a modification to the above receiver is found in the type R.O.433, in which provision is made for the use of reaction. The aerial circuit is loose-coupled as before, though in this instance the secondary coil is tapped to permit of the introduction of capacity reaction. A small lever near the base is provided for this purpose. A.C. battery eliminators are available for use with these receivers. The price of the O.E.333 is £3 3s., and the R.O.433 is £3 10s., in each case complete with coils for the lower waveband and valve.

Loewe valves complete with the necessary multi-contact sockets are obtainable in three types. For detector and two L.F. circuits there is the type 3N.F., while for combining a single radio frequency stage with a single low frequency



Loewe receiver. Type O.E.333.

amplifier there is the type R.N.F.7. These valves cost £2 3s. 6d. A two-stage H.F. valve, type 2H.F., costs £1 12s. 6d. It is appreciated that these valves do not only contain the valve elements, but include in addition the associated interstage couplings of the resistance type. The filament voltage is 4 and the current consumed is 0.3 ampere in respect of the three-section valves.

Attractive cone loud speakers are also shown, intended specially for use with the Loewe sets, the combination forming a particularly simple receiving outfit. In addition, there is a gramophone pick-up, and it is to be noted that sockets are

available on the side of the receivers to permit of its use without modification.

The Loewe Radio Co., Ltd., 4, Fountayne Road, Tottenham, London, N.15.

LONDON RADIO MFG. CO. (112)

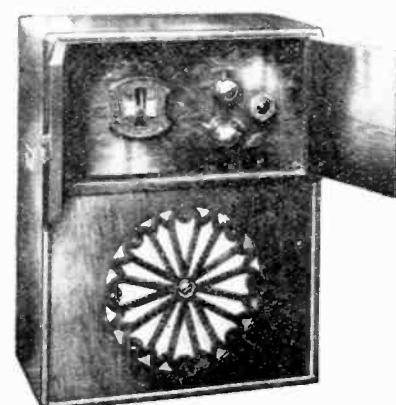
Amongst the various loud speakers shown on this stand the Orphean cone at 29s. 6d. represents good value for money. The circular cone of the speaker is supported in an 11in. square bakelite moulding, and the movement consists of a reed-driven cone which is adjustable. The speaker is so constructed that it can either stand on a table or hang from a picture rail. The "Super" cabinet speaker, with an 11in. cone in a polished domed cabinet of oak, is priced at £6. Space is left within the cabinet for the necessary components that go to make up a two-valve amplifier such as would be used after a gramophone pick-up. There is a popular cone and chassis housed in an 11in. square cabinet which sells at the moderate figure of 20s. complete.

The "Standard" cabinet cone, contained in a well-finished ornamental cabinet in which there is no space for an amplifier, sells at £3 15s.

London Radio Mfg. Co., Ltd., Station Road, Merton Abbey, S.W.19.

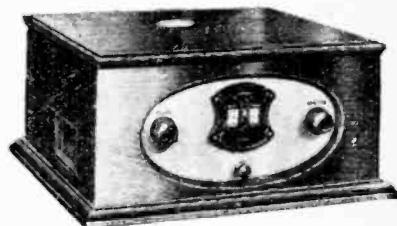
LOTUS (GARNETT, WHITELEY & CO., LTD.) (63)

A visit to this stand reveals at once this season's trend in radio receiver design. A typical up-to-date receiver is the Lotus three-valve all-mains transportable. It is an entirely self-contained set with indirectly heated screen-grid and detector valves, followed by pentode output. A valve rectifier furnishes the H.T. and grid biasing potentials. Being fitted with cone loud speaker and self-contained frame aerial the only connection required is a two-pin plug to the electric supply. To avoid the necessity of swinging the entire receiver the frame aerial is carried on a hinged door at the back of the set. Edgewise thumb-dial tuning with two scales side by side renders control quite simple. There is a two-range switch and a reaction knob. The front panel also carries a pilot lamp,



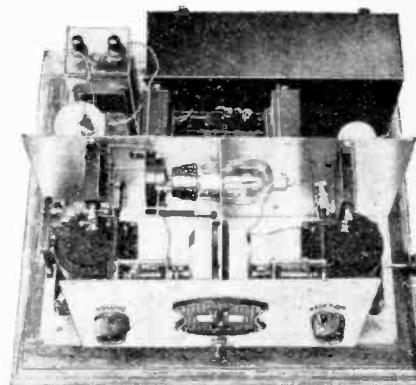
Lotus three-valve all mains transportable

indicating the turning on of the current. The well-finished cabinet can be had in oak, walnut, or mahogany at prices from £25 4s. to £26 5s.



The Lotus three-valve S.G.P. all-mains receiver.

Another all-mains set is the Lotus receiver, type S.G.P. Here, again, we find the combination of indirectly heated screen-grid and detector followed by pentode. Metal panels support and screen the various components. It incorporates a full wave valve rectifier with generous smoothing equipment. The general external design is that of a well-finished cabinet with an oval front aperture exposing a metal panel which carries the controls. With oak, walnut, or mahogany cabinet the price is £21. It



Lotus three-valve S.G.P. kit set.

is claimed that the reproduction of this receiver is worthy of the adoption of a moving-coil loud speaker. It is stated also that reaction, although provided, need not be forced in view of the high efficiency of the H.F. amplifier. Tuning is said to be simple, due, in the first place, to the generous amplification and, in the second, to the tuning controls being of the adjacent thumb-operated type combined with the close matching of the coils. Three alternative tappings are provided to suit different aerials and locations. Wave change is effected by a knob situated on the side of the set. Provision is made for a gramophone pick-up attachment. The wave ranges are 200-550 and 1,000-2,000 metres. Where A.C. mains are not available a corresponding set, priced at £13 15s., is available for battery working.

Of almost similar construction to the above are two sets, the parts for which are in the form of a kit. The main

Wireless World

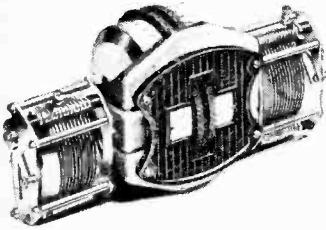
SEPTEMBER 25th, 1929.

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components are mounted in position on the metal panels, and full instructions are given for assembling. The attractive layout of the components will make a strong appeal to the home constructor. Without valves the price of the D.C. model is £7 12s., and the A.C. model, including H.T. eliminator, £14 10s.

A four-valve suitcase portable is also exhibited. It makes use of two screen grid stages, detector, and pentode output, and the price is 19 guineas.

Additions to the range of Lotus components include an all-mains unit, various power transformers, and a generous eliminator smoothing choke. Of attractive appeal, however, are the double- and single-drum dials, of which the dimen-



Lotus drum vernier dial.

sions have been carefully arranged to combine attractiveness with ease of operation. The Lotus all-brass condensers for attachment to these dials are already well known, they having been adopted in several instances in the construction of *The Wireless World* receivers. Reaction and differential reaction condensers, together with Lotus valve holders, H.F. chokes, and intervalve transformers are among the smaller components.

Garnett Whiteley and Co., Ltd., Lotus Works, Mill Lane, Old Swan, Liverpool.

LUNMET (LONDON METAL WARE-HOUSES). (222)

Metal stampings of interest to the radio manufacturer, together with aerial wire and the "Lunmet" insulated terminal, are the principal items of interest to be found at this stand.

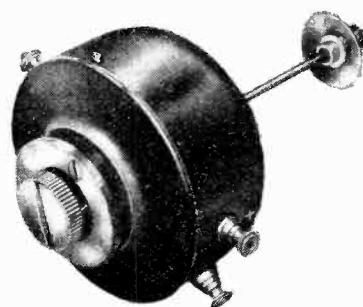
London Metal Warehouses, Ltd., Hill Street, Pocock Street, Blackfriars, London, S.E.1.

M.P.A. (165)

The M.P.A. Mark VI loud speaker unit is a well-made device, and has several refinements not usually found in a low-priced instrument. For instance, it is provided with an extra terminal for earthing the case, a useful feature in dealing with wandering H.F. currents in a self-contained receiver. It is included in the new M.P.A. Plaque loud speaker, which has been completely redesigned since last season. A new low-priced cabinet cone loud speaker, also energised by this movement, has been introduced.

The All-Electric Three is a combination of neutralised H.F. amplifier, detector, and pentode output valve. It conforms with the I.E.E. regulations, and is designed to work on A.C. mains. Provision is made for gramophone reproduction.

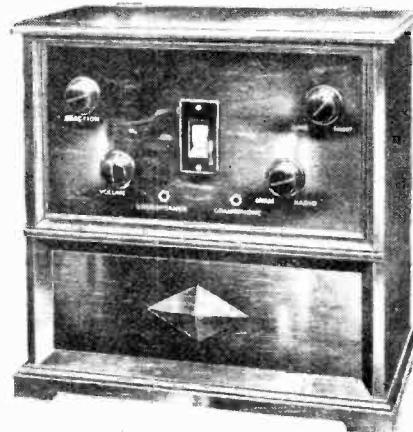
Another set that should be popular is the Screen-Grid Transportable Four, which is entirely self-contained except for a connection to A.C. mains.



New M.P.A. unit.

An all-electric radio-gramophone (also for A.C. supply) is also produced. This includes a four-valve receiver (screen-grid H.F. amplifier), internal rotatable frame aerial, and electric turntable motor.

Components manufactured by this firm include a range of power transformers, heavy-duty smoothing chokes (mention



M.P.A. Self-contained set.

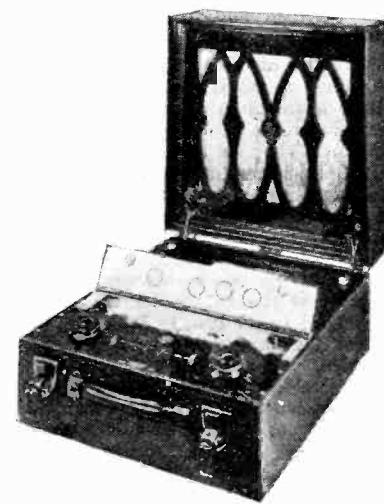
should be made of Type SM/600, designed to carry 600 milliamperes) and change-over switches, cam-operated and of low capacity. A universal eliminator, providing H.T., grid bias, and raw A.C. at low tension for A.C. valves is also manufactured, as well as a more ambitious model for public address work.

M.P.A. Wireless, Ltd., High Rd., Chiswick, London, W.4.

McMICHAEL. (101 & 103)

McMichael products include portable and transportable receivers, mains-driven sets, a kit of parts, as well as various components such as coils, chokes and switches. First in relative importance is the Super Range Portable Four, a now well-known suit-case portable which, while incorporating only one H.F. stage, is not handicapped in its performance against its five-valve competitors. This model now forms the basis of a new set

of the cabinet type, which consists of similar equipment, but is housed in a polished walnut cabinet with oxidised copper fittings. This instrument is offered on the reputation of its predecessor. It is a high-quality, long-range outfit. Tuning is simple, and is by geared thumb dial, and can almost be regarded as single-dial control. The price, including royalties and all equipment, is 26 guineas. Assuming that the



The McMichael Super Range Portable Four.

continuance to market a model is an endorsement of its merit, there can be little doubt as to the high performance of the Super-Screened Four Portable. By the use of two screened valve H.F. stages the aim has been to make available the maximum number of stations. A high degree of L.F. magnification is provided by a pentode. A special system of single-dial tuning is fitted by which the

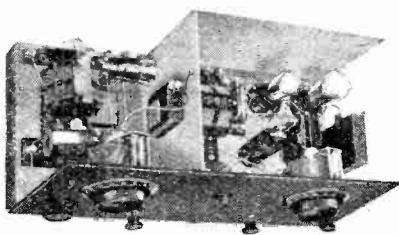


McMichael New Super Range Four.

Stand-to-Stand Report.—

several tuned circuits are used to their best advantage as an alternative to the simple process, often impairing performance, of ganging. The cabinet is of figured walnut, and behind the grille is a Celestion loud speaker. The price is 35 guineas. Mains-operated sets are represented by the Mains-Driven Screen-Dimic Three. This is a receiver of the cabinet type for use with an elevated aerial. It has an H.F. stage, and its circuit is orthodox, necessitating the use of two tuning dials. Incidentally, this is probably one of the few mains sets capable of operation on the ultra short wavelengths of 15m. upwards. Another receiver of unique cabinet design is the Portable Four Table Model. Embodying the receiver chassis of the standard Super Range Model, a modified layout provides for a sloping operating panel, while the loud speaker is arranged as a vertical grille forming the upper part of a desk shaped cabinet.

A kit of parts is available for the home constructor for building a three-valve set. It is of simple design with screen-grid H.F. stage with a choke-fed anode and tuned grid detector circuit. Two sets



The McMichael Screenet Three—a kit set for the home constructor.

of wave-range coils are included, the circuit changes being made by simple switching. Detection is by leaky grid condenser, and reaction is provided. The L.F. stage is transformer-coupled, the loud speaker terminals being in the anode lead of the output valve. Volume control is by variable resistance in the filament circuit of the H.F. valve. Most ingenious is the circuit detail by which the gramophone pick-up is introduced without the need for switching, while the necessary negative grid bias is provided by the grid cell associated with the H.F. stage. The kit of parts costs less than £9, includes high-grade components, and is readily assembled. By the use of interchangeable coils, the tuning range can be adapted to cover wavelengths from 15 to 10,000 metres.

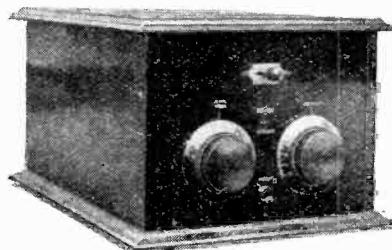
J. McMichael, Ltd., Danes Inn House, 265, Strand, London, W.C.2.

MAGNUM (BURNE-JONES & CO.).
(125)

Two- and three-valve mains receivers shown here are new Magnum products. The two-valve model priced at £16 10s. is a detector L.F. set using Mazda valves. Its two vernier-controlled dials are for aerial tuning and reaction, while, in addition, on the front of the instrument

Wireless World

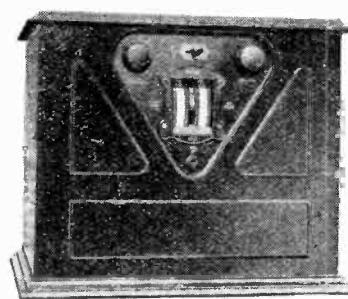
is a two-range switch and jack for gramophone pick-up. The three-valve model is more elaborately constructed and is tuned by means of double thumb dials. There is a volume control in ad-



Magnum A.C. mains receiver.

dition to reaction. The additional valve is an H.F. amplifier, and is the Mazda screen-grid. Dimensions 16in. x 15in. x 14in. There is a five-valve Magnum transportable, priced at 18 guineas. It has two-dial control, the tuning panel also carrying a wave-change switch and break jack for external loud speaker. A suit-case model is also available of similar circuit arrangement. H.T. current consumption is given as only 7 mA. for these receivers. An all-electric gramophone reproducer, known as the "Magnagram," is also manufactured, the loud speaker fitted being of the moving-coil type. The "Magnagram" is fitted with a self-contained frame aerial, and provision is made for radio reception. Tuning is by single dial, while, in addition, there are both reaction and volume controls.

Burne-Jones are well known as manufacturers of components, and, although no definitely new lines are shown, the range includes H.F. chokes, a wavetrap, screening boxes, six-pin coils and bases, single vertical screens, neutralising condenser, fixed condensers, calibrated rheo-



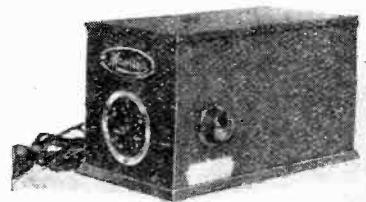
Three-valve Magnum receiver for use with A.C. supply.

stats, grid leaks, panel brackets, a continuously variable high resistance for use as a volume control, valve holders for four-pin and five-pin valves, L.F. chokes, a wavemeter and wavemeter coils, reaction and differential condensers, switches, and a gramophone pick-up. Prices are competitive.

Burne-Jones and Co., Ltd., 288-296, Borough High Street, London, S.E.1.

MAINTEN. (226)

The chief products of this company are H.T. eliminators for D.C. and A.C. mains. In all models great care has been exercised with regard to prevention of shock: for instance, where plugs and sockets are used—and this form of connection is to be found in practically every unit—the sockets are well recessed into insulating bushes. All units are contained within an earthed metal case, so that the requirements of lighting companies and the specification of the I.E.E. are complied with. There are six D.C. eliminators, called D.C.M.1 to D.C.M.6. In the smaller models the whole of the space around the components is filled with wax, which militates against broken contacts and dislodged components should the unit



Eliminator for A.C. mains, manufactured by Mainten.

be roughly handled. The prices of the three models referred to are from 20s. to £2 7s. 6d., and fixed tappings only are provided. The D.C.M. types 4, 5 and 6 have variable control of screen and detector voltages, and a liberal current for power-valve or pentode output is available. No common potential divider is used in any eliminator marketed by this firm, the necessary voltage dropping being effected by series resistances.

A current-limiting device is included in the D.C.M. model's, and even a short circuit of the output does not burn out the resistances or choke windings. A negative choke is used in each case, as its inclusion is found to be essential where the "neutral" conductor is positive. Of six A.C. units five employ rectifying valves, while a sixth contains a Westinghouse half-wave metal-oxide rectifier. The A.C.M.5 contains a Mullard D.U.2 full-wave rectifying valve, and, including royalty, sells at the moderate figure of £6 10s. complete. There is a variable tapping for screen voltage and two fixed tappings for the anode requirements of other valves, the total output being 20mA.

With the widespread interest in selectivity, due to the powerful transmission



Mainten D.C.M.5 eliminator.

Stand-to-Stand Report.—

from Brookman's Park, amateurs will be paying considerably more attention to high-frequency amplification, which, with modern valves, entails comprehensive metal screening; a full range of metal cabinets being shown by this company will thus be of considerable interest.

Mainen Manufacturing Co., Ltd., 126, Portland Road, Hove.

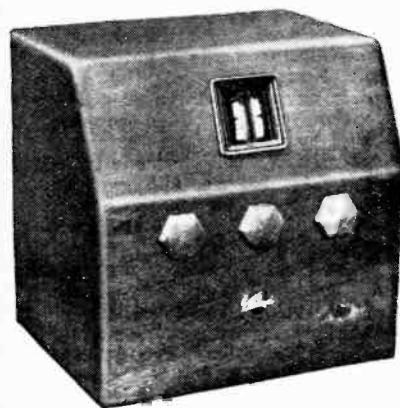
MANUFACTURERS' ACCESSORIES CO. (236)

As the name implies, this stand is principally devoted to a range of radio apparatus of interest to the retailer. H.T. and grid bias batteries are included, bearing the trade name "Reliomac." Mains transformers, together with battery eliminators and chargers, and bearing the name "Maco" are also shown.

Manufacturers' Accessories Co. (1928), Ltd., 85, Great Eastern Street, London, E.C.2.

MARCONIPHONE. (79-84)

It will probably be generally agreed that the new Marconiphone Model 56 Receiver is the star exhibit of this firm. Much can be said in favour of the principle of applying the major part of the total amplification provided before detection; here we have an outstanding example of this procedure. The set, with a total of five valves, includes three S.G.



Marconiphone Model 56 "3 H.F." receiver.

high-frequency amplifying stages, followed by an anode bend detector and a single resistance-coupled L.F. stage. Aerial coupling is "aperiodic," and thus there are four tuned circuits; these are ganged in pairs, and the two edgewise control drums are placed side by side so that they may be driven together as far as possible. As care has been taken to ensure that these pairs of condensers shall run together as closely as is practicable, the ideal of a single control is almost realised. Decoupling is extensively employed, and, while no attempt has been made to get the maximum obtainable gain from each stage, the overall H.F. amplification should be enormous, and one would expect that selectivity

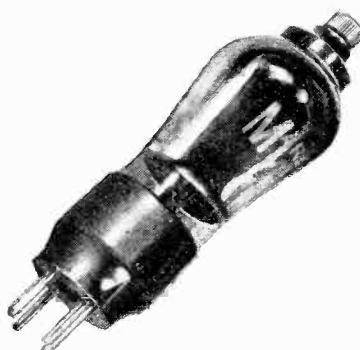
would be sufficient for the most difficult conditions, as a very loose aerial coupling could almost always be used. Incidentally, adjustment of this coupling provides the only form of volume control fitted (except detuning). It is stated that care has been taken to make it thoroughly effective, and one is forced to the conclusion that this form of signal intensity

directly-heated pattern with an output comparable to that of a P.625A. There is provision for a gramophone pick-up, and the two tuned circuits are controlled by a single knob with a balancing condenser across the aerial-grid coil. Volume control is by variation of aerial coupling. This receiver seems cheap at £24.

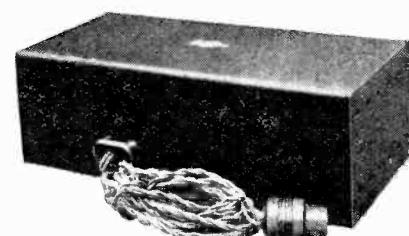
Model 39 receiver is similar in appearance to Model 56, but smaller and less ambitious in the matter of performance. Its circuit is an H.F.-det.-L.F. three-valve combination with reaction. Sockets provide for two alternative aerial couplings. There is space in the base of the cabinet for batteries or an A.C. mains unit. A pentode output valve may be used. The price is £21 complete for A.C. working.

Model 34 short-wave set, reviewed in these pages some time ago, is retained, but its price has been reduced to £22 10s., inclusive of valves. The Model 55 Portable now embodies an improved circuit arrangement.

There is a series of new mains units, among which one may instance the Model A.M.7, with a U.5 rectifying valve. This provides a maximum of 200 volts, with three other outputs variable in eight steps. It also provides raw A.C. for filaments or heaters at 0.8 volt, 4 volts, and 6 volts. The various units are of similar appearance, being housed in metal cases, of which the covers carry sockets corresponding with pins in the bases; when these covers are removed the supply circuit is automatically interrupted.



Marconi S.610 screen-grid valve.



Marconiphone mains unit.

The Marconiphone moving coil loud speaker has undergone considerable modification, and its suspension is now more conventional, as the central flexible spider support, mounted between base and apex of the cone, has been abandoned. The new cone is pressed from buckram, with the spider at the apex as an integral part. A ring of light woven material supports the other end. Prices now range from £4 10s. upwards. There is a new reed-driven cone, in a mahogany cabinet, selling at £3.

No attempt will be made to present a description of this season's Marconi valves of which there is a very complete series in battery (2-, 4-, and 6-volt) and A.C. patterns, with both direct and indirect heating; also power rectifiers.

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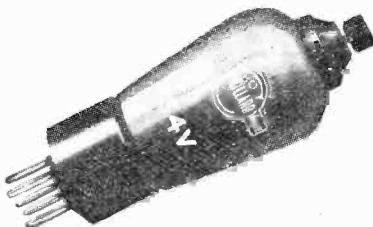
A new gramophone pick-up has just been introduced. This device is stated to give a sensibly uniform output between 25 and 4,500 cycles, and to provide a mean R.M.S. voltage of about 1.5. It should thus be amply sensitive to operate with a two-stage amplifier (or, of course, a detector converted into an amplifier followed by an output valve).

Marconiphone products, including the new pick-up, are demonstrated in the exhibition, and also at 13, Maclise Road, which is near by.

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

MULLARD. (58, 117 & 134-137)

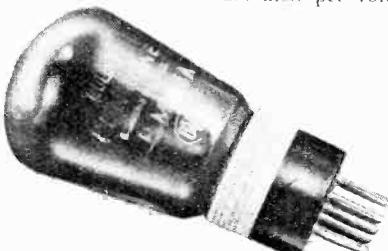
In view of the widespread interest in all-mains A.C. receivers, probably the most attractive exhibits among the new components are the indirectly heated A.C. valves. There is an A.C. screened valve—



The Mullard indirectly heated screen-grid valve—the S.4V.

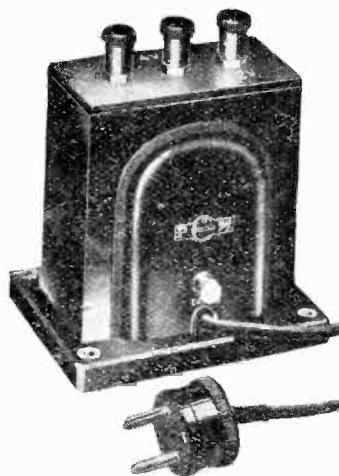
known as the S.4V—having an amplification factor of 1,000 and an A.C. resistance of 1.33 megohms. With a low-loss tuned anode or tuned grid interstage coupling, a single-stage gain of the order of about 100 times should be obtained. A step-down H.F. transformer is theoretically correct for maximum amplification, but as a tuned anode (or tuned grid) circuit which represents a 1 to 1 transformer is used, having many fewer turns on the primary than the optimum value, the selectivity should be considerably better than with a tuned anode circuit and an S.G. valve having an A.C. resistance of, say, 250,000 ohms.

The 354V valve has an A.C. resistance of 14,000 ohms and an amplification factor of 35, giving a mutual conductance of 2.5 mA. per volt. It is suitable for H.F., detector, or 1st L.F. positions, and will handle a grid swing of 8 or 9 volts. The 164V and the 154V are similar valves to the "D" valves, but with indirectly heated cathodes; the former has the high mutual conductance of 2.4 mA. per volt.



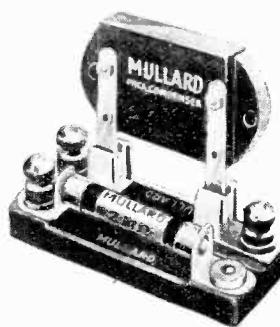
A new super-power pentode—the Mullard PM.24A.

The 104.V has an A.C. resistance of 2.850 ohms, an amplification factor of 10, and a remarkable mutual conductance of 3.5 mA. per volt; it is, of course, a power valve, and will handle about 20 volts grid swing. The heaters of these A.C. valves all consume 1 amp. at 4 volts



Mullard filament transformer for A.C. valves.

Since last Olympia Exhibition a 6-volt S.G. valve and a 6-volt pentode have been added to their respective ranges, and there is now available a super-power pentode (the P.M.24A) for 4-volt accumulators or for direct A.C. filament heating, with a filament current of 0.275 amp. and



Resistance-capacity unit manufactured by Mullard.

a maximum anode voltage of 300. The auxiliary grid, which is brought out as a central pin in the base, should be connected to 200 volts H.T., when the power output will be enormous. It is probably better not to use the whole available grid bias, which appears to be nearly 60 volts, to prevent anode distortion, but even a fraction of this input would result in an output of sufficient amplitude to load the largest domestic loud speaker. The amplification factor of this output valve is 83, and the A.C. resistance 53,000 ohms.

The new P.M. filament transformer, selling at 32s. 6d., is primarily designed to supply the 4-volt heaters of the Mullard A.C. valves. The maximum output is 5 amps. at 4 volts. There are six

models, with primaries suitable for the various A.C. supply voltages. The secondary winding has a centre-tap for cathode and earth connection, and the input frequency range is from 40 to 100 cycles. The combined P.M. grid leak and condenser holder is an innovation of interest; a special link is provided which allows the leak to be shunted across the condenser or to be connected to one side only. The price is 2s. 6d.

Besides a comprehensive range of receiving valves for 2-, 4-, or 6-volt accumulators, there will be retained in the 1930 programme the two Pure Music speakers, the "Permacore" transformer with nickel and silver winding, and the H.T. unit, as well as other 1929 components.

Mullard Wireless Service Co., Ltd., Mullard House, Charing Cross Road, W.C.2.

NEW LONDON ELECTRON WORKS. (67)

Aerial wire is principally shown at this stand. The simplest manner of erecting an aerial is probably with the aid of Electron wire, which is an insulated and stranded lead, or with Super Aerial, which has a more generous conductor. The earth mats shown form a convenient and reliable method of establishing the earth connection. They are conveniently fitted with 25ft. of earth wire. Durable wire, suitable for the running of extension leads, is available in various lengths from 50 to 500 feet. A topical idea is the introduction of 50ft. experimental aerials, which have been specially produced to provide improved selectivity when necessary for the separation of the Brookman's Park transmissions. There are various items at this stand of modest price.

The New London Electron Works, Ltd., East Ham, London, E.6.

NORMA (NORMAN HUNTLY). (235)

Norma components exhibited at this stand include variable condensers, switches and H.F. chokes. An aluminium plate log scale condenser of reliable con-



The Norma Five.

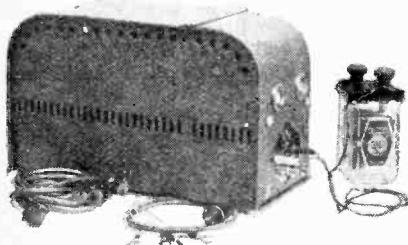
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struction with one-hole fixing and ball race bearing is offered in a capacity of 0.0005 mfd. at the popular price of 4s. In addition there are two portable receivers, the Norma Five, which is available in a lacquered Chinese case at £16, and the Norma Screened Three, said to be capable of good foreign station reception and priced at £11 5s.

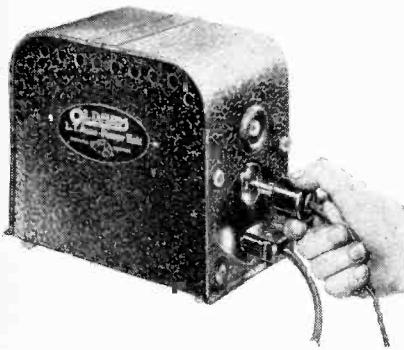
Norman Huntly, 35, Clerkenwell Green, London, E.C.1.



Oldham H.T. and L.T. Auto-Power unit.

OLDHAM. (68 & 70)

Called "power units," an entirely new range of devices is found at this stand by which H.T. and L.T. supply may be derived from A.C. supply mains. These units are not battery eliminators and do not possess the disadvantages commonly met with in such apparatus. Actually they are accumulator batteries which are automatically charged when disconnected from the receiving set. Three important advantages are thus obtained: (1) mains hum and the various complications associated with the mains earth are completely removed; (2) the output voltages are constant almost irrespective of the load—there are no voltage-dropping resistances; and (3) back-coupling, with its associated "motor-boating" is avoided, the unit having practically zero internal resistance. A range of these instruments is available to suit various requirements. There is an H.T. power unit as well as



The Oldham L.T. Auto-Power unit.

an L.T. power unit, each giving the advantages of a battery supply from a mains source. Should batteries be already to hand the rectifier, with its convenient automatic switch, is available. In every

case the rectifier is of the Westinghouse type, and an indicating lamp shows when the rectifier is in operation. A unit combining both L.T. and H.T. equipment is also produced. The most popular model is probably the H.T. Auto-Power Unit, which gives 120 volts, and its accumulator batteries may be loaded up to 100 mA. This is priced at £5 18s. 6d.

Popular-priced Oldham H.T. and L.T. batteries are shown in models to suit all needs. They are in glass containers and are supplied with metal frame and carrying handle. A range of unspillable accumulators in celluloid cases are available for portable set manufacturers and users.

Oldham & Son, Ltd., Denton, Manchester.

ORMOND. (118 & 121)

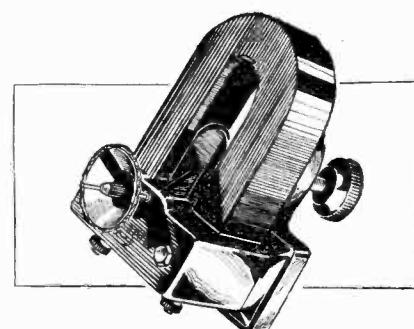
The Ormond exhibit comprises essentially portable receivers, variable condensers for all purposes, loud speakers and loud speaker movements, together with a few minor components. A popular receiver selling at the particularly low price of £15 is the Ormond Five.



The Ormond five-valve portable.

Triode valves are used throughout, and its two control dials provide for tuning and volume. Its loud speaker is of Ormond manufacture and is fitted with a four-pole adjustable unit. A transportable model, which also uses a five-valve arrangement, is offered at the same low price. Its controls comprise one dial tuning, a two-range switch and volume control. The loud speaker is similar to that fitted to the suit-case model. It is a well-finished set and is stated to be very economical in use. A recent addition to the Ormond range is a four-valve suitcase model using a screen-grid valve in the H.F. stage. A high degree of amplification combined with good selectivity results by the use of two tuning dials. The manufacturers state that both British and Continental stations may be easily received on both the broadcast and long wave bands. The loud speaker is of the four-pole Ormond type, and it should be pointed out that the component parts

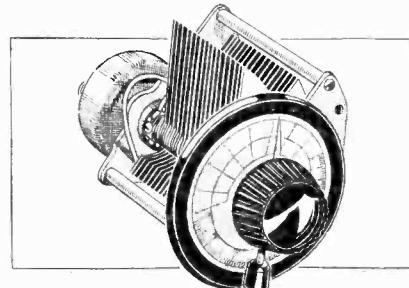
used in these receivers are of Ormond manufacture, a fact that is probably responsible for the popular prices at which



Ormond loud speaker unit.

they are offered. The Ormond Four suitcase model is priced £16 16s.

An outstanding component of the Exhibition is the Ormond four-pole adjustable loud speaker unit. A particularly large polarising magnet is used, and the working parts are completely encased in a well-finished bakelite cover. Ease of fixing is an obvious merit, as it can be readily attached to a back board through which the adjusting knob projects. The cone is readily mounted in a metal and felt washer fitting, and is then attached to the driving rod, easy adjustment being obtained by means of a chuck form of screw. This construction allows of instant removal when required. High quality of reproduction combined with sensitiveness and an ability to handle great volume without chatter are the merits claimed. The price is 12s. 6d. A metal chassis has also been produced to suit the four-pole Ormond unit. It is a strong aluminium pressing 11½ in. in diameter, and is provided with two brass spacing pillars to facilitate assembly. Entire absence of "drumminess" is a property claimed when using this chassis combined with a clear and crisp response and a full bass. The price is 7s. 6d. Complete loud speakers are also available, the model R55 being enclosed in a well-finished oak



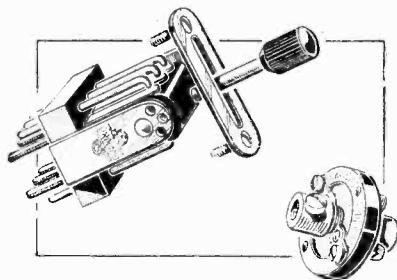
Ormond condenser with the new "pointer" dial.

or mahogany cabinet which is offered at the low price of 50s. Making use of the four-pole unit is another model, which in an oak or mahogany cabinet bears the low price of 29s. 6d. Regardless of price

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however, this loud speaker would appear to be a first-class instrument.

In addition to the extensive range of Ormond condensers, which are now so well known, is seen a small twin log scale model intended for the simultaneous tuning of two radio frequency circuits. Where space is limited this two-section condenser will be found particularly suited. The extremities of the moving vanes are connected to ensure correct spacing with rigidity. Ganged small log scale condensers have also been introduced. These are mounted by the "along the panel" method, making use of a small flexible coupling. This coupling, which is in the form of a bakelite ring on which are sprung two sockets mounted back to back, is obtainable separately. It provides a universal joint and obviates the necessity of strictly aligning the condenser spindles. A condenser fitted with a pointer dial is an entirely new development. This condenser is of exactly similar design to the standard Ormond small log scale condenser, but is constructed mainly of aluminium. The dial is a metal disc with a gold finish, carrying a scale of degrees.



Ormond key switch and condenser coupling.

The dial readings are shown by the pointer, the spindle of the condenser being controlled by a smaller knob. An upper knob provides a slow motion adjustment on friction action condensers. This pointer dial is not supplied separately as it can only be used with condensers having a modified spindle. The price of a friction control condenser complete with the new pointer dial and of capacity 0.0005 mfd, is 9s. 6d.

Push-pull and lever type switches of types which have many radio applications are among the smaller components. The lever type, which is well finished, is particularly suitable for carrying out the circuit changes met with in portable set construction, and in this respect the space it occupies is very limited. Of a low loss design, it may be used in H.F. as well as L.F. circuits. A three contact push-pull switch has many uses, such as for wave changing in Hartley and similar circuits or for "on" and "off" in L.T. and H.T. battery leads. It can be mounted on a metal panel and insulated by means of the ebonite bush if necessary. This switch, which sells at 1s. 6d., is neat and compact and robustly made. It has both terminals and soldering tags.

The range of Ormond jacks has been

adapted so that with the aid of a push-pull device they may be used as switches.

The Ormond Engineering Co., Ltd., Ormond House, Rosebery Avenue, London, E.C.1.

P. & R. (PETO & RADFORD). (108)

This stand is devoted to storage accumulators, both for L.T. and H.T. supply. A variety of different types are shown, in containers of glass, celluloid and "Dagenite"—a moulded material. An attractive model is the P.G.F., an inexpensive glass cell incorporating the well-known Peto & Radford feature of gravity floats, which indicate the state of charge. The 30-ampere hour cell costs 13s. 9d. A range of unspillable cells for portables include, in several instances, the advantage of gravity floats.

Peto & Radford trickle chargers are entirely new products. The A.C. model, which includes a metal rectifier, is suitable for recharging H.T. batteries up to 150 volts; it is fitted with a small lamp bulb which acts as a fuse and also shows when the charger is in operation. The D.C. model is fitted with a milliammeter and costs 29s. 9d., as compared with 49s. 9d. for the A.C. instrument. The fact that such chargers as these are available makes the H.T. accumulator battery a very attractive proposition to those with an electric supply.

Peto & Radford, 50, Grosvenor Gardens, London, S.W.1.

PANDONA. (225)

The all-electric radio-gramophone embodies a five-valve frame-aerial receiver with two aperiodic H.F. stages, and is fitted with a Marconiphone moving coil loud speaker, electric turntable motor, and B.T.H. pick-up. Models for A.C. or D.C. mains are available; it can also be supplied in a form suitable for working with an M.L. converter and 12-volt battery.

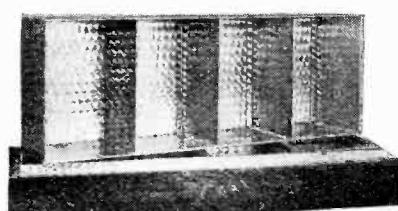
A similar instrument is fitted with an Air-Chrome loud speaker and a spring motor; it also includes a built-in frame aerial.

The "Pentode Two" model, with Air-Chrome loud speaker, is supplied for A.C., D.C., or battery feed.

Pandona, Ltd., 87-89, Edmund Street, Birmingham.

PAREX (E. PAROUSSI). (206)

Exhibits on this stand include a number of special screening boxes and screens, among which is included a metal



Parex metal cabinet.

cabinet intended for the "Kilo-Mag Four" or "Record III" receivers. This is constructed of sheet aluminium with an engine-turned finish, and special care

seems to have been taken to ensure that the seams shall be adequately closed. Coils and H.F. transformers for the "Kilo-Mag Four" are also shown.

A wavetrap, consisting of a section-wound litz coil with a semi-variable tuning condenser, the whole mounted in a screening case, is another new product.

Among other exhibits are a cone-type loud speaker with a built-in clock and a horizontal type of valve holder, specially suitable for screen-grid valves.

E. Paroussi, 10, Featherstone Buildings, London, W.C.1.

PARMEKO (PARTRIDGE & MEE). (68)

Mains transformers for all radio purposes are produced by Partridge & Mee. Representative specimens are shown at the stand, and reference to their list shows quotations for some twenty different types. These are analysed into four classes: (1) for valve rectification; (2) for Westinghouse metal rectifiers; (3) for Igranic Elkon rectifiers, and (4) high voltage output transformers suitable for moving-coil loud speaker requirements. All transformers are built with substantial aluminium frames, with ample separation between the various windings. A range of generous smoothing chokes is produced for use with the various transformers. An interesting form of smoothing choke is one that has been introduced for use in the setting up of rectified L.T. supply. Two models are available, rated to pass, respectively, 2 and 3 amperes. An interesting component is the Universal Output Transformer, intended for use with moving-coil loud speakers. It is only by carefully regulating the primary and secondary windings that good quality is obtained, and this is achieved with this Universal transformer by arranging the primary as six sections and the secondary as five sections. A multiplicity of ratios can be obtained by series and parallel connections, which are obtained by means of adjustable strap connectors. An inter-valve transformer with high primary inductance and a ratio of 1 to 2 is a new component.

A.C. battery eliminators have long been produced by Partridge & Mee, and there is a range of five types at prices from £4 15s. to £16 10s. At the former price is a junior model with valve rectifier giving 26 mA. at 120 volts, together with three intermediate tappings of approximately 50, 70 and 100 volts. A generous model, the A.C. 4, employs two rectifying valves of the R.H.I. type, so that its output of 100 mA. at 500 volts is suitable for the most generous of amplifiers. Combined H.T. and L.T. eliminators are also shown.

Partridge and Mee, Ltd., 74, New Oxford Street, London, W.C.1.

PEERLESS (BEDFORD ELECTRICAL & RADIO CO.). (45)

A screen-grid portable set is one of the principal exhibits of this firm. The layout is of fairly orthodox design, apparatus being mounted in a hide suitcase, of which the lid serves to accommodate the loud speaker and frame aerial. The two variable condensers are

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"ganged," and thus there is but a single tuning control.

A new cone loud speaker chassis of all-

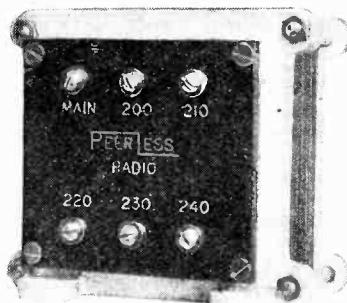


Peerless cone chassis.

metal construction—duralumin is actually used—is another new product. The diaphragm is lightly suspended by a leather ring, and matters are so arranged that Ormond, Blue Spot, or Brown units may be fitted with a minimum of trouble. Indeed, it should not be difficult to adapt this chassis to any type of drive mechanism. The price is only 7s. 6d.

A range of small power transformers, for all standard main voltages and periodicities, is also on show. These components are designed for H.T. outputs from 25 to 75 mA., and also have separate L.T. secondary windings for supplying directly or indirectly heated valves.

The Bedford Electrical & Radio Co., Ltd., 22, Campbell Road, Bedford.



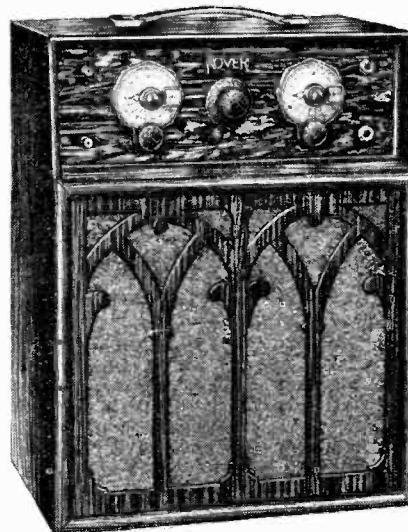
Bedford Electrical Co.'s power transformer.

PERFECTAVOX. (114)

Perfectavox radio-gramophones not only possess outstanding merit by way of finish and design, but are unique as to the technical details of the equipment used. It is stated that the output amplifier fitted in the Standard and Screened Grid models is capable of delivering a power output of 6 watts without overloading, thus revealing the use of generous output valves. The output amplifier in fact is a push-pull arrangement, using the adequate bias of 100 volts. Apart from a volume control which follows the detector, there is a device known as a "brilliance control," which is in effect an

adjustable filter, and therefore can be usefully employed for the removal of surface noise when using the electrical pick-up. An adjustable filter of this type is probably to be preferred to a fixed filter arranged to obliterate the upper frequencies. The smaller sets, as would be expected, use grid rectification, whilst the larger sets, which are preceded by a high-frequency amplifier, use the anode bend detector. Attention is drawn in the descriptive pamphlet to the amplification which is provided and the precautions necessary to prevent overloading. In this respect provision is made for reducing the aerial input by means of a small series connected condenser. Reaction is provided, but it is understood that its use is rarely required. The frame aerial is unique and is built within the lid, but is capable of rotation within the frame.

Perfectavox, Ltd., Alexandra Works, High Street, Yeadon, Nr. Leeds.



Peto Scott Rover portable.

PETO SCOTT (42-44)

The Rover Portable is a cleanly designed self-contained set on fairly conventional lines. Its circuit arrangement includes two aperiodic H.F. stages, detector with reaction, and two transformer-coupled L.F. stages. An external loud speaker may be used, and provision is made for connecting a gramophone pick-up. There is a turntable base, and the valves are gripped between shock-absorbing strips of sponge rubber. The price is 16 guineas.

The "Hotel Orchestra" is an electric gramophone with three-stage amplifier and B.T.H. motor and pick-up. It is designed to provide sufficient volume for a large public room, and can be supplied either for A.C. or D.C. mains. There is ample space for storing records in the cabinet.

The Peto Scott Radio Gramophone comprises a Philips two-valve set housed in a large console cabinet fitted with spring-driven turntable, B.T.H. pick-up, and Air-Chrome loud speaker. Operated in

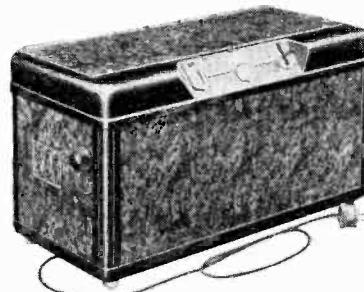
conjunction with an external or indoor aerial, this inexpensive outfit should be eminently satisfactory for average requirements.

This firm specialises in the supply of complete receivers, sets of parts, or commercial kit sets, either for cash or deferred payments.

The Peto Scott Co., Ltd., 77, City Road, London, E.C.1.

PHILIPS. (169 & 170)

British built Philips receivers are an outstanding feature of the Exhibition. While Philips have exhibited in previous years, their receiving sets have been excluded from stands in view of their foreign manufacture. The "All Electric" receiver, type 2511, although only recently available on this market must be regarded as the forerunner of mains operated sets designed for easy operation and with an external appearance suited to the home surroundings. It is worth while studying in detail the many interesting points to be gleaned from a close examination of this set. Firstly, the cabinet is built up by the fitting of bakelite panels on to a pressed metal frame. All corners are rounded, the external finish is durable and the appearance attractive without being decorative. A single lever switch moves from the "off" position through the two wave ranges and then to the position for using a gramophone pick-up. Only when the switch is in the "off" position can the lid of the cabinet be opened. Likewise, lock and key are provided which prevents the switch being moved from the "off" position and until unlocked the set can be neither operated nor opened, while when the lid is lifted the interior is entirely "dead." When switched on a pilot lamp illuminates the transparent drum of the tuning scale. Conveniently placed on the right-hand side is a single tuning knob which actuates the ganged tuning condensers through a reduction gear. In a corresponding position on the left-hand side of the cabinet is a volume control, which it is believed is associated with the H.F. stages. Two screened valves of the indirectly heated type (S4V) are used in the set followed by an indirectly heated leaky grid detector (154V).

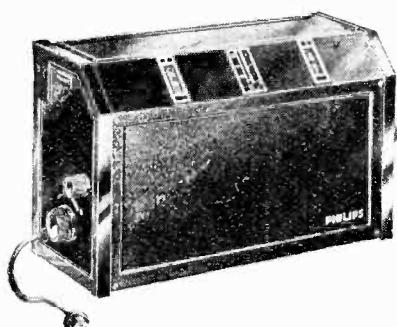


The Philips "All Electric" receiver, type 2511.

The output valve is a directly heated power pentode (PM24A), while the rectifier employs a special full-wave valve (type 2506) with an emitter resembling

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the cathode of an indirectly heated valve. All valves are screened from one another and the various units are contained in screening compartments. Two outputs are available, one suitable for the usual high resistance cone loud speaker and the other is regulated through the output transformer to suit the low resistance Philips moving coil loud speaker. When using a gramophone pick-up an external volume control is necessary indicating that the control fitted to the set precedes the detector. Remarkable range getting properties are claimed. Complete with valves the price is £37 10s.



Philips three-valve "All Electric" receiver.

Another interesting set, type 2514, is one using a three-valve circuit which again operates entirely from A.C. mains. Its circuit is that of an indirectly heated screen grid and detector followed by a pentode output. It covers both wave ranges, and terminals are provided for a pick-up. It has one knob tuning, an edge-wise indicating scale and volume control. With the Philips loud speaker, type 2007, which has been specially designed to suit the receiver, it forms a simple and compact trouble-free outfit, and is priced at £23, complete with valves.

A less expensive model, type 2515, is a mains operated two-valve set with a special detector valve and followed by a pentode. Both wave ranges are covered and provision is made for the use of a pick-up. It is easy to operate and entirely meets the requirements of the average listener, and the price is £12 10s. complete.

Those seeking a commercially built short-wave receiver will be interested in the Philips set type 2802 which, with the aid of six interchangeable coils, covers a wave range of 10/2,400 metres. This is a battery operated set and is fitted with a screen-grid H.F. stage, leaky grid reacting detector, L.F. stage and pentode output. Only with the most distant stations are the four valves used, and a switch is provided to cut out one of the L.F. stages.

Battery operated sets include a three-valve receiver which is very similar to the type 2514 referred to above, but with the omission of the mains equipment.

Space will not permit detailed reference to the Philips H.T. supply units. They

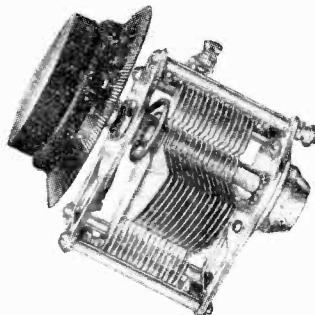
deliver both H.T. and grid biasing potentials and are claimed to be suitable for use with all circuit systems free from hum, while conforming to the most exacting requirements with regard to the use of electric supply current for domestic purposes. In the A.C. models the valve type of rectifier is adopted.

There is also to be seen an extensive range of battery charging equipments for the recharging of H.T. and L.T. batteries from A.C. mains. The home models give charging rates from that of trickle charging up to 6 amperes. All these battery charging sets use arc rectifying valves. There are, in addition, many types suitable for charging station purposes and it is interesting to note that for a three phase model giving a D.C. output of 220 volts at 6 amps. an efficiency as high as 90 per cent. is claimed. As a guide to price, this model is quoted at £16 10s.

Philips Lamps, Ltd., Philips House, 145, Charing Cross Road, London, W.C.2.

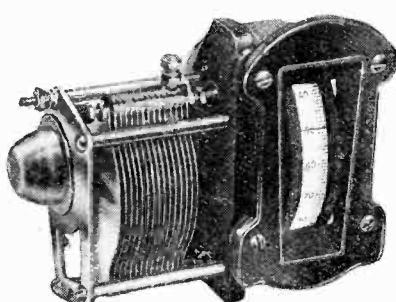
POLAR (WINGROVE & ROGERS). (128 & 133)

Polar condensers are the principal products of this company and one learns that Polar variable condensers are standardised by more than half of the set makers in this country who do not make their own. No fewer than eight different forms of variable condenser are



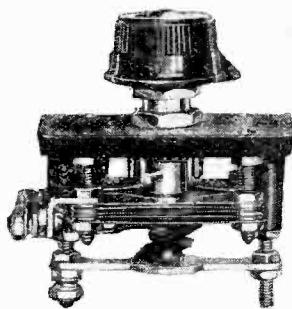
The Polar Ideal all-brass slow motion condenser.

exhibited. Readers are well acquainted with the popular and inexpensive all-brass condenser which is styled "Type No. 3" and has been adopted in a number of *The Wireless World* receivers. It is electrically efficient, has one-hole fixing and pig-tail connector, has steel ball-bear-



Polar condenser with the new drum control.

ings and is reasonably compact. Another model is fitted with slow-motion movement actuated through a hollow spindle, so that unlike many slow-motion condensers complications are not encountered when securing it to the panel. This is the "Ideal" model and the 0.005 mfd. size is 12s. 6d. The slow-motion knob is 2in. in diameter and the fast motion is by the 3in. dial. The reduction ratio is 30 to 1. Examination revealed a particularly smooth action. An entirely new product is the Polar drum control condenser which incorporates both fast and slow motion and is controlled by two 3in. knurled drums. The neat ivorine scale with well finished bakelite escutcheon



Polar differential condenser for reaction control.

produce an attractive appearance. It is supplied for either right- or left-hand mounting, while double and triple condensers of this type are also available. Of interest among the smaller condensers is the "Q.J." model, which is an air-dielectric condenser of compact dimensions and is intended essentially for reaction control. It has a slow-motion action and is supplied with either knob and pointer or knob and dial. The Polar differential condenser, also intended for reaction purposes, should prove a popular component. It has a bakelite frame, brass vanes and an insulating dielectric. Other components to be seen at the stand include coil units, various H.F. chokes, the Polar fixed potentiometer and the "Claricone" cabinet loud speaker.

Wingrove and Rogers (Polar), Ltd., Arundel Chambers, 188-189, Strand, London, W.C.2.

PORTADYNE (WHITTINGHAM, SMITH & CO.). (113)

A series of portable sets are exhibited. The "Portadyne Screened-Grid" receiver, as its name implies, contains a screen-grid amplifier, followed by a detector and two triode L.F. amplifiers. Special attention has been paid to quality of reproduction, and a Brown cone loud speaker and baffle are included. The retail price is 22 guineas, in solid leather attaché case.

The "Super-Five" portable, selling at the popular price of 19 guineas, contains the same L.F. amplifier and loud speaker as the screen-grid set. A transportable set is also available.

Whittingham, Smith & Co., "Portadyne" Works, Chase Estate, Park Royal, N.W.

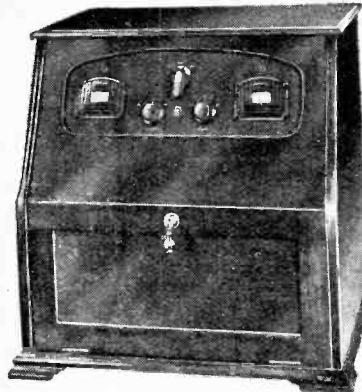
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PYE. (160 & 163)

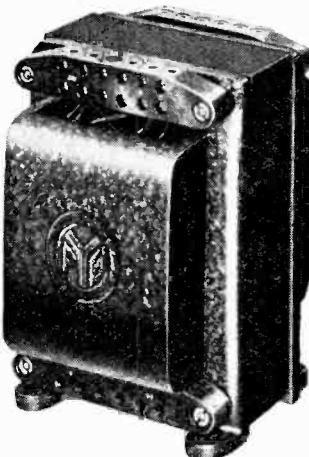
The new receiver, No. 460, is intended for battery operation, but, at the same time, the requirements of those with a



Pye No. 460 receiver.

D.C. supply have been borne in mind (A.C. mains users are catered for by other Pye models). This set includes a double-wound aerial coupling, completely insulated from the filaments, so that the aerial and earth circuit is not in connection with the source of supply. It embodies an S.G. high-frequency amplifier, anode bend detector, and two L.F. stages, resistance- and transformer-coupled. The H.F. valve is a Mazda 2-volt type, which is capable of affording an extremely high magnification.

A new type of edgewise control is fitted, with dials calibrated directly in wavelengths. A gramophone pick-up may be used. The cabinet is of dark walnut, with the high finish usually associated with Pye receivers.



Pye mains transformer.

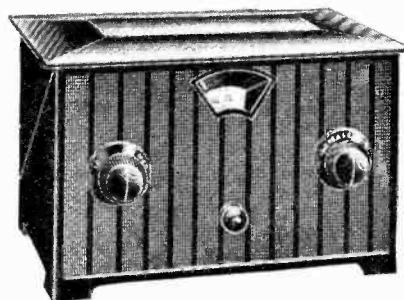
A new type of L.F. transformer has a shroud made of a special alloy which, it is claimed, prevents induction effects between its windings and other windings carrying A.C. current; in a mains-operated set this is a not uncommon source of trouble. The transformer has a step up ratio of 3.3 : 1.

To replace the various output transformers previously manufactured, a universal device has been introduced. This provides for ratios of 1 : 1, 1.8 : 1, and 6 : 1. A similar component for pentode valves is available.

For use as a volume control resistance across the primary of an L.F. transformer, or for any other purpose where a very small current has to be carried, a variable non-inductive resistance has been produced. This is priced at 4s.

New patterns of valve holders, apparently with excellent electrical properties and of extreme compactness, have been introduced to replace earlier models.

For use in the construction of the more ambitious type of A.C. mains set the Pye "Silent Power" transformer should find a ready application. Intended to work with Westinghouse metal rectifiers, it provides, in addition to H.T. voltage, low-voltage outputs for indirectly heated valves, 6-volt output valves, and for loud



R.I. Two-valve receiver.

speaker field supply through a metal rectifier and floating battery or special smoothing circuit. A total output wattage up to 60 is provided for in the design.

The No. 687 heavy-duty choke has six sectional windings, the ends of which are led out to plug sockets mounted on an insulating board.

Transformers for various types of metal rectifiers are also exhibited.

Pye Radio, Ltd., Paris House, Oxford Circus, London, W.1.

R.I. (122-124)

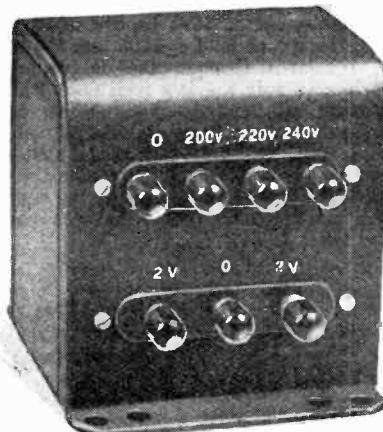
Many readers will welcome an opportunity of examining the Transportable Screened Grid Three, a receiver recently reviewed in this journal, in which an exceptional high standard of efficiency is attained.

The firm is staging an historical exhibit of L.F. transformers (in the design of which they have specialised for many years), starting with an early specimen made by Latour. There is also a show of early H.F. apparatus.

A useful new component is a special power transformer designed for use with the Westinghouse metal rectifier and approved officially by the makers of that device. It sells at 21s., and is part of a range of power transformers for various purposes.

The new R.I. two-valve receiver is of interesting design, if only because it is mounted in an all-bakelite moulded case

with pins protruding through the base. The standard model is for a battery feed, but these pins are so arranged that by placing the set on a special eliminator



R.I. mains transformer.

base pedestal, either for A.C. or D.C. supply, it is automatically converted for mains operation. A pentode output valve is fitted.

A series of wire-wound non-reactive resistances has been produced, with values up to 0.5 megohm. A range of power resistances dissipating up to 10 watts is also available.



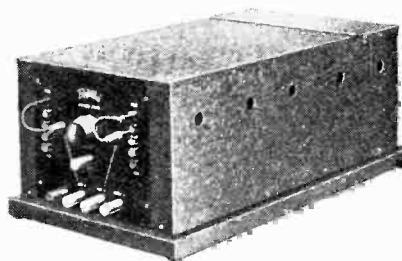
R.I. wire-wound resistance.

The R.I. Portable Testing Set, though not a new season's product, merits the attention of those whose business is concerned with the testing and location of faults in wireless apparatus. Two high-grade meters are mounted on the panel.

Radio Instruments, Ltd., 12a, Hyde Street, New Oxford Street, London, W.C.1.

RADIELLE. (2)

The Radielle Company have recently come to the fore in the manufacture of

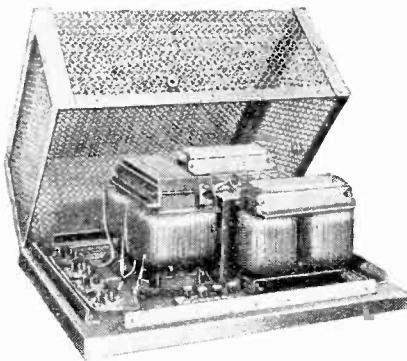


Radielle model R.K. eliminator for A.C. supply.

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mains equipment. At their stand, therefore, one finds various mains transformers and smoothing chokes to suit the requirements of the home constructor as well as numerous power units. The R.K. model for use with A.C. supply incorporates a Westinghouse rectifier and, in addition to the maximum voltage output, there are two variable outputs produced by tapping points and wander leads along resistances. A continuously variable potential is also provided for use with screened valves, and is therefore, in effect, a volume control for the set it feeds.

A heavy duty A.C. mains equipment which is shown has been specially produced for electrically reproducing gram-



Radielle heavy-duty rectifier.

phones where a considerable power output is required. The output is 200 mA. at 400 volts, together with an A.C. voltage suitable for the filaments of the output valves of the receiver. Four R.H.I. rectifying valves are used.

The Radielle Co., Ltd., 18A, Haverstock Hill, Chalk Farm, London, N.W.3.

RADIO GRAMOPHONE DEVELOPMENT CO. (292)

The instrument produced by the Radio Gramophone Development Co. under this trade name is a good example of the best modern practice in the design and construction of apparatus of the class suggested by the firm's title. Several different types are produced, and the D.C. model will be described, as it has been examined in detail. The circuit comprises two H.F. stages (one tuned and one aperiodic), followed by a diode rectifier and two L.F. stages, the last being push-pull. Pre- and post-detection intensity controls are fitted in order to provide for full regulation of volume both for radio and gramophone reproduction. Decoupling devices are applied extensively. A moving coil loud speaker is fitted in the base of the large and handsome cabinet. Two tuned H.F. stages can be fitted where greater range is necessary. The gramophone turntable is driven by a B.T.-H. electric motor.

This instrument is fitted with a pick-up evolved by its manufacturers, in which coil damping is applied to the reed, which

works on a knife edge, against which it is held in position by a rubber spring. This promising component is sold separately at the price of £3, complete with arm.

A neatly constructed power amplifier for public address or gramophone repeater work is also shown. This instrument has a bank of six output valves with grids in parallel and each anode connected to its own output transformer for feeding a separate loud speaker.

Power chokes and transformers designed for heavy duty, manufactured by Messrs William Bayliss and Co., of Sheepcote Street, Birmingham, are exhibited on this stand, as are the "M-L" rotary converters and transformers for power supply.

Radio Gramophone Development Co., 7, St. Peter's Place, Broad Street, Birmingham.

RADIO SERVICE. (204)

Although no apparatus is actually exhibited at this stand, the service which is represented is of no less interest. The organisation is devoted entirely to the supply and maintenance of high- and low-tension batteries, and the delivery service extends to within a radius of twelve miles of Charing Cross.

Radio Service (London), Ltd., 105, Torriano Avenue, Camden Town, London, N.W.5.

READY RADIO. (93)

The principal exhibit on this stand is a selectivity unit to be known as "Susie"—a device designed to provide existing sets with the necessary selectivity for the regional scheme. There are means included for earthing the aerial, and two models are available, one for the medium broadcast band and the other for the longer wavelengths.

Another product is the "dynamic Reproducer" selling at £6, in which it is claimed that a particularly good response is obtained to the higher frequencies.

For those who are protagonists of the parallel-feed circuit for screen grid valves the H.F. choke being shown should appeal.

Ready Radio, Ltd., 159, Borough High Street, S.E.1.

RED DIAMOND (JEWEL PEN CO.). (267)

The chief industry of the Jewel Pen Company is turned and machined ebonite parts. Of these there are being exhibited a large selection of well-finished aerial and earth connectors, plug-in terminals, flex connectors, lead-in tubes, and H.F. choke formers. There are wander plugs, coil mounts, and terminal strips with terminals mounted and the usual engraved markings. A very complete range of plain and threaded bushes is exhibited and should be useful when wooden panels are employed.

Jewel Pen Co., Ltd., 21-22, Great Sutton Street, E.C.1.



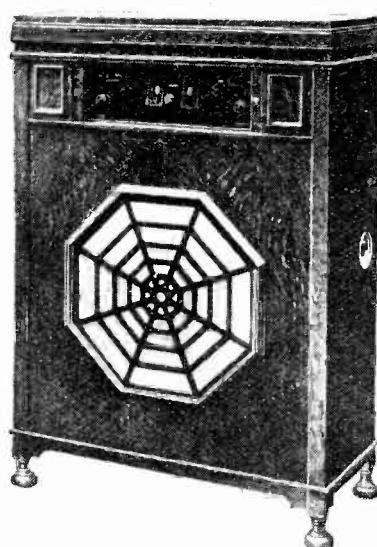
Rees-Mace portable superheterodyne.

REES-MACE. (105)

The writer does not profess to have seen the whole of the Olympia Exhibition—he has so far had quite enough to do in that part of it with which he is directly concerned—but he will be surprised to find a lighter and more compact four-valve portable than the Rees-Mace "Gnome." Weighing some 20lb., and measuring, when closed, 13½in. by 11in. by 6in., this little set must surely represent the limit in compactness. It includes a screen-grid H.F. amplifier with tuned coupling, followed by a grid circuit detector and two L.F. amplifiers. There are two tuning dials and reaction control. The price of the complete receiver is 19 guineas.

Many readers will remember that a Rees-Mace portable with two tuned H.F. stages was recently reviewed in this journal; this interesting model is also exhibited, together with a seven-valve self-contained superheterodyne.

Rees-Mace Manufacturing Co., Ltd., 39a, Welbeck Street, London, W.1.



Argeedian radio gramophone, by the Radio Gramophone Development Co.

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REDFERN'S. (46)

This firm are showing ebonite in various forms suitable for wireless work. "Ebonart" panels are retained, and a cheaper grade, sold under the trade name of "Bulwark," has been introduced.

Ribbed coil formers, in diameters from 2in. up to 4in. and with either 6 or 8 ribs, are also exhibited. At the suggestion of contributors to this journal, a special deep-rib former has recently been introduced, in order to facilitate the construction of section-wound coils of high efficiency approaching as nearly as need be to the ideal specification. These are also useful in the construction of H.F. transformers, for which the method of winding primary turns sandwiched between secondary sections is becoming increasingly popular; properly executed, it is almost as effective as the overwinding method requiring spacer strips, which is hardly practicable commercially.

Redfern's Rubber Works, Ltd., Dawson Street, Hyde, Cheshire.

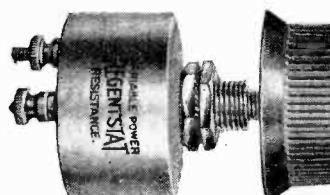
REGENTONE (REGENT RADIO SUPPLY CO.). (16, 17, 18)

Apart from a complete range of H.T. eliminators for all conceivable requirements (in A.C. models, Westinghouse metal rectifiers are fitted as standard), this firm is showing a number of components for use in the construction of all-electric sets and eliminators.

The Regentone Power Box comprises a power transformer, with an extra L.T. winding delivering current at 4 volts for the heaters of A.C. valves, and a Westinghouse rectifier. The whole is mounted in a neat and compact metal box with ventilating slots. The output of this unit may be applied direct to a receiver including the necessary smoothing circuits, or a Regentone Filter Compact—another new product—may be interposed. These two units in conjunction make up a complete eliminator delivering H.T. up to 180 volts at normal load.

The need for comparatively critical adjustment of screening grid voltage is responsible for an increasing demand for variable resistances working over a wide range of ohmic values. To meet this demand, and also for other purposes, such as volume control, a new variable resistance, called the Regentstat, has

been introduced. This component, supplied in a form suitable for panel mounting, has a rated range of from 250 ohms to 4 megohms, and is stated to be capable of dissipating 10 watts.



Regentstat variable resistance.

A range of power transformers and smoothing chokes are also exhibited, together with a neat three-valve A.C. receiver, built in a pedestal cabinet having the appearance of an ordinary occasional table.

Regent Radio Supply Co., 21, Bartlett's Buildings, Holborn Circus, London, E.C.4.

REPRODUCTION. (55)

A new type "Rhapsody Twin" portable Radio-Gramophone is exhibited for the first time. This compact instrument measures only 9in. x 15½in. x 16in., and includes a turntable and spring motor. A volume control, operative on both radio and gramophone reproduction, is fitted.

Various models, both battery- and mains-operated, of the "Rhapsody Twin" radio gramophones are exhibited. Demonstrations are given in Room Q.

Reproduction, Ltd., 5, 6, 7, Dysart Street, Wilson Street, E.C.2.

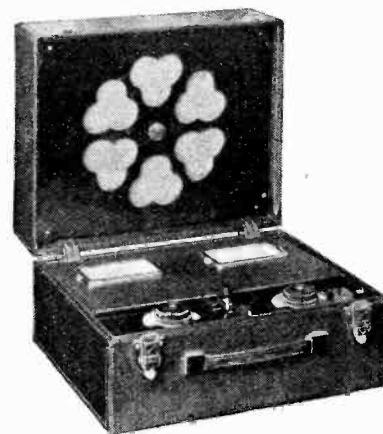
H.T. batteries are fitted, and the loud speaker is of the new Celestion type, with a 14in. diaphragm.

The "Super Ranger Screened Four" is a rather more conventional arrangement of H.F. amplifier, detector, and two L.F. stages. It is also housed in a suit-case type of container and is fitted with a new Celestion loud speaker. An upright model of the so-called "transportable" type is also manufactured.

Rolls-Caydon Sales, 77, Rochester Row, Victoria Street, London, S.W.1.

ROYAL RADIO. (12)

An entirely new portable is seen at this stand. Its circuit comprises a screen-grid stage of H.F. followed by detector and two L.F. stages. The screening, which is concealed, is generously carried out, and good performance is claimed for the set as regards its range-getting properties, selectivity and quality of reproduction. The two tuning dials being small give a neat appearance to the control panel.



The Royal portable.

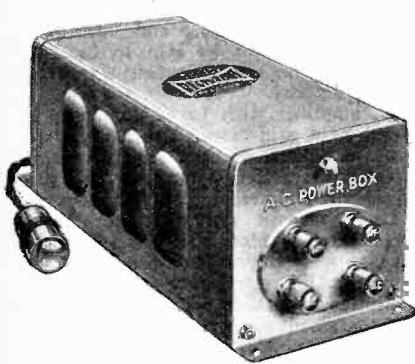
There is a reaction control as well as a two-range switch with mid-off position. Current consumption is less than 9 mA., and the L.T. accumulator has the generous capacity of 25 ampere hours. The loud speaker is of the four-pole balanced armature type coupled to a freely mounted cone diaphragm. The price is £18 18s.

Another interesting receiver is the Royal Radio-Gramophone, which is designed for operation entirely from A.C. mains. For radio reception the circuit is one of three valves, using a screen-grid H.F. amplifier. It is intended for use with an elevated outside aerial, a condition that is generally appreciated. The tuning controls are of the edgewise drum type, and the volume control is arranged to act with both radio or gramophone reproduction. The price is £47 5s. A modified model is available for use with D.C. supply.

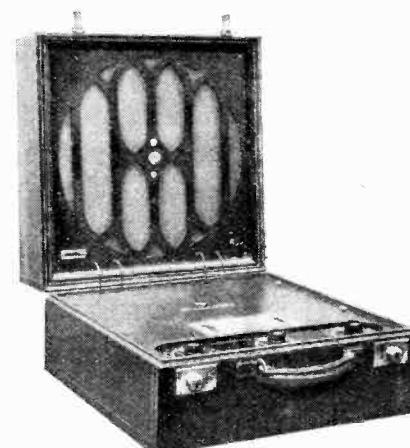
Royal Radio Co., 4-5, Dorset Mews North, Upper Gloucester Place, London, N.W.1.

SELECTORS. (102 & 104)

This firm manufacture portable sets principally, and specimens of each of



Regentone A.C. power box.



Rolls-Caydon "Phantom Regional."

ROLLS-CAYDON. (166)

One of the most interesting of the many portable sets exhibited by this firm is the "Phantom Regional." The circuit is a four-valve combination of two S.G. high-frequency stages, detector, and a pentode output. It is mounted in a real hide crocodile-grained suit-case, and is equipped with an effective form of volume control. Double capacity Hellesen

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their productions is on view. The "Cabinet" model includes many refinements not usually fitted, such as an accumulator capacity meter and provision for charging the accumulator *in situ* from



Selector suit-case portable.

the electric light mains. It embodies a four-valve circuit, including a screen-grid H.F. amplifier, and has two tuning controls.

A large and handsome radio gramophone, with many refinements, and including double turntables, is also exhibited.

Selectors, Ltd., 206-7, Bedford Avenue, Slough Trading Estate, Slough, Bucks.

SEL-EZI. (205)

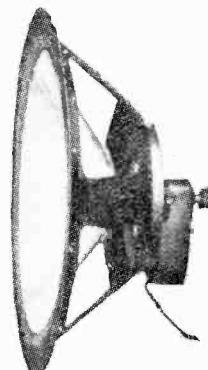
The activities of this firm are devoted to the wholesale distribution of wireless apparatus, and a representative assortment of standard products are exhibited.

Sel-Ezi Wireless Supply Co., Ltd., 6, Greek Street, London, W.I.

SELFRIIDGE. (208-210)

The Wireless Department of this store is represented on these stands, and helpful advice is given to the public as to the choice of radio receivers most suitable to their needs. A considerable amount of apparatus of various kinds is exhibited.

Selfridge and Co., Ltd., Oxford Street, London, W.I.



Baker cone chassis and reed-driven movement.

SELHURST (A. BAKER). (23)

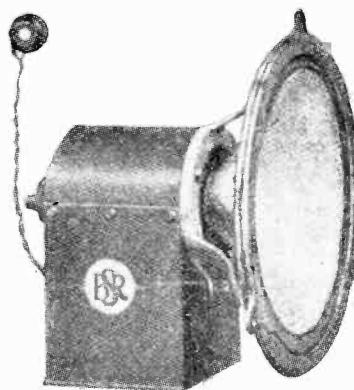
A notable addition to the present comprehensive range of moving coil loud speakers is the super-power model which it is claimed has an extremely wide frequency response. A dynamo steel magnet system is employed, with a field winding of copper wire weighing 10lb. There is a centring device giving free parallel movement for about $\frac{1}{4}$ in., and the sensitivity is such that a quite unambitious amplifier will give a sufficiency of volume. The speaker is finished in crystalline enamel and polished aluminium. The 6-volt accumulator model retails at £5 15s., and that for D.C. mains at £5 17s. 6d. The A.C. mains model, at £8 5s., consumes 1 amp. at 9 volts, and includes Westinghouse metal rectifier, transformer and smoothing equipment. Another A.C. mains speaker at £9 consumes 2 amps. at 9 volts, and contains the same full equipment. A new chassis with floating cone for loud speaker units can now be supplied with either 7in. or 9in. cones with flexible leather suspension designed to fit well-known reed-driven units. The prices are 12s. and 14s. respectively.

A dynamic speaker, known as the "Super 1930 Moving Coil," sells at the popular price of £4 17s. 6d. for the 6-volt unit and £7 10s. for the A.C. unit, which consumes 1 amp. at 9 volts. Both models include a speech transformer. A permanent magnet moving coil speaker is being shown at £6 5s., and contains a

These are actually sealed wet cells, so that an economical source of H.T. or L.T. current is produced, and where charging is carried out by the addition of water to the crystals supplied. For the small H.T. cells, which are in glass containers, it is claimed that the electrolyte, being in the form of a jelly, is unspillable and does not evaporate. Creeping, normally a serious failing, is likewise avoided. The spring connections which are fitted obviate the need for soldering. Generous amalgamation of the zinc prevents deterioration when out of use. The cells, which vary in price between 8d. and 1s., are easily rechargeable. The L.T. battery is intended for use in country districts where it is inconvenient to use an accumulator. The economical discharge rate is 0.25 ampere, with a maximum rate of 0.5 ampere.



New form of Siemens cell suitable for biasing an H.F. stage. A special low-voltage cell has been introduced for use in "Wireless World" receivers in order to avoid an excessive bias potential.



Super-power moving coil speaker by Baker (Selhurst).

cross-shaped magnet. For those who like to construct their own moving coil speakers a perusal of the well-illustrated catalogue issued by this company will reveal the existence of many essential components such as centring devices, oiled-silk and rubber suspensions and diaphragm paper. Advice concerning suitable amplifier design is given, and as suitable quality receivers the "Everyman-Four" and "Megavox-Three" are described.

A. Baker, 89, Selhurst Road, South Norwood, S.E.25.

SIEMENS. (69 & 71)

In addition to the well-known H.T. and L.T. Siemens batteries, suitable for all radio purposes, reference might be made to the cells of the rechargeable type.

Siemens accumulators in glass boxes are also exhibited. The containers are ribbed, and hold the plates securely in position without the use of separators. A good and somewhat unusual feature is that of a glass top with grease-filled cups to the terminal lugs. Of interest to the home constructor is the special fixing tab which now forms the base of the single grid cells such as are used for the biasing of an H.F. amplifier. Attention is drawn to a special cell which has been introduced to conform to the specification requiring a cell of 0.9 volts given in the design of "Wireless World" receivers. This cell is almost essential for the correct biasing of the screen-grid valve.

Moving coil testing instruments are also shown. A useful instrument by which most of the measurements associated with a radio receiver can be made has six ranges, viz.: 5, 15 and 150 volts, 7.5, 75 and 750 mA. When used as a voltmeter the instrument has a resistance of 150 ohms per volt. A useful booklet, entitled "Inside Knowledge," on the correct use of radio batteries is obtainable at the stand.

Siemens Bros. and Co., Ltd., Caxton House, Westminster, London, S.W.1.

SIMPICON (WILLIAMS & MOFFAT). (229)

The drive mechanism of all Simpicon variable condensers has been modified this year by the fitting of a non-spin device,

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which prevents spinning of the slow-motion knob when the direct control is in operation. There is a general improvement in details.

The Duplex type, intended for semi-gang tuning of two circuits, has been modified by placing the direct drive edgewise drums side-by-side in the central escutcheon plate slots, while the outside drums control the slow-motion gear.

As for the standard models, these have been improved by knurling the bevel face of the dial, to give a better grip for direct drive.

A compact 0.0005 mfd. tuning condenser with bakelised sheet interleaving has been produced. It is observed that the outer vanes are made of stouter sheet metal than are the others; thus extra protection is afforded to them.

There is a range of small reaction condensers with both direct and slow-motion drive and brass plates. These are made in capacities of 0.0001 mfd., 0.00015 mfd., and 0.0002 mfd.

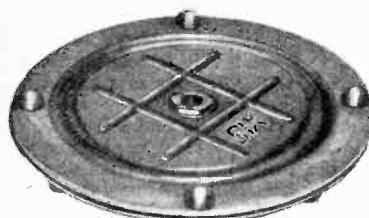
The new Simplicon edgewise dial has a form of gearing slightly differing from that of its predecessor. It is so arranged that it can be mounted either on the right- or left-hand side of the tuning condenser. There is also a new drum dial with knob drive. Prices of all Simplicon condensers have been reduced this season.

Messrs. Green and Falconbridge, of Coventry, are exhibiting on this stand a kit of parts for the home construction of a twin-diaphragm loud speaker. This comprises a steel frame over which fabric membranes are stretched. All parts are included, and full instructions are provided.

Williams and Moffat, Ltd., Ladypool Road, Sparkbrook, Birmingham.

SIX-SIXTY. (288)

A series of new valves, with indirectly heated cathodes for A.C. mains, is introduced. The S.S. .4 G.P.A.C. is a valve suitable for neutralised H.F. amplification or as a detector, and has an amplification factor of 35, and a slope of 2.4 mA. per volt. The S.S. .4 Det.A.C. is an A.C. valve having characteristics very similar to those of the steep slope "D" detectors.



Six-Sixty ball-bearing turntable for portable sets.

The power valve in this series has an amplification factor of 10 and a mutual conductance of 3.3 mA. per volt. The indirectly heated S.G. valve has an A.C. resistance of 1,330,000 ohms and an amplification factor of 1,000.

A new super-power pentode, the fila-

ment of which can safely be heated with A.C., has a maximum anode voltage of 300, but the auxiliary grid voltage should not exceed 200. The valve is capable of giving an enormous power output.

There is a representative range of battery-operated valves with 2-, 4- and 6-volt filaments. To facilitate the orientation of a frame aerial in a portable set, a well-built turntable 7 in. in diameter with peripheral ball race is shown, and sells at 6s. A reed-driven cone assembly,



The Six-Sixty reed unit with cone.

with arrangement for one-hole fixing and having a felt damping ring, is available at 22s. 6d. It is specially suitable for portable sets.

Six-Sixty Radio Co., 122, Charing Cross Road, W.C.2.

SOVEREIGN (J. R. WIRELESS CO.), (266)

Stand No. 266 is devoted to a display of the "Sovereign" products, including the H.F. choke used in the Six-Sixty Kit set recently reviewed in these pages. This component has a rated inductance of 175 millihenrys and a self-capacity of 5 micro-microfarads.

The Sovereign rheostat is made in maximum resistance values of 6, 15, 30 and 50 ohms. The last-mentioned should be useful for inserting in the filament circuit of a 4- or 6-volt low-consumption H.F. valve for volume control purposes. These rheostats are specified for the Mullard S.G.P. receiver.

A dual-range aerial tuning coil is also produced; this component is fitted with a fixed reaction coil, and is intended for use in circuit arrangements where regeneration is controlled by a variable condenser. Other components are a wave-trap, six-pin coil base, and slow-motion dials.

The J.R. Wireless Co., 6-8, Rosebery Avenue, London, E.C.

SPARTA (FULLER ACCUMULATOR CO.), (75)

The Fuller Accumulator Company has just introduced a series of unspillable cells for use in portable receivers. The electrolyte is in the form of a jelly. A glass wool pad is fitted in the base of the cell and an ebonite sheet is mounted over the plates, with the result that leakage should be impossible. It is intended that the cells shall be capable of operation in any position. They are shown in capacities up to 40 ampere hours (at a 20-hour discharge rating).

Ten-volt accumulator H.T. batteries, in multi-compartment glass containers, are manufactured in two sizes. Type M.H.G. is rated at 3,000 milliamper-hours, and the larger batteries, type

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D.M.H.G., at 6,500 milliamper-hours. These five-cell units are priced, respectively, at 5s. and 7s. 6d., and are supplied in a dry-charged condition, requiring only the addition of acid to put them into operation.

A large assortment of other batteries, in glass, ebonite and celluloid containers, are available for inspection, including the well-known Fuller Block cell.

The Fuller Accumulator Co., Ltd., Woodland Works, Chadwell Heath, Essex.

SUNCO (SUN ELECTRICAL CO.). (250 & 251)

The wireless department of this well-known electrical firm are wholesale agents for radio products of all kinds, and a display of products of the principal manufacturers is made.

Sun Electrical Co., Ltd., 118-120, Charing Cross Road, London, W.C.

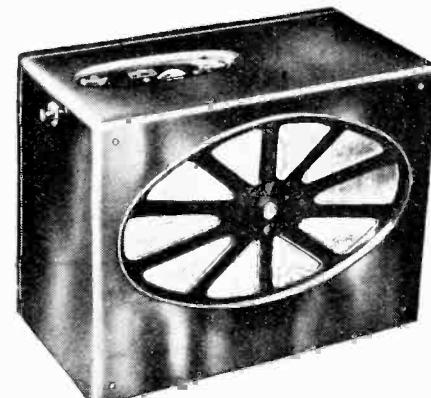
SYLVEX. (231)

Materials for constructing loud speaker diaphragms form the principal part of this exhibit. After having procured a suitable drive unit, one often experiences difficulty in obtaining a suitable material of the required thickness and weight wherewith to make the diaphragm. In addition to a Sylvex card marked out and printed for making a cone diaphragm, sheet pertinax is obtainable cut to size. This thin pertinax sheet is light, stiff and durable. Many home-constructed loud speakers are of poor appearance owing to the fact that the diaphragm is exposed to view behind the grille. A tinsel fabric is therefore available made of metallised cotton, which, it is stated, will not lose its brilliancy.

Sylvex, Ltd., 144, Theobald's Road, London, W.C.1.

SYMPHONY. (129 & 130)

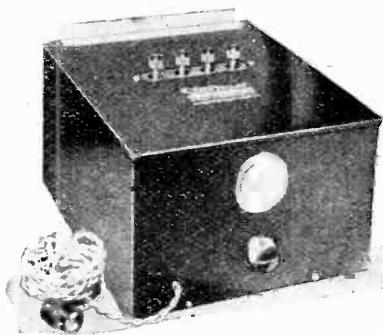
Radio-gramophones and a portable set are the chief exhibits. The battery-operated radio-gramophones, types G.R. or G.R.R., are priced at 40 and 45 guineas respectively. For radio reproduction a five-valve set is pressed into service containing two H.F. triodes linked by aperiodic couplings and there are two



Symphony portable set.

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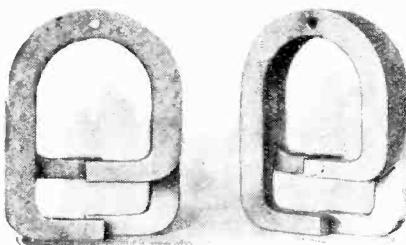
transformer-coupled L.F. stages. Orientation of the frame aerial wound with stranded conductor is effected by a knob on the panel; there are separate frames for the two wave-bands. Reaction is capacity controlled and a non-spillable L.T. accumulator is provided. The all-electric *de luxe* model sells at £125, and



The Symphony eliminator provides both H.T. and L.T. from the mains.

is fitted with an electric motor and automatic stop and switch. All the valves have indirectly heated filaments, including the S.G. valve, around the circuits of which good screening has been arranged. There is a moving coil loud speaker, capable of giving sufficient volume for dance halls, and the whole equipment is contained within an extremely handsome cabinet, with side compartments for record storage.

Symphony Gramophone & Radio Co., Ltd., Axell House, 23-24, Warwick Street, Regent Street, W.1.



Balanced-armature magnet system by Swift Levick.

SWIFT LEVICK. (240)

Permanent magnets find an extensive application in radio technique. This company is exhibiting all kinds of magnets—cast, bent, and stamped in cobalt and tungsten steels as are used in loud speakers, telephones, gramophone pickups, and relays.

An interesting balanced-armature magnet, which is available to manufacturers, has been so designed that the maximum possible flux density exists between the poles, which can only be done by the continuity of the magnetic circuit in magnet steel right up to the gap and

without any joints whatever. The magnets in 35 per cent. cobalt steel will give a flux density on the gaps of about 8,000 lines per square cm.

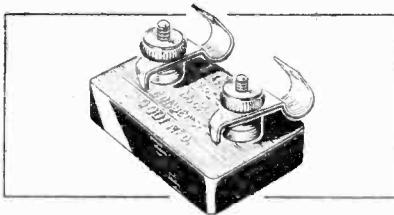
The new cross type magnet for moving-coil speakers is being shown. It consists essentially of a solid steel casting arranged with four outer limbs connected to a circular inner core. No soft iron plates or centre pegs are necessary for completing the magnetic circuit, as is the case with nearly all moving-coil permanent magnet systems. Joint leakage is eliminated, and the highest possible flux density in the gap is maintained. With this magnet gap, flux densities varying between 5,000 and 8,000 lines per square centimetre can be obtained. Cobalt steel is used—a steel which has an extremely great resistance to de-magnetisation.

In our forecast in last week's issue, the inscription under the illustration of the cross type permanent magnet for moving-coil speakers stated that this unit was available to home constructors. This is not the case, as the magnet can only be supplied to manufacturers.

Swift Levick & Sons, Ltd., Clarence Street Works, Sheffield.

T.C.C. (248)

With nearly a quarter of a century's experience in condenser manufacture the dependability of this firm's products is a foregone conclusion. Fixed condensers for

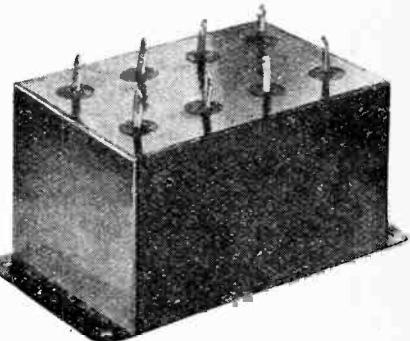


T.C.C. mica condenser with grid leak clips.

every conceivable position in a radio receiver are to be seen on their stand. The well-known upright mica type of condenser, in a green case, has lately been reduced in price. For instance, capacities of 0.0001 mfd. to 0.0009 mfd. now sell at 1s. 6d., whilst 0.01 mfd. variety in mica is priced at 3s. There is now on the market a range of small flat moulded mica condensers with capacities of 0.0001 mfd. to 0.0009 mfd. at 1s. 3d. each, this price includes grid leak clips, and the capacity values are guaranteed to be accurate within 10 per cent. These small condensers have the following dimensions:— $1\frac{1}{8}$ in. \times 1 in. \times $\frac{5}{16}$ in., and are tested to 500

volts D.C. to work at a peak voltage not to exceed 250. The same type of condenser in capacities from 0.001 to 0.01 mfd. can be supplied at a slightly higher price.

With high-frequency stage amplification of over 100 times, the question of power factor in by-pass condensers made of aluminium foil and paper is becoming of importance; it is therefore interesting to note that this company is setting itself



T.C.C. tapped condenser block for H.T. units.

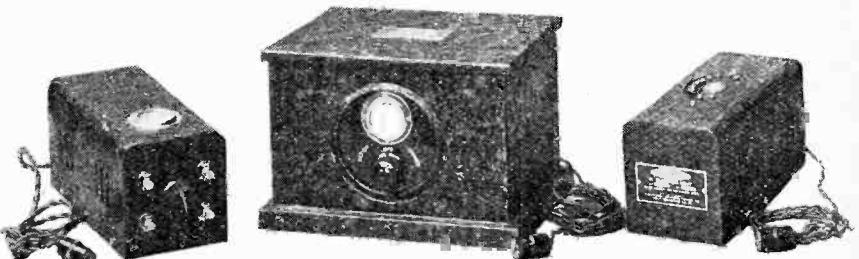
the task of investigating the potentialities of non-inductively wound condensers in both metal and bakelite containers. For low-tension eliminators for filament heating the dry electrolytic condenser is essential. This component is available in a polarised type, with the following specifications, the capacities being measured at 50 cycles:—2,000 mfd., working voltage 12, selling at 15s.; 2,000 + 2,000 mfd., working voltage 12, selling at 27s. 6d., and a model specially suitable for transmitting valves with a capacity of 500 mfd. and a working voltage of 40, the selling price of which is £1. The maximum permissible leakage current in all cases is 10 mA.

Condensers used in mains units are often subjected to voltage surges, and it is therefore very advisable, in order to prevent breakdown, to see that the D.C. test voltages are considerably above the peak value of the supply. For this reason the 800-volt test 2 mfd. condenser, selling at 5s., should ensure an ample margin of safety when used in an eliminator.

Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, W.3.

TANNOY (TULSEMERE MFG. CO.). (276)

This company specialises in battery-substitute units. Two H.T. units con-



Tannoy units for deriving valve current from the mains (Tulsemere Mfg. Co.).

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taining a full-wave electrolytic rectifying device are marketed. Type 12C, suitable for 2- or 3-valve sets, includes a potential divider, giving a variable voltage for each valve. Type 16C.H. gives a voltage output up to 160, and the maximum current is 100 mA. These two units, without transformer or rectifier, are suitable for D.C. mains. The L.T. supply unit consists of a metal-oxide trickle charger with a switch that throws the accumulator in circuit with the set or the charger at will.

Combined H.T. and L.T. mains units have been introduced, selling at £5 12s. 6d., £6 10s., and £8 10s.

Tulsemere Manufacturing Co., 1-7, Dalton Street, West Norwood, S.E.27.

TELSEN. (110)

The well-known Telsen "Radiogrand" transformers have been considerably improved in a number of details. Air spacing and sub-division of the windings is now employed, with the result that proportional amplification of the higher frequencies is increased. The core laminations are redesigned, and internal insulation has been improved. Detachable feet are now fitted, so the user has considerable latitude in the method of mounting.

The smaller "Ace" transformer, specially intended for portable sets, is retained.

Telsen Electric Co., Ltd., Miller Street, Birmingham.

TONEX. (265)

A reacting two-range tuning unit, the "Tonatuna," is the principal product of Tonex. A wave-change switch is contained within the instrument by which the long-wave section becomes short-circuited. Connecting up is simplified by reducing the number of leads to only five, including aerial grid and reaction circuit.

Other Tonex products include the completely screened dual range coil known as the "Univox," an H.F. choke totally enclosed in an octagonal moulding, as well as a valve holder in which the connectors have serrated faces, thus ensuring clean contact.

The Tonex Co., Tonex Works, Walker Street, Blackpool, Lancs.

TRELLEBORG. (281)

The various applications of Trelleborg's ebonite are illustrated on this stand by a comprehensive display of turned and machined component parts and accessories.

Panels in polished black, imitation mahogany, and wavy finish are also exhibited.

Trelleborg Ebonite Works, Ltd., Union Place, Wells Street, London, W.1.

TRIX (ERIC J. LEVER). (211 & 212)

The new radio-gramophone produced by this firm is designed for operation on an A.C. supply. It includes a receiver comprising a detector and two L.F. stages with indirectly heated valves, and is intended for operation with an external

aerial. A volume-control device in the L.F. amplifier is operative on both radio and gramophone reproduction. The loud speaker, consisting of a 6 ft. folded logarithmic horn and a balanced armature unit, is built into the lower part of the containing cabinet. The gramophone turntable is rotated by a spring motor.

Another model is on similar lines, but the turntable and associated gear are arranged as an easily detachable unit, which can be connected to the amplifier through a flexible lead, thus allowing records to be changed in a different room or at any convenient point in the same room. This would appear to be a useful innovation.

The receiver included in the radio-gramophone described above is also supplied as an ordinary table model A.C. set. Choke-filter output is provided and a pick-up jack is fitted.

The Trix 5-valve portable which includes the unusual feature of a special socket arrangement whereby an eliminator may be connected to the set in a few moments, at the same time automatically disconnecting the internal H.T. battery, is also on show.



Trix radio-gramophone.

Among new components introduced this season are 5-pin rigid valve holders for A.C. valves with sockets insulated by sleeves. There is also a promising H.F. choke with staggered windings, priced at 5s. 6d.

Eric J. Lever (Trix), Ltd., 8-9, Clerkenwell Green, London, E.C.1.

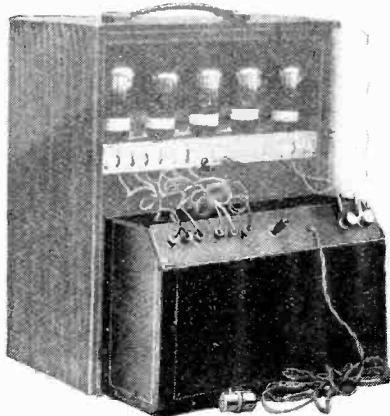
TRUPHONIC. (167)

Owing to the popularity of batteryless receivers, interest will be focussed upon a mains "trickle" unit built essentially to fit the Truphonic Melo-Set, but which can be used with other receivers to convert them to all-mains operation. As the name implies, the unit contains a trickle-charger to maintain the L.C. accumulator

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at its proper voltage, together with an H.T. eliminator.

Owing to the increase in voltage available for amplification, the use of the "Mains-Trickle" unit with a portable set causes a marked improvement in reception,



Truphonic mains trickle unit.

both in range and volume, whilst it does not interfere with the use of the set with ordinary batteries if a lighting supply be not available. The price of the unit is £9 10s.

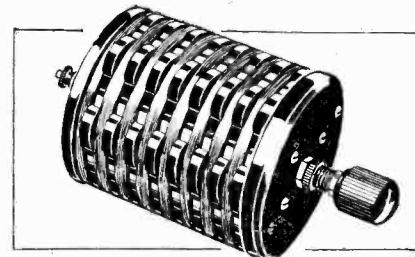
The "Dista-Set" is a four-valve suit-case portable receiver with a single stage of screen-grid amplification. The frame aerial and inter-stage inductances are both tuned by separate condensers, and extreme care has been taken with the screening. This set sells at £21 complete.

The Truphonic suit-case five-valve portable, with two aperiodically coupled H.F. triodes, sells at 16 guineas and the Truphonion loud speaker at £3 10s.

Truphonic Radio, Ltd., Truphonic House, Hanover Park, Peckham, S.E.

TUNEWELL (TURNER & CO.). (95)

Turner & Co. exclusively manufacture coils, and in addition to all forms of standard plug-in coils there are specimens conforming to the requirements of published designs. The range includes a popular dual-range coil which carries



Tunewell two-range tune.

windings for both broadcast and long wavelengths, as well as a reaction coil, which is particularly suited to the simple construction of an inexpensive set. The

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home constructor will find at this stand a coil to meet every requirement.

Turner and Co., 54, Station Road, New Southgate, London, N.11.

ULTRA. (106)

Here, the principal exhibit is a new form of loud speaker known as the Ultra Air-Chrome. On a wooden frame, which is the largest of three models, measuring 18in. x 23in., is a tight linen diaphragm. A reed drive of the balanced armature type is attached at the centre, while a second and smaller diaphragm is arranged so that the convex faces of the two diaphragms face together and join at the point of attaching the drive. Variations due to temperature and climatic



The Ultra Air-Chrome portable.

conditions are avoided by suitably treating the linen. Prices are from £2 2s. to £4 4s. This form of loud speaker chassis is supplied in various forms of cabinets.

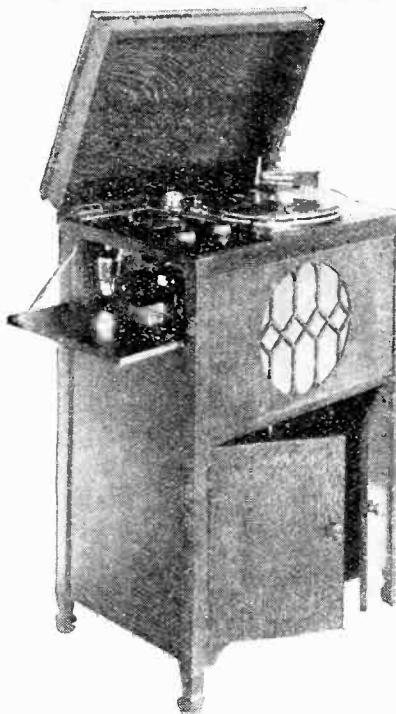
At this stand also is the Ultra Air-Chrome Five, a well-finished portable offered at the popular price of 16 guineas. It has two H.F. and two L.F. stages, covers both wave ranges, and is fitted with a local station rejector circuit. Its loud speaker is of the type described above. Tuning is by edged controlled drum with fine and coarse adjustment. The case is leatherette-covered and the fittings are oxidised. Osram valves are used, the output being the D.E.P. 215.

Ultra Electric, Ltd., 661, Harrow Road, London, N.W.10.

UNIVERSAL GRAMOPHONE & RADIO CO. (40, 41, & 100)

A speciality is made of loud speakers of the folded experimental horn type, and these as well as the Truvox gramophone are demonstrated in Room 1 on the main gallery. Artistic self-contained equipments for both radio and electrical gramophone reproduction, together with electric gramophones and loud speakers, are on view on this stand.

Universal Gramophone and Radio Co., Ltd., Ryland Road, Kentish Town, London, N.W.5.

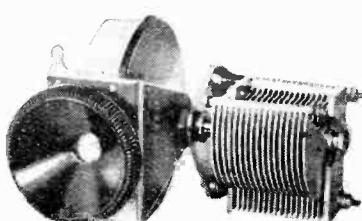


Truvox "Chubby" model mains-operated radio-gramophone.

UTILITY (WILKINS & WRIGHT). (115)

The combination of a drum edgewise dial and a knob drive as applied to variable condensers is not altogether new, but in the "Mite" drum condensers the details of design are distinctly unusual. These components, which are made for both right and left-hand drive, are fitted with a knob having a hole in its centre, through which the drum scale is visible. Reduction gearing is effected by a friction drive between knob and drum. Fitting is by no means difficult, although a comparatively large hole must be cut in the panel to clear the knob. These condensers should have many applications where conventional patterns are unsuitable. They are fitted with internal phosphor-bronze springs, which ensure that good contact is made with the rotor without the necessity of a pigtail.

The Utility Micro-Dial, of the pattern fitted with a fixed aluminium scale with cursor, remains unchanged in essentials, but is supplied with a moulded bakelite



New Utility Edgewise Mite condenser.

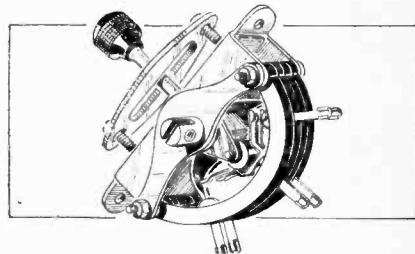
back-plate which improves its appearance.

"Mite" condensers, well known for their extreme compactness, are now produced in "ganged" pairs, the rotors being built on a common spindle. The same components are also supplied in the form of a differential condenser for reaction control circuits of the type in which it is desired to maintain a constant capacity between the detector anode and earth.

Another series of condensers with hollow spindles and reinforced end plates is also being produced. It is understood that these are to be arranged in such a way that the rotors of two or more units mounted together may be turned together, final balancing of the tuned circuits being effected by swinging individual stators, which will be capable of rotation through a few degrees. This is a development of prime importance, which will be carefully watched. Precise details are lacking at the moment of writing.

The Utility New Pattern Switch has been fitted with a modified form of contact arm, which seems to have effected a considerable improvement. The older type of low-capacity switch has been given a definite "off" position by introducing a kink into the swinging metal arc.

Wilkins and Wright, Ltd., Utility Works, Holyhead Road, Birmingham.



Improved Utility switch.

VARLEY. (154 & 159)

Varley products this year are particularly numerous, and in addition to an extensive range of components we find also all-electric receiving sets. There would appear to be no fewer than thirteen different forms of L.F. transformers, including all types of transformer intervalle couplings as well as output transformers to suit all conditions in the output stage.

Pentode Output Transformer.—D.C. resistance, 1,070 ohms. Primary inductance, 28 henrys with 20 mA. Maximum current, 30 mA. Ratio for high-resistance loud speakers 2½:1, and for low-resistance speakers 45:1. This component would appear to be essential for the correct use of the pentode valve. Price £1 1s.

Pentode Output Choke.—Like the above transformer this also has a double ratio. D.C. resistance, 950 ohms. Inductance, 90 henrys at 15 mA. Combined ratios of 2 to 1 and 3 to 1. Price £1 1s.

Dual Low-frequency Choke.—This is an adaptable component in that by suit-

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ably arranging the connections between its four terminals it will suit the requirements of a generous choke intervalve coupling, smoothing choke or heavy duty output choke. Inductance, 70 henrys at 10 mA., or 10 henrys at 70 mA. Maximum current, 140 mA. Price £1 1s.



Varley heavy duty push-pull input (intervalve) transformer.

Standard Low-frequency Choke.—Intended for use as an output filter or for smoothing in a mains eliminator. Inductance, 16 henrys at 100 mA. Maximum current, 140 mA. Price £1.

Heavy Duty L.F. Intervalve Transformer.—This is an entirely new component specially introduced to serve as an intervalve coupling between a small power valve and the output stage. Ratio, 5 to 1. Inductance, 44 henrys at 5 mA. Price £1 3s. 6d.

Output Transformer.—By providing a double ratio this transformer permits of the use of loud speakers of either high- or low-resistance windings. Ratios, 1 to 1 and 20 to 1. Maximum primary current, 30mA. Price £1 1s.

Push-pull Output Transformer.—Here again a double-ratio output is provided. Total primary inductance, 48 henrys at 1,000 cycles, no D.C. passing. Price £1 4s., including royalty.

Heavy Duty Push-pull Input Transformer.—This is an intervalve coupling which may suitably follow a small power valve. A new refinement is that the secondary is wound in two separate sections, making it possible to separately control the two output valves. Ratio, 2½ to 1. Price £1 5s., including royalty.

Push-pull Output Choke.—Like the standard output choke, this has a double-ratio secondary to suit high- and low-resistance loud speakers. Primary inductance, 38 henrys at 1,000 cycles, no D.C. passing. Price £1 1s.

Constant Inductance Low-frequency Choke.—This is an important new component in which the inductance of 20 henrys remains reasonably constant when carrying up to 100 mA. Useful as an output choke or a smoothing choke in eliminator construction. Price £1 1s.

Ni-Core I L.F. Intervalve Transformer.—This new component follows the modern practice with regard to the use of high-permeability alloy in place of stalley iron. It occupies less space than the corresponding intervalve transformer referred to above, and has a D.C. current-carrying capacity of 2.5 mA. Ratio, 4 to 1. Price £1.

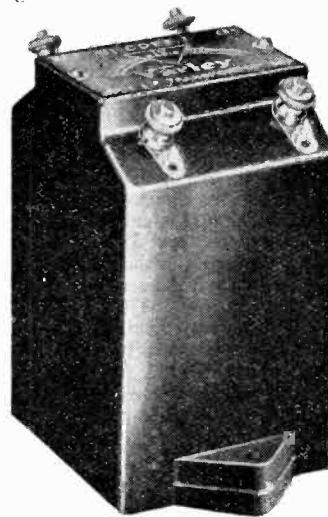
Ni-Core II L.F. Intervalve Transformer.—A compact model that has been produced to combine best performance with lowest possible price. Maximum D.C. current, 2 mA. Ratio, 4 to 1. Price 15s.

Low-tension Low-frequency Choke.—Intended for use in low-tension eliminators, and therefore possesses the low D.C. resistance of only 0.5 ohm. Current-carrying capacity, 3 amperes. Price £1 1s.

Mains Transformers.—A range of five models to suit Westinghouse and Elton metal rectifiers. Price £1 5s.

There are in addition numerous high-output mains transformers for use with both valve and metal rectifiers, and suit the requirements of the generous output stage using valves suitable for operating moving coil loud speakers. They are adequately protected and ventilated, and conform to I.E.E. recommendations.

A new and particularly useful component is a power potentiometer rated at 25 watts. The resistance units are interchangeable. This component has many applications in receiver and eliminator construction. The body is of moulded bakelite, and it is secured by one-hole fixing.



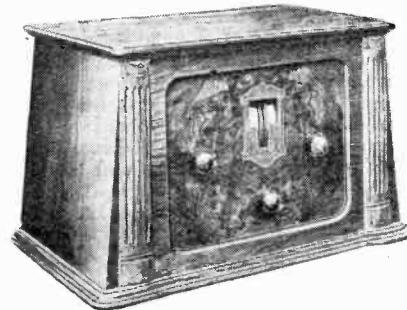
Varley L.F. transformer, the Ni-Core I.

There is a range of Varley mains receivers for use with either A.C. or D.C. supply. Tuning is by thumb dial. Provision is made for the use of a gramophone pick-up.

The well-known Varley gramophone pick-up embodies minor modifications as compared with last year's model. Its compound suspension arrangement reduces record wear to a minimum, gives a particularly uniform frequency response, and is entirely free from chattering.

ters. It is a particularly well-finished accessory, and the adaptor has been modified to suit H.M.V., Columbia, as well as Continental tone arms. The average mean generated potential is 0.2 volt. Price £1 17s. 6d. Resistance-capacity coupling units and H.F. chokes are also shown.

Varley, Kingsway House, 103, Kingsway, London, W.C.2.



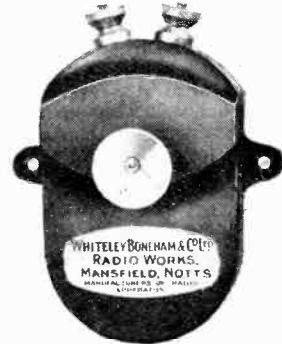
The Varley mains-operated receiver.

VOLTRON. (217)

All brass-built variable condensers are the principal exhibit at this stand. A noteworthy point of construction is the entire insulation of both moving and fixed plates from the frame, thus rendering them particularly suited to the construction of mains receivers where there may be a difference of grid bias potential between condenser and screening. In addition, their suitability for use in D.C. mains receivers is appreciated by the removal of the danger of making contact with the supply.

The many components shown here include wire-wound resistances, complete resistance-coupled units, transformers of the high permeability core type in bakelite moulded cases, matched H.F. chokes for portable set construction, H.F. chokes, small fixed condensers, reaction and neutralising condensers, as well as a complete range of British-made Voltron valves.

Vottron Co., Ltd., 3, Queensway, Ponders End, Middlesex.



W.B. Four-pole unit.

W.B. (WHITELEY, BONEHAM & CO.). (66)

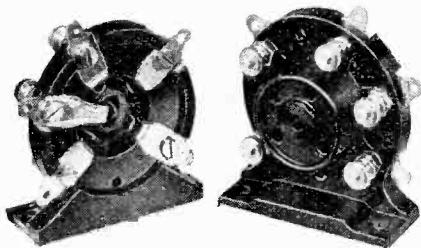
The W.B. four-pole balanced-armature loud speaker drive unit is built around a large cobalt steel permanent horseshoe

Stand-to-Stand Report.—

magnet. It is provided with an adjusting knob controlling the armature setting, and is supplied with conical washers for attaching the cone to the drive rod. This instrument is sold at 12s. 6d., a complete chassis and cone being available at 10s. 6d.

A workmanlike moving coil loud speaker of fairly conventional design is also exhibited. It should prove exceptionally sensitive, and is also economical, as the pot-winding magnet consumes but half an ampere from a six-volt accumulator. It is sold either as a kit of parts for home assembly or as a complete instrument. A model suitable for mains field excitation is also produced.

The new W.B. valve holders are of almost universal application. They can be mounted either horizontally or vertically, thus being suitable for screen-grid valves, and, though provided with a central socket for the new five-pin A.C. valves, can, of course, be used with battery-heated triodes or S.G. amplifiers.



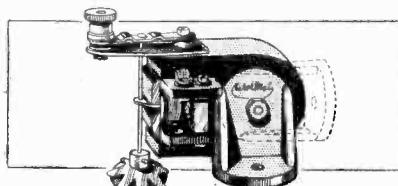
W.B. Universal valve-holders.

For this purpose it would be as well—but not essential—to remove the cathode socket; this operation presents no difficulty. It would be correct to describe the sockets as spring grips for the valve pins; their design is similar to that of those included in earlier models, and has already been commented upon favourably in this journal.

Whiteley, Boneham and Co., Ltd., Nottingham Road, Mansfield, Notts.

WATMEL. (111)

The Watmel Orthotone is a high-class radio gramophone giving an output suitable for home requirements, but is nevertheless considered to be particularly suitable for public hall requirements. The price is 75 guineas. Another Orthotone model is the "Imperial." The cabinet is of first-class design and is 3ft. 6in. in height. The tuning dials of a three-valve receiver are arranged beneath the loud speaker grille, the entire front being closed by doors. A novel feature is that in the event of failure of the battery



Watmel loud speaker unit.

Wireless World

supply the instrument can be used as an ordinary gramophone, making use of the generous sound chamber normally associated with the loud speaker. The set nevertheless is provided with an electrical pick-up, price 25 guineas.

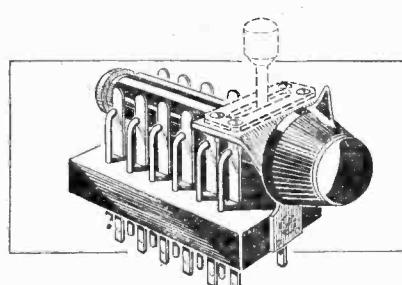
"The 1929 Imperial Three" is an easily built set for the home constructor. The circuit is that of a two-range tuner followed by the detector and two L.F. stages.

Watmel components include fixed capacity condensers, grid leaks and holders, a two-range reacting tuner, various forms of chokes for use as inter-valve couplings, L.F. transformers, H.F. chokes and switches, as well as a gramophone pick-up arm. A new component of importance is a balanced armature loud speaker movement. The construction is such that the armature is normally in a neutral position between four polarised poles. By this means it is not merely attracted, but its displacement is differential and a generous movement becomes possible. While being sensitive, therefore, generous amplitudes can be handled without loss of adjustment or chattering. This is a well-finished component, and sells at 18s. 6d. Its mounting bracket is arranged so as to provide either a horizontal or vertical fixing.

Watmel Wireless Co., Ltd., Imperial Works, High Street, Edgware, Middlesex.

WAVEMASTER (WEBB). (284)

An exhibit of nicely finished variable condensers. Several different patterns are made, and prices are distinctly moderate. *The Webb Condenser Co., 42, Hatton Garden, London, E.C.1.*

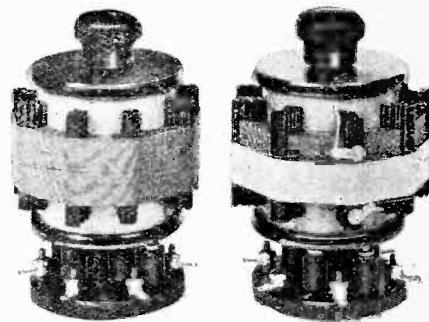


Wearite switch with either lever or knob operation.

WEARITE (WRIGHT & WEIRIE). (221)

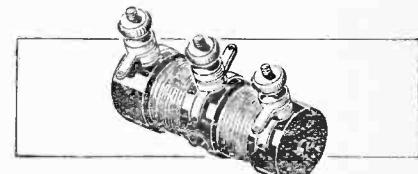
The exhibits at this stand reveal the precision of the instrument-making workshop as opposed to mass production. This fact is conspicuously revealed by the excellence of finish of the Wearite anti-capacity switches. Although these switches are primarily intended for making the many circuit changes necessary in portable sets they meet all amateur requirements and can be safely used in H.F. as well as L.F. and mains circuits. The standard model is convertible from knob to lever operation and can be secured to the panel either by one-hole or bracket fixing.

Coils for home constructors' sets have long been a Wearite speciality, and it is an almost established practice to apply to this firm at once for the coils specified for various designs put out for the home constructor. A wide range of coils can be examined built in accordance with the various set specifications.



Specimens from the range of Wearite coils for the home constructor (The Foreign Listener's Four).

An extension of activities is revealed by the production of mains transformers. Complete separation by means of bakelite sheet between the various windings has been adopted and generous models are available conforming to the require-

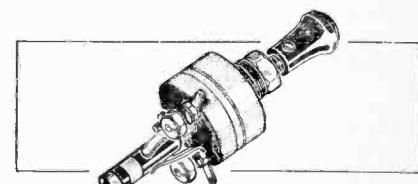


Wearite fixed potentiometer for obtaining a mid-point tap.

ments of the home constructor engaged in the building of a mains receiver. Smoothing and output chokes complete the requirements as regards the construction of mains apparatus. Cast ribbed frames are used for securely clamping the cores of transformers and chokes. Among minor components is a useful potential divider which, with a fixed centre tap, is used for providing a point of zero potential on A.C. circuits.

Genuine paxolin panels and formers are also shown, Wright and Weirie acting as retail distributors in respect of these materials.

Wright and Weirie, Ltd., 740, High Road, Tottenham, London, N.17.

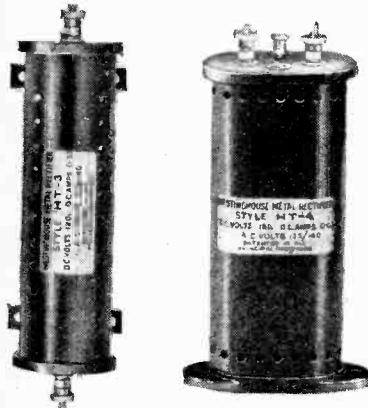


Wearite aerial shortening condenser and switch.

Stand-to-Stand Report.—

WESTINGHOUSE. (13 & 14)

The well-known metal-oxide rectifiers developed by this company, with the exception of the G.B.1 unit for grid bias, have been of the full-wave bridge connected type. These rectifiers have given a very liberal output, and there has lately been a growing demand for slightly less ambitious equipment suitable, for instance, for popular kit sets where the total anode current does not exceed 20 or 30 mA.



(Left) New Westinghouse half-wave rectifier—the H.T.3.
(Right) Westinghouse rectifier (H.T.4) for voltage-doubling circuit.

This need has been met by the H.T.3 and H.T.4 units, which respectively give 20 mA. at 120 volts and 30 mA. at 180 volts; the first mentioned is a half-wave rectifier, in connection with which it is interesting to mention that the ear can tolerate a greater super-imposed ripple voltage at 50 cycles than with the full-wave arrangement giving 100 cycles. The H.T.3 model requires an input transformer, the secondary of which does not give more than 140 volts on open circuit; the price is 21s. The H.T.4 equipment, selling at 37s. 6d., gives a full-wave rectified output, and is used with an ingenious voltage-doubling circuit, whereby the usual bridge of four rectifiers is replaced by a network of two rectifiers and two condensers. The connections are such that the transformer secondary voltage and the peak voltage charge in the condensers are additive, resulting in what is effectively a step up irrespective of the transformer.

The same transformer as that advised for the H.T.3 is used with the H.T.4, and although it only delivers 135 volts from the secondary, the rectifier has an output of 30 mA. at 180 volts. For those whose houses are connected to A.C. mains and who wish to charge their L.T. accumulators at home, the A.3 rectifier, delivering 1 ampere at 9 volts and selling at 23s. 6d., merits attention. The A.4 unit, selling at 39s. 6d., is capable of giving 2 amperes at 9 volts, and besides giving sufficient output for large wireless batteries, is, incidentally, quite useful for charging car batteries. The H.T.1 and H.T.2 equipments for H.T. eliminators,

giving 100 mA. at respectively 200 and 350 volts, have been reduced in price to 7s. and 15s.

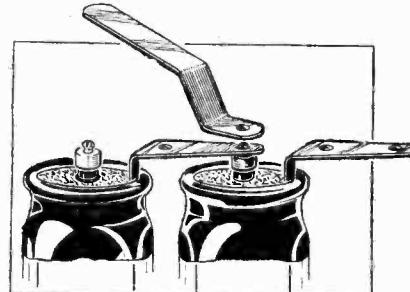
For trickle-charging 2-, 4-, or 6-volt accumulators at 0.5 amps. the R.421 rectifier at 27s. 6d. will be retained on the market for the new season.

Westinghouse Brake and Saxby Signal Co., Ltd., 82, York Road, King's Cross, London, N.

WET H.T. (57)

Standard Wet H.T. cells have been improved by manufacturing the elements—zinc, sac, and carbon—in the form of a cartridge, which is merely inserted in a glass container, to which a chemical solution is added. The addition of a cork, which slips over the carbon rod, completes the process of assembly. A new method of interconnection is now provided; the end of each carbon is fitted with a brass cap carrying a spring stud, which engages with a hole in the zinc connecting strip of the next cell. A special tool is provided, and with its help a firm and permanent connection can be made in a moment. The above remarks apply to the large-capacity cells, such as are economical to use for a modern set consuming a fairly heavy anode current. When the cells are exhausted they can be restored to their original condition by fitting new cartridges and fluid.

The use of measuring instruments is always to be encouraged, and it is interesting to note that this firm has produced an inexpensive meter intended for mounting on the panel of a receiver. The Three-in-One Panel Test Meter, as it is called, reads L.T. volts up to 6, H.T. volts up to 150, and anode current up to 30 millamps. It is supplied complete with a plug board whereby the necessary circuit alterations for obtaining these various readings may be made, and also an ivorine tablet engraved with instructions for inserting the plugs (which are also supplied). The complete equipment costs 13s. 9d.



New method of connecting Standard wet H.T. cells.

An inexpensive milliammeter, in ranges of 0.25 and 0.50 millamps., is also produced. This instrument operates on the polarised magnet system, and, by fitting jewelled bearings, it has been possible to improve sensitivity and consequently to reduce its resistance. The figure stated to apply to the 0.25 millamp. instrument is only 20 ohms—a very low value for a meter selling at 9s. 6d.

The Wates "Star" loud speaker unit is a balanced armature mechanism of

which the construction is much more robust than that of the average device of its kind. Separate adjustments for setting the spacing between the magnets and the position of the armature are provided.

The products of this firm are demonstrated at 7, Beaconsfield Road, near the Exhibition.

YAGERPHONE. (6)

There are radio gramophones and complete receivers for this season's programme. The Y.59 radio gramophone is a handsome piece of furniture made in oak or mahogany, and contains a large double spring Collaro motor with 12in. turntable. The valve amplifier employs a simple system of resistance coupling with anode-feed devices. There are no transformers at all in the set. For D.C. mains the price is £37 15s., whilst the A.C. model sells at £39 12s. 6d.

The Transportable-Five receiver, retailing at £13 15s., embodies two H.F. valves, which are aperiodically coupled. The volume control consists of a capacity control of reaction, and the last valve—a super-power valve—is choke-filter coupled to the loud speaker. One-dial tuning is employed, and there is a wave-change switch.

There are a number of other radio gramophones and receivers in attractively finished cabinets.

Yagerphone, Ltd., 28, Charlotte Street, E.C.2.

ZAMPA (MIC WIRELESS CO.). (56)

The Universal Tuner, a new season's production, has a built-in inductance control switch and can be used in aperiodic aerial circuits. It covers wavelengths between 250 and 2,000 metres, and embodies a reaction coil.

The double cone chassis comprises two conical diaphragms with diameters of 14in. and 6in., mounted on an oxydised metal frame with fretted front. It requires only the addition of a drive unit to turn it into a complete loud speaker.

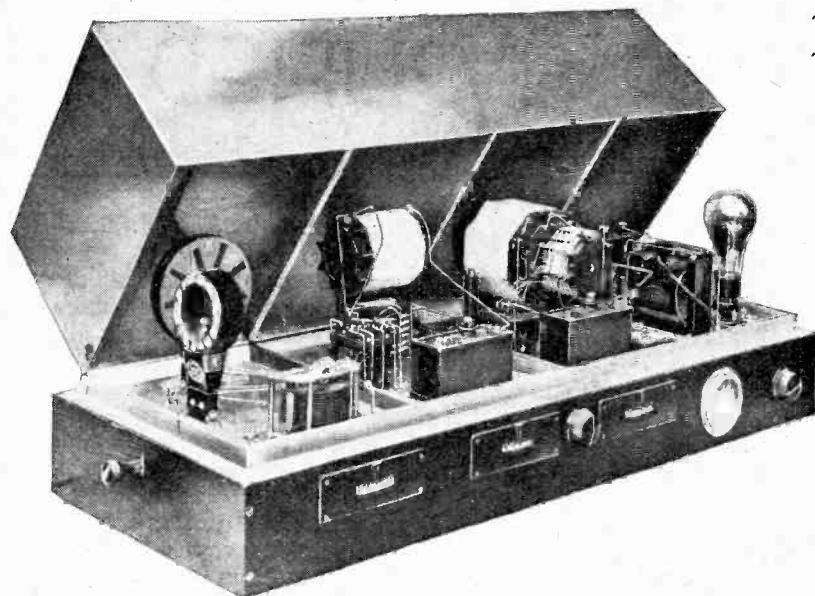
The Zampa moving-coil loud speaker has been redesigned and has a novel magnetic system of high-permeability steel. The cone is 8½in. in diameter and is centred by a new device. A 20 : 1 step-down transformer is mounted within a sheet-metal shroud, which also encloses the magnetic system and is extended to form a base. The instrument is supplied in various forms suitable for battery or mains operation.

A two-valve mains set is designed along novel lines; a two-unit construction is adopted, the radio-frequency and tuning panel being intended for mounting in a position where its controls are accessible, while the amplifier may be placed in any available space in an existing cabinet or other container. Provision is made for gramophone reproduction, for which the pick-up is permanently connected, being thrown into circuit by means of a switch. This set is also supplied in self-contained form.

A low-priced A.C. eliminator, with a half-wave rectifying valve, is exhibited.

Mic Wireless Co., White Horse Place, Market Street, Wellingborough.

SOME RECENT WIRELESS WORLD RECEIVERS.



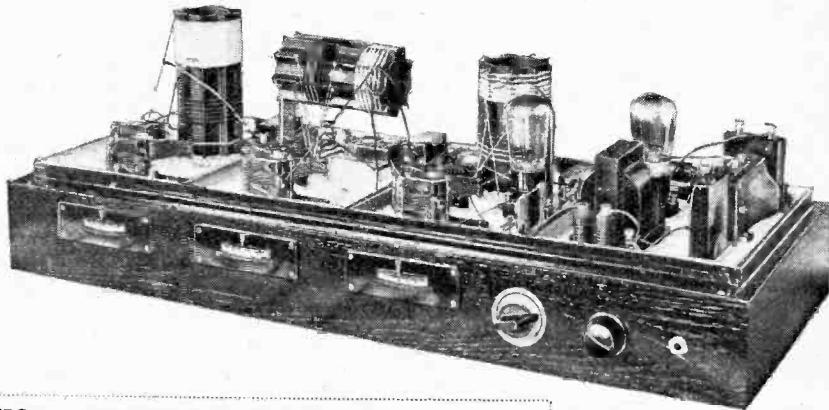
THREE TYPICAL CONSTRUCTIONAL SETS DESCRIBED IN THIS JOURNAL.

THE WIRELESS WORLD RECORD III.

THIS receiver which was described with full constructional information in the issues of September 4th and 11th was designed to achieve the utmost in single stage H.F. amplification. The measured stage gain is 500, and this established a record which has never previously been approached. A.C. indirectly heated valves are used.

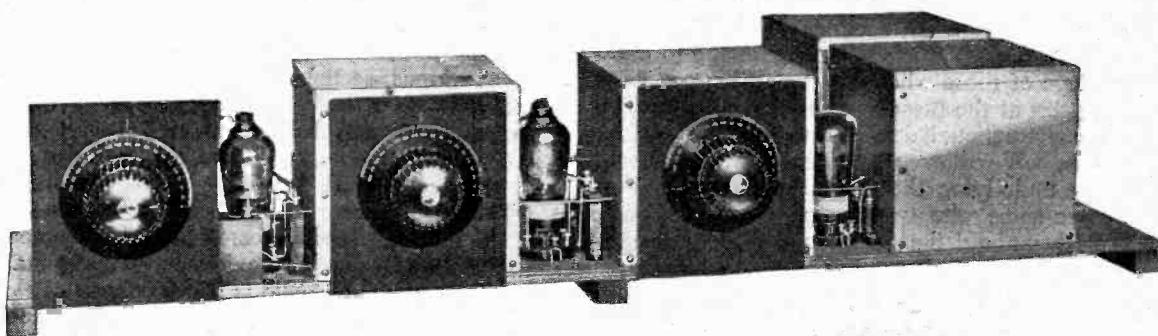
THE NEW KILO-MAG FOUR.

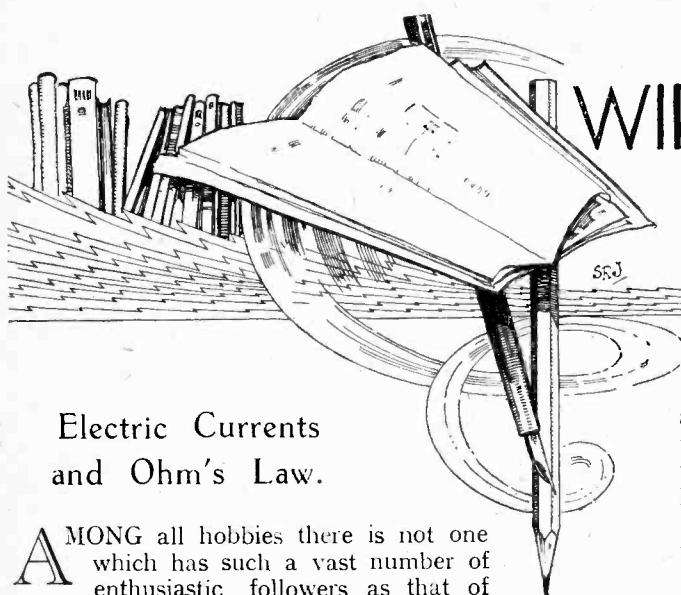
THIS is a redesigned and up-to-date edition of a popular Wireless World set. It employs two H.F. screen-grid stages and gives extraordinary range and selectivity without loss in quality. Complete constructional details are to be found in the issues of August 14th and 21st, 1929.



THE FOREIGN LISTENER'S FOUR.

A HIGHLY selective and sensitive receiver designed to operate entirely from A.C. mains, valves with indirectly heated filaments being employed. The receiver is simple to build and gives loud speaker results on most of the best European programmes. This receiver was described and illustrated with detailed constructional drawings in the issues of July 31st and August 7th, 1929.





Electric Currents and Ohm's Law.

AMONG all hobbies there is not one which has such a vast number of enthusiastic followers as that of amateur wireless telephony. It is a hobby which has a lasting fascination for young and old alike, and holds within its sway not only those who have had a technical training in electricity, but tens of thousands who would possibly never even have heard of Ohm's law but for wireless—people in every walk of life.

Technical Progress.

One of the factors which keeps the hobby so much alive is the rapid rate of development and improvement in the efficiency of receiving sets. One has only to remember that not much more than five or six years ago it was common practice to try a circuit out with the various components placed loosely on a bench or table, and then, having got it to work without howling or oscillating after a great deal of trouble, to attempt to transfer it to a cabinet, often with disastrous results! Compare this with the modern apparatus where scientific screening and screen-grid valves or neutralisation are employed. The modern receiver *must* be built once and for all in its final form as far as the set constructor is concerned. Experimental work has become more tedious and expensive, and this has led to the publication by *The Wireless World* of complete specifications of highly efficient sets designed and tried out in the laboratory. Manufacturers of various components have also designed sets embodying their particular apparatus, and offer for sale complete kits of parts with the necessary diagrams and instructions.

It would be very interesting and enlightening to know what percentage of those who construct their own wireless receiving sets at the present time do so according to the precise constructional details given in the various radio journals, without even an elementary knowledge of the theory underlying the respective designs. Possibly there are some who would argue that it is waste of time to bother about theory when such complete instructions are available, all the brain-work having been done by someone else! But the writer feels convinced that on the whole the great majority of set constructors

WIRELESS THEORY SIMPLIFIED

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

are very keen to know the why and wherefore of everything relating to their respective sets, and more often than not feel envious of those of their friends who have had a grounding in the theory of electricity and magnetism. After all, there is not much satisfaction in working in the dark, and an elementary knowledge of electricity and magnetism as applied to radio adds enormously to the interest of the work, and saves many a pit-fall.

Perhaps one of the commonest problems met by the present-day amateur is how to adapt a new design of receiver so that it can be housed in his existing cabinet, the old set having become obsolete and inadequate to meet the present-day standards of range, selectivity and quality of reproduction. This applies in particular to cases where the cabinet is an expensive one. Or, on the other hand, it may be desired to bring an existing set up to date by making certain alterations. Armed with a little theoretical knowledge, the amateur will be able to judge for himself what alterations as regards lay-out would be permissible in any specified design or which of the old components could be used in the new set. And, most important of all, it is the man with some theoretical knowledge who generally gets the best results from his set, and is usually able to locate a fault quickly should one develop.

In writing this series of articles the author realises that possibly there will be among his readers quite a number who have not approached the theoretical side of the subject at all, and, bearing this in mind, every attempt will be made to render the treatment as simple as possible, and numerous examples will be worked out to simplify matters still further.

The Electric Current.

In a receiving set currents of electricity are controlled by various means in order to produce the desired effects in the various sections of the receiver. In the first place, what is a current of electricity? We talk of it as something which flows, as though it were some kind of fluid passing through a wire or conductor, and yet that conductor will have the same dimensions and weight whether there is a current flowing in it or not. But the conductor will become heated to some degree, and this may be the only evidence we have that a current is passing. The point is that a current of electricity does not affect our senses directly, but manifests itself

Wireless Theory Simplified.—

by its peculiar effects, and it is these effects which are utilised in the various ways to be described as we proceed.

The notion that a current of electricity is something which flows is an excellent one, and the discovery of the existence of electrons has proved that there is a great deal of truth in it. Let us compare our wire carrying the current to a hose-pipe connected to a tap which is turned on, so that there is a current of water flowing through it. The pipe and the running water within it will have a definite and constant weight because water is entering at one end exactly at the same rate as it leaves at the other. Suppose now that the tap is turned off with the nozzle end of the hose held above the level of the tap so that the pipe remains full of water. The weight will still be the same when the flow of water has ceased.

Electrons.

We may view the wire carrying the current of electricity in exactly the same way, but, before completing the analogy, it will be necessary to introduce and define briefly what is meant by an electron. According to the generally accepted electron theory, every atom of matter is built up of a number of minute negatively charged corpuscles moving in definite orbits around a central positively charged nucleus. These minute outer corpuscles each carry an equal negative charge, and are called *electrons*. Each electron possesses the same mass, and is so small that, comparing it with an atom of matter, Sir Oliver Lodge once likened it to a fly in a cathedral!

We are not concerned with the structure of the atom, the nature of which is determined by the number of electrons moving in definite orbits round the nucleus, but with the fact that each atom has attracted to it large numbers of free electrons which may be withdrawn or moved from atom to atom. It is the *motion* of these electrons in any definite direction which constitutes an electric current; that is to say, a current of electricity in a wire is a stream of electrons passing along the wire from atom to atom entering at one end and leaving at the other. When the current is "switched off," the electrons simply stop moving and remain where they are just as in the case of the hose-pipe, where the water came to rest when the tap was turned off. Hence even a piece of wire which is not carrying a *current* of electricity is, nevertheless, full of electricity in a stationary state. To start a current then all that we do is to set in motion streams of electrons which already exist in the circuit. This will explain why the weight of a conductor remains unchanged when a current of electricity is passed through it in spite of the fact that the electrons themselves have mass.

We must now consider the strength of the electric current and the unit in which it is measured. The strength of the current is represented theoretically by the number of electrons which pass a given point in

the circuit every second, but as the electrons cannot be counted in practice, the strength of the current is gauged in terms of its physical effects. The practical unit is the *ampere*, and is defined internationally as that steady current which deposits 0.001118 gram of silver per second by electrolysis—that is, by the process used in electro-plating.

Electromotive Force and Resistance.

To start and maintain an electric current, *i.e.*, to set electrons in motion in a circuit, some sort of force is necessary just in the same way as force or pressure is required to drive the water through the hose-pipe, the magnitude of this force depending on two things. Taking the hose-pipe equivalent first, the necessary pressure will depend on (*a*) the quantity of water required per second, and (*b*) the nature and size of the pipe. Obviously, to get a rapid flow through a thin pipe will call for a large pressure, and *vice versa*. Similarly in the electric circuit the necessary driving force, which is called the *electromotive force* (E.M.F.) will depend on (*a*) the quantity of electricity passing per second, *i.e.*, the current, and (*b*) the opposition offered to the passage of the current by the conductor itself.

This opposition is what is referred to as the *resistance* of the conductor. It can be looked upon as a frictional resistance offered to the passage of the electrons through the conductor. Resistance is measured in ohms, the ohm being defined internationally as the resistance of a column of mercury of certain specified dimensions. The resistance of a conductor

depends on its dimensions, the material from which it is made, and very often upon the temperature. The metals have low resistance and allow the current to pass easily, whereas ebonite, glass and all so-called insulators offer such high resistance that it is only possible to drive the minutest currents through them. Dry air is one of the best of insulators—what a calamity if it were not!

Ohm's Law.

It was discovered by Ohm that a definite simple relationship exists between the current, electromotive force and resistance in a circuit, namely, that the E.M.F. required to drive a current through a conductor is exactly proportional to the strength of the current and to the resistance of the conductor. This is known as Ohm's Law and can be applied to any circuit where the current is a steady one. (The laws obeyed by alternating currents will be discussed later.)

The practical unit of electromotive force is the *volt* and may be defined as that electrical pressure which is necessary to drive a steady current of one ampere through a resistance of one ohm. If a conductor has a resistance of R ohms and it is desired to drive a current of I amperes through it, we see from Ohm's Law that the required electromotive force will be $E = I \times R$ volts. Or if we know the E.M.F. and the resistance the current is given by $I = E/R$ amperes; and similarly the resistance is $R = E/I$ ohms.

SEPTEMBER 25th, 1929.

Wireless Theory Simplified.—

Numerical Example.

Ohm's law is thus seen to be a very simple one, but when a circuit consists of more than one resistance or contains branches care must be observed when applying it. As an example let us consider the simple closed circuit of Fig. 1, where a battery whose E.M.F. is E volts, and which has an internal resistance of r ohms (for, like a conductor, even a battery has resistance), has connected across its terminals an external resistance of R ohms. A current will flow round the closed loop through the two resistances R and r in turn, so that the total resistance of the circuit will be $R+r$

ohms. Denoting the current by I and applying Ohm's law to the complete circuit we get $I = \frac{E}{R+r}$ amps.

To take an actual case, suppose that the battery is a 6-volt accumulator whose internal resistance is 0.2 ohm, and that the external resistance R is represented by a number of valve filaments having a combined resistance of 3 ohms. The current drawn from the battery will then be,

$$I = \frac{6}{3+0.2} = \frac{6}{3.2} = 1.875 \text{ amps.}$$

(This same circuit will be considered in greater detail in the next part.)

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.

TECHNICAL ASSISTANTS AT OLYMPIA.

Sir,—May I be allowed to bring to the notice of those concerned a glaring fault I noticed at last year's Wireless Exhibition?

I attended the show on the opening day, taking a day trip up specially to see it.

I noticed that, with hardly an exception, those in charge of the stands were conspicuous for their extraordinary lack of technical information. One could purchase any article, but as for getting any satisfactory characteristics of the various transformers, chokes, coils, and valve efficiency, the ability to give this was beyond the average assistant.

Now we who go to the show go with an object, not just to see how pretty it all is. We want information and facts, not suppositions. I was told that "experts" would be in attendance on Monday (the show opened on a Saturday) and other days.

I propose to visit the Exhibition this year and I want a lot of information, besides what will occur to me during my wander round. I hope it will be forthcoming.

I might add that friends of mine found the same trouble even when "experts" were supposed to be present.

E. J. B. CURTIS.

AMATEUR STATUS.

Sir,—I should like to draw the attention of all those amateurs who appear disgruntled with our position to a leading article, by the President of the American Radio Relay League, in the September number of the magazine *QST*.

For the benefit of those who do not read *QST*, may I quote just a few passages from the article?

"Sometimes I wonder if a good many of us A.R.R.L. people are not inclined to overlook big matters just because somebody talks a good deal about small matters. Every now and again somebody starts trying to pull apart our A.R.R.L. because Headquarters has done, or has not done, something or other."

"Whose A.R.R.L. are they trying to pull apart? Is it Headquarters' A.R.R.L.? Not a bit of it. It is your and my A.R.R.L. and the other fellows' A.R.R.L. they are pulling apart."

"Have you ever stopped to think what the effect would be were we radio amateurs to adopt those methods? We would have twenty or thirty different warring amateur radio organisations all shouting at each other, calling each other names, and demanding different things. How far would Amateur Radio get?"

Now, surely, this is the very sort of storm in a teacup that some are trying to stir up at the moment in this country; and, if so, are they not "small matters"?

Well, it is "my A.R.R.L." just as it is "my R.S.G.B." and both are out to uphold the honour of amateurs, provided the amateur is out to uphold his own honour and the honour of "Ham" Radio.

The whole situation sums up to the fact that every amateur must lend his weight to the common cause, and not to individual taste. If the latter is in the majority, then we can add the letters "R.I.P." after Amateur Radio. G2ZC.

Sir,—It occurs to me that my previous letter to you, reproduced in your issue of August 21st, under the heading "What the A.R.R.L. Thinks," may be misconstrued by many British amateurs.

Naturally, we wish it well understood that, as stated in my previous letter, the comment referred to your editorial in the issue of July 10th, wherein you commented on the attitude of the British Government authorities toward British amateurs. My comment is in no way to be taken as applying to any other editorials.

A. L. BUDLONG,
Assistant to the Secretary.

The American Radio Relay League.
Hartford, Connecticut, U.S.A.

Sir,—The question of the amateur status has unfortunately resolved itself into an argument as to which is the best organisation. May I inform all intending correspondents that Mr. Bradley's assertion that the A.B.R.S. talk to the exclusion of action is disproved by the fact that action has been taken in conjunction with the R.S.G.B. whereby some benefit may accrue to the whole of the amateur movement.

In the meantime I do feel it is necessary to prevent any misunderstanding arising from the paragraph in Mr. Lawrence Fuller's letter published in the September 11th issue. Mr. Fuller is evidently unaware of the full facts of the case referred to in my previous letter. The affair in question was not a concern of the A.B.R.S. but the Manchester Radio Scientific Society, and was taken up by the A.B.R.S. after the said Society had fought a good deal of the battle themselves, and further, he proves by stating that any amateur would have such restrictions imposed upon him, that he knows practically nothing of the case at all, and I would advise Mr. Fuller to make himself *au fait* with the whole of the circumstances before he dares to comment in such a journal as yours.

In any case, it does not matter one iota who is the premier society or organisation that has done this or that, but what does matter is that the amateurs of this country shall cease quibbling amongst themselves, and get down to brass tacks to improve their status, and their general line of action in connection with a science which provides more field for study than for argument.

Manchester. J. E. KEMP.

RE DECAPPING VALVES.

Sir,—A quick method is, after unsoldering the wires, to bring the valves gently to the boil in water. The cement will be softened, and the base can be removed entirely without damage. The process takes five minutes or so.

Henley-on-Thames,

V. PHYLLIS GEORGE.

READERS'

PROBLEMS.

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

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

Without Decapping.

Will you give me an idea as to what results should be expected from a "Record III" receiver constructed in accordance with the published specification, but without the "decapped" detector valve? V. L. M.

With this modification, the receiver would still have a performance well above the average, but amplification would be appreciably reduced, and the special advantage of the detector grid circuit with regard to its inductance-capacity ratio would to a certain extent be lost. It would be necessary to remove several turns from both primary and secondary windings of the medium-wave H.F. transformer.

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Modifying the Original "Regional" Set.

I am thinking of modifying my original "Regional" receiver (with a neutralised triode H.F. valve) by fitting the auto-transformer-coupled tuned aerial arrangement of the new "S.G. Regional" receiver. My object is to attain even higher selectivity than at present: do you consider that the proposed modification will justify itself by results? J. H. W.

It cannot be denied that the aerial coupling arrangement included in the new version of this set enables the operator to make a better adjustment of coupling between the two circuits, and in your locality we should expect that the consequent gain in selectivity should be worth while, but only if a screen is interposed between aerial and secondary coils.

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"Record III" Gramophone Attachment.
I have started to build the "Record III" receiver, and should like to know if it is possible to fit a gramophone pick-up. If permissible, I propose to use a jack, arranged so that the insertion of the plug (to which the pick-up will be connected) will automatically convert the present detector into a first-stage L.F. amplifier.

Will you please let me have a circuit diagram showing a suitable method of connection? C. B. A.

It should in the first place be pointed out that, due to the high H.F. stage magnification afforded by this set, great care must be taken to avoid the addition of

leads in the grid circuit which might be responsible for interaction. However, if reasonable precautions are observed, it

scheme. It will be obvious that the body of the jack must be insulated from the metal screening case, otherwise a short-circuit across the bias battery would be introduced.

Reference lettering in Fig. 1 corresponds with that in the original circuit diagram. It will be hardly necessary to add that the extra bias connection shown is for supplying the detector valve when converted to function as an amplifier.

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Electric Gramophone Motor.

I am having a certain amount of trouble with induction effects between my recently installed gramophone motor and the L.F. amplifier of a radio-gramophone receiver. This seems to be due mostly to sparking between brushes and commutator, which cannot be entirely obviated, in spite of the most careful attention. Can you suggest an easy and simple method of effecting a cure? S. R. C.

We think that you would be well advised to try the simple expedient of connecting two large condensers in series across the brushes, and joining the connection between the condensers to earth. The capacity of these by-pass condensers should be as large as possible—not less than 4 mfd. each.

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Pentode Economy.

Will you please tell me how to reduce the total anode current consumed by my pentode output valve, without in any way sacrificing quality of reproduction, which is at present quite satisfactory? D. T. B.

Unless you are satisfied with reduced volume, we fear that it will be impossible to retain your present quality of reproduction and at the same time to reduce the consumption of current from the source of H.T. supply. (It is, of course, assumed that the valve is being worked under the correct operating conditions.)

It is usual to reduce anode current both by overbiasing the grid and by reducing the voltage applied to the pentode screening grid. We suggest that you experiment with both of these schemes, finally adopting the working conditions found by trial to give the most pleasing results with the anode (and screen) current that you can comfortably provide for the valve.

RULES.

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

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

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

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

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

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

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

SEPTEMBER 25th, 1929.

Eliminator Dangers.

I am told that it is possible to get a serious shock from wireless receiving apparatus when head telephones are connected to a set supplied with H.T. current through an eliminator. Do you agree with this, and, if so, will you outline briefly the necessary precautions to take in order to obviate all risk of danger from this source?

E. V. N.

It is generally agreed that head telephones should not be connected directly in the anode circuit of a valve to which a high H.T. voltage is applied; this is irrespective of the source of supply. When the set is fed from D.C. mains, it is almost inevitable that one pole of the supply will be earthed, and also in connection with the set; this increases the risk of an electric shock to the operator; but, apart from this fact, it is safe to say that a well designed and well-constructed eliminator is practically as safe to use as a battery of the same maximum voltage.

As for safety precautions, a double-wound output transformer, with adequate insulation between primary and secondary, will render the set perfectly safe to use with headphones, as will the use of a choke-filter output device, although, to be on the safe side, it is recommended that blocking condensers should be fitted in each of the telephone leads.

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Field Magnet Current.

Is there any reason why the field magnet winding of a moving-coil loud speaker should not be supplied with current from the battery used to heat the filaments of the receiving set?

E. N. P.

No; it is quite usual to employ the ordinary L.T. battery for the dual purpose of heating filaments and energising the magnet. Of course, before doing so you should assure yourself that the capacity of your battery is adequate for the demands that will be put upon it.

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A Substitute for H.F. Amplification.

As you will see from my address, I live but a few miles from the Brookmans Park transmitter. Having listened to initial tests from that station, I have come to the conclusion that an exceptionally selective arrangement will be necessary here in order properly to separate the twin transmissions (when they begin), but signal strength is so great that for purely "local" work H.F. amplification would appear to be unnecessary. It seems to me that the use of cascade tuned filters in conjunction with a tuned and loosely coupled aerial circuit would provide a useful solution of my problem, and I should be obliged if you would give me the diagram of a recommended circuit, preferably with not more than three tuning controls. An anode bend detector will be used, as it is realised that this will be helpful in reducing interference.

S. F.

Your reasoning is quite sound, and we think it should not be difficult for you

to devise an arrangement capable of affording the necessary selectivity: due to the proximity and high power of the new station, there should be no doubt that signal strength would be more than sufficient with the circuit arrangement shown in Fig. 2. In this diagram, L and C represent the aerial loading inductance and aerial tuning condenser, while L₁ and C₁ are in the intermediate tuned circuit; L₂ and C₂ form the tuned detector grid circuit. It will be observed that a few

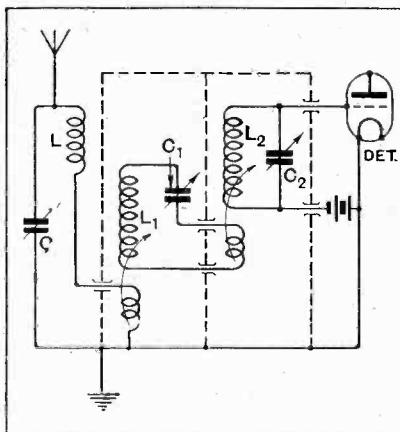


Fig. 2.—Intermediate filter circuit combined with separately tuned aerial.

turns of wire (for coupling purposes) are connected in series with L and L₁, and that thorough screening (indicated by dotted lines) is provided in order that coupling may be well under control.

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H.T. and L.T. Inter-connection.

I have a receiver in which H.T. negative is joined internally to the L.T. positive bus-bar. It is noticed that this is opposed to the practice adopted in all the receivers described in your journal, in which H.T. negative is invariably shown as connected to L.T. negative. Would it be worth while altering the set to conform with this method of connection? P. R. G.

As far as performance is concerned, this is a very small and unimportant matter, and a change in connection would not bring about any improvement, except, possibly, in one of those comparatively rare cases in which interstage coupling and consequent instability is brought about by the negative-positive connection.

The method adopted in *The Wireless World* sets was first standardised mainly as a safety measure; there can be no doubt that it reduces the risk of accidental damage to valve filaments.

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Neon Lamps.

Your recent article, "The Neon Lamp as a Stabiliser," suggests an easy way of improving my eliminator. Can you tell me where the special lamps can be obtained?

S. N.

Neon lamps, sold under the trade name of "Osglim," are manufactured by the General Electric Company, Ltd., and should be obtainable through your dealer.

A.C. Valves Without A.C.

It so happens that I can recharge my L.T. accumulators at little cost and without much trouble, and in consequence I am considering the possibility of using A.C. valves with their heaters supplied with current from an accumulator battery. (The mains here are D.C.) My particular problem is to know whether it would be permissible to use these valves (with heaters taking 1 amp. at 4 volts) in conjunction with a Px.650 valve in the output position. As you know, this valve requires a 6-volt battery. Would there be any harm done by feeding the heaters of the indirectly heated valves from the same source through a voltage-absorbing resistance?

L. C. H.

Beyond the fact that current consumption will be high, there is no objection to your proposed plan, but care must be taken to see that the resistance (or resistances) used for absorbing the surplus voltage are of adequate current-carrying capacity, in addition to being of the correct ohmic resistance. These points can be decided by consulting the wire tables appertaining to the particular brand of resistance wire you desire to use.

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Chokes for Decoupling.

Is there any reason why an L.F. choke should not be used for decoupling purposes in place of the resistance which is commonly specified? I ask this question because I wish to "decouple" the anode circuit of a valve in which no very great drop in voltage can be tolerated.

W. B. J.

A choke can often be used quite successfully for this purpose; indeed, it is possible to visualise conditions where it would be more effective than a plain ohmic resistance of the highest value ordinarily permissible. It must not be forgotten, however, that the impedance of a choke falls off with a decrease in frequency; and, if the amplifier is so designed that it passes on the lower audible frequencies at full strength, it is quite possible that the choke would not be effective, and that motor-boating would take place.

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Detector H.T. Voltage.

Although it is usual to specify for a grid circuit detector an H.T. voltage not greatly in excess of 60, I notice that occasionally a pressure of as much as 120 volts is recommended. Will you tell me the reason for this, as a study of one particular receiver for which this detector voltage is advised does not reveal any special feature in the circuit arrangement?

T. T. B.

In cases where a comparatively high anode voltage is recommended for a "leaky grid" detector, it will almost invariably be found that the valve is of the high-impedance type, of the kind usually sold for resistance-capacity amplification. By applying a high anode voltage, the working impedance is reduced to a value where it becomes possible to insert an L.F. coupling transformer in the anode circuit, giving a step-up in voltage to the first L.F. valve.