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As many of the circuits and apparatus described in these
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EDITORIAL COMMENT

The Radio Show

Recording Impressions

IN this, the third special Show Number of *The Wireless World*, the technical staff having now had time to examine the exhibits more critically than was possible in the first rush days of the Exhibition, contribute their impressions of the principal features of technical interest in all sections of the manufacturers' products. With the aid of these critical summaries we hope our readers will be able to form an accurate idea of just what progress has been made in technical radio development in the past year.

In the years that have gone by receiver design has made very rapid strides, and on occasions the technical developments have been so numerous that either it has been impossible for manufacturers to take advantage of them all at once, or some manufacturers less cautious than others have introduced these innovations into their large-scale production of receivers before they had reached a stage when they were suitable for incorporation in receivers for the public. Sometimes considerable trouble in the way of servicing these receivers resulted. To-day manufacturers are more cautious; they do not rush to incorporate every new idea in their sets, but rather they strive to make the receivers as efficient and reliable as possible, whilst not omitting to include every new feature which has proved its dependability and worth.

Past Progress too Rapid

Receivers of this season might be regarded by technicians as showing less advance over developments of previous years, but the improvements which have been made and the addition of technical features since last year would, in any other industry, be looked upon as really startling developments, and if they are not so regarded in the radio industry to-day it is only because in the past we have been accustomed to progress which has been, if anything, too rapid.

The addition of short-wave ranges to so many types of receiver is the outstanding circuit change of the year, and it will be a matter of considerable interest to watch the reaction of the public to short-wave listening when these receivers get into their hands in large numbers. There can be no doubt that short-wave listening is very fascinating, but whether the public will maintain an interest in it, or whether the novelty will wear off, is a matter on which it would be risky to attempt a prediction.

Popularity of Portables

One interesting feature of this year's Show is the apparent increase in the interest in lightweight portable receivers on view. It would seem as if the publicity which has been given to the subject of car radio has attracted the attention of the public to the value of a wireless set which can be taken about. The portable set, in spite of the disadvantage that it has to be maintained with batteries, has the very definite pull over a set installed in a car that it can be used more flexibly and can be listened to without the necessity of sitting in the car in order to do so.

Television may be described as the "star turn" of the show; it is an amazing engineering achievement and there seems to be little doubt that, technically, television can go ahead as soon as the B.B.C. inaugurates a regular service. We would have liked to have seen the first television programme put out to visitors to Olympia the very best in the way of entertainment which the B.B.C. could expect to do in, say, the first six months of a television service. But, if what we have seen at Olympia is, from the point of view of entertainment value, regarded as good enough, we do not think the public will be wildly enthusiastic about it. We hope that the public will judge only the technical achievement of television on these first transmissions and will not be influenced to imagine that this is the best in the way of entertainment which could be provided for them.

A CONSIDERED ANALYSIS OF THE NEW RECEIVERS

NOW that we have had time to consider the true significance of the Olympia Exhibition, it becomes clear that although real technical developments may be fewer than in previous years, design is by no means stagnant; indeed, in most other spheres of activity the innovations of the present season would be hailed as almost revolutionary.

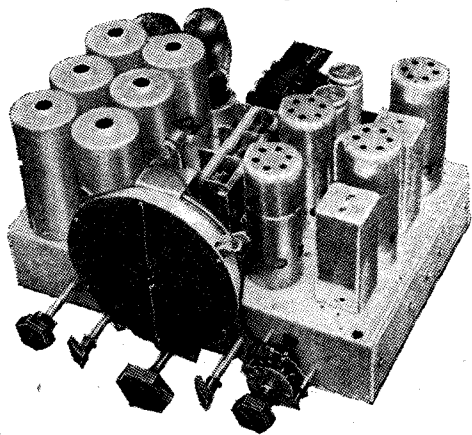
Television has been treated in our pages for more years than many of our readers have lived, but television receivers as regular articles of commerce are a distinct innovation which is now dealt with for the first time.

Next in point of interest, and at present with a wider appeal, come the all-wave sets, which have also become standard productions of the British wireless industry. In the basic design of normal broadcast receivers something approaching stability has been reached, but modification and improvement of details is still going on.

Developments of the season in other fields are treated under appropriate headings elsewhere in this issue.

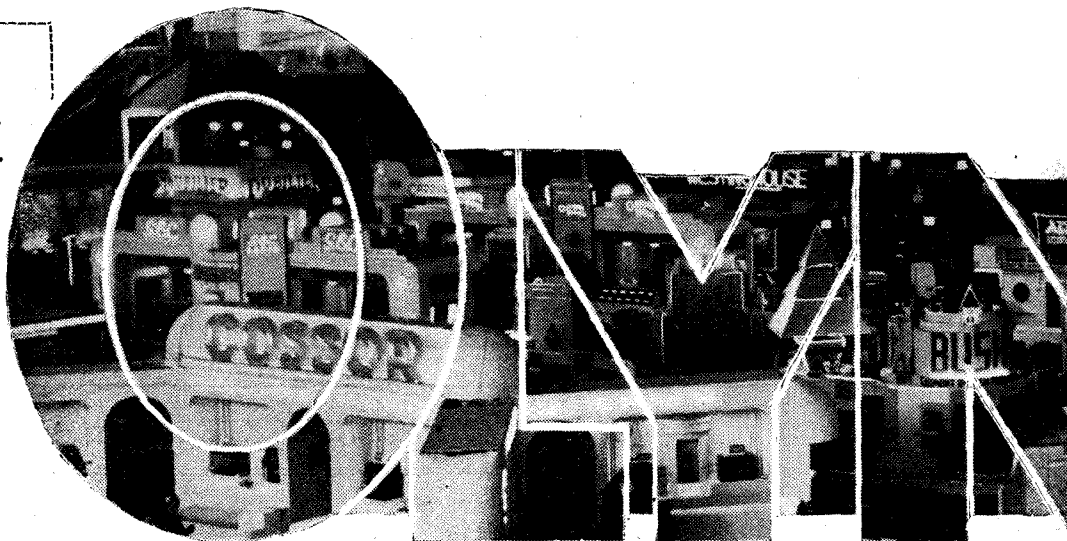
ALL-WAVE RECEIVERS

THE term all-wave receiver is generally used to describe any set having a wider tuning range than the customary 200-500 metres and 800-2,000 metres. It does not convey, therefore, that the receiver can be tuned to any wavelength within the enormous band used in wireless communication. It is more limited in meaning than this, and



Chassis of the R.G.D. Model 625 all-wave receiver.

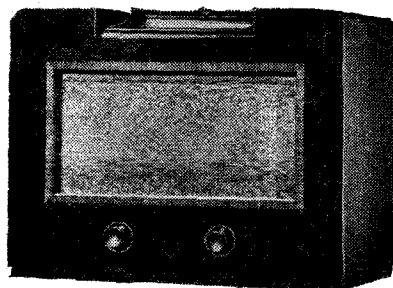
means precisely that the receiver includes one or more short-wave bands in addition to the medium and long. A set is all-wave



in the sense that it can receive short, medium and long wavelengths, but the different bands only rarely overlap to provide a continuous tuning range.

As one might expect, the less expensive types of receiver generally include only one short-wave range, but there is less uniformity in this respect among the costlier examples of the radio art. Some of the most expensive models include only two short-wave bands, while cheaper sets have three, and some still adhere to the single band. This divergency of view on the part of the designers is doubtless brought about by the fact that it is possible in a single range to cover all the more important short-wave broadcasting stations, and the addition of extra bands, while certainly giving some increase in the number of stations it is possible to receive, does not increase the number proportionately.

Multi-band receivers, however, are likely to give a somewhat better performance so far as the purely short-wave circuits are concerned, for the width of each band is usually rather narrower and it is easier to secure high efficiency. This does not necessarily mean, however, that of two

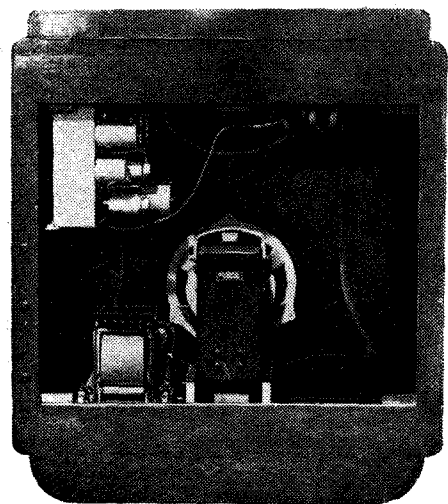


Philips 714B all-wave receiver.

sets of equal price the one with several short-wave bands is the better from the point of view of overall performance. A single short-wave range naturally costs less than two, so that the receiver with the one band may prove superior in selectivity or quality, it may be more sensitive or selective, it may have a better quality cabinet or be of more robust construction. It is thus reasonable to suppose that when two sets carry the same price the one having the fewer wavebands will give the

SHOW

better performance over its more limited tuning range, and a choice between the two must consequently be based on individual requirements. Either set will be



A rear view of the Sound Sales Radio-Gramophone.

the more suitable according to the purpose for which the buyer intends it.

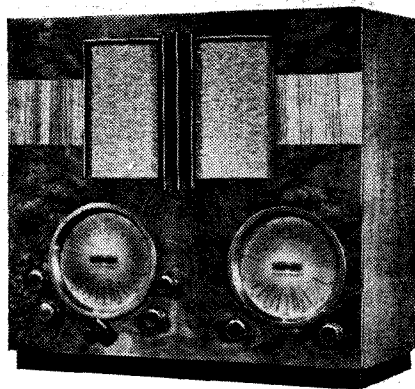
All-wave receivers have for some years been obtainable in the larger types of set, and one firm which has consistently included short-wave bands in its sets is R.G.D. The large model is the 1220, a radio-gramophone with a 12-watt output stage and using resistance-coupled push-pull amplification. Variable-selectivity is included, and a separate amplifier is fitted for AVC purposes. This firm, however, now produces a superheterodyne of moderate size with an attractive specification. It is the Model 625, and it includes a signal-frequency amplifier operative on all bands. This is followed by a triode-hexode frequency-changer and a single IF stage tuned to 465 kc/s. Variable-selectivity is provided in two steps, low and high, and is obtained by providing one transformer with an additional coupling coil which can be cut out of circuit

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REVIEW

by means of a switch when high selectivity is needed.

A duo-diode-triode provides detection, delayed AVC, and the first stage of LF amplification, and is followed by a triode output valve. Two short-wave bands—16.5-51 and 48.5-150 metres—are provided in addition to the medium and long wavebands, and the switching is arranged so that all unused coils are short-circuited. One feature of interest is that the aerial coupling coils are of high inductance and



The Dynatron Valkyrie all-wave receiver.

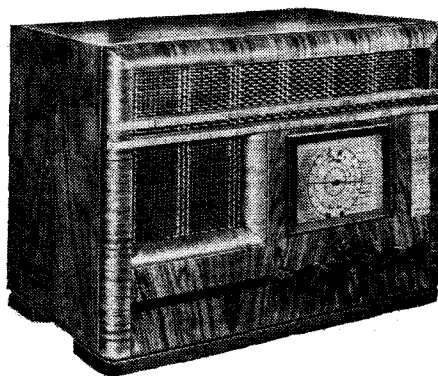
resonate at a lower frequency than any within the tuning range. The HF transformer primaries, however, are of low inductance and resonate at a higher frequency than any within the tuning range. In this way more even sensitivity over the waveband is secured, and the variations in selectivity over the tuning range are reduced. As a table model this set costs 25 guineas.

The Pye receivers are also of the two short-wave band type. The Model CAW costs 33 guineas and covers 13-33 and 30-80 metres, in addition to the medium and long wavebands. A signal-frequency amplifier is used and followed by an octode frequency-changer. There are two IF stages tuned to 465 kc/s, and a duo-diode

detector and source of AVC. This is followed by a single LF stage, feeding a push-pull output stage in which triodes are used. A QAVC system is incorporated, which depends upon metal rectifiers for its operation, and is fed from a third winding on the last IF transformer.

A smaller receiver produced by this firm, the T10, has the same tuning range but only a single IF stage, and the first valve is an octode frequency-changer. A duo-diode-triode is employed for detection, AVC and LF amplification, and the output valve is a pentode. This set costs 18 guineas.

The radio-gramophone produced by Sound Sales includes an all-wave set with a single short-wave band covering 16.5-50 metres. The receiver is actually *The Wireless World All-Wave Super Seven* with the addition of a phase-reversing stage feeding into the Push-Pull Quality Amplifier, which can be supplied for outputs of 4 to 12 watts. A dual-suspension speaker is fitted, and the cabinet is



Marconiphone all-wave superheterodyne, Model 346.

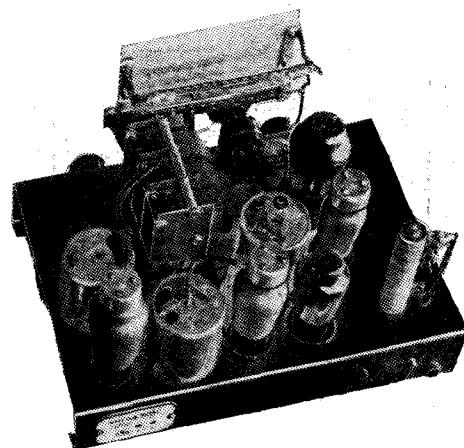
arranged with open sides to reduce box-resonance to a minimum.

The Dynatron all-wave apparatus is unusual, in that the short-wave equipment is quite separate from the main receiver. In the case of the Empress, for instance, the main body of the equipment consists of a straight set covering the medium and long wavebands only. Three HF stages are used, and there are six tuned circuits employing iron-cored coils. Special

arrangements are made to avoid the selectivity varying over the waveband, and the coupling of the band-pass filters is varied automatically with the tuning control in order to achieve this end. Variable-selectivity is provided, and the control varies both the circuit coupling and resistance in order to maintain a flat-topped resonance curve at low selectivity.

A diode detector is used and followed by a phase-reversing stage, which feeds the double resistance-coupled push-pull amplifier. A separate diode is used for AVC purposes with its own amplifier, and a further amplifier is provided for operating the tuning indicator. For short-wave reception, this equipment is preceded by a converter, which has a signal-frequency amplifier and a triode-hexode frequency-changer. There are two wavebands of 11-28 and 27-75 metres, and in order to avoid microphony not only is the gang condenser flexibly mounted but also the oscillator coil. Incidentally, all short-wave coils are iron-cored.

The H.M.V. Model 801 covers an unusually wide range in its three short-wave bands, for it gives continuous coverage from 7 metres to 140 metres, and can consequently be used for reception of the sound accompaniment to television. An HF stage is fitted, and the frequency-changer is a triode-hexode. There is one IF stage, followed by a duo-diode-triode, two LF valves, and a push-pull output stage. AVC is naturally included, and there are separate tone controls for the bass and treble. A dual-ratio tuning control is fitted, and a good point is the fitting of a vernier indicator to the dial. Smaller receivers produced by this firm have the



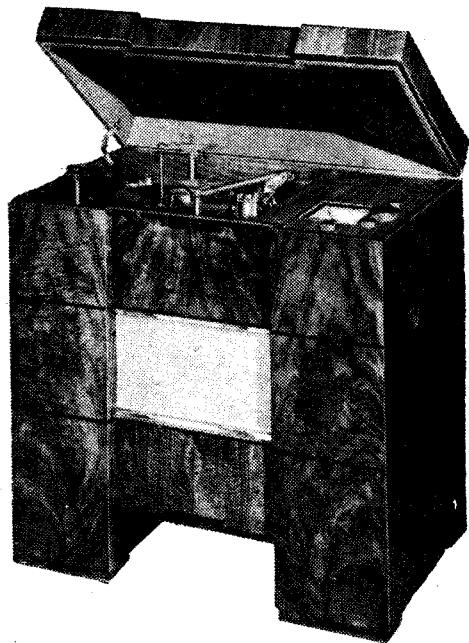
Chassis of the Halcyon Royal County receiver.

same wide tuning range and are similar in design up to the detector. The duo-

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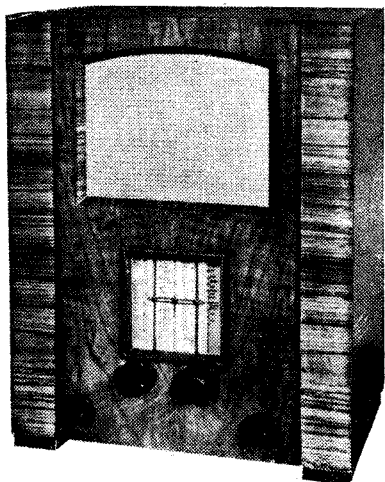
diode-triode used in this stage, however, feeds a pentode output valve.

The Marconiphone receivers also include a tuning range extending down to 7 metres. Signal-frequency amplification is used and a triode-hexode frequency-changer. The intermediate frequency is 460 kc/s, and the single amplifier stage is followed by a duo-diode-triode feeding an output pentode.



The G.E.C. Fidelity All-wave Record Changer Radiogram.

Receivers with a single short-wave band are probably in the majority, and among them must be mentioned the Halcyon Briton. This covers 16.5-51 metres and has an octode frequency-changer which is preceded by a band-pass filter on medium and long waves, but by a single tuned circuit on short waves. There is a single IF stage, followed by a duo-diode which acts as a detector, provides AVC, and feeds the output pentode. On medium waves a sensitivity of 18 μ V is claimed, while the figures for long and short waves are given as 100 μ V and 40 μ V respectively. The Royal County receiver produced by this same firm is

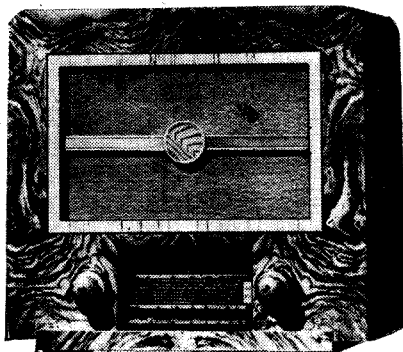


The Bush Radio S.S.W.33 all-wave receiver.

similar, but employs a duo-diode-triode for detection, AVC, and first-stage LF amplification, with the result that higher sensitivity is obtained.

The G.E.C. sets have a single short-wave band of 16-98 metres. The Fidelity All-Wave receiver has a screen-grid HF amplifier and a triode-hexode frequency-changer. There are two IF stages, tuned to 445 kc/s, for which HF pentodes are used, and this amplifier is followed by a duo-diode-triode which is transformer-coupled to an output pentode. A sensitivity of 3 μ V. is claimed, and the set can be supplied with a wavelength range of 16-550 metres continuously instead of the usual ranges which include the long wave-band.

The Mullard receivers have a short-wave band of 16.7-51 metres, and one of the smallest is the MAS3, which is listed at 11½ guineas. An octode frequency-changer is used, and there is one IF stage operating at a frequency of 128 kc/s. The output valve is a pentode, and the set is arranged so that inter-station muting can be obtained by pressure on the volume control knob.



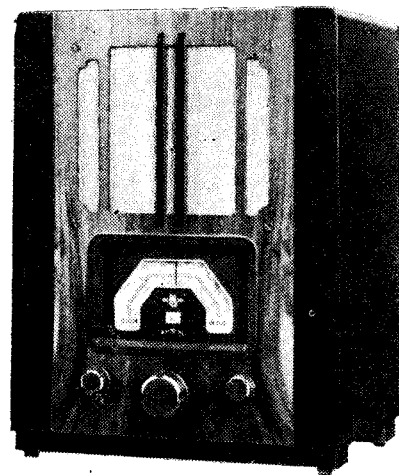
The Mullard MAS3 all-wave superheterodyne.

Kolster-Brandes also adhere to the single short-wave band, and for their sets the range covered is 19-50 metres. Several all-wave models are made; the K.B.560 is a superheterodyne with a triode-hexode frequency-changer, one IF stage, and a duo-diode-triode which feeds the output pentode. A band-pass pre-selector is used on the medium and long wavebands, but a single circuit on short waves. Provision is made in the design for the use of the Rejectostatic system of interference elimination, and the set is priced at 16 guineas.

A smaller receiver produced by this firm is the K.B.515. It has the same tuning range, but is a straight set with one HF stage, a triode detector and a pentode output valve. A similar receiver, the K.B.535, designed for battery operation, is listed at 8½ guineas.

The Invicta AW57 has three short-wave bands—five bands in all. It covers 13 metres to 550 metres without a gap, and there is the normal long waveband of 800-2,000 metres. An octode frequency-changer is used with one IF stage feeding a duo-diode triode. The output valve is a pentode, and the set costs 22 guineas in radio-gramophone form.

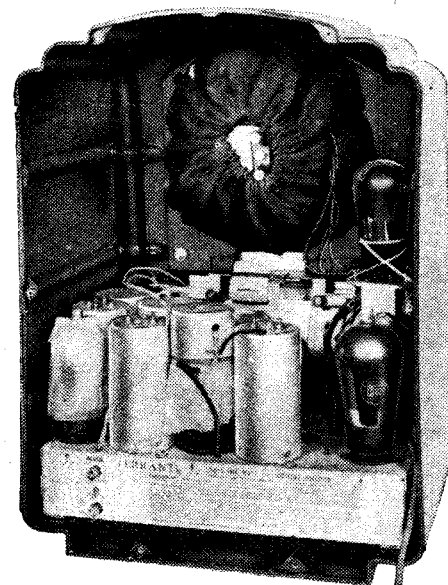
The smallest all-wave receivers are not of the superheterodyne type, but are straight sets of the HF, detector, pentode



The Kolster-Brandes Model 515 all-wave receiver.

class. Such sets naturally rely greatly upon reaction for their sensitivity on short waves, and rarely, if ever, can AVC be provided. Nevertheless, they are capable of giving a very good performance and meet many requirements admirably.

One set which falls into this class is the Ferranti Parva, which costs only 9 guineas. This firm does not, however, confine itself to small sets, but has a number of superheterodynes, among which is the Nova.



A rear view of the Ferranti Nova superheterodyne.

This has three valves, a heptode frequency-changer, one IF stage, and a duo-diode output pentode. It costs 12 guineas.

BROADCAST BAND RECEIVERS

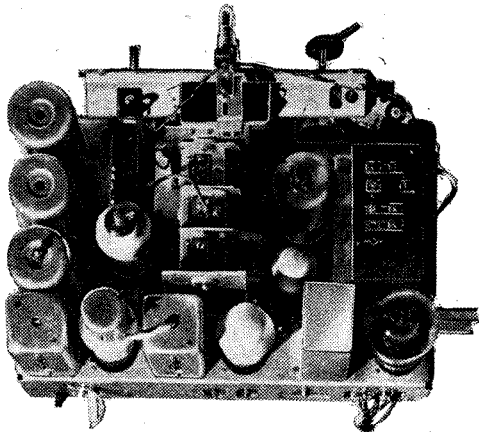
THIS year we have to record the disappearance of an old friend—the det.-LF set, which has served us well since the earliest days of telephony. Possibly a few sets of this type linger on in the manufacturers' catalogues, but, except for

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specialised short-wave use, none were to be seen at Olympia. Except on sentimental grounds, there is little reason for regret; the det.-LF circuit has long outlived its usefulness for broadcast reception under modern conditions.

Another old friend, the HF-det.-LF three-valve circuit, seems to be holding its own quite comfortably both in mains and battery-driven versions, and is still satisfactory enough for those who listen mostly to the local station, with occasional foreign reception when conditions are suitable. The HF-det.-LF sets are now classified into two distinct categories—two-circuit and three-circuit models. The extra selectivity of the three-circuit sets, generally described as band-pass models, is naturally worth the slight extra cost it entails when facilities for occasional long-distance-work reception are desired.

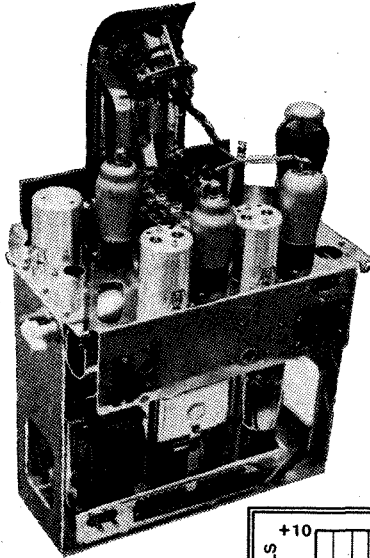
The backbone of the British wireless industry is still the small superheterodyne, and in this class of receiver most of the developments that have taken place are to be found in the all-wave models already dealt with. In the broadcast-band versions now under discussion, improvements are mainly of a detail nature; the basic circuit is sensibly unchanged. Most of the sets may be divided, as last year, into two classes—those with high-level detection and those with low-level detection. In the first class the detector feeds straight into the output valve without the intermediate LF amplifier that is a feature of the low-level set, in which the detector deals with relatively small inputs. Both methods have their advantages, but there is a tendency for the high-level system to be confined mainly to the less expensive sets in which a double-diode-pentode acts as a second detector, source of AVC voltage, and output valve. However, a number of the sets now employ separate double-diode valves, but the circuit is essentially



Chassis of Marconiphone Model 291 superhet.

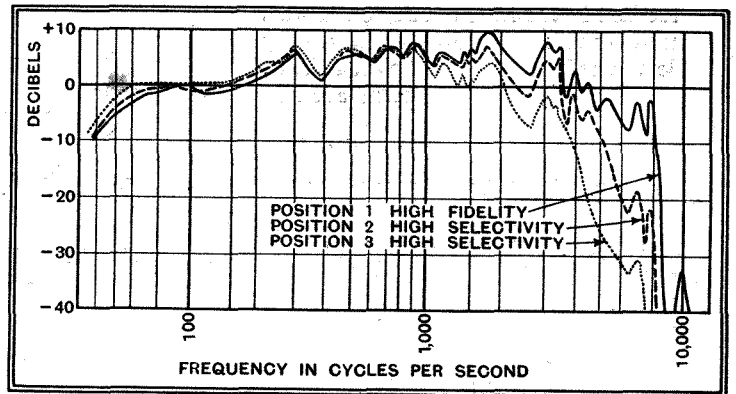
the same. With a few exceptions signal-frequency amplification is not found in the cheaper sets. As a rule, there is a band-pass input filter which, with the oscillator section, makes a total of three tuned circuits. The two-circuit set (single tuned input circuit and oscillator) does not appear to have made much headway, but it is attractive on the score of cost.

Talking of cost, there seems to be little change in prices this season, although values are undoubtedly better, due to improved workmanship and to the inclusion of refinements that did not find their way last year into standard models. Prices of the typical small superhet. vary from under £10 to some 12½ gns. for the table models; a guinea or so more may be charged for some sets with extra refinements.



Unconventional chassis layout of Ekco AC97 receiver.

Overall response curves (including loud speaker) as taken by the makers, of the Ekco AC97. Input 1,000 kc/s, modulated 30 per cent.; output measured at 12in. on axis of speaker. Note the sharp cut-off at about 8 kc/s.



A good example of the small superheterodyne with low-level detection is the Marconi Model 219, neatly housed in a well-made cabinet of attractive design, which costs 12½ gns. The circuit arrangement includes band-pass input, a heptode frequency changer, and single-stage IF amplifier working at 125 kc/s, which is followed by a separate double-diode valve. Next comes an intermediate LF stage, resistance-coupled to an output pentode which feeds an elliptical cone speaker. Refinements include AVC (now accepted as a matter of course) and a silent tuning switch which applies a saturating voltage to the grid of the LF valve in order that a signal may be tuned in by the help of the tuning indicator without distressing noises.

Another AC superheterodyne, this time typical of high-level detection practice, is the Kolster-Brandes KB540. Again there is a band-pass input circuit, a heptode frequency-changer, and a double-diode which feeds directly into the output pentode. Variable selectivity, which is included in this case, is admittedly not a refinement usually found in receivers of the 10- to 12-guinea class (this model costs 11½ gns.), but otherwise the circuit is typical, although in many other sets the

diode rectifier electrodes are included in the same bulb as the pentode output valve.

Still another small superheterodyne which has points of exceptional interest is the Ekco model AC97 at 12½ gns. This set includes a frequency changer, IF stage, double-diode-triode, and a triode output valve. In the LF amplifier there is a special filter network designed not only to eliminate 9 kc/s whistles, but also to give a sharp cut-off just below this frequency. The effect of this filter is clearly shown in the accompanying response curves. There is also a three-position selectivity control switch, which, in position 1 (high fidelity), imposes damping on the IF amplifier; in position 2 damping is removed and the IF amplifier is working at its maximum useful selectivity. In the third position, normally used only for long-distance reception when conditions are unfavourable, high-note response is reduced still further by attenuation in the LF section.

To compensate for the normal characteristics of the human ear, the volume control is arranged so that at low settings both bass and treble are accentuated. This is carried out by ganged potentiometers

working in a compensating circuit. The loud speaker is a special model with a curved cone which has a main resonance well below 50 c/s and a flux density of over 10,000 lines per sq. cm.

With the help of a silent tuning switch actuated by pressing lightly on the condenser knob, a paralysing voltage is applied to the IF amplifier through a circuit with a time-constant suitably chosen to prevent clicks. Thus it is possible, with the help of the cathode-ray tuning indicator provided, to tune in a station accurately without noise.

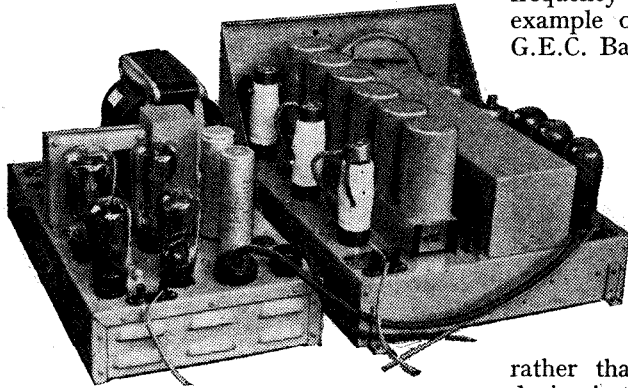
Turning to general tendencies, it would appear that iron-cored coils are more generally used in superheterodynes than last year, and figures in quite a number of cases in the IF amplifiers.

One swallow does not make a summer, but two or three low-priced sets include triode output valves instead of the more popular pentode. The Ekco set just described is one of these, and there is also a Bush model.

Apart from the comparatively simple and inexpensive straight HF-det.-LF sets already mentioned, the tuned radio-frequency amplifier still has its adherents in more ambitious receivers. In the Dynatron Ether Empress model, for

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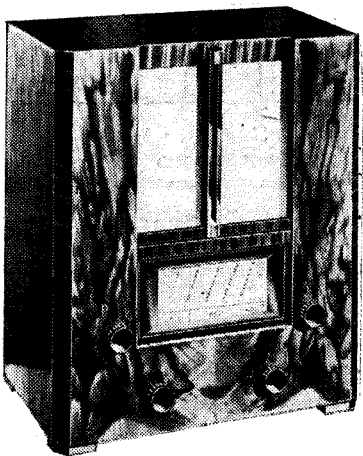
example, there are no fewer than three HF stages with a total of six tuned circuits. Variation of selectivity at different wavelengths, which has hitherto



Six tuned circuits: power and receiver units of the Dynatron Ether Empress.

been a drawback of the straight HF amplifier so far as quality reception is concerned, has been overcome by providing for automatic change of coupling to retain constancy. Straight HF amplifiers are also included in the Haynes tuner units as embodied in the high-quality apparatus produced by this firm. Incidentally, they include the refinement of amplified AVC, which is by no means universal even in quite expensive sets.

In our "obituary notice" on the det.-LF set we might almost have included the



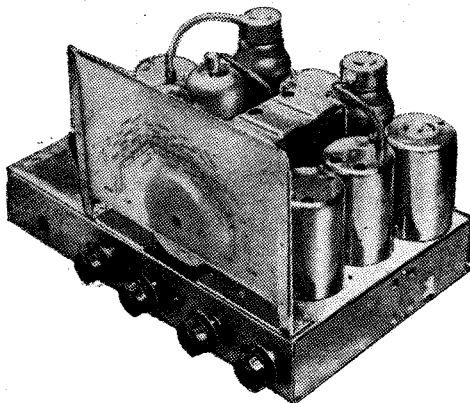
Battery superheterodyne with QPP output: the G.E.C. model.

purely DC receiver, although we should probably have been accused of being too late, as its fate was clearly sealed a year ago. Now the DC user is catered for quite satisfactorily by the universal models, and in this field there is at least one important development. This is to be found in the Philips production, in which there is a built-in converter which comes into operation on DC supplies, but is rendered inoperative on AC. This innovation will be particularly appreciated by those on 100-volt DC supplies. The Milnes series-parallel accumulator system also caters for those who have to make the best of awkward voltages.

So far as the battery-operated broadcast-band receiver is concerned, there are perhaps fewer changes than in the mains

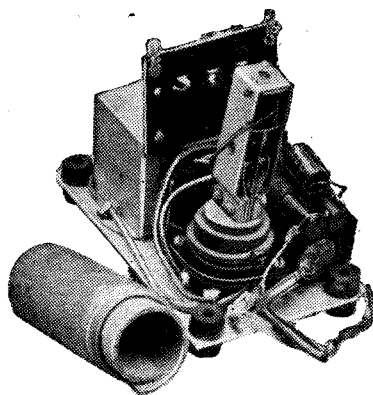
models, at any rate with regard to the circuit arrangement. There is perhaps a greater tendency in the superheterodynes to use a stage of signal-frequency amplification, but in many attractive sets the frequency changer is the input valve. An example of this practice is seen in the G.E.C. Battery Super, in which the QPP output valve is preceded by a stage of L.F. amplification given by the triode section of a double-diode-triode valve. In the Decca battery set, which has an HF stage, the diode feeds direct into the output pentode.

The greatest novelty of all among the battery sets is in the form of an adjunct rather than in the basic circuit. This device is the vibratory generator, which, in the Ekco Model BV67 superheterodyne,



Chassis of Aerodyne Model 50 battery superhet.

takes the place of an HT battery and supplies 14 milliamps of anode current at about 130 volts from a 4-volt accumulator. The device is about the size of a valve and is fitted with standard valve pins; it is heavily insulated with rubber, and the

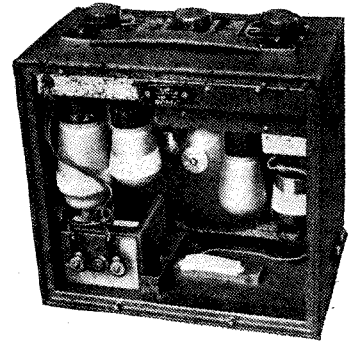


The Ekco vibratory HT generator, with cover removed, and associated apparatus.

vibrator unit, which is self-rectifying and fitted with two pairs of contacts, works quite silently. It is stated that, although these units are easily replaceable, they have already been life-tested up to 1,500 hours without showing any falling off, so renewals should not often be required.

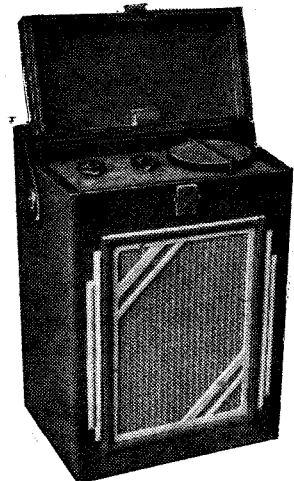
The portable set seems to be an essentially British institution; in other countries they are produced rather as "stunts," and not as sober articles of commerce for

which there appears to be a constant demand. This demand probably accounts



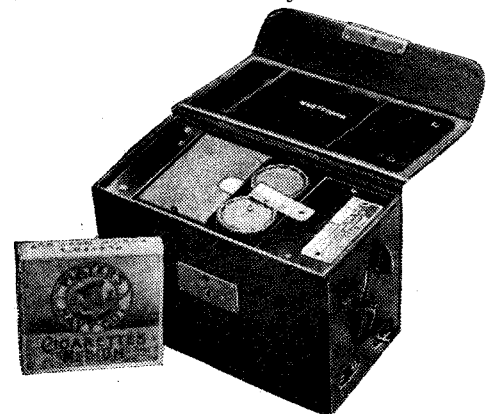
Interior of Beethoven "Baby" portable, with HT battery removed.

for the present high state of development, and manufacturers have had encouragement to produce the really compact and light portable that was one of the features of the Show. The Vidor and Burndept models, which weigh under 15 lb., are good examples and include a three-valve HF-det.-LF circuit. Although it has more valves, the new Beethoven "Baby" portable weighs only 10 lb. One of the latest of the miniature sets is the Wayfarer Major with an HF-det.-2LF circuit, including a Harries output tetraode. The weight of this set is 14 lb., including a permanent-magnet moving-coil speaker.



The new Wayfarer Major miniature portable.

A non-radio exhibit which nevertheless employs radio technique and so may be dealt with here is the Multitone Deaf Aid. Normal methods of controlling volume and tone are somewhat bulky for inclusion in



One of the new Multitone deaf-aid amplifiers

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apparatus which must above all be light and inconspicuous, and so a novel system has been devised, volume and tone control being effected by reaction between the output valve and the grid of the input valve. The input grid load is capacitive (a crystal microphone), and so if reaction is applied through a resistance, tone is affected. For the control of volume, reaction is applied through a condenser. Another feature of certain Multitone appliances is a limiting device that prevents unduly loud noises from being produced; it operates on the bridge system with a lamp in one arm, rather in the manner recently described in this journal in connection with a system of volume expansion.

TELEVISION RECEIVERS

INTEREST at Radiolympia was by no means confined to normal receiving equipment, for, in addition to the all-wave apparatus referred to elsewhere in this issue, television receivers were to be found in surprising numbers in view of the fact that experimental transmissions from the Alexandra Palace have only recently commenced. The interest in such equipment is due partly to its novelty, but from the technical viewpoint it is brought about largely by the variety of methods employed. For good or bad, there is no such thing as a conventional television receiver, and each maker does what seems right in his own eyes without fear of criticism.

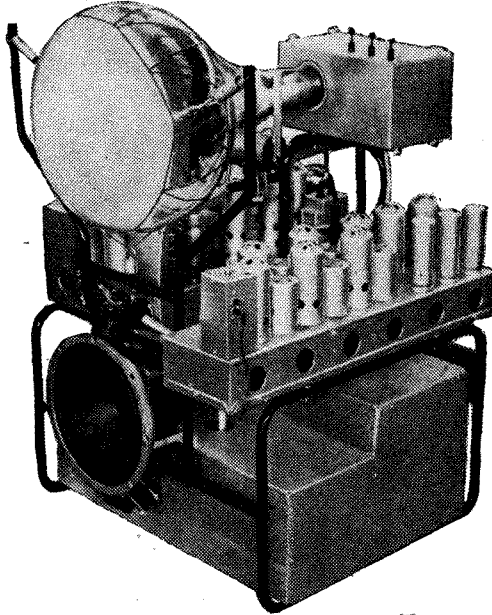
Since every receiver is different, a general description is impossible, and it is necessary to treat each firm's products separately and with as full detail as circumstances will permit. The Pye equipment has separate sound and vision channels, and is available in two models. Both have the same vision chassis, but one is designed for sound reception on ultra-short waves only, whereas the other includes an all-wave receiver.

The former, Model 4201, has for sound reception a receiver in which the first valve is a triode-hexode frequency changer. A single IF stage is employed and followed by a duo-diode-triode from which AVC is obtained. The output valve is a pentode delivering some 4 watts to the loud speaker and an overall response curve flat up to about 15,000 c/s is claimed.

The vision receiver, which has an overall gain of about 100,000 times also commences with a triode-hexode frequency changer and is followed by four IF stages. The detector is of the anode-bend type and a pentode-type valve is used to feed a pentode LF stage from which the vision signal is taken to modulate the cathode-ray tube. The output of this valve is also taken *via* a phase-reversing stage to the synchronising separator, which consists of a screen-grid valve operated so that it can separate the synchronising pulses from the vision signals.

The synchronising signal from this valve is applied to the two time-bases.

The frame deflection is magnetic, and two valves are used in the time-base, one being a gas-filled relay and the other an amplifier. The line deflection is electrostatic, however, and the time-base employs hard valves, two valves being used for the time-base proper and one for the output.



An interior view of the Pye television receiver. The mains equipment is contained in the base, with the vision and sound receiver chassis above.

The mains equipment is contained in a perforated case which forms the base of the apparatus and contains four rectifiers—one for the sound receiver, one for the vision receiver, one for the time-bases, and one for the HT supply to the cathode-ray tube. The picture is approximately 11 in. by 9 in. and in black and white; it is viewed directly, since the tube is mounted horizontally. The equipment has 22 valves apart from the CR tube.

The apparatus produced by Halcyon employs a straight set for sound, but a superheterodyne for vision. On sound, an HF stage precedes the detector, which is followed by an LF stage and then an output pentode. The mains equipment is built on the same chassis, so that the sound equipment is completely self-contained and has five valves, including the rectifier.

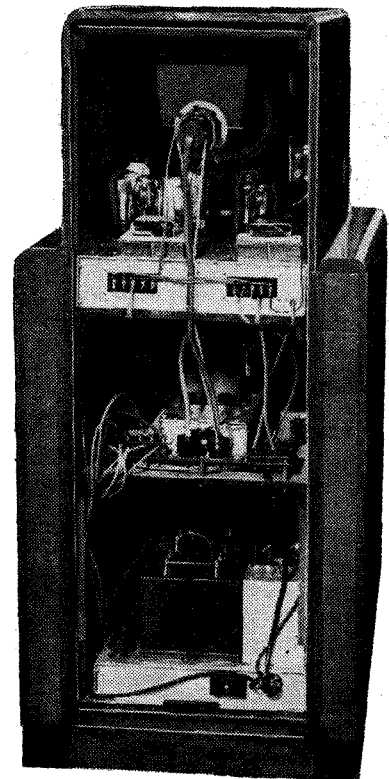
The vision receiver commences with a triode-hexode frequency-changer and has two IF stages and a diode detector, followed by an LF stage, the output of which feeds the cathode-ray tube; this gear is assembled on one chassis with its own mains equipment, including the rectifier. Each of the two time-bases contains a gas-filled relay and an amplifier, while one rectifier supplies both with the necessary operating voltages. Two additional mains units are provided—for the HT supply to the CR tube and for grid-bias. Seventeen valves are used, and the picture is 8 in. by 6 in. The cathode-ray tube is mounted horizontally for direct vision, and is protected by a

sheet of plate glass. The complete equipment is priced at 90 guineas.

Direct viewing is also adopted in the Cossor receiver, in which a 13½ in. cathode-ray tube is used. The picture size is 10 in. × 7½ in. and is black and white. The receiver is a superheterodyne, and the sound portion may also be used for normal broadcast reception.

In the case of the G.E.C. equipment the input circuits are common to both sound and vision channels. An HF stage is used followed by a triode-hexode frequency-changer, after which the signals are separated and passed through their respective IF amplifiers. The sound amplifier has two stages, and is followed by a duo-diode-triode and a pentode output valve. Five stages are used in the vision amplifier, however, and are followed by the detector and a pentode output valve which feeds the cathode-ray tube and also the synch separator—a device for separating the synchronising and vision signals.

A diode is employed for this purpose, and controls the two time-bases, in each of which three valves are used. A gas-filled relay operates as a relaxation oscillator, and its output is fed to the cathode-ray tube deflecting plates through an amplifying stage in which two valves are used in push-pull. Two time-bases are provided, of course, to generate the line and frame deflecting voltages. A single rectifier is used to supply the HT for the sound and vision channels, and two other rectifiers for the CR tube and time-bases.



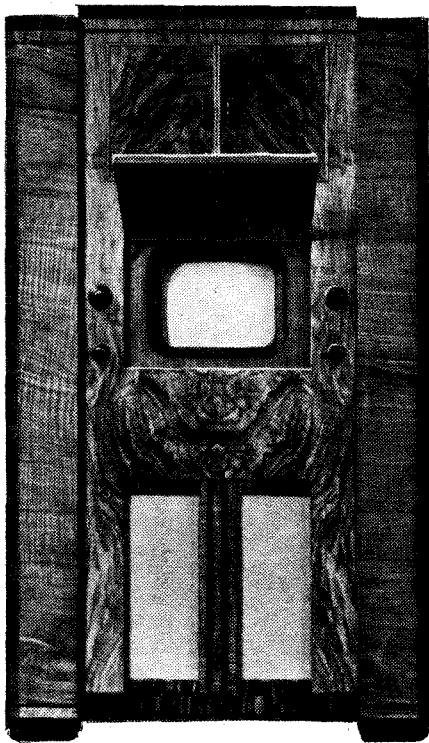
A rear view of the Halcyon television receiver. The vision and sound receivers are mounted in the top compartment with the time-bases below and the mains equipment at the base.

Thus, in all, twenty-three valves are used. The cathode-ray tube has a diameter of 12in., and is encased in metal. It is

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mounted horizontally and viewed directly through a glass plate. Electrostatic deflection is used, and, as already stated, the time-bases are provided with push-pull output stages to avoid trapezium distortion. The picture is about 9in. by 7in., and it is black and white. Two different models are made—one for sound reception on ultra-short waves only, and the other for all-wave reception.

Direct vision is also adopted in the Philips receiver; the black-and-white picture measures 8½in. by 7in. The vision receiver is a superheterodyne with an HF stage followed by a two-valve frequency-changer. Three stages of IF amplification are used before the detector, and there is one LF stage. Electrostatic deflection is employed, and the time-bases are both of the hard-valve type; three



The G.E.C. television receiver, Model 3702. The sound equipment includes an all-wave receiver.

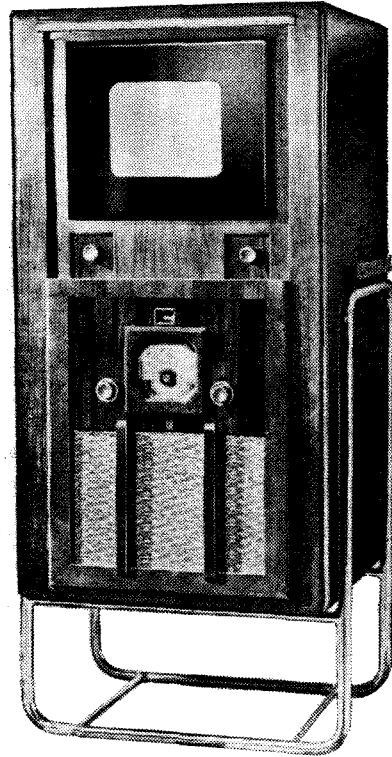
valves are used in each, and three rectifiers are used for the power supply.

For sound reception, an eight-valve superheterodyne is provided, covering the 7-metre band, in addition to the medium and long wavebands.

In the case of the "Televisor" receiver shown by Bush Radio the tube is viewed indirectly. Actually, the cathode-ray tube is mounted vertically, and the lid of the cabinet is arranged to rest at an angle of 45 degrees to the vertical and carries a mirror on its underside. The picture, therefore, is seen in the mirror, and it has a size of 12in. by 9in. The receiver is a superheterodyne, employing a total of twenty valves.

H.M.V. also adopt indirect viewing in their television apparatus. Two models are available, the difference between them being merely in the sound equipment, since one includes an all-wave receiver,

while the other has a sound receiver designed for operation on the ultra-short waveband only. The cathode-ray tube



The Philips television receiver, in which hard-valve time-bases are used.

has a diameter of 12in., and it is understood that magnetic deflection is used.

All told, twenty-three valves are used, of which four are for the superheterodyne sound receiver and fifteen for the vision receiver and the time bases.

The Marconiphone receivers are in two models, the difference again lying in the sound equipment. Indirect viewing is used with a vertical CR tube and a mirror



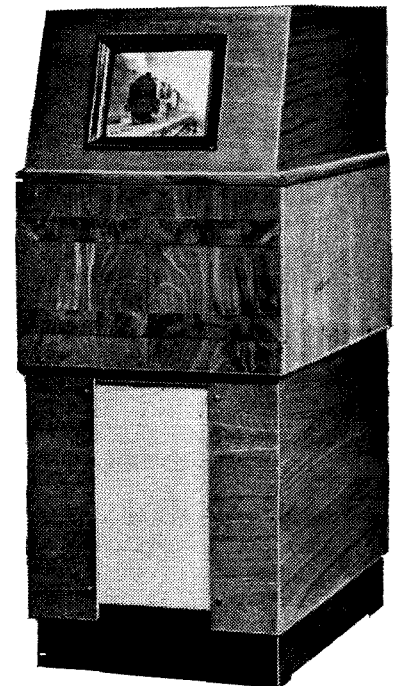
The H.M.V. Model 901 television receiver, in which the sound equipment covers ultra-short waves only.

in the lid of the cabinet. The sound receiver of the Model 702 is a superheterodyne with a triode-hexode frequency-

changer, one IF stage and a duo-diode-triode feeding a pentode output valve.

The vision receiver is a straight set, having no fewer than five HF stages before the detector. Variable tuning is not fitted, the circuits being pre-tuned to 45 Mc/s. The diode detector feeds the vision signals to the cathode-ray tube and also delivers the synchronising impulses to the two time-bases which generate the voltages for the line and frame scanning.

The two Ferranti receivers differ in the amount of amplification provided, one model being intended for use at only moderate distances from the transmitter and the other having adequate sensitivity to permit reception anywhere within the service area of the station. The sound and vision equipment is entirely separate, save for the HT supply, and the sound receiver is fitted with AVC. The picture



The Ferranti television receiver giving a picture of 9in. by 7in.

size is 9in. by 7in., and the colour is "electric light" white. The smaller model is priced at 85 guineas and the larger at 100 guineas.

The Ekco-Scophony receiver is distinct from all others in that no cathode-ray tube is used. Mechanical methods are employed, and a picture size of 16in. by 12in. is obtained with an HT supply of only a few hundred volts. It is understood that mirror drums of remarkably small dimensions are employed for scanning and operated by small motors in the anode circuits of valves which are controlled by the synchronising pulses in the signal.

A 75-watt lamp is used as a light source and modulation is effected by a special cell, the operating principle depending on the retardation of light passing through a liquid in which supersonic waves are set up. These waves are produced by applying the vision signal to a quartz crystal which is in contact with the liquid.

Dual Television Receivers

THE TWO TELEVISION TRANSMISSIONS, SOME PRACTICAL CONSIDERATIONS

By E. G. O. ANDERSON

(Television Section, Ferranti Ltd.)

THE Baird system on 240 lines and the Marconi-E.M.I. on 405 lines are running alternately, and this arrangement will stand when the regular service starts later in the year. Any television receiver should be capable of receiving both transmissions without complicated and critical adjustments having to be made.

Some information as to the difference between the two systems is of interest:

	Baird.	Marconi-E.M.I.
No. of frames per picture ..	1	2
No. of frames per second ..	25	50
No. of lines per picture ..	240	405
No. of lines per frame ..	240	202.5
No. of lines per second ..	6,000	10,125
Picture ratio ..	4 : 3	5 : 4
Ratio of black edging to picture (line) ..	1 : 45	1 : 17
Ratio of black edging to picture (frame) ..	1 : 27.5	1 : 27.5

If the receiver employs a cathode-ray tube for the reconstituting device all the changes needed for the alternative systems are relatively simple.

This is extremely easy to do if the receiver employs a conventional gas-filled triode time base circuit for line and frame scanning, i.e., it is only necessary to increase the capacity of condenser Co (Fig. 1) in each case. Therefore, a switch may be used in each case to change over from Marconi-E.M.I. to Baird. With switch "S" open the line scanning circuit generates 10,125 c/s, and with "S" closed 6,000 c/s, and with switch "S" open the frame scanning circuit generates 50 c/s, and with "S" closed 25 c/s.

MANY people will wonder how it is that two different systems of television transmission can be received on the same type of set. The author explains the technical differences in this article.

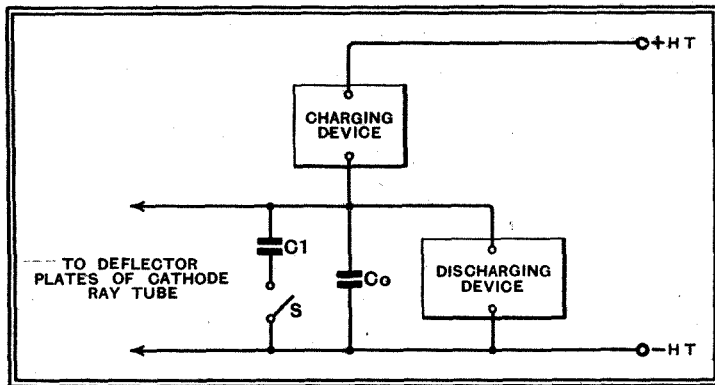


Fig. 1.—Traversing circuits for both line and frame scanning are the same except for capacity of Co.

The first difference one notices between the two systems is that Baird has only one frame per picture, whilst Marconi-E.M.I. has two. In the latter, the picture is built up of one frame of 202½ lines (these being the odd lines of the complete picture) in 1/50th of a second and then another frame of 202½ lines (these being the even lines of the complete picture) in the next 1/50th of a second. This is called intercalating or interlacing. As the intercalating is carried out at the transmitter there is no need to devise any special means for doing it at the receiver.

Changing Over

The only adjustment necessary as regards timing of the receiver is to arrange for the decrease of line scanning frequency from 10,125 c/s (Marconi-E.M.I.) to 6,000 c/s (Baird) and a decrease of frame scanning frequency from 50 c/s to 25 c/s.

necessary to keep the height of the picture the same in each case. Taking an example of this, it is also found that it is not necessary to increase the length of the line scan for the Baird picture.

If one has a cathode-ray tube on whose screen there is a picture frame scan of 9 inches, to keep the right ratio for Baird pictures the picture length must be 12in., and for Marconi-E.M.I. 11.25in. Referring to the table again it is seen that the ratio of black edge to picture (line) is 1 : 45 in the case of Baird and 1 : 17 in the case of Marconi-E.M.I. Now, if the length of the black edging is added to picture it is seen that in the case of Baird the line scan length is 12.25in., and for Marconi-E.M.I. 11.95in., which is a difference of only 0.3in. This assumes that the flyback of the time bases is infinitely rapid, which is not the case, and so the difference between the two is even less. As at the most the difference

is only 2.5 per cent. it is not worth while making an expensive adjuster for picture lengths. There is no need to make provision for increased height of the frame scanning relative to each other, as we have already said that for simplicity and comparison purposes we want the scan the same height, and there is no allowance to be made for the ratio of black edge to picture, as it is the same in each case, 1 : 27.5 (see table).

It has been shown the only change so far necessary is the timing of both frame and line traversing circuits. There is, however, one other important change to be made—the increase or decrease of spot size of the cathode-ray tube to suit either the Baird or Marconi-E.M.I. pictures. Taking the tube with the gin. frame scan, there must be added 0.35in. for the back edging; therefore the total scan length is 9.35in. For Marconi-E.M.F. pictures of 405 lines the width of each line must be $\frac{9.35}{405}$ inches, which equals 0.023in., and for 405

a Baird 240-line picture $\frac{9.35}{240}$, which is 0.039in., a difference of 0.016in., or 41 per cent., which is very large. This being the case it is obvious that if we make the spot size correct for a Marconi-E.M.I. 405-line picture, there will be a distance of 0.016in. between lines when a 240-line picture is received; this will spoil the pictorial value when the picture is viewed at short viewing distances from the gin. by 12in. picture. If a larger tube is used the effect will be even more-marked, when viewed at the same distance.

Varying the Spot Size

This disadvantage can be overcome by increasing the width of the picture element when receiving the 240 line Baird picture so that the lines of enlarged width fill the rectangle forming the picture frame.

This can be done very simply by adding a high-frequency oscillation to the cathode-ray tube deflector plates which are already producing the picture scanning. The oscillation must be of very high frequency so as not to interfere in any way with the modulation or shape of the picture.

There is an excellent place to derive such an oscillation in a television receiver employing the superhet principle, namely, the local oscillator circuit. If a coil is coupled to the oscillator coils so as to have a high-frequency potential induced in it by the oscillator valve this may be placed in series with the frame scanning leads to

Dual Television Receivers—

the cathode-ray tube deflector plates as shown in Fig. 2.

The effect of this high-frequency potential is to cause the light spot on the

obtain a larger sized spot in the direction of frame scanning to fill up the gaps left between the lines, if some such system is not adopted.

It is seen now that it is possible to make

valves in the two final stages. These valves are really fascinating pieces of work, and the sight of an engineer cutting off so many inches of pure tungsten wire, from a reel carried in his pocket, for a new filament has to be seen to be believed.

Turning now to our reception notes, we find that the high sun-spot activity level mentioned by H. W. in the last edition of these notes has been maintained—and the U.S. and other stations using "daylight" frequencies have been well heard until sunset or later.

This marked sun-spot activity was also responsible for the very noticeable shortening of the skip distances which took place on August 14, when the Empire transmitters were at local-station strength at many points within 200 miles of Daventry, and reception of the Berlin sound and vision ultra-high frequency transmissions was reported.

A slight alteration was made to my receiver on Wednesday, August 19, a 76 separate triode oscillator being added to the 6A7 pentagrid converter, a change which certainly improved the performance on the higher frequencies if not generally, and on realigning the receiver, W3XAL on 17.78 Mc/s was intercepted at really excellent strength from 9 p.m. onwards.

Good results were also obtained from W3XE on 15.27 Mc/s at 10 p.m., the organ which followed being quite enjoyable with only occasional drop-outs, W8XK on 15.21 Mc/s was definitely good, too, at 11.18 p.m., and clear of DJB. The "scattered radiation" from GSG on 17.79 Mc/s was also good and 100 per cent. intelligible at this time.

Good to excellent results, with some weak periods, were again obtained from W3XAL on Thursday evening, August 20, and at 10.15 p.m. some entertainment of good programme value, namely, "The Pirates of Penzance," by the National Light Opera Company, was given by W8XK on 15.21 Mc/s.

The Boston station W1XAL now appears to be working properly again, and was a good signal of excellent quality at 11 p.m., subject to some sideband splash from Rome 20 kc/s away.

On Friday evening the "Esso" news from W8XK on 15.21 Mc/s was good and just separable from DJB again (single IF stage).

Conditions seemed a little poorer on Saturday evening, and at 11.45 p.m. W2XAF was just intelligible on 9.53 Mc/s, but subject to bad sideband QRM from DJN.

Listening at Epsom on Sunday on my father's receiver I was impressed by the extraordinarily strong and steady signals received from the Empire transmitter GSH on 21.47 Mc/s, a regular daily occurrence apparently.

In the late afternoon, VK2ME on 9.59 Mc/s was a fair signal, of good intelligibility—but unfortunately marred by static. Later in the evening both W2XAD and W8XK were peaking to excellent.

Indicative of the overdue trend to autumn conditions was the appearance of W1XK on 9.57 Mc/s at fair at 10 p.m. Sunday, but the optimum frequency from the States was still as high as 16-17 Mc/s at 11.30 p.m.!

Very good reception was again obtained from W3XAL at 7.15 p.m. on Monday, August 25, but only poor signals at 9.45 p.m. on Tuesday. On both these days, however, conditions on 15 Mc/s appeared to be normal.

ETHACOMBER.

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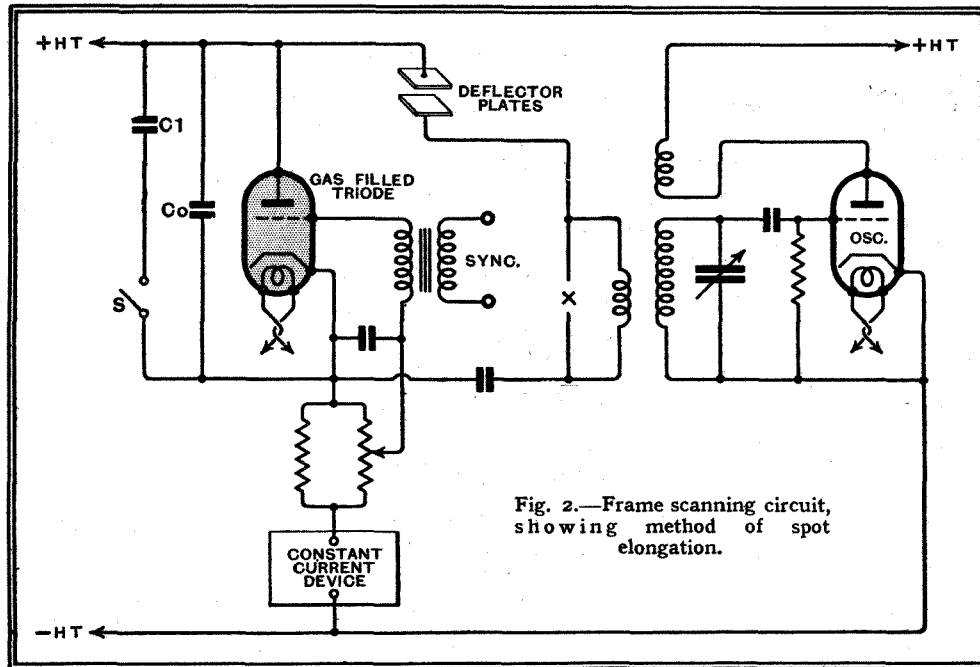


Fig. 2.—Frame scanning circuit, showing method of spot elongation.

fluorescent screen to oscillate at a high frequency in the plane of frame scanning and at right angles to the plane of line scanning and thus the spot is apparently elongated in the direction of frame scanning. In this manner it is possible to

all the adjustments very simply, namely, by three switches. These, of course, can be ganged together and they are customarily actuated by a change-over knob marked "Baird-E.M.I." and mounted on the control panel of the receiver.

On the Short Waves

NOTES FROM A LISTENER'S LOG

SPECTROSCOPY seems to be becoming more and more allied with the art of radio-measurements of the electron densities in the ionosphere.

Every wireless enthusiast is aware of the enormous amount of research that goes on daily in attempts to correlate short wave conditions with observed terrestrial and solar phenomena of various kinds.

In these columns, for example, reference has often been made to the effect of sun-spot activity on short-wave conditions and, by inference, on the ionisation levels in the upper atmosphere.

More recently, too, reference was made to an attempt to correlate short-wave conditions with an "absorption line," of wavelength about 2,000 Angstrom units, in the extreme ultra violet of the solar spectrum. It is believed that certain of the lines lying between 1,300 and 2,000 Å° may be connected with the presence of atomic oxygen in the F2 layer, but it is difficult to make measurements in this part of the spectrum, which is well outside the visible portion, and photographic methods are necessary, using specially prepared silver-bromide plates (Schumann's Emulsion—sensitive up to 1,200 Å°).

The lines in the ultra violet are not the only ones, however, the intensity variations of which may be correlated with ionospheric conditions, and there may be a close con-

nection between the green line of the night sky (5,577 Å°) and F layer ionisation levels.

This famous line was for many years thought to be due to an unknown element, no trace of which had been found on the earth, or to krypton, but eventually proved to be associated with the quite common element oxygen, when in an excited state known as the metastable condition.

The solution of the mystery of this line was due to Lord Rayleigh—and interested readers are referred to the Proceedings of the Royal Society, A119 of 1928, A124 of 1929, and A129 of 1930, for detailed information.

It is very intriguing to note that the probable reason for the connection between the intensity of the green line and the state of ionisation of the F2 region is that this line is actually due to light radiated as a by-product of one of the processes of ionisation!

This fortnight's notes would not be complete without some reference to the signals from Alexandra Palace, both the vision and sound transmissions have been very strongly received in South-West London, and to date very little, if any, car ignition interference has been experienced. Perhaps one of the more interesting facts about the equipment at Alexandra Palace is the use by Baird's, in their vision transmitter, of continuously evacuated tetrode demountable

The New Receiver

POINTS TO CONSIDER IN MAKING A CHOICE



ALL-WAVE or merely the normal broadcast bands? Except for those who confine themselves strictly (or, perhaps, merely principally) to local-station "quality" reception, that is the topical question for anyone who is faced with the pleasant task of choosing a new season's receiver. Most manufacturers have produced at least one all-wave model, and many have gone to the length of turning out hardly anything else.

It will be helpful to consider quite dispassionately the advantages and disadvantages of the modern "all-wave" feature. It costs, of course, a little more, all other things being equal, but design has now reached a measure of stability and the extra cost is a small matter when one realises that a 1936-1937 model can with some confidence be expected to give pleasure to its owner for several years before he begins to feel that it is due for replacement.

AS most receivers are now divided into fairly sharply defined classes, the making of a choice is probably rather easier than of previous years. Obviously, the first thing to do is to decide on the class, and then to consider the rival attractions of sets in that class.

Continuing on the debit side, it is logical to assume that the all-wave set, with its more complex wave-changing system, is bound to be slightly more susceptible to trouble. That must be admitted, but manufacturers and designers have thought about it already—in fact, the matter has probably cost them several sleepless nights—and their very first task when all-wave sets were mooted was probably to devise a trustworthy switching system that could be depended upon to work—and to go on working. Actually, the majority are fitted with a similar type of cleverly designed switch of proved reliability.

Although one should not subscribe to the idea that the provision of one or two short wavebands throws open to the ordinary listener a continuous stream of entertainment from the uttermost ends of the earth, it is a fact that short-wave reception does add enormously to the interest of listening, provided the feature be

used intelligently and with some appreciation of the hour-to-hour vagaries of the short waves.

Of course, the various all-wave sets differ considerably in effectiveness on the shorter bands. In some of the cheaper models in which a single band is provided, the addition of short waves may be little more than a kind of make-weight, but one which, as many will agree, is very acceptable. If short-wave listening is regarded as being really important, the more bands the better, and it will also be well to find out if any HF stage that may be fitted is operative (and also tuned) on the short waves.

Whatever type of set is under consideration, it should be remembered that the wireless industry is not yet sufficiently standardised and stabilised for the true value of everything offered to be virtually identical. In general, the rule that one gets what one pays for holds good, but there are probably more exceptions than in other commercial fields, and it is rather fascinating to try to spot the real bargains. We all know that stages and tuned circuits cost money and, broadly speaking, the more of these the better. But if the buyer is asked to pay more for a set with a given number of stages and tuned circuits more than the price for which he can buy a competing set with precisely the same basic specification, he is certainly entitled to ask why. There may be a good answer to this question, or there may not. Of course, such things as reliability and ultimate service cannot appear in the specification, but if given in good measure, they are worth paying for quite heavily.

Mechanical excellence is probably of less importance in wireless receivers than in most other things with which it can be fairly compared. But that does not mean that electrical considerations should be allowed to outweigh entirely the mechanical aspect of the subject. In the first place, the manufacturer who takes a proper pride in turning out a good mechanical job probably pays at least equal attention to the unseen electrical details. Also, it is important that the few

moving parts there are should move sweetly throughout the life of the set.

For those who have decided on a plain receiver (as opposed to a radio-gramophone) the next problem to be solved is whether it is to be a table model or a console. The console cabinet is certainly better from the acoustic point of view and provides a larger baffle area with greater freedom from box resonance. The table set, on the other hand, is much more convenient to operate and so should appeal more strongly to the confirmed long-distance listener. However, there is a possibility of compromise here, and a recent experience of *The Wireless World* Information Department may serve as a suggestion. The querist had just bought a console set, of a make that we know to be good, but he complained that, although quality, range and selectivity were perfectly satisfactory, he had been forced to give up prolonged listening to foreign stations because he could not sit down comfortably in front of the set and operate the knobs at the same time. The Information Department countered by suggesting that the receiver chassis could be removed from the console cabinet and mounted in a small box, leaving the loud speaker in its present position and joining the two units together with a flex lead. The correspondent was delighted, and it seems a pity that two-unit sets on this plan are not more readily available.

Receiver or Radio-gramophone?

After this digression, we must return to the receiver-radio-gramophone question. Those who favour the Rolls-Royce type of set have little choice in the matter, as the majority of the highest priced instruments are only available in radio-gramophone form. In the less ambitious categories, the radio-gramophone is often a

The New Receiver—

rather better set than its receiver counterpart, not only because the baffle area is greater but because certain refinements, particularly in the output stage or loud speaker, are sometimes introduced. In the cheaper classes there is little difference, and choice becomes purely a personal matter; it is sometimes more convenient and, perhaps, slightly cheaper to use a table set in conjunction with a playing desk and pick-up for gramophone reproduction when it is required.

So far as the general public is concerned, external appearance is supposed to have a preponderating effect in influencing decision, but the better informed reader of *The Wireless World* probably sees this matter in truer perspective and is more likely to be influenced by the "suitability for purpose" of the container in which the set of his choice is mounted than by its ornamental value.

Having come to a tentative decision, the prospective buyer will probably decide on having demonstrations of the sets which appeal most to him. Here there are all kinds of pitfalls for the unwary, and one should steel oneself against forming too-hasty conclusions without making due allowance for the conditions under which the demonstrations are given. Just as the *gourmet* is supposed to refresh his palate by eating a *sorbet* before the main course of a meal, so the set chooser should take the opportunity of hearing a good orchestra. This advice has been given before in these pages, but it is well worth while repeating.

Looking for Distortion

Those who are not blessed with a musical ear are at a disadvantage in spotting resonance or other defects in reproduction; it is helpful to remember that a serious resonance is generally shown up very plainly by listening to the set at a considerable distance—so far, indeed, that the general reproduction is unintelligible, but the resonance, if it is serious, will still be responsible for plenty of noise.

True bass reproduction may be confused with resonances which converts low notes, irrespective of their real pitch, into a sound that owes its character to the peculiarities of the speaker or cabinet rather than to the transmitted sound.

Turning to the other end of the frequency scale, high-note reproduction may be judged by listening to speech and particularly noticing whether sibilants are blurred.

At one time it was considered wrong to come to a conclusion on the range and other desirable features of a set as a result of listening to it during the hours of darkness when "freak" conditions are prevalent in the ether. Now that almost all sets are highly sensitive, this advice rather loses its point and, indeed, a night-time test rather tends to show up such defects as lack of selectivity and especially second-channel whistles, and is accordingly valuable.

RANDOM RADIATIONS

By "DIALLIST"

Transatlantic Relays

I TAKE off my hat to the B.B.C. for the way in which they have done many of the relays of U.S.A. programmes of late. A particularly good instance was that of the Women's Radio Revue from New York, which was an item of one of our evening programmes. The American announcer told us that it was coming from W2XAF and W2XAD. As sent out by the London Regional it was extraordinarily good. There was none of the absence of "top" that one so often notices about long-distance relays, none of the "sad sea waves" effect (which, by the way, many of the uninitiated believe to be the sound of Atlantic rollers), hardly any fading and no atmospheric interference. I happened at the time to be testing a commercial "all-wave" receiver of the small superhet type, and that seemed a rather good opportunity for seeing what its sensitivity really was like. Accordingly, I flicked over from London to W2XAF and found it so faint a signal that it wasn't worth bothering about. W2XAD was coming in more strongly, but there was a great deal of fading and a certain amount of unwanted noise—a great deal of which was due to the fact that I had to turn the volume-control knob as far as it would go towards "full on" to obtain anything like decent strength from the loud speaker.

At the Palace

THE first thing that strikes you about the London high-definition station at the Alexandra Palace is that those responsible for it have no doubt in their minds that television has come to stay. There's nothing of a hook-up nature about either Marconi-E.M.I. or Baird plants. All of the gear gives you the idea at once of solidity and having been built to last. Other pens will, no doubt, give you full descriptions of what we saw. I'll make no attempt to do so, but will just mention one or two of the things that I found of particular interest. First of all, the huge screen-grid valves used in the Baird transmitter. These are of the demountable type. They can be taken to bits, and any defective part replaced in a remarkably short time. Pumping is done in the transmitter itself, and the necessary vacuum is obtained in about twenty minutes. These huge valves are water-cooled, and there is a most ingenious system which ensures that should their temperature rise beyond a certain point from failure of the water supply or any other cause they are automatically switched off, whilst indicators show where the trouble is.

The Electron Camera

Though I'd read a great deal about the electron camera I'd never actually seen one before; nor was I quite prepared to find it so sensitive as it is. The instrument used by Marconi-E.M.I. is the Emitron, which looks rather like a large studio camera. Such is its sensitiveness that in the studio the lighting did not have to be particularly bright, whilst ordinary daylight was sufficient for it to produce on the television screen a brilliant picture of near and distant scenes in front of the Palace. More remark-

able still was the televising of such scenes at the Press demonstration at Olympia as late as 7.45 the following evening. I understand that Baird's have also developed an instrument that serves the same purpose, but it was not on view. Instead, they have their intermediate ciné system, which enables scenes with their accompanying sounds to be televised with a time lag of only forty seconds. The advantage of this method is, of course, that a permanent record can be obtained for transmission at a later hour or a later date if necessary.

A Third System

Meantime, there's a third system of television—it was mentioned in the Committee's Report—which seems to have interesting possibilities. This is Scopphony. I am not going to express any opinion about it. I'll just tell you what I saw during a recent visit to their laboratories and you can form your own views. The "home" receiver is to give a picture of sixteen by twelve inches. In the laboratory model that I saw the screen was, I believe, a little smaller, though not very much. The demonstration took the form of televising several talkie films over a cable from the transmitter in one room to the receiver some distance away in another. On the screen I saw both a Jessie Matthews film and one of the Mickey Mouse series. The illumination was brilliant and one had an impression of extraordinary smoothness about the pictures. In a cabaret scene the figures of the dancers at the back of the stage were less than an inch in height, yet one could walk right up to the apparatus without losing detail.

Very impressive was the projection by direct television, and not by an intermediate ciné method of pictures, on a screen measuring five feet by four. Here the illumination was again excellent. The lines were, naturally, more in evidence, but they were not in the least troublesome to one's eyes. With a big screen well lit up the optimum viewing distance is, of course, greater, and this automatically lessens the "lines" effect.

A Mechanical Scanner

The two other systems of high-definition television now in use employ the cathode-ray tube. Scopphony does not. There is a mechanical scanner of the mirror-drum type only four centimetres in diameter which runs at high speed. The illumination in the home receiver is furnished by a 75-watt car head lamp bulb, and that of the receiver giving the five feet by four picture by a standard ciné arc lamp, a novel method of light modulation being used. Apparatus is at present under construction for the projection, again by direct television, of pictures of full ciné theatre screen size.

The Poster

IN some previous years the Exhibition posters have provoked a certain amount of discussion, but never have I heard one so heartily and so widely condemned as this year's effort. In fact, of all the people whom I have asked what they thought about it, and of all those whom I have heard discussing it amongst themselves, not a single one had a good word to say for it. The main objection is that it doesn't suggest a serious radio exhibition, which, after all, is what Radiolympia is supposed to be.

Mechanical Highlights

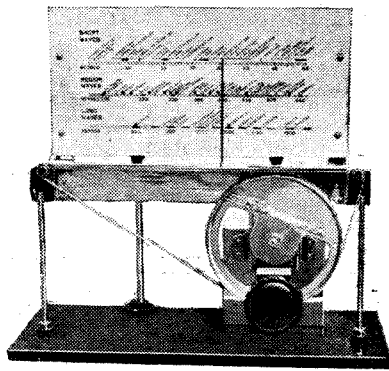
NON-ELECTRICAL FEATURES SEEN AT THE SHOW

A COLLECTION of components, dumped down apparently at random and untidily wired together with straggling leads, may work quite passably as a radio receiver; that is probably why the electrical designer has hitherto taken most of the credit for developments, while never a thought has been given to the work of his mechanical confrère. In the days when wireless apparatus was handled only by those who knew something about it this state of affairs was satisfactory enough, but ever since wireless sets began to be used by those who were completely ignorant of their technicalities there has been a continuous, though rather slow, improvement from the mechanical point of view.

This tendency became particularly noticeable last year, and the good work has gone forward steadily. Even the expert begins to appreciate the greater pleasure to be derived from handling apparatus that has been neatly assembled in a workmanlike manner with smoothly working and easily accessible controls.

Although the "works" of the new sets are, with hardly an exception, constructed on lines that have now become conventional, there are many detailed improvements, and the eye of the mechanically minded visitor at Olympia was seldom affronted by untidy chassis on which components were precariously perched in a way which seemed positively to invite early dislodgment.

Tuning dials, the most obtrusive feature of all sets, naturally come to mind first. This year they are even more obtrusive,

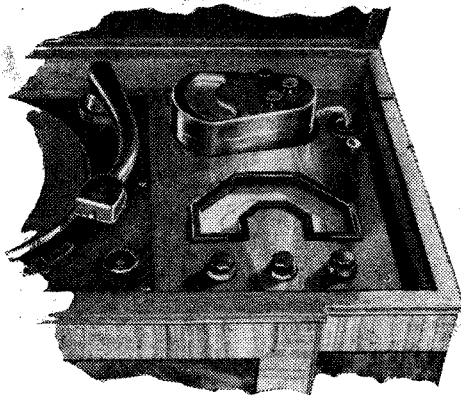


Simple but effective: the "Velvet" drive, fitted to Halcyon all-wave sets, rotates the condenser spindle through a phosphor-bronze braided cord, spring-tensioned and working over a drum and pulleys.

but that is inevitable; clarity and legibility can hardly be obtained in a small dial, and in any case the general increase in size is surely not objectionable. There is a slight tendency towards the wider adoption of the tell-tale control panel (a feature of last year's Ferranti sets and retained in the

present season's models) which shows not only the tuning position but also the settings of subsidiary controls.

Designers still seem to be unable to make up their minds as to whether the average user tunes his set while sitting down or standing up; Philips have found an ingenious way of meeting both schools of thought by providing a hinged indicating panel of the tell-tale type which is adjustable so that it can be seen comfortably in either position.



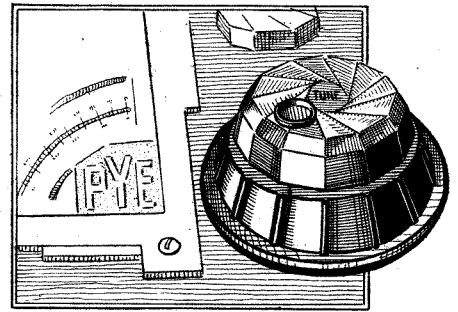
Remote control: the unit shown behind the tuning dial may be taken to any part of the room. It gives control of tuning and volume.

Unfortunately, the placing of dials and controls is not always entirely logical; indeed, some makers adopt for their local-station sets an arrangement that would be entirely suitable for a long-range set (which is generally operated in a sitting position), while their more ambitious models have a distinctly inconvenient layout of controls. Perhaps the most advanced solution to this problem is to be found in the Aerodyne remote control tuning system, which allows the receiver to be tuned and otherwise controlled from any position in the room. This system, described in our issue of October 18th last year, is now fitted to a six-stage superheterodyne radio-gramophone; the 20ft. multi-core cable through which the controls are operated electrically is wound on a drum fitted with a spring-return mechanism which is housed inside the cabinet. Any desired length of cable may be paid out as desired.

The introduction of all-wave sets has naturally been responsible for many ingenious drive mechanisms, most of them

of the two-speed type providing relatively coarse tuning for normal wavelengths and critical adjustment for the short waves.

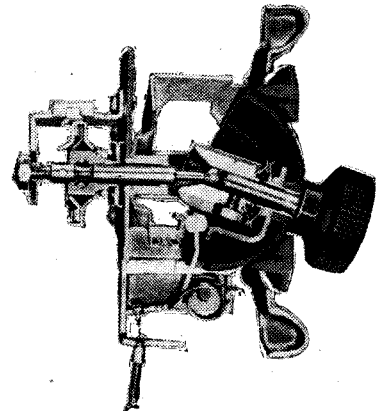
What is normally a slow and tedious process—that of tuning over a large section of the scale—is overcome in the Pye



Quick-acting tuning system on a Pye receiver; a recess is provided on the knob for the finger tip.

all-wave television set by providing a balanced flywheel drive which, once started by a twist of the wrist, spins the tuning condenser rapidly to approximately the desired position, the final setting being arrived at by the ordinary method of adjustment. Another Pye set includes a knob with a sunk cup for finger-tip operation which also helps in speeding up the process of tuning, while a similar result is achieved by a projecting peg fitted to the R.G.D. knob.

One of the most original control systems was to be seen in several of the more ambitious Philips sets. The control knob is mounted on a universal joint; simple rotation controls the tuning condenser through reduction gearing, while side-to-side or up-and-down movements effect respectively the adjustments for tone and



Photograph of a sectional model of the Philips' multiple-control knob.

volume through flexible wire links. Rotation of a ring surrounding the knob bush actuates the wavelength switch.

Many correspondents and contributors

Mechanical Highlights—

to our pages have protested against the fitting of awkwardly shaped control knobs—hexagonal, octagonal, or even square. The worst examples seem to have disappeared, but there still remain a few that are by no means comfortable to handle. One supposes that the artist-designer, whose ways are often inscrutable, considers that they improve the appearance of the set.

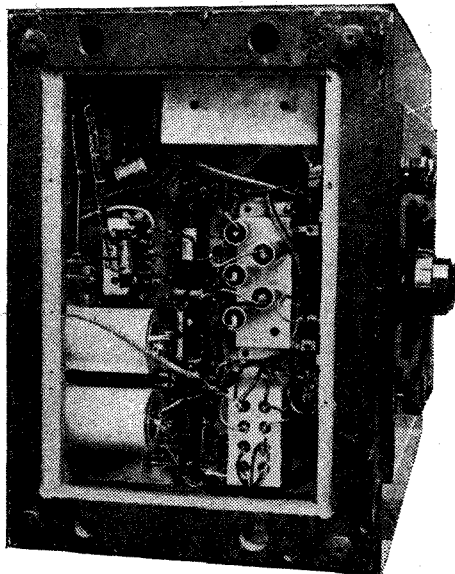
The general tendency towards automatic operation is certainly more marked in the radio art than in any other branch of science or industry. An interesting mechanical example of this trend is to be found in the Ferranti sets. As everybody knows, a receiver with variable selectivity should be tuned with the control in the high-selectivity position, but most of us forget all about it until we notice difficulty in finding the adjustment that gives best signals. In the Ferranti sets forgetfulness does not matter; as soon as the user begins to rotate the tuning knob the selectivity control is automatically restored to the high-selectivity position through a simple mechanical arrangement controlled by a pawl.

Short-wave Calibration

Calibration of the tuning scales fitted to the new all-wave sets has been found rather a problem. The general plan, at any rate in the less expensive sets, seems to be to provide a wavelength scale marked to indicate the position of the bands allotted to broadcast telephony. This is satisfactory enough as a rough guide, but it is economically almost impossible to provide a scale that will allow the adjustment corresponding to any desired station to be predetermined with complete accuracy; as a result, tuning position cannot be definitely recorded. In some cases this difficulty is overcome by fitting an auxiliary scale with arbitrary calibration. One of the most notable of these is the Ferranti Magnascopic dial, in which a part of the subsidiary scale is projected on to a screen fitted in an aperture above the main dial. Projection and magnification are carried out by an ingenious arrangement of lenses and mirrors. In the McMichael all-wave set there is a secondary pointer, geared down from the main drive, which traverses a small auxiliary scale in the manner of a seconds hand on a watch. The small pointer makes a complete revolution for each four or five degrees of angular displacement on the main indicator.

With regard to cabinets, polished wood is still the most popular material, though bakelite is well represented by improved designs, and any prejudice against it that may exist is rapidly being worn down. Cellulose-enamelled wooden cabinets were shown by H.M.V., and it is understood that a set housed in one of these has been supplied for the King's House, recently built by the Royal Warrant-Holders' Association. These cabinets, finished in any colour, can be supplied at extra cost.

An unusual form of construction is used in one or two of the Marconiphone cabinets, which are built up of wooden panels supported on a welded metal framework. Externally they look quite conventional, and the metal certainly adds to rigidity and strength. The cast aluminium cabinet used in the construction of one of the Eddystone all-wave sets offers an advantage by providing screening, as the various stages are each mounted in their own compartment.



Easy access is given to the under-side of this Pye receiver by removing the cover.

Rightly or wrongly, the conventional external layout for both table sets and radio-gramophones has been generally accepted, and so it can be assumed that there is little public demand for any radical changes. One of the few departures from convention was seen in the H.M.V. bureau cabinet, which not only houses an extremely ambitious superhet. radio-gramophone with self-changing mechanism but also serves as a useful writing desk. Little criticism can be directed against the essentially practical nature of this layout, and it may quite possibly start a vogue.

We wireless people are perhaps ill-qualified to express an opinion on the artistic appearance of the sets, but the general opinion of the ordinary visitor seemed to be that a substantial improvement had taken place. Cabinet design has been through many phases; at one time there was a glut of almost Victorian over-ornamentation, to be followed by equally meaningless "frills and trimmings" in the modernistic style. Most of these have disappeared, and designers seem to depend for attractiveness on good proportions and a clean external layout.

In the important matter of accessibility there has been no great change, but certainly none for the worse. The new Pye arrangement appears to be very sensible. A removable base below the cabinet discloses most of the components which are likely to need attention, and the removal of four bolts then allows the chassis to be easily withdrawn if required. The HF

unit construction also embodied in certain Pye sets indicates another mechanical tendency; the unit assembly of signal-frequency and oscillator coils, switches, etc., makes possible short connecting leads and allows easy removal of the section as a whole for repair, or, if necessary, for replacement.

Finally, mention should be made of the R.G.D. method of mounting the loud speaker in a chamber which opens out into an "acoustic corridor" built into the cabinet. This has the effect of greatly increasing the baffle area and should bring about a worth-while improvement in bass response, as well as helping to eliminate undesirable resonances and microphonic troubles.

The Radio Industry

A CATALOGUE issued by Aeronautical and General Instruments, Ltd., Purley Way, Croydon, describes and illustrates the various special cabinets in which R.I. Airflo receivers are now obtainable. These include hand-painted models, and others in rare woods with a satin finish.

In an advertisement for Polar condensers in our issue of August 21st, the capacity of the smallest air-dielectric trimmer was given as 20 m-mfds. Messrs. Wingrove & Rogers ask us to say that this should be 25 m-mfds.

The new season's Dubilier catalogue giving details of condensers and other products of the firm, together with much useful information, is now available from Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3. A larger catalogue containing specialised information and full details of sizes, etc., is available for manufacturers only.

A leaflet describing British-made Pilot receivers is available from Pilot Radio, Ltd., 87, Park Royal Road, London, N.W.10.

The Technical and Commercial Radio College is moving to larger premises at Fairfax House, High Holborn, London, W.C.1. Telephone: Holborn 7450.

The Amperite Corporation, of 561, Broadway, New York, sends us particulars of a new velocity microphone.

A catalogue describing in detail the various chassis produced by the Armstrong Manufacturing Co. is now available. Address: 100, King's Road, Camden Town, London, N.W.1.

Ostar-Ganz Valves

PRICES of Ostar-Ganz valves supplied by Eugen J. Forbat, 28-29, Southampton Street, Strand, London, W.C., have been considerably reduced. As an example, the A520 triode, previously costing 16s. 6d., is now priced at 13s. 6d. Most readers will know that these valves are of the high-voltage universal type, with heaters designed for direct connection across the mains (either AC or DC).

A new pentode output valve, Type M44, has just been introduced. This is a companion to the M43, but has a steeper slope. A specimen valve submitted has a Continental side-contact base.

Incidentally, the same firm are selling a photographic exposure meter of the photo-cell type at the low price of £2 19s. 6d., complete in leather case.

Valves and Sets—THEN AND NOW

A 1936 Set with 1921 Valves—92 of Them!

By "CATHODE RAY"

ADVERTISERS sometimes tell you how many ordinary valves the three or four or five multiple types used in their sets are equivalent to. It is not stated how far back into history they go for the standard "ordinary" valve, but I do remember a time when only one type of valve was available to the public—the French "R," and this, therefore, seems to qualify for the position. If so, it appears that the advertisers are making uncustomarily conservative claims. Out of curiosity I roughed out a skeleton design for a modern receiver using only "R" valves.

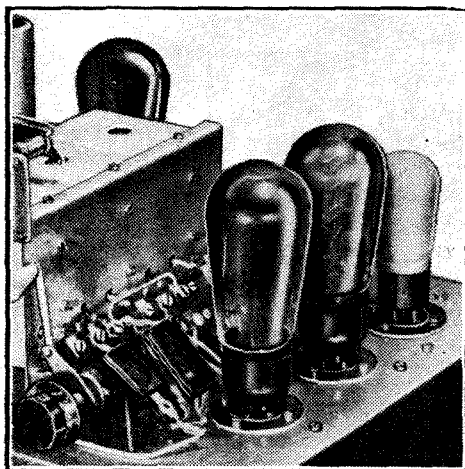
I took as a model a typical superhet of the high sensitivity type, selling at about £16, with five valves plus rectifier. There is a variable- μ pentode for the HF stage, an octode or triode-hexode frequency changer, another pentode for IF, a double-diode triode for detection, AVC, and LF amplification, and finally a pentode in the output stage. Only a few microvolts are required at the aerial terminal to give about 3 watts to the loud speaker.

This is quite an ordinary performance in these days, with the valves now available, but sets a problem when one is restricted to low-efficiency triodes throughout, with amplification factors of 8 and anode resistances of over 30,000 ohms. There are two ways of getting useful amplification at radio-frequencies from triodes; one is neutralisation (many recent recruits to radio may never have heard of the "neutrodyne"!) and the other is the two-triode stage expounded by Colebrook. The latter conforms more closely to modern standards of stability and reliability, so our imaginary set starts off with a Colebrook pair. The calculated amplification of this stage is lower than that of the single modern valve; and, as we anticipate a further drop at the frequency changer, we put in another pair of triodes as HF amplifiers. Provided that the screening and decoupling are good we have a stronger signal at this point than the modern receiver.

Two valves are needed for the frequency changer, of course, and the output from them works out about level with that in the other set. Another Colebrook pair of valves for IF gives quite a substantial magnification at 120 kc/s, but not quite enough for a diode detector; so a single low-mag. stage follows. Then a pair of valves as diodes. AVC is a difficulty; in fact, if the full modern standard is insisted upon I don't quite see how it can be done. But there are a number of valves working at low signal levels, and with a little care it ought to be possible

to provide tolerable AVC by conventional grid-biasing methods, even with triodes. The output from the detector diode is calculated to give about 3 volts, and an audio stage is needed before the output. That is 12 valves so far, consuming $8\frac{1}{2}$ amps. filament current!

But that is nothing compared with the output stage. By running the valves at 200 volts on the anode, a pair of them in push-pull under the most favourable conditions ought to give about 80 milliwatts output. So we want 40 pairs. Actually, the result is not likely to be 40×80 milliwatts, for owing to slight mismatching there is always some loss in efficiency when running a number of valves in parallel. Another thing, the input impedance of so many valves would probably be so low as to require at least one more valve in parallel in the previous stage.



An example of the two-triode HF amplifier expounded by Colebrook and put to practical use in the *Wireless World* Q.A. Receiver which was described in the issues of Feb. 8th and 15th, 1935

But even neglecting these possible extras, the specification is quite alarming enough. A 92-valve receiver could certainly not be built comfortably into a modern table cabinet, for the filament battery to supply 4 volts 65 amps. would occupy more than all of that space. The supply of 300 watts—260 for filaments and 40 for anodes—would also render the maintenance cost decidedly high.

It might be considered rather more fair to make the comparison on the basis of a modern battery-driven set. Even so, the performance of a good 6-valve receiver with QPP could hardly be attempted with any fewer than 44 "R" triodes.

There is nothing about the components

of such a 1921 receiver—loud speaker apart—that could not have been turned out in the home workshop, given, of course, a 1936 brain directing operations. So it seems that most of the advance in these 15 years, as regards the means at our disposal, has been on the valve side.

But it must be remembered that although the imaginary receiver was built around (or more probably staggering beneath a load of) 1921 valves, the services of a 1936 designer were engaged. Real equipment at the former date was extremely rudimentary all round. Adjusting the focus to about half the distance, to examine a period when the tendency of design was leading up to the modern receiving set, what do we see?

Selectivity is hopeless according to present-day standards, but the need for more is becoming acute. The sensitivity that has since become commonplace among the general run of sets is attained in very exceptional cases. Much the same can be said about volume. As regards cost, in about a year's time a self-contained multi-valve cabinet receiver with built-in moving-coil speaker—a forerunner of the modern set—is to be offered at a price of just over £40, and will be considered incredibly cheap at that.

There is only one respect in which progress may be said to have been retrograde since the appearance of that particular model. The tone of the *average* modern set is no better, and perhaps rather worse. That is the fault of super-selectivity, small cabinets and light construction, and price competition. But it is unfair to compare the ordinary £12 model of to-day with an exceptional design of 7 years ago; comparing corresponding grades, high or low, there has been progress in this respect, too.

As a sidelight on the price comparison, perhaps it is not generally realised by the 1936 buyer that for his twelve guineas, or even less, he is presented with what would be considered only a few years ago as quite an accurate wavemeter, costing a good deal more than the whole price of the set. The wavelength scale of a modern receiver, if of reputable manufacture, is correct within one or two per cent., which was considered good laboratory accuracy at the dawn of broadcasting. At that time, too, "receivers" commanding high prices consisted of little more than elaborately mounted valve holders; batteries, 'phones or loud speakers, and sometimes even tuners, were all expensive "accessories."

As I am writing I have just seen the *Wireless World* review of the "Challenger" 24-valve receiver. To provide an equivalent performance with "R" valves ... (That will do!—Ed.)

Alexandra Palace Television

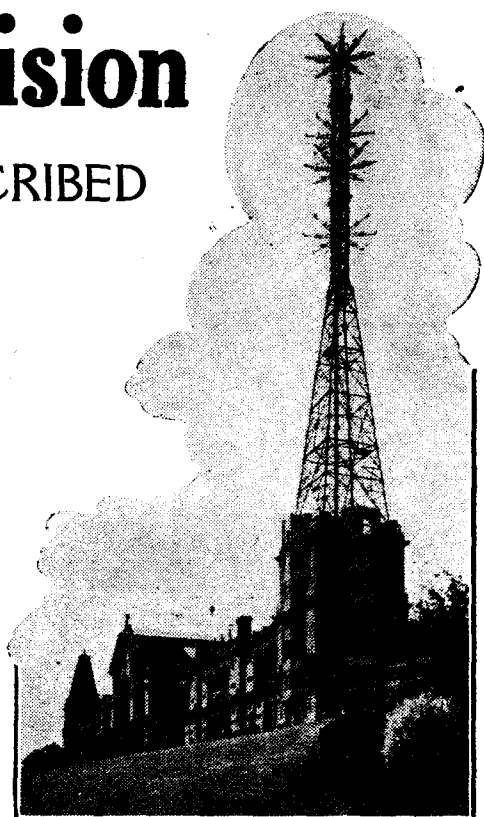
THE ALTERNATIVE SYSTEMS DESCRIBED

NOW that the transmitting apparatus is installed in the Alexandra Palace, and experimental transmissions have commenced, technical details of the apparatus employed are available. It will be remembered that the Baird and Marconi-E.M.I. companies have each installed separate equipment, which is to be used alternately for transmissions by the different methods developed by these firms. In each case the gear can be divided into sections performing similar functions,

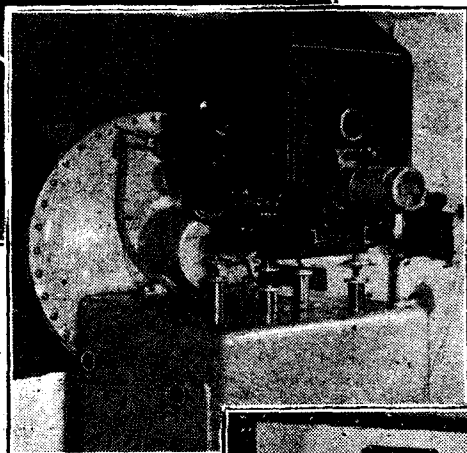
The spotlight beam from the scanning unit is focused through the window of the projection room into the studio. It is the light reflected from the subject being televised which actuates the photo-cells, and there are actually four of these of the multiplier type. The output from each is amplified in the studio, and again in the projection room, where it is mixed with the synchronising signal and passed to the control room.

Intermediate film scanning is employed when large scenes have to be dealt with.

The subject is photographed on 17.5 mm. film with a motion-picture camera of the intermittent type, the sound also being recorded on the film. The film then passes into a developing chamber beneath the camera, and, after being developed, is washed, fixed, and washed again, the whole process taking only 30 seconds. The film then passes through a scanning compartment which is not unlike the one already described, although there are naturally many minor points of difference. A similar scanning system is also provided for dealing with standard 35 mm. films, although here the film runs continuously at the rate of 25 frames per second. After a magnification the combined



A view of the Marconi-E.M.I. Studio showing the Emitron camera in use appears above, while the Baird Spotlight projector is shown on the right.



picture and synchronising signals are fed to the control room, in which the outputs from the various scanners can be selected and faded. The output from the fader is taken to a low-gain amplifier, which feeds the sideband-corrector amplifier to which the line and frame synchronising pulses are also fed.

In the transmitter itself crystal control is used, the crystal oscillating at 1.406 Mc/s, and its output being passed through amplifiers and

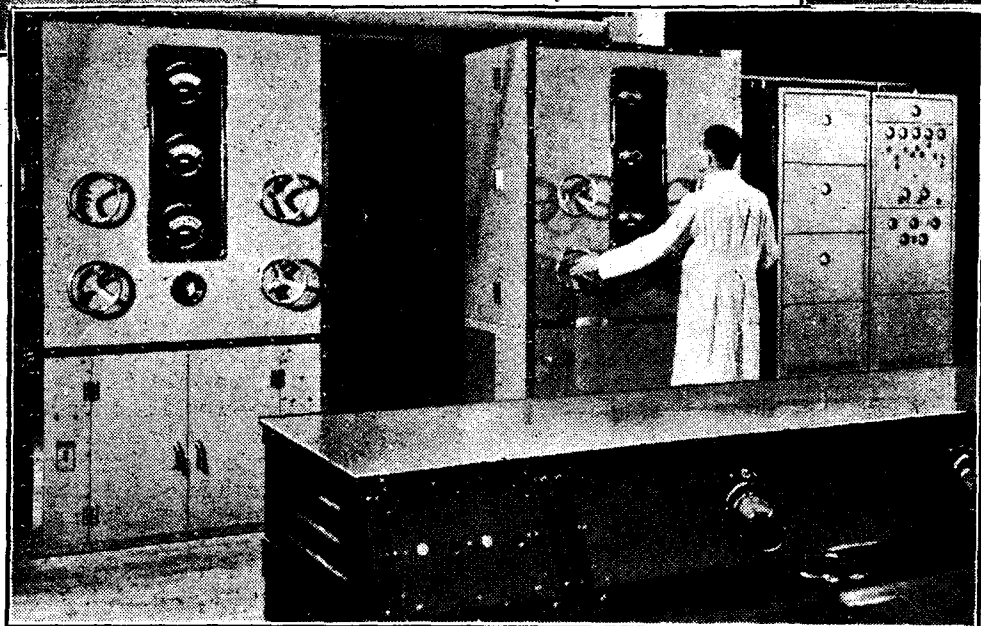
The Baird control desk and part of the transmitter are shown below, while the photograph on the right depicts a portion of the Marconi-E.M.I. control room.



but the actual methods employed are very different.

In the Baird system three different types of scanning apparatus are provided. For studio work "Spotlight" scanning is used; a beam of light is focused through a small water-cooled rectangular window situated at the top of the scanning unit, in which there are two discs running in vacuo and driven by separate synchronous motors also running in vacuo. The scanning disc revolves at 6,000 r.p.m. and has 240 apertures arranged in four spiral traces. The second disc has a spiral slit and acts as a shutter, so that only one of the 240 holes is exposed to the light at any instant.

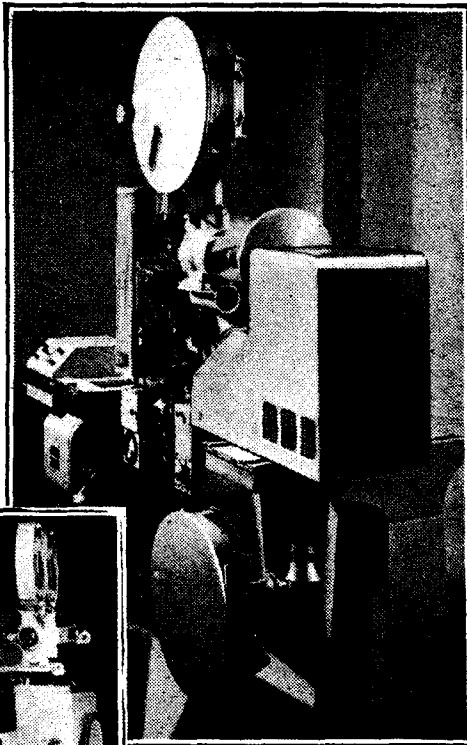
The line-synchronising impulse generator is associated with this apparatus and consists of a light source, optical system, photo-cell, and the necessary amplifiers. There are 240 holes arranged in a circular trace around the scanning disc, and the passage of light through these causes the photo-cell to give a pulse of current for every hole.



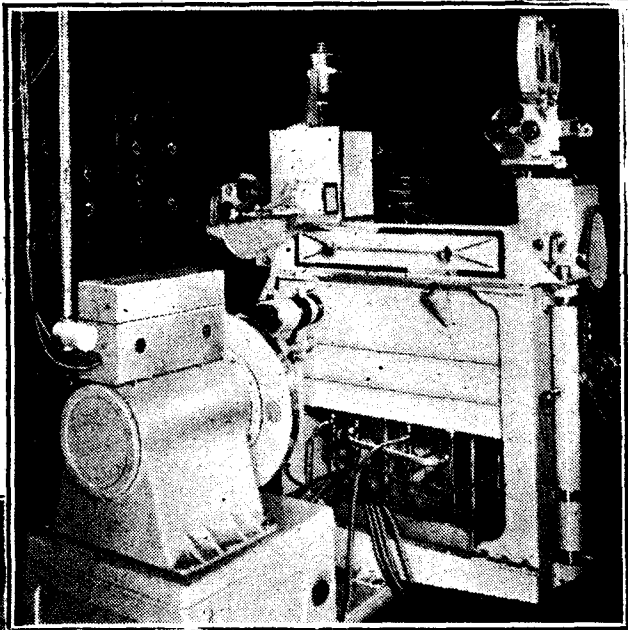
Transmissions

frequency-doublers. The output from this stage is about 100 watts at 45 Mc/s, and is taken through a concentric feeder to the drive stage, in which a water-cooled tetrode is employed and in which modulation is effected. The modulated signal is then passed to the output stage, in which there is also a single water-cooled tetrode. The circuits associated with this stage are also water-cooled, the cooling system being also employed to provide the necessary damping.

At various stages through the chain monitoring devices are employed, and in certain



On the left is the Baird Intermediate Film Scanner; above can be seen the Marconi-E.M.I. Emitron Instantaneous Television Camera unit.



2 millivolts is obtained, the sensitivity being adequate to allow of the camera being used under conditions of normal daylight or studio lighting. The output of the camera is fed straight into the head amplifier, in which two resistance-capacity-coupled stages are used in

addition to the input and pentode output valves. The output is designed to match the impedance of the 18-way cable connecting the camera to the later amplifiers.

Two leads, which are screened and of low capacity, carry the picture signal from the camera to the main amplifiers, while four other leads supply the high- and low-frequency scanning impulses for the electromagnetic deflection of the electron beam of the camera. The remaining leads carry the necessary supply voltages for the camera and head amplifier.

Six Emitron cameras are

employed, and their outputs taken to the mixer unit, containing two banks of valves with commoned anodes. In this unit the output of any camera can be selected, or the outputs of two or more mixed and passed on to the B amplifier, which has three RC-coupled valves in addition to the output valve. One stage is employed for interference reduction; this is done by feeding the signal with any interference on to a portion of the valve curve which tends to rectify the interference peaks, leaving the picture signal unrectified. The output of the B amplifier is fed into the C amplifier, which contains three further RC stages.

Following this is the Suppression Mixer. The first valve is a diode which rectifies the AC input and corrects it into a varying DC signal, and there are then two stages of amplification. This unit is followed by the Synch. Mixer Unit, in which the vision signal is combined with the synchronising pulses, and this in turn is followed by the Distribution Amplifier, the output stage of which feeds the transmitter.

The Transmitter Circuits

Included in the transmitter are the modulators, which are fed from the Distribution Amplifier, and modulate the carrier of the transmitter. The final modulation stage employs a CAT6 valve with 5,000 volts HT supply.

The transmitter proper starts with a master oscillator at 22.5 Mc/s. A temperature-compensated coil is used, and the frequency is maintained with an accuracy of one part in 20,000. A frequency-doubler then follows and is in turn followed by stages of amplification employing valves of increasingly large power-handling capacity until the final power amplifier is reached, in which two CAT9 valves are used in push-pull. Modulation is effected in this stage, and the output is coupled to the aerial feeder.

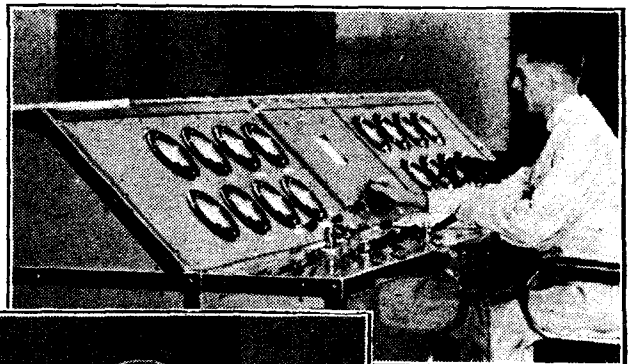
The sound equipment provided includes five Marconi-E.M.I. moving-coil and three ribbon microphones, in addition to gramophone and sound-on-film reproducing equipment. The distribution system is unusual in that no valves are employed for isolating

instances these take the form of cathode-ray tubes. A considerable amount of additional apparatus is employed for providing the operating potentials for this gear.

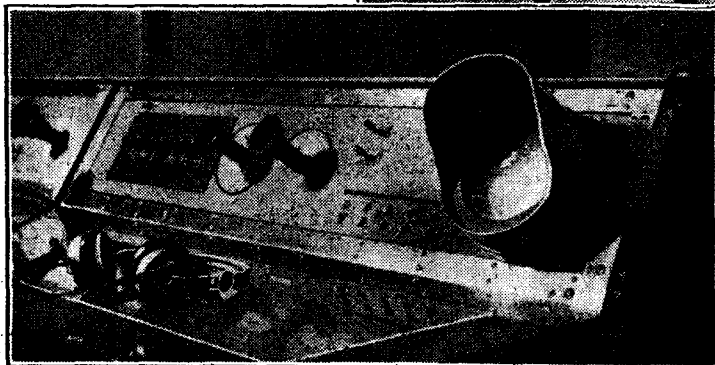
The Marconi-E.M.I. system is entirely electronic, and the Emitron camera is employed as the link between the visible and the electrical. The basic unit, however, is the

pulse generator, for this provides the necessary pulses for operating the camera and also for the synchronising signals. It consists essentially of an oscillator system providing output signals in the form of black bars for testing, line and frame synchronisation pulses, interference suppression pulses, black-out pulses for camera-gun flyback, camera-gun line and frame scanning pulses, and picture shape-correction pulses.

The Emitron camera operates on the cathode-ray principle and contains a mosaic plate of photo-electric material upon which the image is focused. This is scanned by the electronic beam, and an output of about



The Marconi-E.M.I. transmitter control desk is shown above, while the left-hand photograph shows the Baird control desk for vision and sound.



the various circuits, although they are naturally used in the amplifiers.

SPEED always holds the imagination of the public, and especially the listening public. The roar of engines as they hurtle along track or road lends itself admirably to broadcasting, and with a quick, flowing commentary motoring events are always well worth listening to.

Two relays are to be given from the ninth R.A.C. Tourist Trophy Motor Car Race over the thirteen-and-two-thirds-mile Ards Circuit near Belfast on Saturday from 11.45 to 12.45 and 4.15 to 5.15 (Nat.). Three commentators will describe for listeners the progress of this 410-mile race from the Grand Stand, Newtownards, and Barn Hill, Ballystockart. The cars taking part are ordinary sports models, minus their hoods, screens, and lamps.

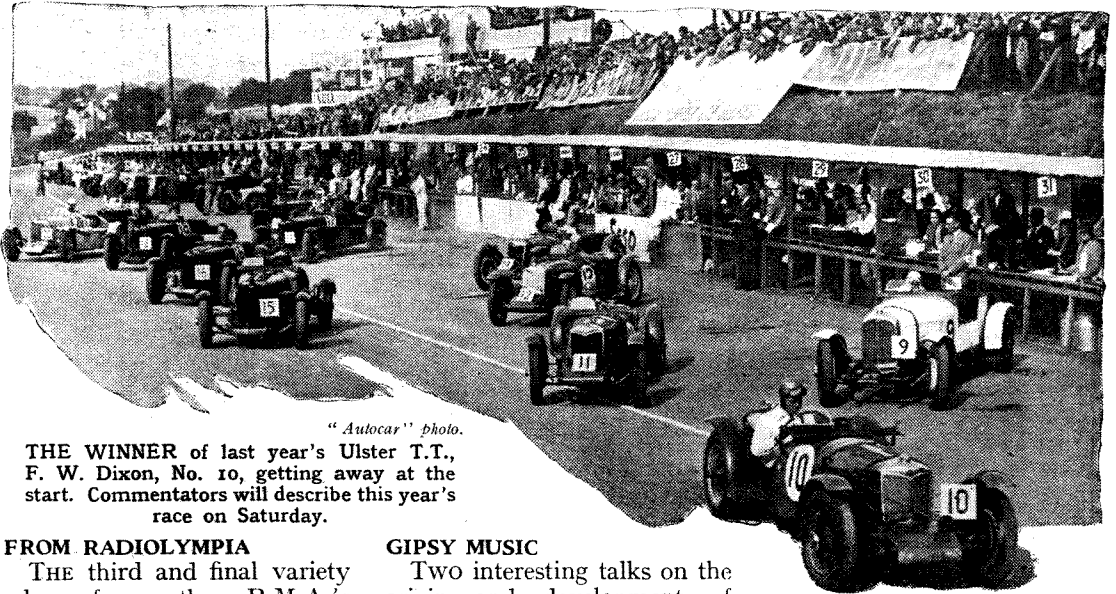
MODERN GLADIATORS

The first tournament to decide the speedway champion of the world is to be held at the Wembley Stadium on Thursday, when a commentary will be given to Regional listeners at 9.30. Out of an entry of sixty-three, the sixteen who have come through the preliminary tests with the highest percentage meet in this final combat.

SINGLE-WICKET CRICKET

T. WOODROOFFE will give running commentaries from Wittersham Green, in Kent, at 2.45 and 4 on Saturday (Nat.), when a whole Eleven of the Isle of Oxney play against two professionals, Ashdown of Kent and Wensley of Sussex. These two young men are out to repeat the result of a similar

Listeners' Guide for



"Autocar" photo.
THE WINNER of last year's Ulster T.T., F. W. Dixon, No. 10, getting away at the start. Commentators will describe this year's race on Saturday.

FROM RADIOLYMPIA

THE third and final variety relay from the R.M.A.'s Theatre at Olympia will be given at 8.35 on Saturday (Reg.), the closing day of the Radio Exhibition. Among the artistes who will be heard are Ann Penn, Leonard Henry, and Les Allen with his Canadian Bachelors.

MICROPHONE DEBUTS

A NEW feature in English programmes makes its first appearance on Tuesday at 8 (Reg.). Carroll Levis, a Canadian, has been conducting amateur hours in some of London's cinemas and is enthusiastic about the quality of the talent discovered. It is his intention to draw, from all over the country, aspirants to broadcasting, and bring them

GIpsy MUSIC

Two interesting talks on the origin and development of gipsy music are to be given by P. Thurston Holland, a well-known authority on the subject. Each talk will be illustrated by typical themes played from records to show how indebted to gipsy folk music were many of the great composers. The first of these talks will be given on Monday at 9.15, Regionally, and the second on Thursday week, September 17th.

PROMENADE RELAYS

TO-NIGHT'S relay from the Queen's Hall at 8.20 (Nat.) includes Beethoven's Pianoforte Concerto No. 3, played by Arthur Rubenstein. During Saturday's concert, part of which will be broadcast Nationally at 8.35, Constant Lambert will conduct his own work, "King Pest." On Monday, Wagner night, the first part of

soloist in Tuesday's Prom. to be broadcast at 8 (Nat.). Brahms' Third Symphony is the only part of Wednesday's concert to be given to listeners; this will be at 9.5 (Reg.).

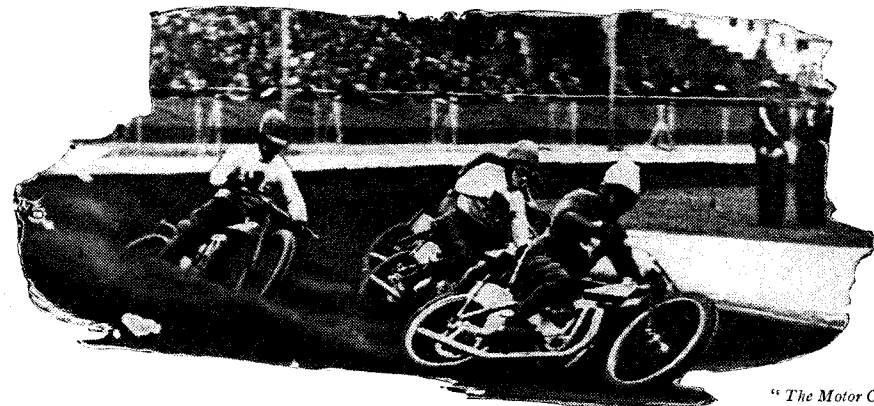
The first performance in England of the ballad, "The Ferryman's Bride," with Muriel Brunskill as soloist, is among the four works of Sibelius to be heard on Thursday at 8 (Nat.).

"LOVE AT PAR"

THIS is the title of a comedy with music about love and tired city stockbrokers to be produced by Martyn C. Webster in the National programme on Monday at 8 and Wednesday at 7. The book is by Mabel and Denis Constanduros, and the music by George Barker. Among the artistes taking part are Mabel Constanduros, Peter Haddon, Marjery Wyn, and Bobbie Comber.

WOMEN'S FREEDOM

THE younger of our readers cannot imagine life without the fair sex at the swimming bath, cycling in shorts, and as the tender nurse in our hospitals, yet all these spheres have been entered only through the efforts of others for the emancipation of women. Salient points in the fight for their freedom will be recalled in the programme, "Louisa Wants a Bicycle," or the Fight for Women's Freedom, to be produced by John Cheatle and M. H. Allen at 8.55 on Tuesday (Reg.).



THRILLS AND SPILLS will be pictured for listeners from the World's Speedway Championship meeting on Thursday.

"The Motor Cycle" photo.

event of 1832, when two professional cricketers, Wenman and Mills, skittled the villagers for 48 after Wenman had made 150. We shall see, or rather hear, what happens on Saturday.

to the microphone in an informal hour, headed "Carroll Levis and his Discoveries." He will interview his protégées before the microphone, after which they will give a three-minute turn.

the Prom. will be relayed Regionally at 8, beginning with the "Flying Dutchman" Overture. The soloists on Monday will be Miriam Licette and John Brownlee.

Elisabeth Schumann is the

the Week

Outstanding Broadcasts at Home and Abroad

VIENNA AGAIN

VIENNA, the source of inspiration for innumerable writers and composers, again comes into the programmes in the melodrama, "Episode," which is an adaptation for broadcasting by Marianne Helweg and Felix Felton of the Viennese film of the same title. The action takes place in Vienna soon after the War. Constance Cummings takes the part of Valerie Gartner, an art student, in the broadcast on Thursday at 8.30 (Reg.).



"H.M.V." photo.

Peter Dawson, who will give a song recital at 8 o'clock on Wednesday, during which John Wills will give a pianoforte interlude.

OPERA

FRIDAY'S programmes from abroad include the opera "Russalka" by Dargomijski, based on Poushkin's dramatic national legend, from Moscow at 7. Three-quarters of an hour later Bucharest gives a recorded version of Massenet's "Manon," performed by the Company of the Opéra-comique, Paris.

Saturday has a very full operatic programme. At 8 a performance by the Cast of the Opéra from the Sarah Bernhardt Theatre of Massenet's "Hérodiade" is being relayed by Paris PTT. Leipzig relays Lortzing's three-act opéra-comique, "Die beiden Schützen," at 8.10. The transmission of greatest interest

SVEA LIVGARDES MUSIKKAR, the Band of the Swedish Royal Guards, will give an hour's military music from Oslo at 8 on Tuesday.

to English listeners is probably that at 8.45 from Radio-Paris, when "Lalla Rookh," the two-act opéra-comique by David based on Thomas Moore's exquisite Oriental poem of that name will be broadcast. The Irish poet received £3,000 for it, which was a colossal sum for those days—1817.

Sunday's only opera performance is Donizetti's "Don Pasquale" at 8.30 from Paris PTT.

Soviet operas are the subject of a programme of excerpts from Moscow at 8 on Wednesday.



OPERETTA

A WEEK not particularly rich in this type of programme begins with that ever-popular favourite, "Lilac Time," from Radio-Paris at 8.45 to-night.

Two more popular operettas are to be given on Saturday. From Brussels No. 1 comes Oscar Straus' "The Chocolate Soldier," while from Prague twenty minutes later comes "Die Fledermaus" by Johann Strauss.

From Paris PTT at 8.30 on Tuesday will be heard Lecocq's "La fille de Madame Angot," with Inghelbrecht conducting,

and we can, therefore, be assured that the music will be given a perfect interpretation.

GERMAN STATIONS

MOST of the German stations this week include in their evening programmes relays from the National Socialist Annual Party Rally at Nürnberg, and it is therefore impossible to give all the intricate details of individual programmes.

ANGLO-SPANISH

UNDER the above heading from the Swedish stations at 7.50 on Thursday will be given a selection of English fox-trots and waltzes and Spanish tangos. The guest during this programme will be Carmen del Rio, who will sing the choruses in either language.

ENGLISH SPOKEN HERE

THE Danish broadcasting organisation is giving listeners a generous helping of English this coming week. At 9.15 a.m. on Sunday F. C. Reynolds, an English singer, is giving a talk on English from Kalundborg. English lessons are to be given on Monday and Thursday at 6.35, whilst on the latter evening at 8 is to be included a programme of old English songs.

INTERNATIONAL

HIKERS of twenty-two nations gathered for the International Congress of Hiking Hostels in Copenhagen are coming to the Danish microphone on Tuesday at 9.35 to give a special international programme of their own choice. The programme director has waived aside an otherwise strict rule in allowing the hikers to do and say what they like, no manuscript having been presented beforehand.

THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, SEPTEMBER 4th.

Nat., 6.30, Sullivan programme: B.B.C. Military Band. 7.25, Arcadian Follies from the South Pier, Blackpool. 8.20, Prom. Reg., Mrs. Jack Hylton and her Band. 9, Records of German Romantic Opera. 10.30, Roy Fox and his Band.

Abroad. Radio-Paris, 8.45, "Lilac Time."

SATURDAY, SEPTEMBER 5th.

Nat., 11.45 and 4.15, Commentaries from T.T. Motor Race, Belfast. 2.45 and 4, Commentaries from Wittersham. 7.30, "Brown Sails," descriptive commentary from Dunure, Ayrshire. ¶John Watt in "The Full Story," Part II. 8.35, Prom.

Reg., 8.35, Radiolympia Variety. 10.30, Bobbie Hinde and his Band from Aberdeen.

Abroad. Paris PTT, 8, "Hérodiade" from the Sarah Bernhardt Theatre.

SUNDAY, SEPTEMBER 6th.

Nat., 5.10, Chamber Music, Spencer Thomas and The Ginke Trio. 9, Mantovani and his Tipica Orchestra. ¶B.B.C. Theatre Orchestra and Trefor Jones.

Reg., 5.15, Ballad Concert. Constance Willis (contralto) and Roy Henderson (baritone). 6.45, Recital: Elisabeth Schumann and Leon Goossens (oboe).

Abroad. Strasbourg, 8.30, Alsatian evening—music, folk humour, sketches.

MONDAY, SEPTEMBER 7th.

Nat., 8, "Love at Par." 9, Piano-forte Recital: Kathleen Long.

Monday, Sept. 7th (continued).

Reg., 8, Prom. 9.15, Talk: Gypsy Music. ¶Fred Hartley and his Novelty Quintet.

Abroad. Deutschlandsender, 8.30, "The Niederwald Flight," Musical Play.

TUESDAY, SEPTEMBER 8th.

Nat., 6.30, Brass Band Concert. ¶The Karl Caylus Players. 8, Prom. 8.55, B.B.C. Dance Orchestra.

Reg., 8, Carroll Levis and his Discoveries. 8.55, "Louisa Wants a Bicycle."

Abroad. Deutschlandsender, 8.10, Musical Variety and Music on Three Pianos.

WEDNESDAY,

SEPTEMBER 9th.

Nat., 3, St. Leger Commentary from Doncaster. 7, "Love at Par." 8, Song Recital: Peter Dawson. 8.40, "Episode."

Reg., Al Collins and his Dance Orchestra. 9.5, Prom. ¶The Gershon Parkington Quintet.

Abroad. Strasbourg, 8.30, Symphony Concert from Vichy.

THURSDAY, SEPTEMBER 10th.

Nat., 7.30, "Camp Fire on the Karroo." 8, Prom. ¶The Leslie Bridgewater Quintet.

Reg., 8, "Evergreens of Jazz," No. 2.—George Scott Wood and his Six Swingers. 8.30, "Episode." 9.30, Commentary from Wembley Speedway. 10.30, Lou Preager and his Band.

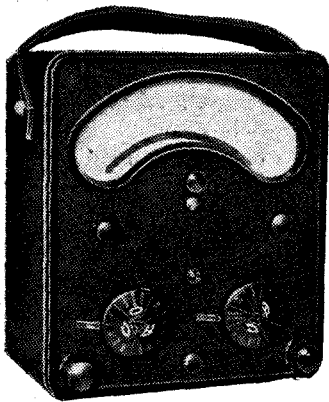
Abroad. Luxembourg, 9.15, Symphony Concert.

Measuring Instruments

THE voltmeter, ammeter, or milliammeter made in but a single range is the most common of all instruments, and many are on view at Olympia. To give details enough to guide, or even interest, a possible purchaser of instruments of this kind would involve cataloguing such a vast number of different models that no space would be left for other and more important matters. Those who were interested doubtless visited the stands of Ferranti, Everett Edgcombe, and Weston, all of whom are well-known makers of instruments. In addition to these makers, there was a display of Metropolitan-Vickers instruments on the Ediswan stand.

Multi-Range Meters

The average experimenter or serviceman finds that one or two meters are all he needs, provided that each can be used as a milliammeter or as a voltmeter on any one of a number of different ranges at will. Multi-range meters are made up, with self-contained shunts and multipliers, by all makers of single-range meters,



The latest Avometer Model 7

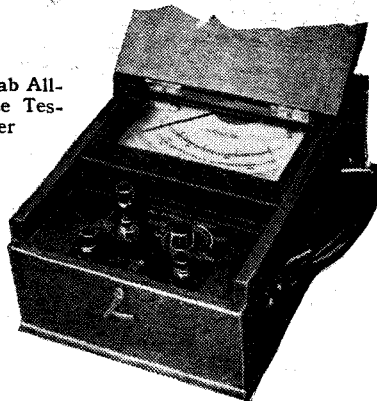
most of whom offer a number of different models. Again, there can be no attempt to enumerate all the various combinations of ranges that can be had; the would-be purchaser must consult the catalogues of the various makers. There are some, however, which are worthy of special mention either because of their ingenuity or their novelty, or because they offer some special features not commonly found in an ordinary multi-range volt-ammeter.

Probably the most ambitious instrument in the Show is the new Model 7 Avometer, made by the Automatic Coil Winder and Electrical Equipment Company. This offers, in all, no fewer than forty-six ranges. For DC current there are ten ranges, the lowest requiring 1 mA. and the highest 10 amps. for full-scale deflection. There are eight ranges for the measurement of alternating currents, the

lowest being 0.5 mA. and the highest reading to 10 amps. Twelve ranges are provided for DC voltages, the lowest being 0.50 mV. and the highest 0.1,000 volts. Alternating voltages from 0.5 volts up to 0.1,000 volts account for eight more ranges. Resistances from 0.5 ohms to 1 megohm can be measured in three ranges, using internal batteries as a source of power, while by connecting the meter to an external source of voltage, either AC or DC, two more ranges extend the scale to 40 megohms. By using 50-cycle mains, capacities from 0.01 to 0.20 mfd. can be read. Finally, the instrument can be used as an output wattmeter, reading outputs from 1 milliwatt to 4 watts, the power being dissipated in a 4,000-ohm resistance contained within the meter itself. This scale is calibrated also in decibels with respect to the standard output of 50 milliwatts. The coil is safeguarded against overload by an automatic cut-out, and a press-button is fitted to double the deflection on any of the current or voltage scales for more convenient reading in awkward cases. The maximum current taken on any voltage range is 2 milliamps. Older models of the Avometer and Avominor remain available at their old prices; this newest and most comprehensive addition to the range of meters costs £15 15s.

Everett Edgcombe offer a 29-range meter in their "All-purpose Tester." This gives full-scale deflection for from 0.25 to 500 volts, AC or DC, in six ranges, and for 1 to 1,000 milliamps, AC or DC, in five ranges. As an ohm-meter it measures resistances from 1 ohm to $\frac{1}{2}$ megohm in two ranges, and by connection to AC mains, capacities from 0.0005 to 15 microfarads in five ranges. With a 3 $\frac{1}{4}$ in. dial it costs £6 15s., but it can also be had in two forms with a 6in. dial at £9 15s. and £11 11s.

Radiolab All-Purpose Tester

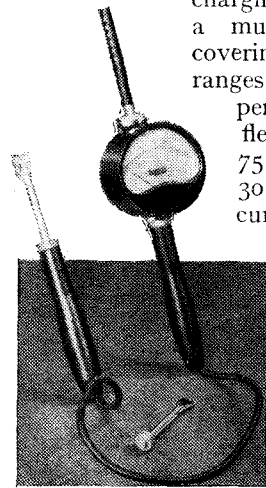


The wide range of Ferranti instruments has been extended by the addition of their AC/DC Circuit-tester No. 2. This is especially notable for the very high resistance—2,000 ohms per volt—on both DC and AC voltage ranges. The unusually

APPARATUS FOR THE TEST BENCH AND LABORATORY

low current-range of 0.500 microamps. is provided for both AC and DC; there are no other AC current ranges, but volts up to 600 can be measured. Resistances up to 100,000 ohms are measured with a self-contained battery; the maximum can be extended indefinitely by using an external battery as described in the instructions. Capacities up to 1 mfd. can also be measured. The price is £7 10s.

Crypton, battery-charging specialists, offer a multi-range meter covering rather unusual ranges. At 1,000 ohms per volt full deflection is given by 75 mV., 3 volts, and 30 volts, while the current ranges are 3,



Crypton cadmium plate-tester for accumulators

30, and 300 amperes. Even for these high currents external shunts are not needed.

A meter-unit made by Wearite is remarkable in including a range of inductance-measurement from 5 to 120 henrys; for this, as for capacity measurement with this and other meters, AC mains are used as driving-voltage, in this case through a step-down transformer giving 4 volts. A self-contained battery gives resistance measurements up to 100,000 ohms, higher values being read with the aid of an external battery. AC and DC voltage ranges up to 500 volts, at 1,000 ohms per volt, are included, as are also voltage-ranges up to 1,000 at a lower resistance and a series of DC current ranges. The complete instrument sells at £6 17s. 6d.

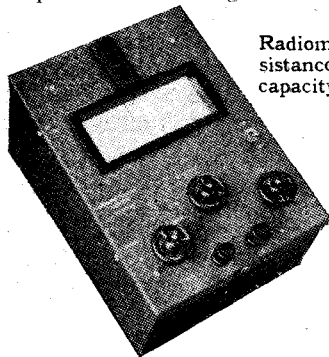
It should be noticed that all instruments with AC voltage-ranges can be used to measure the audio-frequency output of a set or a valve by connecting them in parallel with a resistance providing the desired load. This should be fed through a 1:1 transformer to avoid voltage-drop.

Capacity-meters and Ohm-meters

Crypton are showing an ohm-meter which, with self-contained battery, reads in

Measuring Instruments—

two ranges ohms from 0.1 to 200,000. The resistance and capacity bridge made by Radiometers, at £6 6s., contains a 600-cycle oscillator for energising the bridge and a pentode amplifier indicating the output on a moving-coil instrument.



Radiometers resistance and capacity bridge

It reads from 100 ohms to 4 megohms in two ranges, and from 0.00005 to 25 microfarads in three ranges. Standard comparison resistances and condensers, accurate to $\pm \frac{1}{2}$ per cent., together with the necessary batteries, are contained in the case.

The Avo capacity meter uses a resonance method, resonance being indicated visually. It gives direct readings by retuning of capacities from 0.0005 to 0.1 mfd. in six ranges; on the lowest range 0.0005 mfd. is the maximum, not the minimum, measurable. A capacity of $1\mu\text{F}$. can be detected with certainty. The instrument can be driven either from batteries or from a power unit; either is connected externally, and neither is included in the price of £21.

Valve-testers

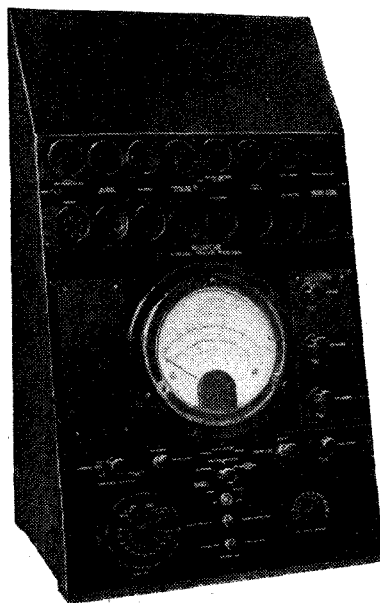
The most frequent application in wireless practice of any meter is the measurement of the currents and voltages associated with a valve, with a view to testing the correct working of either the set or the valve itself. To make these measurements easier and more convenient, valve-testers have been designed by several makers. These fall into two groups, of which the first relies on the set to provide the various voltages and currents, and is primarily designed to facilitate the connection of the meter in any desired lead. The second group includes more complex instruments, generally containing their own power supply, whose function is to test the valve as such by measurement of mutual conductance and other properties.

Wearite offer a valve-tester which falls into the first class; it is used in conjunction with an external multi-range meter such as that made by the same firm. In addition, it has an arrangement for measuring, at a low voltage, the total emission to all electrodes strapped together, the figure thus obtained being compared with that given by a valve of the same type known to be in working order. A self-contained power unit lights the filament at any desired voltage and supplies the voltage for the other electrodes.

The Everett Edgcombe "Omni-Select-

tor" and the Weston "Selective Analyser" fall into the same (first) class of valve-testers, and offer means of reading the voltages and currents at all electrodes of a valve. The valve is removed from the set and a plug is connected in its place, the valve being plugged into the instrument, which has switches or jacks allowing of the insertion or connection of a meter at the various points required.

One of the most ambitious instruments of the second class, designed for the testing of valves as such, is the Everett Edgcombe "Visual Valve Tester" sold at £19 19s. This is all-mains operated, and fitted with a single large-dial meter reading voltages and currents in any circuit at will. Since all voltages are variable, a complete series of curves can be plotted if required. In addition, a mutual conductance test can be made at any point of a curve by applying 1 volt AC to the grid and reading off the alternating anode current, picked up through a current transformer. This gives direct readings of mutual conductance in milliamps. per volt. Means for detecting grid-



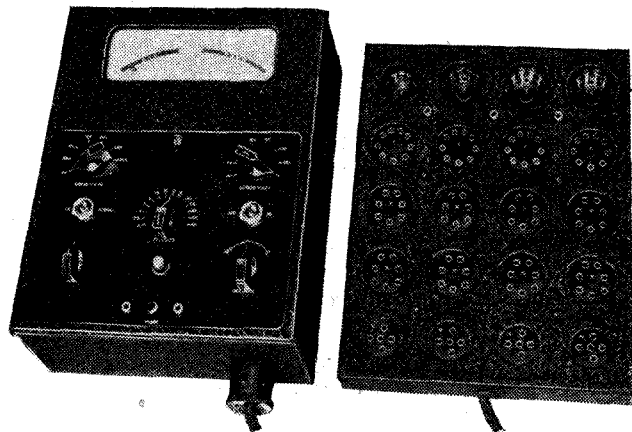
Radiolab visual valve tester

current and testing interelectrode insulation (limit 10 megohms) are also provided. A novel feature is the provision of a test for oscillation in connection with frequency-changing valves; a tuned circuit is connected to the valve-holders in which such valves are to be inserted for measurement, oscillation being detected by observing the change in anode current when the tuned circuit is short-circuited.

For £10 10s. the same firm offer a simpler valve-tester in which the anode voltage is fixed at 100 or 200 volts (either can be chosen at will) while grid and screen voltages are variable at will. The grid-bias can be reduced by one volt by

means of a switch, no matter what may be the absolute setting of the bias. By observing anode-current change the slope may therefore be read at any desired point on the curve. Means for testing for continuity of filament, interelectrode insulation, and diode emission are also provided.

The Avo Serviceman's Valve-tester provides for variation of anode and screen



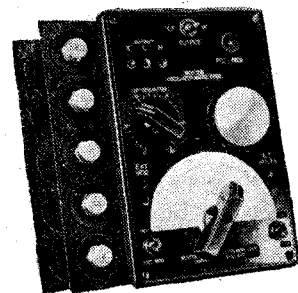
Avo valve tester

voltages, but is limited in grid voltage to either zero or -1 volt. This enables mutual conductance at the standard conditions of measurement to be read off. It takes, like most other instruments, all English and American valves; at the time of writing the price is not fixed.

Radiometers have a valve-tester embodying five separate meters to permit simultaneous readings of various currents and voltages to be made; this tester, which costs £60, is noteworthy as providing anode voltages up to 600 for testing high-power output and small transmitting valves.

Oscillators and Signal Generators

One of the least expensive oscillators for providing a testing-signal is that made by Everett Edgcombe at £6 15s., including batteries and valves. It covers, without breaks, the range 175 to 3,000 metres in four ranges controlled by switches. The output is regulated by an attenuator calibrated to 40 db. below the maximum output; this is given for three wavelengths, and approximates to 200 mV.



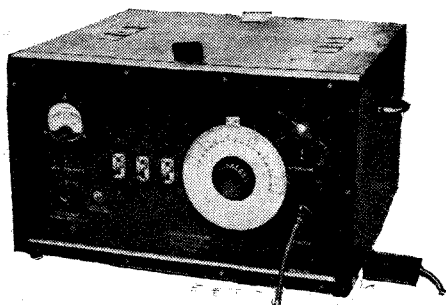
Weston oscillator, Model E692

Internal fixed-depth modulation is provided, but can be switched out if plain radio-frequency is required. A range of wavelengths from 25 to 50 metres, and provision for external modulation, can be added as extras if required.

Measuring Instruments—

The Weston oscillator at £19 19s. covers, with the aid of six plug-in coils, the range 25 megacycles to 100 kilocycles, and is provided with an attenuator that will reduce the output to below 1 microvolt. Internal fixed-depth modulation is provided; this can be switched out and modulation from an external source supplied. The audio-oscillator is available as a source providing about 1 volt at 400 cycles.

The Wearite TD6 signal generator, mains driven, costs £33. With switched coils it tunes from 12 to 3,000 metres without gaps, and is provided with an attenuator controlling the output from about 10 μ V. to about 200 mV. in six steps. Modulation, available also as an audio-frequency signal of about 20 volts, is

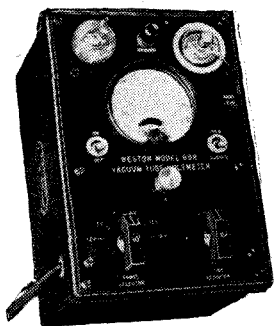


Wearite signal generator

provided, and an output voltmeter of ranges 50 and 500 volts is included. The same firm make a less ambitious oscillator at £6 15s. An Avo signal generator is available at £15 15s.

Valve Voltmeter

An advance model of a valve voltmeter was available for inspection at the Weston stand; it sells at £24 and reads from a minimum of 0.4 volt (a very readable deflection, this) up to 16 volts in six ranges. It uses an anode-bend detector, and is entirely mains-driven, a neon tube being used for stabilising the HT supply.

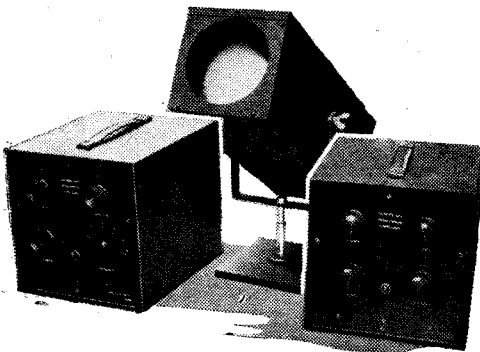
Weston valve
voltmeter,
Model 669

Since the input impedance (resistive) is of the order of 10 megohms at radio-frequencies, it may be connected to read high-frequency voltages, after appropriate re-tuning, at any point in a set.

Oscillographs

Cossor Oscillographs are available in three forms, ranging from a portable mains oscillograph in which the time-base

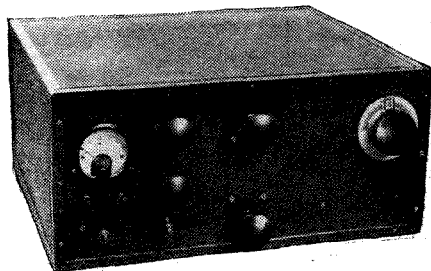
is sinusoidal at the frequency of the mains to the high-vacuum oscillograph which incorporates a linear time-base controllable in frequency up to 5 megacycles for the examination of phenomena of very high frequency. The first-named is satisfactory for the examination of waveforms up to at least 5,000 cycles, the time-base sweep



Wearite cathode-ray oscillograph

being drawn out so that the portion used is effectively linear. The linear portable oscillograph using a gas-focused tube incorporates a time-base adjustable in frequency to 10 kc/s, and will deal with phenomena of frequency up to at least ten times this.

The Wearite oscillograph, in which the tube is screened from magnetic fields by enclosure in a mu-metal housing, has a linear time-base of maximum frequency 30 kc/s. The tube is of the gas-focused

Belling-Lee short-wave interference-measuring
apparatus

type, and the whole equipment, including power-unit and time-base, sells at £29.

Quality at Olympia

NEW readers of *The Wireless World* may not realise that my instructions, received annually from the Editor, are that I shall report on technical improvements which are of interest to those who are (dreadfully) named "quality enthusiasts"; the attitude adopted by many exhibitors being that a "quality enthusiast" is an eccentric person who cannot appreciate the "excellence" of a mass-produced receiver.

It is common knowledge that the cheap set does not avoid distortion owing to the fact that it is built down to a price, and it is unfortunate for us quality "hams" that a receiver and speaker, to give really good reproduction, must be rather costly. However, facts are facts, and I can dis-

miss the majority of the exhibits at Olympia as being of little interest to us eccentrics. I must, however, put on record an entirely new description of a mass-produced receiver, the description being invented by one of the exhibitor's staff, well known for his almost inexhaustible supply of quips and stories. No less than "variable fidelity"—a term pregnant with all sorts of meanings.

Assessing the value of exhibits stated to be high-fidelity was much more difficult. An abler pen than mine has explained how completely the annual Radio Exhibition fails to give the visitor any idea of the quality of the goods shown, and at every stand I visited where the manufacturer offers a wider frequency response than usual my ears were assailed by the excruciating distortion of the "common feed." It is a great pity that the searcher for good reproduction should be so grossly misled by the powers that be. He naturally finds his way to the stands of the manufacturers who are trying to improve reproduction, and the only result is that the wider frequency response shows up to an even greater degree the beastliness of the whole scheme.

New Speaker Types

I should like to have the opportunity of hearing all the new speakers on a good broadcast transmission. Among the top note specialists there now appear to be two schools of thought—the "duoders" and the "twin coners." How gratifying to find so much attention being given to extending the frequency response of speakers, and how disappointing not being able to arrive at any decision as a result of healthy and heated arguments with the respective exponents.

Time will show the capabilities of these new speakers, and the searcher for first-class reproduction will have to exercise his critical faculties to a greater extent than in the past, for the simple reason that he has a wider choice; not so wide, however, as to cause him serious embarrassment.

Receiver and amplifier design follows the well-trodden path, and shows a wise tendency to reject the apparently attractive high-efficiency output stages which have been introduced in recent years.

I intended to write a whole page on this year's show, but candour compels me to admit that I could only do so by inserting a lot of padding which, however amusing it might be to write, would not help you. I can but summarise, then, by saying that the man who wants something better than the ordinary sort of wireless set has a wider choice than ever before.

He cannot make his choice at the annual exhibition, but has to spend his time going round to all the manufacturers one after another, trying to remember what the last demonstration sounded like. Some day it may be made easier for us, but I wonder how long we will have to wait.

"THE CRITIC OF QUALITY."

More About OLYMPIA

By FREE GRID

THE Olympia Exhibition is now fast drawing to its close, and I must confess that I am not at all sorry, as I feel thoroughly weary and worn-out after my diurnal tours amid the booths of the performing fleas and the fat lady, to say nothing of the display of legs in the R.M.A. Theatre and the other side-shows which the organisers have so thoughtfully provided for us.

There were, of course, some wireless sets on show there, although you might not believe it; indeed, thousands of people who actually visited Olympia will probably cast aspersions on my veracity. Even Mrs. Free Grid, who went to Olympia several times, at first hinted that I was telling untruths, but at last grudgingly admitted that perhaps, after all, I might have been correct, as she never did believe in bothering about side-shows in any case, but invariably went straight to the main thing, which was in this case the R.M.A. Theatre.

Too Old for Television

Although disappointed at once again failing to fight my way to the stands before the year's output had been sold out, it was in connection with television that my real disappointment occurred. I was naturally quite as keen as any of you to get one of the sets in order to see what television really does look like, and for months past I have been secretly saving all the pocket-money which Mrs. Free Grid allows me. To my bitter disappointment, however, I found that the whole output had been sold for so many years ahead that I shall never be able to see television at all unless there be something in the reincarnation theory. You see, the trouble is that I am getting old and well-stricken in years, and the period for which the output of the various television factories has been sold is far beyond my insurance company's estimate of my expectation of life. Never mind, some of you younger fellows will, perhaps, live to own one.

Talking of television reminds me that a peculiarity about such receivers as were exhibited this year—or at least some of them—was that the picture on the end of the cathode-ray tube was viewed indirectly through the medium of a mirror. An "engineer," whom I managed to catch at one of the stands during an odd moment when he was not absent for a meal, told me that this was to avoid the danger of lookers being struck by flying fragments should an "implosion" occur.

An implosion, I learnt, was a new word which had been coined to describe what happens when the glass walls of a cathode-ray tube breaks down under the mechanical strain of having a high degree of vacuum inside and air pressure outside

My tours amid the booths.

them. My informant told me that this horrible new word was used because all the fragments of the tube flew inwards, and so it could scarcely be called an explosion. I remonstrated strongly at this contradictory statement, pointing out that if the fragments of glass really did fly inwards there was no risk of spectators being struck, whereas, on the other hand, if this risk really did exist the phenomenon could scarcely be called an implosion. My informant was a foeman worthy of anybody's steel, however, for he at once explained that, owing to the exceptionally high vacuum in a cathode-ray tube, the velocity with which the glass fragments fly inwards when an implosion occurs is so great that, like electrons, they overshoot the mark and come out the other end. I removed my hat in tribute to true genius and passed on.

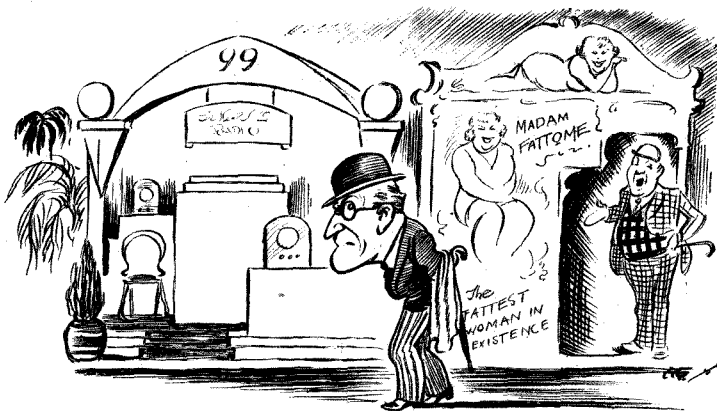
However, the genius was entirely misplaced, as I learnt later that not only is there no danger of a cathode-ray tube doing any imploding or exploding, but that the purpose of the mirror arrangement,

I removed my hat in tribute.



apart from the question of correcting the slight curvature-distortion of the tube, was to enable the latter to be mounted in a vertical position, thus permitting a more artistic cabinet layout. I must point out, however, that some makers have managed a perfectly inoffensive layout, using this unwieldy tube in a horizontal position. Implosions apparently are confined to X-ray tubes, and even then the "plosion" is strictly *in*, the only part which is *ex* being the pop.

It is hardly necessary to tell you that the great feature (I nearly said stunt, but the Editor won't let me) of this year's



show is the inclusion of short waves, which are to be found in practically every set. As I mentioned a few weeks ago, manufacturers have been frantically treading each other underfoot in the mad rush to include this refinement in their wares this year, and I must confess I fail to see any logical reason for it. I am not trying to throw cold water on short-wave listening, but what I want to know is what is the reason which prompted their inclusion this year but was absent last year and the year before that, for short-wave transmitters were with us in abundance then, and yet we had only one or two expensive sets, and a few convertors for the poverty-stricken, to cater for the needs of short-wave listening. I suppose it is due to some profound psychological reason which only Freud could explain, for my finer feelings will not allow me to entertain the wicked suggestion that it was simply because the manufacturers couldn't think of any other novelty to dish up to the public this year.

At least one maker had the courage to exhibit an automatic record-changer which would cater for the eight-inch records which we have all of us secretly obtained from "one-price" stores, although, of course, we never admit it openly. Such things have appeared before, but have usually faded out very quickly—at least their makers have—but this one is by a maker so well known that he will find it hard to get away when the thing goes wrong. For a moment I thought that there was a second auto-changer of this type in the field, as another firm exhibited a notice to the effect that their product dealt with 8, 10, or 12in. records, but I speedily recovered my mental equilibrium and realised that what the notice really meant was that the instrument dealt with eight records of the 10in. or 12in. variety.

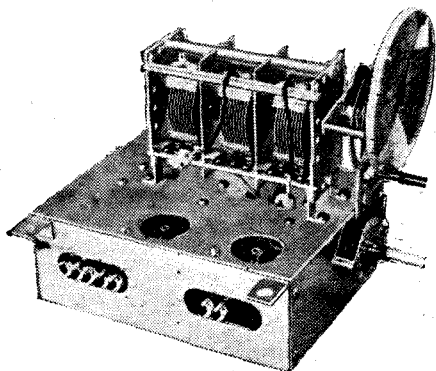
I have been so busy that I have not had time to patronise either the tattooed lady or any of the fortune-tellers. I particularly want to see one of the latter, as the future of wireless exhibitions is sorely puzzling me, and I want to know if there is any truth in the rumour that there is to be a complete circus next year.

COMPONENTS:

A REVIEW OF PROGRESS

FOR some time past now it has been a more or less general policy for manufacturers to place on the market new components as soon as the designs are ready for production, rather than wait for the opening of the Show and then release a galaxy of new items.

This is, of course, a sound policy and essentially practical, as the new parts, often associated with some new technical development in receiving technique,



Rothermel "Radio Heart" tuning unit.

allowed a steady progress in set design to be carried on throughout the year.

It does, however, detract somewhat from the glamour of Olympia, as many of the components shown this year were possibly familiar to some visitors. Yet in a review of the past year's progress all the recently introduced components must be taken into account, since they are essentially a part of the new season's products and indicate the broad, general lines of receiver development in the near future.

Regarded from this angle, it was clearly apparent that progress has been made in the design and manufacture of every type and class of component. The degree of improvement varies, of course, which is quite understandable, as many of the modifications introduced last year have not always been matched by development in other directions, so that the components being found to meet all immediate requirements need no further change, at least for the time being.

All-wave Coil Units

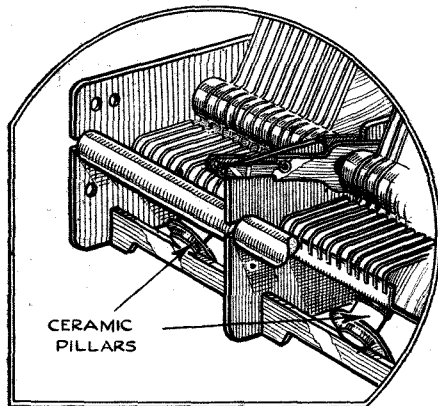
Tuning coils, for instance, have not changed to any marked degree for ordinary broadcast use, though Varley and Bulgin both had a few new models. The former were mainly of the iron-core pattern and embodied the Nicore type of coil, while Bulgin coils were almost exclusively of the air-cored variety. Both types still have their adherents, for Wearite had about an equal number of each.

Where modifications had been made they generally took the form of catering for short-wave reception in addition to the ordinary broadcast bands. One example of an all-wave coil was shown by Wearite,

and Bulgin had a coil unit covering the short, medium, and long waves.

An all-wave tuner, complete with condenser, HF, and frequency changer valve holders was seen on the Rothermel stand, which, described as the "Radio Heart," had a short-wave range in addition to medium and long waves. These were for use in superheterodyne sets with IF amplifiers of 465 kc/s. Another form of all-wave coil assembly, though in this case designed in unit form and enabling various combinations to be chosen, was shown by C.A.C. This includes two short, as well as medium and long wave ranges.

Though all the well-known coil makers were showing IF transformers for 110 kc/s, models for the higher frequency of the order of 465 kc/s were more in evidence this year. Bulgin included two variable selectivity models and one with fixed coupling. Sound Sales retains last



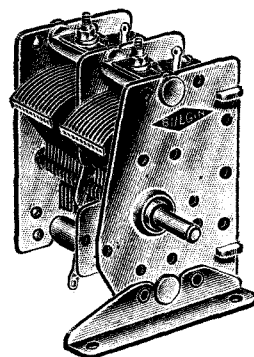
Plessey type "K" condenser with ceramic insulators and low minimum capacity.

season's model, which is a variable selectivity type with sectionalised litz-wound iron-core coils and air-dielectric trimmers; Wearite had two, one with air, and the other with iron-cored coils and fixed coupling, while Varley also had two models. One was a Nicore coil with a pre-set adjustment for band width, and the other, also with pre-set variable coupling, had air-dielectric trimmers.

Despite the fact that all-wave sets were a prominent feature of the Show, it has not been thought necessary to produce any special tuning condensers giving a reduction in the maximum capacity for the short waves only but retaining the normal capacity for the ordinary broadcast bands. A good slow-motion drive with fast and slow speeds seems to serve this purpose at present.

Plessey, however, were showing some new-style condensers, in which the special requirements of short waves are taken into account, though these are for set makers'

use only. In the "K" type, for example, they adopt a wider spacing than has been used for some time past, and the stator sections are supported on short pillars of ceramic material. Without built-in trimmers a condenser of 366 m-mfds. each section has the low minimum of



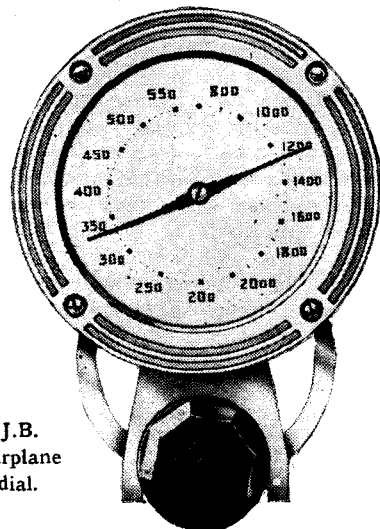
Bulgin "P" type two-gang condenser.

8 m-mfds. only, and in one of 427 m-mfds. maximum the minimum capacity is but 10 m-mfds.

Polar were also showing a new model gang condenser in which bakelite or ceramic insulation is optional, and though these embody trimmers the minimum capacities are quite low.

Bulgin has this year included a series of gang condensers of 0.0005 mfd. per section, and assembled in sturdily built frames, as well as a range of slow-motion dials in various styles. These are fitted with double-ended pointers, and some include wavelength-calibrated scales.

Dials with double-ended pointers, which permit of scales being used covering 360 degrees as compared with the 180-degree scales when only a single-ended pointer is



J.B. Airplane dial.

fitted, will apparently be the popular pattern this year, for Plessey were showing a long range for the set maker, and J.B. had several for the home constructor.

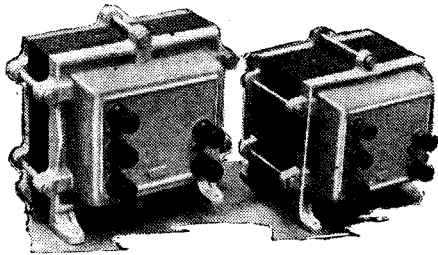
Components—

Polar dials have been modified slightly and now embody an improved driving mechanism, but otherwise retain the same external appearance as hitherto.

Iron-cored components, such as LF transformers, chokes and mains transformers, all show some improvement this year. The standard models cover all reasonable requirements, and can now be obtained either totally enclosed in metal shields or with the bare necessities only, and omitting such refinements as terminals, though in either form the workmanship and finish are of a very high standard.

High Voltage Transformers

Too much stress cannot be placed on the design and care in manufacture of mains transformers to-day, since the operating voltages of receivers are rising and good insulation is of paramount importance. Working voltages of 350 are quite common, while in many amplifiers this may rise to 500 or so. The HT secondary of the transformer must, therefore, give twice this voltage when valve rectifiers are employed.



Haynes mains transformers, types T150 and T100.

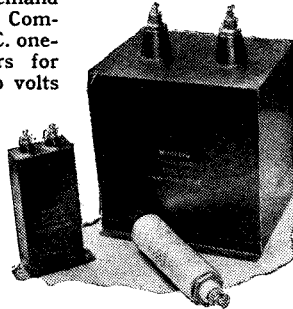
These potentials become insignificant compared with those that are now required for operating cathode ray tubes in television receivers, for 4,000 to 5,000 volts DC now has to be found. Half-wave rectifiers suffice for this purpose, since the tubes take only a very small current. The steps taken to ensure safety in use are a special feature of the mains transformers made by Haynes Radio for television purposes. In all the high-voltage models the valveholder for the rectifier is embodied in one of the end-plates which totally encloses the windings as well as the leads to the valveholder pins. The new high-voltage rectifiers all have a top plug connection, but protection of this is catered for by Bulgin, who has introduced a large bakelite cap with the metal connector very effectively insulated.

Examples of mains transformers in various types were also shown by All Power Transformers, Bulgin, Davenset, Heayberd, Sound Sales, Varley and Wearite. Among the products of these firms were also included smoothing chokes, and in some cases LF and output transformers as well.

The output transformer has not always received quite as much attention in the past as its function deserved, though it

must not be overlooked that such pioneers as Ferranti and Varley have been producing high-grade components of this type

High voltages demand good insulation. Compare these T.C.C. one-mfd. condensers for 1,500 and 5,000 volts DC working with an ordinary 440-volt 8 mfd. electrolytic.

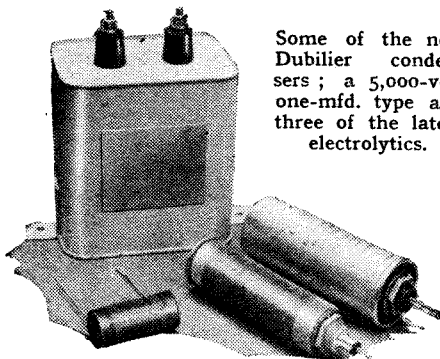


for a long time. This year Sound Sales were showing what can well be regarded as an outstanding example for high-quality reproduction in broadcasting equipment. It has a response characteristic that is ostensibly flat from 20 to 20,000 c/s, this good performance being obtained by employing no fewer than sixteen sections and cross-connecting them. It is used in push-pull circuits and is described as the Model SS036. Haynes Radio were also showing some exceptionally well-made components of this type.

Smoothing Condensers

High-voltage supply units naturally require for their assembly smoothing condensers of an appropriate voltage rating, but this does not present any difficulty, since both T.C.C. and Dubilier have for long been making condensers for use at potentials far exceeding those ever likely to be used in television receivers. They have been shown at Olympia in past years, but generally in the form of transmitting condensers and as examples of the respective firms' products.

The wireless engineer concerned only with receiver and amplifier design has not had occasion to enquire deeply into the question of types and sizes available, but this year information on condensers for use in circuits up to possibly 5,000 volts DC has not been an uncommon request.



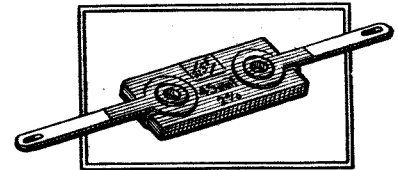
Some of the new Dubilier condensers; a 5,000-volt one-mfd. type and three of the latest electrolytics.

This was, of course, anticipated by both firms in question, as among their respective exhibits were several examples of special condensers. The T.C.C. were showing some new petroleum jelly impregnated type for working potentials of from 1,000 volts DC upwards, whilst Dubilier had some for a similar range of voltages but described as the oil-immersed type.

In addition to the interest created by the high-voltage type, one's attention was also attracted by the many improvements made to existing condensers and also to the new models introduced this year. T.C.C. have extended their Aqueous range of electrolytic condensers and were showing them in capacities up to 32 mfd. This style is claimed to be surge proof and actually to function as a voltage regulator, since if the normal working potential is much exceeded, the condenser passes a heavier leakage current, so loading the circuit and preventing the peak voltage attaining too high a value before the valves in the set warm up and draw current from the rectifier.

Plessey has also developed a new style of dry electrolytic that also has surge-proof characteristics and serves as a voltage regulator.

T.C.C. were showing multiple block paper dielectric condensers in many more combinations than hitherto, as well as dry electrolytics in a variety of capacities.



British N.S.F. Silvered Mica condenser.

Some new and interesting condensers of the small capacity kind were shown by Dubilier this year.

Ceramic material is used for the dielectric with a metal coating forming the condenser plates. Very good stability in the capacities under all conditions is one of the features of this style, which is made in the form of miniature cups, discs and tubes. It is possible to make these condensers in capacities as small as 2 m-mfd. and possibly less, while tolerances of the order of one per cent. can be guaranteed in certain cases.

Midget Condensers

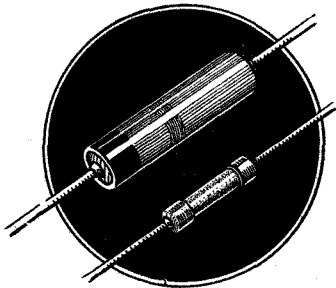
There was another new model described as the metallised mica type, in which the plates consist of metal deposited on each side of a strip of mica, the outside faces then being protected by thin bakelite plates and finally varnished. This style was shown also enclosed in a ceramic moulding.

Both patterns appear to be particularly well suited for use in ultra-short-wave receivers, not only in view of their small physical size, but also in regard to the stability in capacity that can be ensured.

Wingrove and Rogers were showing on the stand of British-N.S.F. miniature condensers somewhat similar in form and consisting of a strip of mica with silver deposited on each side and having protecting side plates also of mica. These are known as the Silvered Mica type, and can be made from very small capacities up to about 0.001 mfd. This form of con-

Components—

struction ensures a very stable capacity that remains constant with quite large changes in temperature, so that they should prove ideal for use in short-wave and television receivers.

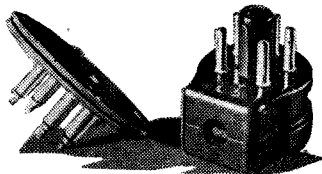


Erie insulated resistor and element

Few changes have been made in the popular type of resistances for use in this year's sets. The carbon composition type remains much as hitherto, though if any modifications have been effected in the actual manufacture it is kept a closely guarded secret. In appearance, at least, the stick, or rod, type resistance is identical with last year's model. Erie were showing a long range, but with the addition of a new form of assembly having the resistance element enclosed in a ceramic case to completely insulate it. These were shown in low wattage types, such as quarter and half-watt. Dubilier had some small half- and one-watt wire-wound resistors in sizes of from 0.25 ohm to 500 ohms in the former pattern and up to 2,000 ohms in the one-watt size. When a wire-wound type is thought advisable, such as for grid bias cathode resistors, these should prove useful.

Heavy-duty wire-wound resistances were shown also by Bulgin, British-N.S.F., as well as by Erie.

For LF volume controls and in circuit arrangements in which there is no DC flowing through the resistance, the composition element is undoubtedly quite satisfactory, as a considerable amount of research has been given to the design of this style, and on the whole they stand up to their work very well indeed and rarely give trouble.



The new Belling-Lee multi-connector.

For some time past it has been a common practice to employ multi-pin plugs and sockets for interconnecting the receiver chassis and power pack where the two are assembled separately. The arrangement of the pins, their spacing and size, are usually the same as the base cup of a valve, and a valve-holder has generally been employed as one half of the connector. A connector plug that could be inserted into a valve-holder is not the ideal arrangement, for it is not fool-proof.

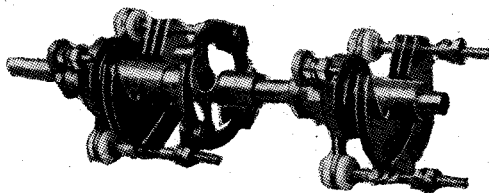
This year some special plugs and sockets

of the multi-pin type that do not fit the standard valve-holder were shown. Belling-Lee had a model in which a bakelite positioning pin is moulded in the plug portion so that it will only fit its companion socket part, in addition to which a key on the side of the pin ensures that it be inserted the correct way round. It was shown in five- as well as in ten-way types.

The new Bulgin flat-pin plug and socket could also be used for the same purpose, though this has been evolved primarily as a loud speaker extension fitting, as flat pins are adopted to prevent any confusion arising between these extension points and mains lighting or power points.

Short- and ultra-short-wave parts were markedly more in evidence this year, the advent of television, which, of course, utilises channels below ten metres, no doubt being largely responsible for the present interest in the ultra-shorts.

There was, as usual, quite a lot to interest the short-wave experimenter on the Eddystone stand; coils, condensers, insulators and the like, all embodying low-loss ceramic insulating material, being very



Eddystone ultra-short-wave condensers ganged by flexible coupler.

prominent. Bulgin had produced a host of new parts, far too numerous to mention in detail but, nevertheless, highly interesting, while the Radio Development Co. were this year making a special feature of short- and ultra-short-wave components.

There was a range of special television components on Varley's stand, the principal parts shown consisting of coils and wide-band IF units for embodying in vision receivers.

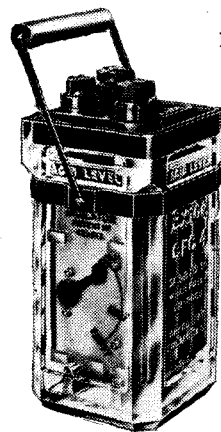
Short-wave convertors were well in evidence at the Show, and, as many of the new sets also catered for the short waves, it seems that the short-wave bands are going to be well combed for distant programmes this year. They were shown by Aerialite, Eastick, Eddystone, Farrex, Haynes Radio, R.I., and Union Radio, among others.

The development in battery-charging equipment has made very marked progress during the past twelve months, all the well-known firms catering for garages and charging stations were showing long ranges of models. Crypton, Davenset, Diggle, Ediswan, Heayberd, Sound Sales and Westinghouse were some of the firms mainly interested in this style of equipment.

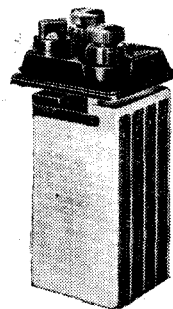
Although all the makers of dry batteries and accumulators have made some improvements in their products, on the whole these take the form of internal modification, mainly with a view to the produc-

tion of a better article without increasing the price.

The tendency seems to be now to employ more valves in battery sets, con-



Exide new Hycap cell and plate assembly.

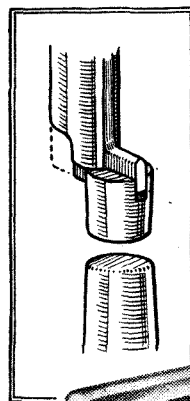


sequently both HT and LT batteries are called on to deliver somewhat heavier currents than hitherto.

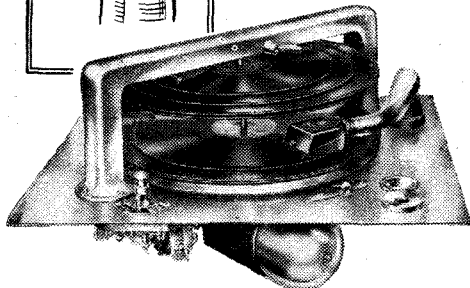
Exide have accordingly introduced a new series of small LT cells similar in appearance to the mass type but fitted with thinner plates. They are known as the Hycap range. Fuller also had some cells designed along similar lines and described as the Type F.M.G.

GRAMOPHONE EQUIPMENT

IN this section of the industry the greatest activity during the past year seems to have been in the development of new record-changers. The process has been one of further simplification of design,



The new Collaro record-changer, plays 9-inch, 10-inch and 12-inch records mixed in any order. The record release mechanism is incorporated in the centre spindle.



with the implied corollary of greater reliability of operation and freedom from damage as a result of negligent handling.

The general tendency seems to be to use the centre spindle as a record-selecting device instead of the former arrangement of claws or swivel rests arranged round the outside of the turntable. In the latest Garrard Type RC4 mechanism, for in-

Components: Gramophone Equipment— stance, the centre spindle is curved and has a step upon which the eight in. or 12in. records rest. A single claw at the side of the turntable pushes the lowest record in the pile a fraction of an inch, thus allowing it to slide over the curved part of the spindle on to the turntable. With the ordinary type of pivot for the pick-up tone arm the increase in height as records are added to the pile on the turntable would cause the needle to incline from the vertical. To overcome this difficulty the tone arm bearing providing vertical movement cuts through the tone arm at an angle, such that the bearing is always at right angles to a line drawn to the needle point. This does not correct for the change

in rake of the needle, but this can be neglected if the lateral angle is always kept at 90 degrees.

In view of the fact that 9in., 10in., or 12in. records can be mixed indiscriminately, the new Collaro record-changer is of remarkably simple construction. Here, again, the vital part of the record-selecting mechanism is contained in an extension of the main spindle, which in this case is carried by a bridge spanning the turntable. The subsidiary spindle is slotted, and carries a trigger which supports the records to be played. A lateral movement of this trigger releases a single record on to the main turntable spindle. One important advantage of this method of selection is that, being controlled from the centre, its

action is unaffected by buckled records.

As the record falls, its diameter is gauged by light feelers attached to the vertical sides of the bridge, and the result is transmitted to the levers under the base plate which determine the point at which the tone arm is lowered. A lightly spring-loaded bias then moves the needle from the border to the first groove of the record, and this action is timed for 2 seconds only to avoid side pressure on the grooves. The usual stop and start, repeat and reject features are combined in a single control.

There is nothing fundamentally new to report in pick-up design, and the two main types—magnetic and piezo-electric—continue to provide the standard of quality demanded by modern electrical recordings.

The "D.G." to Visit Australia?

SIR JOHN REITH, it is well known, studies the activities of other broadcasting organisations with the keenest interest—a pursuit which must yield him increasing happiness as the years roll by, for one country after another appears to be using the B.B.C. organisation as a model for its own.

South Africa, which the British "D.G." himself visited in an advisory capacity, is copying the B.B.C. pattern. So are Canada and Australia. It was a visitor from the Commonwealth the other day who wrote, after an interview with Sir John: "What a wonderful grip he has on Australian radio conditions!"

The Cynics

The visitor—a prominent radio journalist from Sydney, added: "The rumour that Sir John contemplates a trip to Australia is exaggerated—although he may go after television has been perfected."

In the light of this statement, the cynics may argue that the "D.G." never will see Australia; but cynics have once or twice been wrong.

It Looks So Simple

PROBABLY not more than ten per cent. of the sightseers who elbow their way through the television demonstration booths at Radiolympia appreciate fully that the little pictures are coming to them through the ether. The images are, generally speaking, so good, and follow film technique to such a remarkable degree, that even the most seasoned of radio amateurs can easily forget at times that he is not in the "standing only" crowd at a news theatre.

No Second Chance

At the Alexandra Palace, too, the scene is strikingly reminiscent of a film set. The same multi-kilowatt lighting, the same microphone booms, the same tense atmosphere directly the whistle blows—with this difference, that everyone realises

that here there is no opportunity to "cut" and start again if things go wrong.

Tele-nerves Discovery

One of the most striking discoveries made in the studios during the past week is that artists are apparently less terrified by television cameras and microphones than by the microphone alone. "Tele-nerves," it would seem, will not be so prevalent as "mike fright," which exerts such a petrifying spell over newcomers to sound broadcasting.

What is the psychological explanation?

What's Next?

Between now and the opening of the service the contractors will carry out further tests. Then the B.B.C. engineers will experiment with the gear and continue with reception tests and field-strength measurement for some weeks before asking the productions staff to supply them with programme material.

All of which points to the fact that Gerald Cock and his little army are determined to consolidate the positions already won before attempting to capture the whole-hearted support of the British public. That they

BROADCAST BREVITIES

NEWS FROM PORTLAND PLACE

will reach this objective no one can now have any reasonable doubt.

Engineering Triumphs in a Radio Play

TWO triumphs of engineering will be epitomised in a feature programme which Felix Felton is to produce in September. "Suez and Panama" is the title of this radio-dramatic story of the success and failure of Ferdinand de Lesseps, the engineer who splendidly completed the Suez Canal in 1869, but was balked by floods, malaria and financial difficulties when he attempted the great Panama project thirteen years later.

Personal Antagonisms

The radio play, which has been devised by Alfred Dunning, promises great human interest, for, in addition to the great de Lesseps, the characters represented will include Lord Palmerston, Prime Minister of Great Britain, and Rothschild, the financier.

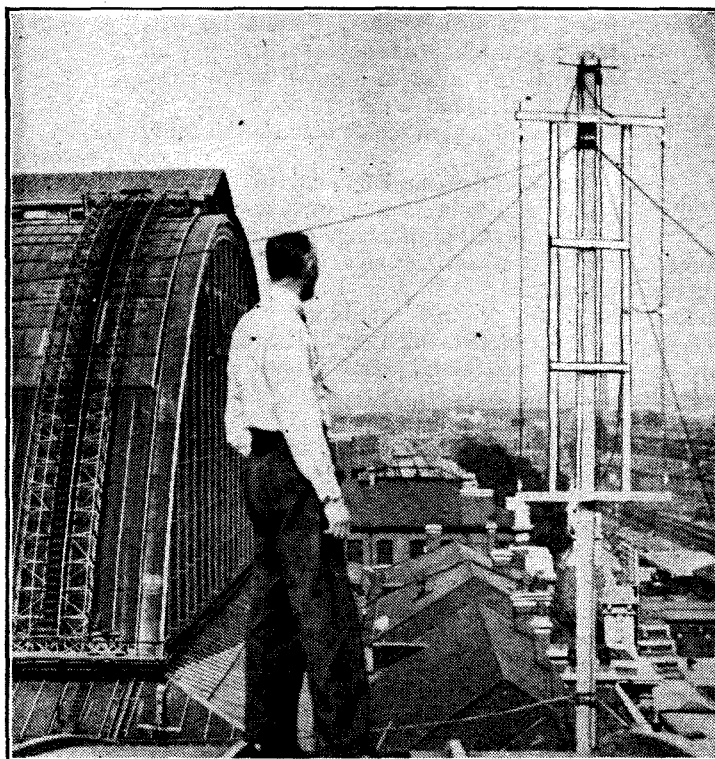
Conflicting interests should add to the drama, for de Lesseps was hedged around by personal antagonisms, although backed by staunch supporters as well.

Incidentally, the play should give grand scope to the Effects Department.

Mr. Baldwin to Broadcast —To America

THE Right Hon. Stanley Baldwin, Prime Minister of Great Britain, is to join the little army of celebrities who talk to a microphone in this country without being heard by the resident population. The occasion will be the Harvard University Tercentenary Celebration, and Mr. Baldwin, sharing time on the air with President Roosevelt, will broadcast greetings to America's oldest educational institution at 8 p.m. (B.S.T.) on September 18th.

The Prime Minister will be heard over the National Broadcasting Company's network and no doubt many British listeners with all-wave sets will be tuning-in W3XAL Bound Brook on 16.87 metres (17,780 kc/s).



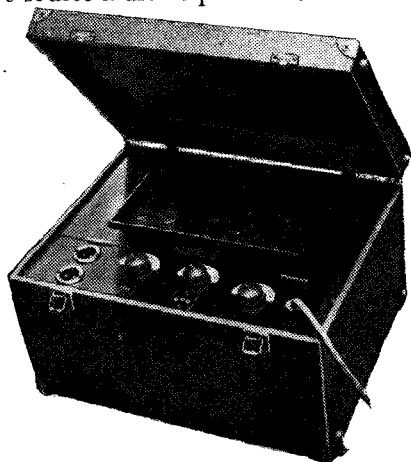
The aerial for demonstrations of television reception at Olympia was erected by the G.E.C. A Belling-Lee engineer, seen in this photo, reported on the question of electrical interference.

Developments in PA Equipment

THOSE who have visited the Show regularly during the past few years will have noticed that on each occasion more and more firms were interesting themselves in the design and construction of amplifiers mainly for public address use. This section is now becoming a very important one, as is evidenced by the number of firms that were showing apparatus of this type at Olympia.

The equipment may be divided into two broad classes, mobile and permanent installations respectively. The mobile, or portable, units have been evolved for use where an installation is required at an indoor or outdoor function for several hours only, and consequently it must be assembled in conveniently sized units. Provision for the use of two or more microphones with independent controls is usually made, and it is customary to include a gramophone turntable for supplying musical entertainment between times.

In equipment of this nature considerable importance attaches to the question of power supply, as the electric mains will not always be available, and an alternative source must be provided.



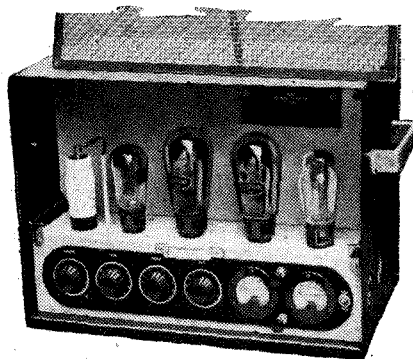
Shaftesbury high-gain amplifier for use with ribbon microphone.

Shaftesbury Microphones have solved this matter in a most ingenious way, their MM/15 amplifier being designed to operate either from AC or DC mains, as well as from a 12-volt car battery. This is achieved by employing 13-volt universal valves and embodying a rotary converter. Though it gives 15 watts undistorted power output, the consumption with battery operation is only $3\frac{1}{2}$ amps. at 12 volts.

This is not its only feature of interest, as the circuit used is a high-gain one, and a ribbon microphone can be employed without the addition of a pre-amplifier. Though it includes a gramophone turntable, the overall size is only 16in. \times 16in. \times 13in.

Another transportable-type amplifier for battery operation is the Ardente Model YB313. It is rated at 10 to 12 watts output and is designed for installing in a car,

the power being drawn from the starter battery, in this case a 6-volt type. In order to effect some economy when not actually operating, yet maintaining the equipment ready for instant use, there is fitted a switch that allows the valves to be kept adequately heated, but reduces the drain on the battery by at least 10 amps.



Sound Sales 14-watt amplifier; model SS14 PA.

Provision is made for use of a carbon, as well as a moving-coil microphone, and also a gramophone pick-up.

Tannoy were showing also a compact portable amplifier, known as the G.U.B.10 Model, contained in a case measuring 16 $\frac{1}{2}$ in. \times 16 $\frac{1}{2}$ in. \times 11in. It is quite self-contained, having a spring gramophone motor, though an electric one could be fitted if required, and provision for battery operation is made by supplying an external converter in a small metal case. Tannoy also had a long range of units in this form, some of which embodied a radio receiving set.

Most of the amplifiers up to 15 watts power output can, of course, be regarded as transportable, if not portable, for they are all of reasonable size, though some are particularly compact, an outstanding example of the small unit being the G.E.C. Model BCS1587. The Grampian range, the Sound Sales models and the units made by Haynes Radio can be included in this category.

These units, whilst quite suitable for PA work, where some six to twelve watts output will give the service required, are, perhaps, better described as general-purpose amplifiers, as their outputs are of the order often used for broadcast reception in the home, for gramophone reproduction, and for home recording. High quality of reproduction has been the aim in designing these new units.

Push-pull output stages are quite commonly used; some makers favour the orthodox transformer coupling, while others employ a phase reversing scheme

APPARATUS
FOR
HIGH-QUALITY
REPRODUCTION

that dispenses with an input transformer to the last stage. One of the Sound Sales models comes in this category, while another is the Duophase amplifier, made by Haynes Radio. In Haynes' amplifiers the required phase reversal is obtained from a centre-tapped choke in the anode circuit of the penultimate stage. Both the 6-watt Model S and the 14-watt Model V embody this system.

Ferranti has designed for the home constructor a high-power amplifier embodying the low-loading principle for the output stage, and this is available in kit form.

The large amplifiers designed for permanent installation such as in hospitals and also for relaying broadcast and



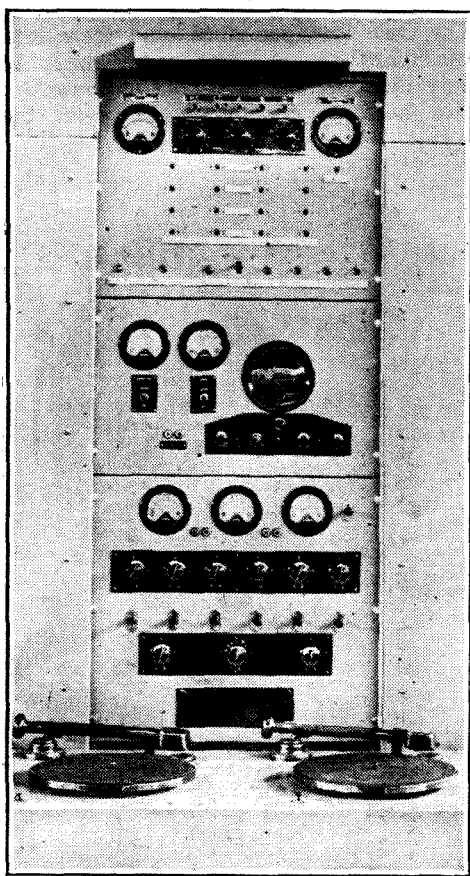
Ardente amplifying equipment embodying superheterodyne radio unit, 20-watt amplifier and a monitoring loud speaker.

gramophone records through a block of flats are, as a rule, built in rack form. A metal frame standing on the floor is em-

Developments in PA Equipment—

employed, and the various units are accommodated on shelves giving easy access to the back for servicing and replacements, with the various controls and meters mounted on panels enclosing the front of each section. The method of construction is often referred to as the P.O. rack system, since it bears a close resemblance to the assembly and layout of a telephone switchboard.

In view of the nature of the service which this style of amplifier has to provide, it generally includes a radio unit and is, in effect, a broadcast receiver followed by an elaborate amplifying system. Examples of these were shown by Ardente, G.E.C., Marconiphone, Prism, and Tannoy, among others. Often dual turntables are fitted with switching and fade-in controls and mixing controls allowing for inputs from radio, gramophone, or microphone to be passed to the output circuits, as desired.



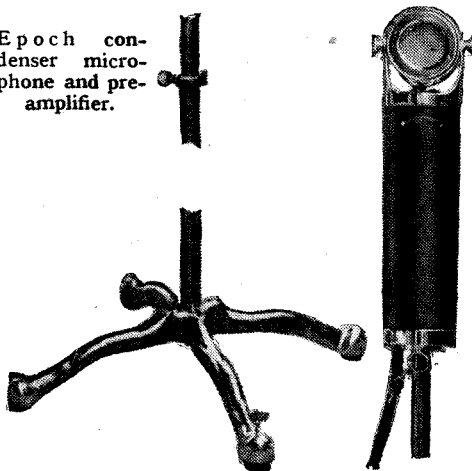
A fine example of a rack-built sound-relaying equipment, comprising radio unit, amplifier and dual turntables; shown by Marconiphone.

Kingsway Electricals were showing also a rack-built amplifier for sound distribution to a network of loud speakers.

A novel, though nevertheless quite practical, application of sound-reproducing apparatus was seen on the Tannoy stand. It consisted of an orthodox piano in which a small moving-coil microphone had been fitted. The idea is being developed primarily for dance bands and concert use, to enable the pianist to play in a normal manner, yet enabling the pianoforte passages to be amplified up to any level.

Provision is also made for the attachment of another microphone, presumably for the vocalist, as both microphones'

Epoch condenser microphone and pre-amplifier.



volume controls were located on the left of the keyboard.

In striving to raise the overall standard of sound reproduction, the microphone has come in for considerable attention. A few years ago the carbon type predominated, and, though it is still popular, many changes and improvements have been effected in its design. The carbon pattern was being shown by Ardente, by the G.E.C., and by Shaftesbury Microphones, which firm's Bio-Tran model is now encased in a neat bakelite moulding obtainable in several different colours, by Sound Sales and by Tannoy. The last mentioned has evolved an exceptionally neat pattern, quite small and housed in a streamline metal case and known as the new "T" type.

A well-made version of the *Wireless World* transverse current microphone was shown by Ealex, by East London Rubber Co., and also by 362 Valves, the makers being Gilbert Industries.

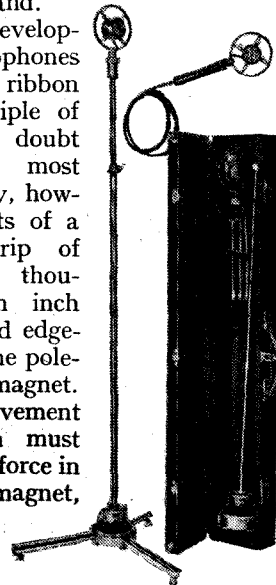
There has been considerable progress made in the development of the moving-coil pattern, with the result that improved

and new models have now become available. Among the firms now making them can be mentioned Epoch, Gramplan, G.E.C., and Whiteley Electrical.

Condenser microphones appear to be in the minority class this year, as only Epoch had one for examination so far as could be ascertained, though it is known that Bulgín also include an inexpensive model among their various components. Piezoelectric, or crystal, microphones, in stand and hand patterns, were to be seen on Rothermel's stand.

The latest development in microphones this year is the ribbon type, the principle of which is no doubt familiar to most readers. Briefly, however, it consists of a very light strip of metal, a few thousandths of an inch thick, suspended edge-wise between the pole-pieces of a magnet. Any slight movement of the ribbon must cut the lines of force in the gap of the magnet,

Tannoy microphone and stand with portable carrying case.



and consequently a voltage is generated and a current flows along the strip when its two ends are joined together. As this voltage is very small, it is usually stepped up by a transformer before being applied to the input terminals of the amplifier.

One great advantage of the ribbon microphone as made for PA and broadcasting use is that it is equally responsive back and front, whereas the carbon and moving-coil patterns are mainly unidirectional. Examples of this new style were shown by Ardente, Gramplan, and Shaftesbury Microphones.

Loud Speakers

THIS year's loud speaker exhibits do not disclose any startling novelty, and this may be taken as an indication that existing designs are satisfying the various purposes for which they were produced.

One finds well-tried units such as the Rola G12, the Celestion "Auditorium," and the Magnavox "Sixty-Six," still in demand. There are several good reasons for the success of these types. In the first place, their diaphragms and magnet systems are big enough to give a true bass response without having to resort to resonances to provide the required balance. Secondly, they are able to deal with any volume which is likely to be required in an ordinary room without approaching diaphragm amplitudes which might intro-

duce harmonic distortion. Thirdly, their high-frequency response is not spoiled by the peaks in the region of 3,000 cycles, which are often a feature of smaller units. Finally, their high-frequency response, while not extending far enough to enhance local interference troubles and heterodyne interference, is yet sufficient to balance the already excellent bass response.

Reception with speakers of this type is not confined to the local station, and they are perhaps better fitted than any other to do justice to the many excellent foreign programmes available, whether these are received direct or as a relay through our own stations. There seems every reason to believe that the design of these general-purpose loud speakers, and we use the term in a complimentary sense, has

Loud Speakers—

reached, or is very closely approaching, finality.

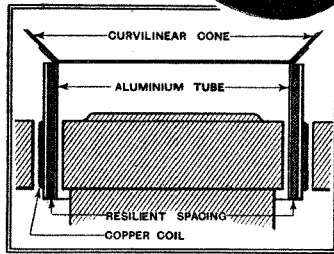
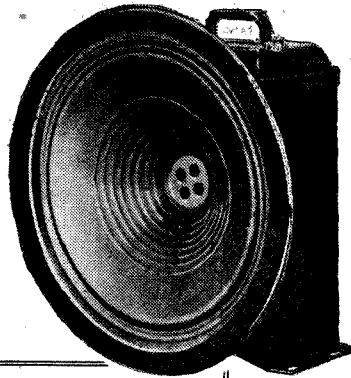
That is not to say that we may anticipate a period of stagnation in loud speaker design, for new demands are constantly arising and new problems are presented by growing sections of the industry—public address, for instance. While really high-quality reproduction must be the luxury of those who are situated close to a B.B.C. station, or, alternatively, being situated at some distance, are happily free from interference troubles, there must be very many thousands who enjoy the necessary signal-to-noise ratio and who can use and insist upon a frequency response up to 10,000 cycles or more. Current loud speaker types designed to fulfil this demand fall naturally into two groups. Those employing the double-voice coil principle and those with twin diaphragms.

Of the former type the Magnavox "Duode," introduced since last year's Show, is a notable example. The main

top, where the inertia of the main diaphragm system would in any case restrict output, the aluminium tube, due to its resilient mounting, is able to vibrate freely and independently under the influence of

junction with the speech coil former is just below that of the high-frequency cone, and the nature of the material ensures that energy is transmitted through this junction to the main diaphragm as a whole at frequencies below the point at which the smaller diaphragm ceases to be an effective radiator. All the mechanical properties involved have been very carefully proportioned, and the resulting overall curve is remarkably uniform. Amplitude distortion is guarded against by making the voice coil long compared with the gap, and the use of exponential cones for both high and low frequencies prevents the production of sub-harmonics which often give rise to harshness at high volume levels.

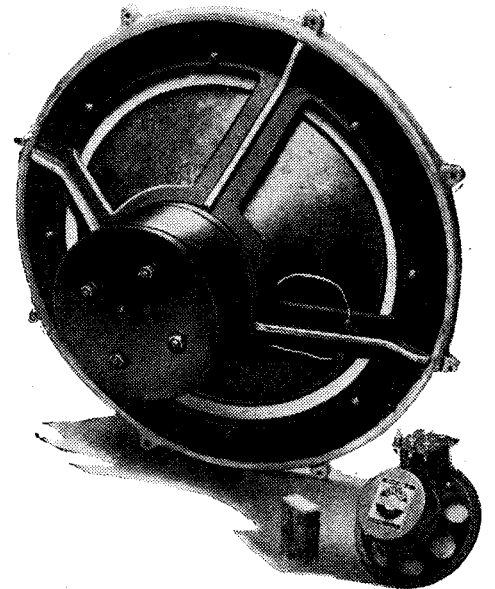
This year's Show has seen a big increase of activity among firms manufacturing public-address equipment, and many new speakers have been developed to handle the large power outputs provided by PA amplifiers. The Celestion "Auditorium" loud speaker, for instance, is now available with a diaphragm of 18in. diameter. The cone is exponential, and there is a subsidiary spherical diaphragm which not only increases the high-note response but also excludes foreign matter from the



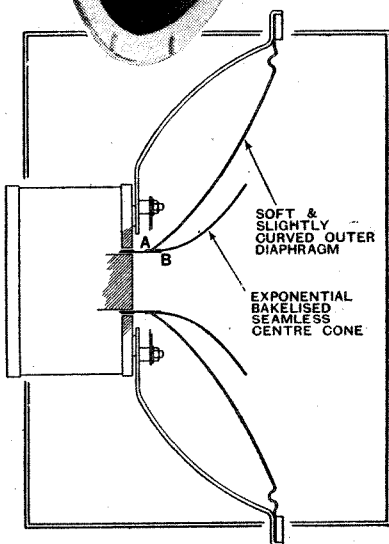
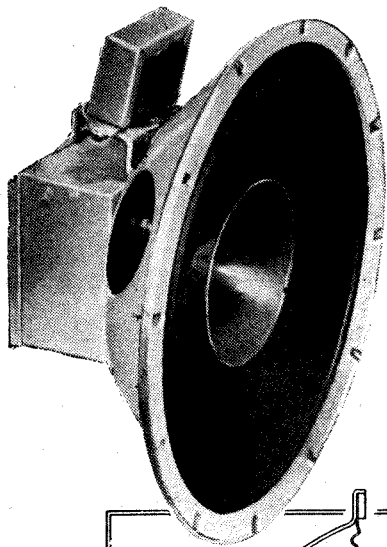
An auxiliary aluminium ring is the active element at high frequencies in the Magnavox "Duode."

eddy currents, and, in conjunction with portions of the diaphragm near the apex, radiates energy at the same level as the output in the middle and lower registers. A further advantage of this method of construction is that at low frequencies the aluminium ring acts as an excellent damping device in conjunction with the steady flux in the air gap.

A high flux density is essential to the success of any high-fidelity reproducer, and the permanent magnets used in the Goodman's "Auditorium" loud speakers are of exceptionally high performance. These speakers are representative of the twin-diaphragm method of maintaining response to the upper limit of audibility. Both diaphragms are of the exponential type, and the small centre cone is a very light and rigid one-piece moulding of bakelised paper. It is rigidly cemented to an extension of the speech coil former, and is so designed that even at the highest frequencies the force due to the moving coil is transmitted equally by all parts of the assembly. The main cone, on the other hand, is of a softer material, and the periphery is freely corrugated to permit the development of large amplitudes. The



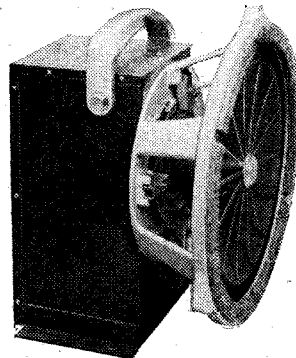
A permanent magnet loud speaker for PA work, the Epoch "Super Cinema PM" compared with the 5in. Dwarf from the same range.



Twin exponential cones are used in the Goodmans' High Fidelity Auditorium PM speakers. The junction A of the main diaphragm is resilient by comparison with B, the bakelised centre cone joint.

voice coil, instead of being attached rigidly to the diaphragm, is wound over a thin aluminium tube with a spacing of resilient material. At low frequencies the drive is transmitted to the diaphragm with negligible mechanical loss, but at the extreme

Great freedom of suspension and ample clearances are provided in the Sound Sales "Dual Suspension" loud speaker to ensure reliability under the conditions of working met with in PA work.



centre pole piece. The back of the diaphragm carries a corrugated centring device which completely seals the gap at the rear. Most units of this type are designed for excitation from mains supplies, but the Radio Development Co., Ltd., have succeeded in producing a permanent magnet model, the Epoch "Super Cinema PM" with a comparable performance. It handles 30 watts without distress, and the accompanying photograph gives some idea of its generous proportions.

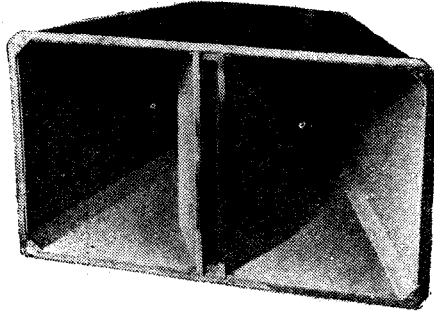
A PA loud speaker must be capable of standing up to prolonged hard work without mechanical breakdown, and a good deal of thought has been given to this aspect of the design in the Sound Sales "Dual Suspension" unit. The speech

Loud Speakers--

coil is centred by a large-diameter rear suspension, and the periphery of the cone is held by a series of radial strips of non-resonant material. The movement is extremely free, and any possibility of the speech coil fouling the pole-pieces is entirely eliminated by the parallel action of the diaphragm under the dual control.

Damage to the loud speaker is much less liable to occur when it is used in conjunction with a horn, and for outdoor work at least loud speakers of this type are now generally employed. Unfortunately, they are often somewhat cumbersome and difficult to transport, but this disadvantage has been overcome in the Grampian "Jekta" diffuser in which the adoption of the re-entrant air column system has re-

sulted in an extraordinarily compact and efficient reproducer.



Grampian "Jekta" diffuser in which the re-entrant horn principle has been adopted to maintain a wide frequency response with compact overall dimensions.

demonstration under conditions where the observer has to be kept at some distance it is natural that the last centimetre of available space should be filled; in private use the receiver would normally be adjusted for a slightly smaller picture which could be viewed from a lesser distance.

There is a slight flicker, to which some people appear to be more sensitive than others; the writer hardly noticed it, and certainly found it no barrier to enjoyment of the picture.

Technical Achievement

In general, the demonstration leaves one with the feeling that the technicians have done their part nobly, and that the success of television as an entertainment now depends almost entirely on finding for transmission material that will adequately maintain the interest of the "looker-in" after the first thrill of novelty has worn off.

The exhibits of the B.B.C. consist chiefly of two stands opposite the Addison Road entrance. At these are shown the various B.B.C. publications. A series of figures, boldly displayed, shows the year-by-year growth of licences from 580,000 in 1923 to the present number of nearly 7½ millions. A number of globes show the parts of the world reached by each of the six wavelengths used for Empire transmissions.

An interesting exhibit is the original Savoy Hill dramatic control panel; it is very crude compared with the modern panel shown in a photograph alongside it. There is a schematic diagram of the modern control panel, showing how the output from ten studios, in two groups of five; can be manipulated to build up a single performance.

Visitors Make Records

Machines that produce a small record of one's own voice are to be found opposite the television demonstration. These records, which play for well over half a minute, are cut on aluminium and can be played repeatedly with a wooden needle. If desired, they can be heard on the spot, for the machine incorporates a small reproducer feeding a pair of telephones.

An interesting demonstration is that of the Radio Interference Bureau, which is run by the R.M.A. in collaboration with the General Post Office, the B.B.C., and the Electrical Research Association. It deals primarily with methods of suppressing, at the source, noise of all kinds likely to interfere with wireless reception. Details are given, for example, of the methods used for the suppression of the disturbances that can be caused by trolley buses, which were at one time a source of great annoyance to listeners. There is a demonstration of the short-wave interference caused by motor cars, and the effectiveness of various types of suppressors connected in the sparking-plug leads can actually be measured at the stand. Part of the stand is devoted to an exhibition of commercially available interference suppressors of all types, including a model of the Belling-Lee "Eliminoise" aerial system. Official Post Office tests on the disturbance caused by vacuum cleaners and other household devices are shown in progress.

And finally, most valuable of all to listeners, a number of members of the Post Office engineering staff are always on duty to give advice and to supply informative literature and help to those who suffer from interference, however caused.

The Sideshows at Olympia

Popularity of the Television Demonstrations

OF the non-commercial exhibits intended for the instruction and entertainment of visitors to Olympia the television demonstration is undoubtedly the most important. Certainly it is the most popular, as the queues waiting for an hour or more before each demonstration eloquently attest.

When one's turn comes to enter the darkened booth in which the pictures can be seen there is a choice between turning to right or left. On either side several television receivers by different makers are in operation, but unless one is "in the know," or under the guidance of a friend able and willing to divulge State secrets, it is not possible to discover which receiver is which, since all but the screens on which the pictures appear are completely covered by curtains.

A barrier debars one from approaching nearer than ten or twelve feet from the screens, but since this would appear to be the nearest point from which the pictures may be examined while yet remaining critically sharp in outline, nothing is lost by being kept a little way from the screen. At the distance of viewing the height of the picture, which is rather less than the width, covers a length of about two inches on a ruler held at arm's length. The apparent size of the image, therefore, is about that of a photograph seven inches by five viewed at a distance of about five feet, and corresponds roughly with the apparent size of a cinematograph picture seen from the back row of a rather unusually long cinema. The detail to be seen on the television screen does not fall below that expected of a sharp photograph or projected picture viewed at these distances.

Television Entertainment

The clarity of the pictures seen quite definitely showed that provided the material transmitted is sufficiently interesting to hold the attention, television as at present offered is quite near enough to perfection to offer very considerable entertainment value. An announcer was "televised" by the spotlight system while he told us what the next item on the programme was to be, and though his

face by no means filled the screen the writer is perfectly confident that he could pick him out at once in a crowded room.

Faults of course there were, but none were serious enough to detract from the picture. Interference caused flashes and splashes of light on the screen, cutting across the picture in horizontal lines that lasted only for a fraction of a second. In a place less infested than Olympia with electrical apparatus this particular trouble might be expected to be absent if suitable precautions against it were taken, though it is probable that the ignition systems of motor cars might cause interference in a receiver located right on a main road.

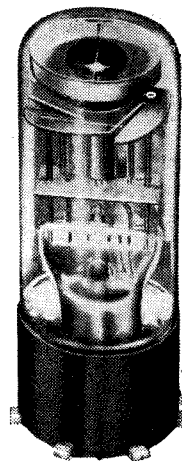
An occasional invasion of the picture-space by the synchronising signal is a fault that will probably be cured long before these words are read. On written announcements (film captions, for example) slight distortion was noticeable, though its amount varied from receiver to receiver. It appeared to be due to reproducing the picture on a scale slightly too large for the cathode-ray tube to accommodate comfortably. At a public



A picture that tells its own story

Latest Electronic Developments

THE NEW VALVES AND CATHODE-RAY TUBES

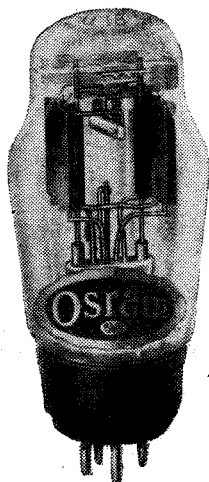


The Mullard TV4 cathode-ray tuning indicator.

ALTHOUGH many new valves were shown at Olympia few demand any alteration in circuit technique. The triode-hexode is established as a frequency-changer for short-wave and all-wave sets and is now marketed by Cossor, Marconi and Osram, Mazda, and Mullard in mains types. It has, however, by no means displaced the heptode and octode, particularly in the range of battery valves, largely because it consumes rather more current from the HT supply.



The Osram H42 triode with top-grid connector.



The Osram U18 rectifier.

The HF pentode seems now finally to have ousted the screened tetrode as an HF or IF amplifier, largely because of its higher AC resistance, but partly because of the absence of a negative resistance kink in its characteristic. Changes are creeping into this class of valve, however, and there is a general tendency towards connecting the control grid to the top-cap and the anode to a base-pin instead of *vice versa*. This has the advantage of making the HT wiring less accessible and it will no longer be possible to get a shock through accidentally coming into contact with the top-cap of a valve. A further advantage resulting from the change is a reduction of the input capacity, and this is especially helpful in designing short-wave apparatus.

The "top-grid" connection is also finding its way into triodes. AC/DC types have long had this arrangement and a 7-

pin base; an AC model, the Marconi and Osram H42, has now made its appearance, however. The advantage of the top-grid in the case of a triode is the greater freedom from hum pick-up and the lower grid-anode capacity. This arrangement is adopted by Osram for the N43 output pentode with the particular object of keeping the grid-anode capacity at a minimum. This is especially important in the case of a valve designed for use in television apparatus, as this one is. The pentode, of course, normally has a much lower grid-anode capacity than the triode, for the space-charge and suppressor grids exercise some screening effect, but the capacity can be considerably reduced by bringing the grid connection out at the top of the bulb instead of to the base with all the other connections.

The N43 is an output-type pentode similar to the well-known N41, but it is by no means the only valve designed for television receivers. Both Osram and Mullard have special HF pentodes which are characterised by considerably higher mutual conductances than ordinary types. The Mullard TSP4, for instance, has a mutual conductance of about 4 mA/V under normal operating conditions, but at the expense of anode current consumption it is quite possible to operate it with a mutual conductance of no less than 6.0 mA/V. The total current is then about 20mA. Valves such as these are hardly

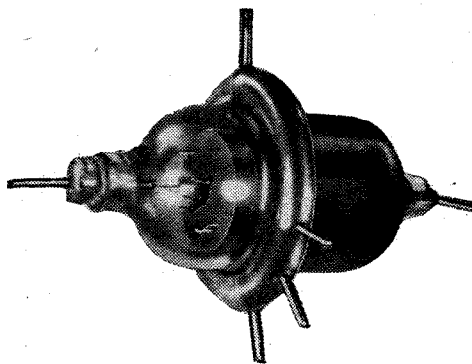
stage which it is not difficult to reach in sound receivers with ordinary screened valves. Television amplifiers, however, can give only a low gain per stage because of the extraordinarily large band of frequencies which they must pass. There is little or no danger of instability, and a high mutual conductance in the valves is essential if the necessary gain is to be secured with no more than four or five IF stages.

Special Ultra-Short-wave Valves

The new valves which are of special interest from the experimenter's point of view are the Acorns of Mullard and Osram. They are of minute dimensions, are indirectly heated, and have characteristics similar to their larger counterparts save for two things. These are, first, the interelectrode capacities are smaller, and secondly, and just as important, because of their small dimensions the electrons from the cathode reach the anode more quickly—in other words, the transit time of the electron is less. This is very important in ultra-high frequency working, because when the transit time of the electron becomes comparable with that of one cycle of the operating frequency the input impedance of the valve becomes quite low.

It is this factor which largely limits the gain possible at very high frequencies, and it is possible to obtain good results at much higher frequencies with Acorns than with ordinary valves. At the present time, the latter are satisfactory for wavelengths down to about 5 to 6 metres, and the Acorn seems to offer little advantage. At shorter wavelengths, however, the Acorn comes into its own and the lower limit of some of the present specimens is as low as 0.7 metre (430 Mc/s). Such wavelengths are, of course, at present of purely experimental interest, and are not yet used even for television purposes.

Besides stimulating the development of special valves television has to an even greater extent hastened the growth of the cathode-ray tube and many firms had on view large diameter tubes designed for high-definition television reception. Cossor, Ediswan, and Mullard all make tubes of about 12in. diameter. Uniformity does not yet exist in the heater ratings, some specimens requiring 2 volts and others 4



Mullard Acorn HF pentode.

suitable for normal purposes, for it would be very difficult to make use of their high mutual conductance without meeting very serious difficulty from instability. There is a limit to the possible stable gain per

Latest Electronic Developments—

volts, but most need an anode potential of from 4,000 to 6,000 volts in addition to several other lower voltages for other electrodes.

Fortunately, the current consumption of a cathode-ray tube is extremely small, for this permits the HT supply unit to be reasonably economical. Special rectifiers are needed, of course, and most firms make a half-wave rectifier with a "top-anode" for use in the mains equipment, and its cost is little, if any, more than that of the conventional rectifier used in sound equipment. In this last apparatus the use of increasingly large output stages has created a demand for a rectifier having a larger output than the usual 120 mA, a demand which is now met by the Marconi and Osram U18, which is rated for an output of about 500 volts at no less than 250 mA. In addition, the mercury vapour range of rectifiers has been extended by a specimen, the GU5, having an output of 1,000 volts at 0.5 ampere.

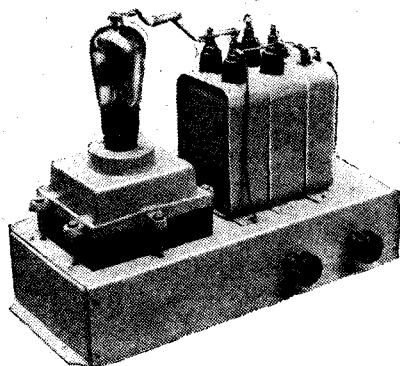
Electronic devices now find wide application in fields other than those of wireless and television. Perhaps the deaf-aid is the one which occurs to the mind most readily, and special midget valves of remarkably small dimensions are marketed by Hivac and Mullard. Gas-filled triodes find application in industry, as well as television, and both the Osram gas-filled relays and the Mazda Thyratrons were to be seen at Olympia, while the cathode-ray tube in types of great use in measurement and laboratory work was shown by Cossor, Ediswan and Mullard.

Gas-focused tubes of high deflection sensitivity are extremely useful for low-

frequency work and have the advantage of operating from comparatively low voltages. For high-frequency work, of course, vacuum tubes become essential and require rather higher voltages. In general, their sensitivity is lower, but in many of the laboratory types it is considerably higher than in the large tubes which are so necessary for television.

CATHODE-RAY EQUIPMENT

THE increasing use of the cathode-ray tube for both laboratory and television purposes demands rather special associated apparatus. The tube in general demands much higher voltages for its operation than are customary in other apparatus, and this entails a special construction if the gear is to be free from breakdown and safe to operate. Fortunately, the current taken by the CR tube is



Haynes Radio high-voltage unit for cathode-ray tubes.

extremely small, so that these special precautions can be observed and the equipment yet remain of reasonable dimensions and cost. The maximum voltage required by the largest tube at the present time is of the order of 5,000 volts, but the current is to be measured in microamperes.

High voltage units suitable for supplying cathode-ray tubes were shown by Haynes Radio and have outputs up to 5,000 volts, while provision is made for varying the maximum output and for variable voltages for the other electrodes. Particular attention is paid in the design to insulating the high voltage circuits.

Television work with cathode-ray tubes also demands time-bases delivering outputs of as much as 1,000 volts with a saw-tooth wave form. This firm is also marketing a double time-base unit with such a maximum output. Gas-filled triodes of the argon type are used as the oscillators, and although one is of low frequency for the frame scanning-voltages and the other of high frequency for the line scanning, both are adjustable by means of variable resistances, and the range of control provided is adequate to cover the requirements of reception of both the Baird and the Marconi-E.M.I. transmissions of television.

Each oscillator is provided with its own output stage, which consists of a pair of triodes operating in push-pull, the push-pull connection enabling a saving in the HT voltage to be effected and also avoiding trapezium distortion in the raster. The unit contains its own mains equipment so that it is completely self-contained. It is priced at £24, and the high voltage unit costs £9 10s.

The Institute of Wireless Technology

THE Rt. Hon. Lord Gainford and Lord Hirst of Witton have become patrons of the Institute of Wireless Technology.

Turkish Loud Speaker Curfew

DURING the past few weeks several instances have occurred in which county councils have passed by-laws against loud-speaker nuisance. It appears that the nuisance has now spread as far as Turkey, since a rigorous ban has been imposed in Ankhara, the capital, against the use of wireless sets after 11 p.m. unless all the windows are shut.

Midget Loud Speaker

WE have had midget receivers with us for a long time now, but it has remained for the Leipzig Fair to produce the first miniature extension loud speaker. It measures 6½ in. x 4½ in. x 2½ in., and is primarily intended for the nursery. Owing to this latter fact it is got up to represent a miniature receiver and is complete with dummy illuminated dial.

NOTES AND NEWS

Car Radio Figures

WE have often been told of the vast popularity of car radio in the U.S.A., even to the extent of the assertion that eight out of every ten cars are fitted with it. At last there are some actual figures available, and it appears that less than two out of every ten cars possesses a built-in wireless set, the actual figure being 14.3 per cent.

Special Chair for the Deaf

ONE of the less conventional of the exhibits at Olympia, which closes its door at 10 p.m. to-morrow night, is the special radio chair for the deaf. Reproducers are carefully arranged in the back of the chair so that a partially deaf person can hear the programme comfortably by leaning back. It is also useful to persons with normal hearing who do not wish to annoy other people by switching on the loud speaker, but at the same time do not wish to be inconvenienced by headphones. This chair has been designed by Mr. J. Poliakoff, of

the Multitone Electric Co., which specialises in hearing aids for the deaf.

Snowdon Five-metre Tests

MR. H. L. O'HEFFERMAN, G5BY, informs us that on Sunday, August 23rd last, he erected a portable station south of Strumble Head, in Pembrokeshire, and was in two-way telephonic communication with G6YQ on Mount Snowdon. G5BY'S signals were reported as R9+ on Snowdon, while G6YQ was readable twenty feet from the headphones. The distance was about 87 miles. G5BY also reports hearing G6AA (portable) on Holyhead mountain at about 96 miles, but did not succeed in working with him. G6YQ informed G5BY that he had worked G6IA in the Isle of Man, G2OI (portable) at Bury, Lancs, and EI8G, near Dublin.

The information was also received that G5BY was heard by G6IA on 'phone at R6 at about 160 miles.

G5BY used an 8-watt trans-

mitter and a three-section Franklin aerial backed by reflectors and suspended from a 30-ft. mast.

Budapest Exhibition

THE habit of holding a yearly wireless show is gradually spreading over the whole of Europe. Yesterday the Hungarian Exhibition at Budapest was opened. One would have thought that, with their love of music, broadcast listening would have been exceedingly popular among the Magyars, but evidently this is not so since only 350,000 people—equal to 4½ per cent. of the population—are licence-holders. It is hoped, therefore, that this exhibition will do much to change this state of affairs. No television receivers are shown, but many receivers tune down to 6.5 metres, and will be capable of receiving the sonic side of the proposed Budapest television transmissions. Receivers of the simpler type are cheap, and some dealers are seeking to win customers by issuing a free licence with every set, thus bringing the actual price for a two-valve receiver down to the equivalent of 24s.

Recent Inventions

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

RECEIVING BOTH SHORT AND MEDIUM WAVES

A RECEIVER designed to handle both medium and short waves, carrying, say, television pictures and associated sound, picks up both signals on a composite aerial. The short-wave aerial is a dipole which is coupled to its input valve through a feed-line which is surrounded for part of its length by an outer screening-tube. For the short waves the outer tube is effectively earthed through a series resonant circuit, though the medium waves build up along it, and are fed to a second input valve.

E. C. Cork, A. D. Blumlein, and E. L. C. White. Application date August 17th, 1934. No. 445968.

BAND-PASS COUPLINGS

A TRANSFORMER coupling is designed to give even transmission over a wide band of frequencies, of the order of those used in television. For this purpose both the primary and secondary coils are so wound that their natural or inherent frequency lies outside the limits of the signal frequencies. Preferably the natural frequency of the primary coil is higher than the highest, and the secondary lower than the lowest margin of the band of frequencies to be handled. This is ensured by inserting suitable resistances in series or in shunt with each of the windings.

Radio Akt. D. S. Loewe. Convention date (Germany) October 27th, 1933. No. 446346.

ELIMINATING STATIC

TO prevent the passage of static disturbances, the tuned input circuit includes a valve V, which is triggered by the high voltage of

the disturbing impulse to produce a momentary discharge, which is applied to block one of the LF stages V and so open-circuit the loud speaker. This prevents either signal or disturbance from being heard, but since the cut-off time is very short it does not affect the apparent continuity of the signals.

The action of the blocking discharge is momentary and clear-cut, normal conditions being restored immediately afterwards. A rectifier R is inserted in the cut-off line to prevent the passage of any transitory back EMF, which would tend to throw the grids of the push-pull valves V positive, at the end of each blocking period.

Ideal Werke Akt. fur drahtlose Telephonie. Convention date (Germany) December 15th, 1934. No. 446634.

SCANNING SYSTEMS

IN order to eliminate "flicker," two or more glow-lamps are spaced around the scanning disc at the receiving end, and are fed with the incoming signal through "delay" circuits which compensate for their different positions. Each lamp produces one complete picture per rotation of the scanning disc, but the pictures are so superposed that they present only a single image to the eye. In effect the picture is illuminated in a number of different places at once, and any flicker then occurs so rapidly that it does not affect the eye.

T. A. Smith (assignor to Radio Corporation of America). No. 2029395. (U.S.A.)

CATHODE-RAY TUBES

THE tube is of double-conical shape with the fluorescent screen at the middle, or widest,

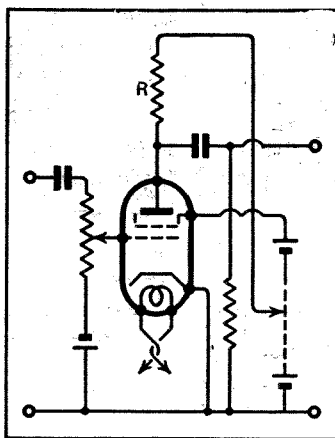
part, and a "gun" assembly of electrodes at each end. The screen is made of an elastic substance, such as mica, which can be rolled up for insertion from either end of the tube, and then expands into place at the middle of the tube.

Such a tube is used for interlaced scanning, by the separate electron streams from the two end "guns." Or the two series of scanning lines can be accurately superposed to produce a brighter picture.

Ferranti, Ltd., and M. K. Taylor. Application date September 6th, 1934. No. 445464.

RECTIFIER CIRCUITS

A VALVE is arranged to give substantially rectilinear rectification without causing any damping effect upon the tuned input



Detector stage giving minimum damping on tuned circuit.

circuit. As shown in the figure, the valve is of the screen-grid type, and is operated with a sufficiently high bias on the screen-grid to cause secondary emission and so to produce a negative-

resistance effect. The anode resistance R of 20,000 ohms is tapped to the HT battery so as to give an effective voltage on the anode of from 50 to 130 volts. The screen-grid is maintained at 150 volts.

When the applied signal voltage throws the control grid negative, the cathode emission is materially reduced, and this, in the ordinary way, makes it impossible to keep on the straight part of the characteristic curve. But as the secondary emission is now much less, the anode current falls, and with it the anode voltage. The secondary electrons all return to the anode, forming a reverse current, which keeps the characteristic curve flat, even though the control grid is maintained sufficiently negative to avoid the flow of any grid-current. The latter condition prevents any damping effect on the tuned input circuit.

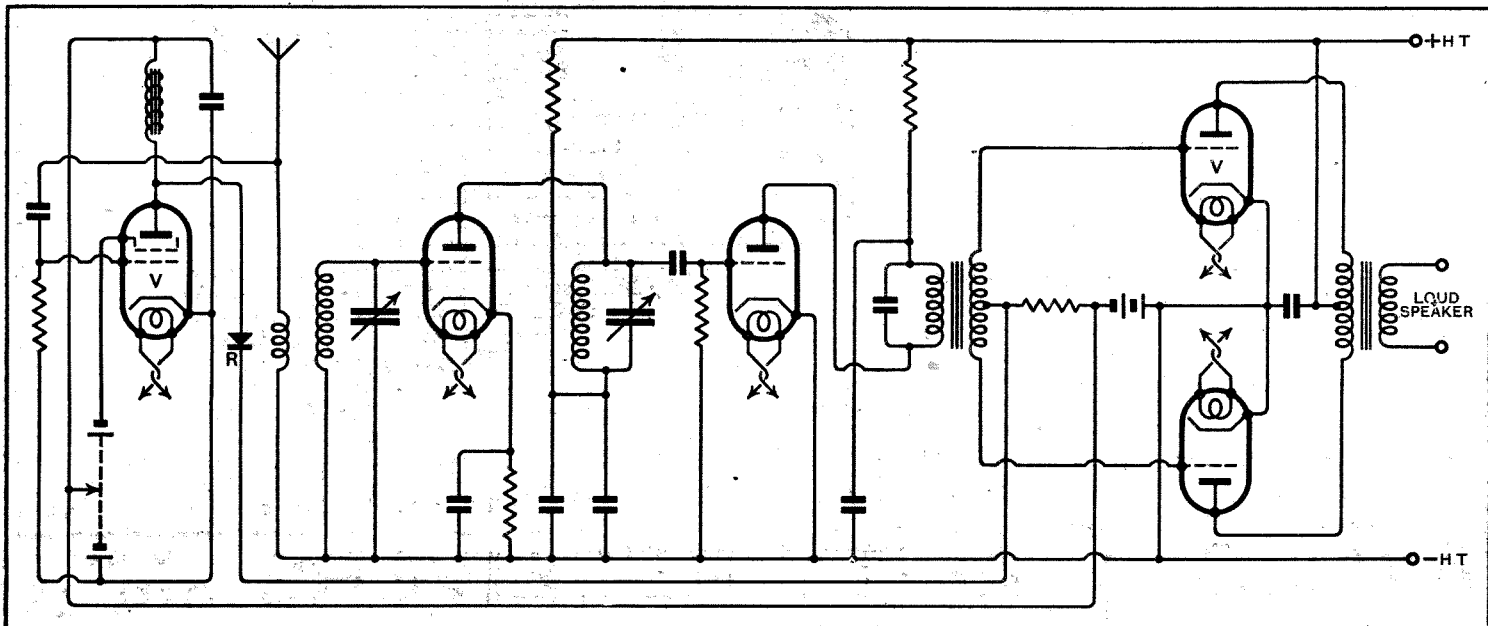
D. C. Burkinshaw. Application date October 30th, 1934. No. 446671.

DIRECTIONAL WIRELESS

FOR short-wave working it is quite common to use metal mirrors or reflectors to concentrate the waves into a parallel beam. But in practice, when such a mirror is used with a single dipole aerial, the arrangement is found to be inefficient since the comparatively large size of the waves relative to the mirror prevents the formation of a clearly defined focal point.

Accordingly the single dipole is replaced by several dipoles arranged in a row, so that together they cover the whole of the "diffused" focal area, and receive a larger fraction of the total reflected energy.

Telefunken ges fur drahtlose Telegraphie m.b.h. Convention date (Germany) September 3rd, 1934. No. 446619.



Method of suppressing static disturbances.

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

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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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EDITORIAL COMMENT

Television

Problems of the Future

IT may seem out of place at a time when the first high-definition transmissions of television have only just come into being and when these are for the present only of an experimental nature, to start to worry about problems of the future which television may hold in store for us. But no one who is watching developments can fail to recognise that there are problems to be confronted, perhaps in the not-far-distant future, the magnitude of which will depend to a considerable extent on how far they can be anticipated and preparation made in the early stages to meet them when they come.

The comments of a visitor from abroad may be expected to be pertinent, because his mind is not entangled with political and other influences which affect development of television in this country for the very good reason that he is not aware of them. "Why," we were asked, "are there two systems? Could not your Government have arranged that there should be only one system, making use of the best points in the competing systems so that receivers could be designed for one type of reception only?" And a second question was, "How are you going to justify continuing transmission with expensive programmes if your Government or the B.B.C. does not know if there are enough people using sets to make it worth while?"

Why Two Systems ?

Let us consider first of all the question of why television should not be put out on one system only. Our answer can be found by reference to the report of the Television Committee, which readers will remember was issued in January, 1935. In that Report the Committee said that the ideal solution, if it were feasible, would be that as a preliminary to the establishment of a public service a Patent Pool should be formed into which all television

patents should be placed, the operating authority (this would be the B.B.C.) being free to select from this Pool whatever patents it desired to use for transmission.

Later the Committee stated that they had seriously considered whether they should advise the Postmaster-General to refuse to authorise the establishment of a public service until such a Patent Pool had been formed.

It was because the companies owning the separate systems could not be induced to come together that we now have two types of transmission with, we suppose, the possibility of still others now that the precedent of allowing more than one type has been established.

More Systems in View ?

If rivalry between different transmitting systems, present and future, continues, is it the intention of the Postmaster-General to permit this indefinitely, or will the public be asked to vote for the best system with the idea of adopting it for the future?

We can only hope that it will not come to this, but that the pooling of patents will be effected before that time, on a basis which will be satisfactory to all concerned and enable one type of transmission to be put out whilst giving every contributing party a fair and proper share by way of reward for invention and development work already achieved.

The second question was also anticipated in the Television Committee's Report where we find a recommendation worded as follows: "We hope that it may be possible to negotiate an arrangement with the trade, whereby periodical returns may be made of the total number of television sets sold in each town or district, since this would provide some measure of the growth of the demand."

We hope that the need for keeping this record will be recognised at the outset, as it will prove extremely important as time goes on to know to what extent the service is being supported, and this record should be made public.

PHONES

MODERN TYPES

FOR QUALITY

BROADCAST RECEPTION



neighbours. If the demand grows to the point where a large number of firms are tempted to add quality earphones to their list of products, it is to be hoped that they will make a serious study of the problems involved, as a movement which must inevitably do much to mitigate the loud speaker nuisance might otherwise be nipped in the bud.

With experience of moving-coil cone loud speaker construction at their fingertips many firms will no doubt wish to

AFTER a long period of neglect the earphone appears to be gaining in favour as an alternative to the loud speaker for high-quality reception. This article discusses the fundamental differences between the two types of reproducer and gives details of some recent earphone designs

THE landslide from earphones to the loud speaker which took place shortly after the establishment of broadcasting as a social service had its origin not so much in any technical deficiency in the phones themselves as in the change in outlook of the listener. From an essentially individualistic pursuit, listening became the concern of the whole family, and the installation of a loud speaker was reluctantly accepted by the pioneering amateur as a necessity. The early loud speakers, however, were so bad that for many years those who wanted the best quality available still put their faith in earphone reception, preferably in conjunction with crystal detection.

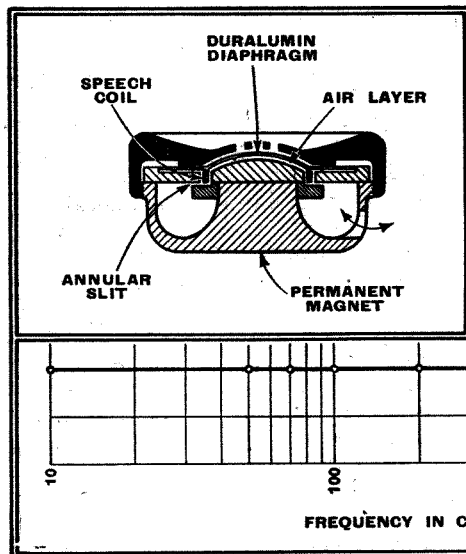
Since that time the loud speaker has improved out of recognition, and the earphone has become the Cinderella among electro-acoustic devices. In certain spheres, it is true, the loud speaker has never seriously challenged the earphone, and in all work requiring concentrated listening, such as long-distance short-wave communications, aircraft installations and alternating bridge work in the laboratory, the earphone still holds its own. For this work, however, a high standard of linearity in the acoustic response is not necessary. In fact, for some purposes it is definitely an advantage to have the phones tuned to one particular frequency.

Among thoughtful amateurs, however, there has always been a demand that the earphone should be given a fair trial from the point of view of high-quality reception of broadcasting, and there are now signs that something is being done to cater for this demand. There must be many people living in flats who would welcome a mode of listening which gives quality comparable with the best loud speakers, and yet is not a source of annoyance to

construct their earphones on this principle, and, while there is no reason why this should not be done, there are fundamental differences between earphone and loud speaker reception which should be clearly understood.

Air Leakage

In the first place, the loud speaker is faced with the task of radiating self-propagating waves in free air, whereas the earphone has to create a pressure variation in a confined volume of air. It is obvious



Cross-section and response curve of the Wente and Thuras high-quality earpiece.

that any leakage in this volume must affect the frequency response. This leakage may take place at two points: at the contact between the phone and the ear, and between back and front of the diaphragm, if the normal loud speaker form of construction is adopted. In general, the latter form of leakage can be neglected if the air gap is small, as it must

be if efficiency is to be maintained with the reduced size of permanent magnets necessary in order to keep the weight down. Alternatively, this air gap may be turned to useful purpose in controlling the motion of the diaphragm, as a gap of this form possesses two useful properties, namely, acoustic resistance and reactance.

The leakage between the earphone and the ear itself is not so easy to control, and for successful operation the only safe course is to ensure that it will not exist at all.

Diaphragm Amplitude

The second fundamental difference between the loud speaker and the earphone is in the type of constancy of vibration required to maintain equal sound pressure throughout the full range of audible frequencies. It is well known that the amplitude of oscillation of a loud speaker diaphragm increases as the frequency falls, and on heavy bass passages the movement of the diaphragm is easily visible. At the high frequencies, on the other hand, a microscope would be required to disclose any movement of the diaphragm. The reason for this is that the condition for uniform radiation from a loud speaker requires the maintenance of uniform velocity of motion, by which is meant the speed at which the diaphragm passes through the mean position during the course of its vibration. To satisfy this condition at low frequencies the displacement from the mean position—that

is to say, the amplitude—must be increased proportionally.

In the earphone, on the other hand, it is found that for uniform pressure in the confined air space constant amplitude is required, so that the maximum velocity of the diaphragm, instead of remaining constant as in the loud speaker, decreases as the frequency falls. In loud speaker

Phones—

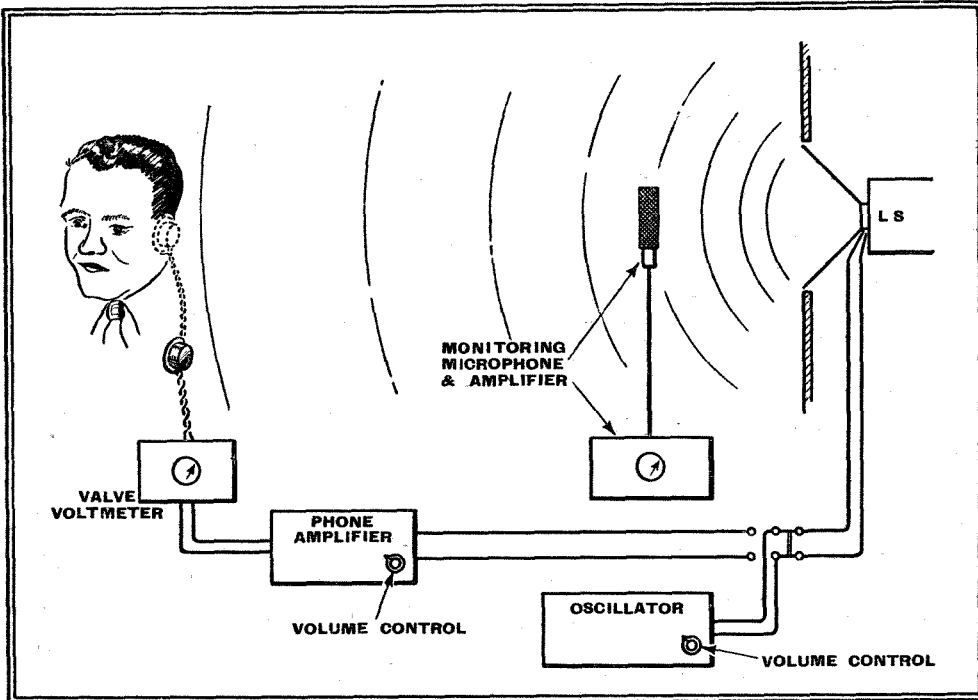
design the attainment of the required increase of amplitude towards the extreme bass is materially helped by arranging that the fundamental resonance of the diaphragm system falls low down in the scale, if possible below the lowest fre-

piece. Any microphone measurements must, therefore, be made in conjunction with an artificial ear of standardised design based on the average of a large number of persons. Alternatively, the effect of the ear may be left for subsequent correction and a curve prepared of the per-

method are worthy of incorporation in a curve, however, long experience is required, and it would be advisable to average the results of as many observers as possible. It is easy enough to estimate the sound to within 2 db. in the middle register, but at the ends of the musical scale it is much more difficult, and the ear soon tires of the effort to form a judgment. In tests of this nature it is advisable to take frequent rests and to come back fresh to the task.

Current Types

Judged by subjective frequency tests along these lines and also under normal listening conditions, the examples of modern earphone design at present on the market show very promising results—even the moving-iron diaphragm type are a vast improvement on their predecessors of ten years ago. Iron diaphragm phones are, in fact, still widely used for monitoring purposes in transmitting stations. The chief characteristic of the old iron diaphragm phones was a colossal peak to about 1,000 cycles and very little else, but in the modern type this peak appears to be very little more than 10 db. above the average level, and there is often a peak at about 5 or 6 db. round about 250 cycles which helps to fill out the response towards the bass. There is quite a useful output at 50 cycles, and in spite of what the textbooks say it is of much purer quality than the majority of moving-coil loud speakers as used in sets. The high-frequency response, on the other hand, is not so good, and above 2,000 or 3,000 cycles there is a sharp cut-off.



Schematic diagram illustrating the subjective method of testing earphones.

quency it is required to reproduce. In the case of earphones, however, constant amplitude is more easily obtained if the resonant frequency is placed above the highest frequency to be received.

The Moving-coil Earphone

One example of how these requirements have been achieved in practice is provided by the Western Electric receiver designed by Wentz and Thuras. Here a light "spherical" diaphragm of duralumin is employed, and the restoring forces are supplied by the stiffness of the flexible surround and by a very thin layer of air between the diaphragm and the centre pole-piece. As the diaphragm vibrates, air is in circulation through an annular slit between the back of the diaphragm and the hollow magnet which is opened to the air. This provides a control both of resonance and damping. All the acoustic quantities involved have been translated into electrical equivalents, and the resulting circuit has been solved mathematically to give the best possible constancy of amplitude. It will be seen that the divergence from linearity between 10 and 9,000 cycles is nowhere greater than at 5 db., and that, apart from the dip at 4,000 cycles, the observed curve is better than that predicted by calculation.

The testing of earphones presents even greater difficulties than those associated with quantitative measurements on loud speakers. As the room in which it is used modifies the output from a loud speaker, so the shape and volume of the ear cavity affects the response of the telephone ear-

formance of the earpiece alone. The curve of the Western Electric unit was taken by means of a condenser microphone clamped to the earpiece and enclosing a volume of about 15 c.c. In order to eliminate disturbances due to the natural resonance of the cavity, a hydrogen atmosphere was used instead of air, so that the response curve really refers to the earphone alone.

For finding how an earphone is likely to behave under normal reception conditions the subjective method of test is probably best, though its success depends entirely upon the skill and experience of the observer. A continuously variable oscillator is required, and the output from this is switched first to a loud speaker, which is adjusted to give a predetermined level of sound output. This is monitored by a microphone, and the input to the loud speaker adjusted for each frequency until the same intensity of sound is measured by the microphone. The earphone is supplied from the same oscillator and provided with a separate volume control and voltmeter, the volume control being adjusted until the observer judges the sound given by the earpiece to be equal to that of the loud speaker when the earphone is taken away. Provided the observer maintains the same distance from the loud speaker and that the tests are made in the open air, the reciprocal of the voltmeter readings reduced to a db. scale will give a very fair curve of performance which will include all modifications of the response due to cavity resonances and leakage.

Before any results obtained by this



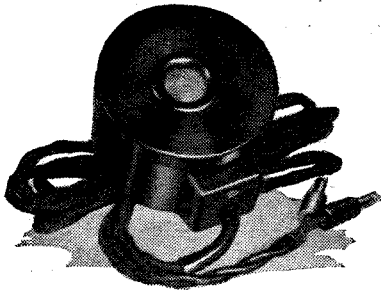
Rothermel-Brush piezo-electric phones.

The piezo-electric crystal would seem to be ideal for application to earphones. For one thing it is extremely light, as no magnets or coils are required, and it should be of great value in aircraft work, where ordinary magnetic earphones might affect the compass, which is often not more than a couple of feet in front of the pilot's head. From the quality point of view there is an adequate bass response, and their chief merit lies in the maintenance of output up

Phones—

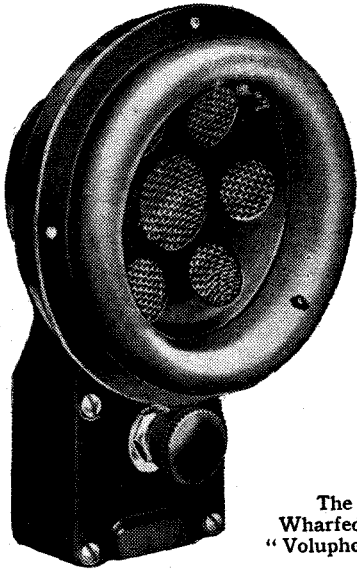
to frequencies of the order of 12,000 cycles at least.

An earpiece has just been marketed by the Instrument Section of E. K. Cole, Ltd., which is in every way a precision product. It operates on the moving-coil principle, and is supplied with a calibration curve which shows a steady rise of about 30 db. between 50 and 650 cycles, a fall of about 10 db. to 1,000 cycles, after which the output is maintained with minor irregularities to 3,000 cycles. There-



Ekco moving-coil earphone Type TF371.

after there is a steady fall of another 30 db. between 3,000 and 12,000 cycles. Cavity resonance has been overcome by a conical block with a small clearance from the diaphragm, the centre aperture being about 1 centimetre in diameter. An input of only 10.4×10^{-15} watts is required at 1,000 cycles to produce a sound at the normal threshold of audibility. On the other hand, the unit is capable of handling inputs up to $2\frac{1}{2}$ watts without signs of overloading—i.e., the earphone, not the normal ear! The outside diameter of the unit is about the same as that of an



The Wharfedale "Voluphone."

ordinary earpiece, and the weight is $10\frac{1}{2}$ oz.

In the "Voluphone," recently introduced by Wharfedale Wireless, the problem is tackled from an entirely different standpoint, and some very interesting results have emerged. The diaphragm is 3 in. in diameter, and the rubber pad surrounding the edge of the instrument goes outside the ear and presses against the side of the head. Due to the large volume of air enclosed

the cavity response is reduced from the normal average of about 7,500 cycles to the vicinity of 5,000 cycles, and although this is not very marked it should be useful to people suffering from slight high-note deafness. The high-frequency response above this frequency, incidentally, is very good, and appears to be still rising at 10,000 cycles. The curious thing about this earphone is that the volume appears at first to increase as the phone is taken slowly away from the ear; but, of course, the true bass response disappears as soon as there is leakage round the sides of the rubber surround. With this form of construction it is possible to vary the balance of tone, not only by moving the instrument

away from the head slightly but also by moving it from side to side when the phone is pressed against the side of the head.

With so many divergent types available, we confidently expect to see a revival of interest in earphone reception, not only on account of its novelty in these days of almost universal loud speaker, but because of the economy in cost of the output stage required to give reproduction free from overload distortion, the fact that it is independent of the acoustic characteristics of a room in which it is used, and because those who like to listen-in to orchestras at a volume comparable with the original will be able to do so without creating a public disturbance.

DISTANT RECEPTION NOTES

Wavelength Wanderings

FOR a long time after the Lucerne Plan had come into force it seemed that one largish portion of the medium-wave band was always to be a most unhappy hunting ground for the long-distance enthusiast. There was a certain amount of confusion and of mutual interference in all parts of this band during the early days of the Plan, but matters gradually straightened themselves out on the wavelengths between 300 and 550 metres. Later the improvement crept gradually down to about 260 metres. But there it stopped; below this there was nothing but howling, whistling and spluttering chaos.

The I.B.U. had a formidable task, as was shown by the monthly charts recording the day-by-day wavelengths of stations. The private French transmitters and other unruly small fry wandered up and down as they liked—I am quite sure they'd have wandered *sideways* had such a thing been possible! To straighten out the confusion between 200 and 260 metres appeared to be an undertaking beyond the wits of man.

If you have not explored those once hopeless wavelengths for some time, try them after dark now and judge for yourself how well the I.B.U. has carried out its work. There is still a considerable part of this band that is useless, but that is only natural, since it is given up to national and international common wavelengths. You will, however, find that many of the stations which once had individual channels in theory only now have them in practice. Monte Ceneri, Copenhagen, Nice (though sharing with Kharkov), Lille P.T.T., Radio Marconi (Bologna), Gleiwitz, Radio Lyons and the Eiffel Tower are all to be heard with fair certainty. Not too bad a clean-up!

Have you noticed the extraordinary strength with which either Turin or Trieste is coming in? As they share the wavelength of 263.2 metres and give the same programme, you can't be sure which it is. There has been no official announcement that I have seen of either station's having increased its power, but the transmission, from whichever it comes, is now so strong that on one or two occasions when speech was being sent out I have noticed distinct sideband splash into the London National.

The French Ministry of P.T.T. has passed the plans for a 20-kilowatt

station at Tunis, and the work of erection is to be pushed forward rapidly. Under the Lucerne Plan provision was made for a future Tunis station to share the 514.6 metre wavelength with Madona. As, however, another French station, Alpes-Grenoble, is already working on 514.6 metres, a wavelength reshuffle amongst some of the French stations may be found necessary. However, so many quarts have already been fitted into the pint pot of the medium waveband that room for another little 'un will doubtless be found somewhere. D. EXER.

"Wireless World" Great Circle Projection Map

THIS map has been prepared especially for short-wave listeners and amateur experimenters so that the true distance and direction from London of any place in the world may be found in a simple and straightforward manner.

It is drawn on a Zenithal Azimuthal Graticule centred on London, while round the periphery of the map, which measures 24 in. in diameter, is a protractor marked off in degrees.

The scale is 1,000 miles to the inch, and a foot rule with the inches divided decimally will give both distance and direction simultaneously. It thus provides the essential information needed for the erection of a directional aerial either for experimental short-wave transmissions or for the best reception by overseas listeners of the B.B.C.'s Empire broadcast stations.

The price is 2s., post free, and it is obtainable from *The Wireless World*, Dorset House, Stamford Street, London, S.E.1.

The Radio Industry

THE relaying of speech and music during the Southend-on-Sea "Festival of Light" is being undertaken by Gilbert Industries, Ltd., 519, London Road, Westcliff-on-Sea.



The Registered Offices of the National Radio Engineers Association, Ltd., have been removed from 114, City Road, E.C.1, to larger premises at Royal London House, Finsbury Square, E.C.2.

Television Reception

APPARATUS which is employed for the reception of vision signals and for their reconstitution into a picture is considerably more complex than that needed for sound, and it is the receiving difficulties rather than the transmitting which have so long delayed the inauguration of a television service. The necessary apparatus can conveniently be divided into two parts—the receiver proper, which corresponds fairly closely with the customary sound receiver, and the reproducing equipment, which corresponds with the loud speaker in sound apparatus.

The only way in which a vision receiver differs from a sound set for the same wavelength is in the width of the band of frequencies to which it must respond. It is well known that in ordinary broadcast reception the receiver must be capable of dealing with frequencies up to 5,000 c/s for good quality and up to 10,000 c/s, or even higher, for very high-quality reproduction. This means that the receiver must be capable of giving a substantially uniform response over a range of, say, 10,000 c/s on either side of the signal frequency to which it is tuned, or, in other words, it must pass a band of frequencies 20,000 c/s in breadth.

The frequencies involved in television are so much greater that such a band is totally inadequate, and if the best results are to be secured the band-width must be as much as 4,000,000 c/s! It is probable that a somewhat smaller band will be considered tolerable, at least for a time, but it is unlikely that a width of less than 2,000,000 c/s will be considered satisfactory.

In order to secure such a wide band-width careful design of the receiver is necessary, and coupled pairs of tuned circuits embodying heavily damped coils are needed. The degree of amplification obtained is consequently low, and many more stages are required to obtain the same sensitivity as in a set designed in accordance with the much less stringent requirements of sound reproduction.

The Vision Amplifier

At the time of writing it seems doubtful whether the straight set or the superheterodyne will prove the more popular. Either can be used and will give good results; the writer, however, is inclined to favour the superheterodyne, and at the present time it is undoubtedly easier to secure adequate amplification with it. Some four or five stages of IF amplification are required, but a single valve frequency changer of more or less conventional design can be employed. An HF stage preceding this is undoubtedly an advantage.

Following the detector, which presents

TYPE OF EQUIPMENT REQUIRED

special problems in view of the high modulation frequencies which it must handle, one or two stages of LF amplification are normally needed. The output required is fortunately not large, and is voltage rather than power, for, unlike a loud speaker, the cathode-ray tube is a voltage-operated device. The amplifier, however, must have a flat frequency response curve over the enormous range of about 20 c/s to at least 1,000,000 c/s, and preferably 2,000,000 c/s! Furthermore, it is also important that phase distortion should be very low.

It will be clear, therefore, that the re-

more valves would be necessary. It is not, however, and the reproducing gear itself contains many valves. In fact, it is this portion of the apparatus and not the receiver itself in which the chief problems of good vision reception lie.

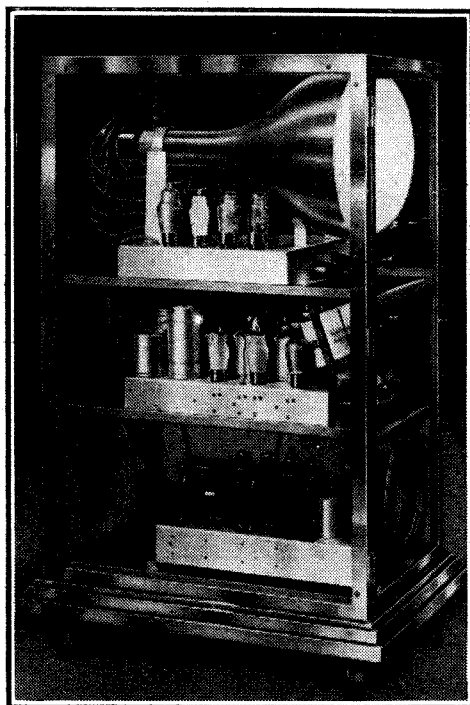
The cathode-ray tube itself is an expensive item, and must have a mains unit to supply it with the necessary voltages, and this must contain a rectifier. The maximum voltage required varies with the tube employed, and present types usually need between 3,000 and 6,000 volts, so that the smoothing condensers are fairly costly.

When the tube is fed from its mains unit with the correct voltages a spot of light appears on the screen, and this is modulated by the signal by the simple process of connecting the receiver output to the appropriate electrodes of the tube. In order to produce a picture, however, it is necessary for the spot to traverse the screen in a series of parallel lines. It is made to do this by applying suitable voltages to the deflecting plates, and these are generated by special oscillators known as time-bases. Two are required, one to deflect the spot in a vertical direction and the other to deflect it horizontally, and if trapezium distortion is to be avoided it is generally necessary to take the output of each in push-pull.

The Time-bases

There are many forms of time-base. The simplest which can be devised to have a push-pull output will probably have two valves, of which one is a gas-filled triode. Such a simple time-base, however, will require an HT supply of the order of 1,500 volts, so that more valves are generally used and operated at a lower voltage. Each time-base proper may contain three or four valves, therefore, if the HT supply is kept down to some 750 volts and one or two more valves may be needed to permit the time-base to be synchronised exactly with the transmission. At least seven valves are likely to be required, in addition to the ten or so used in the receiver, and about three more will be needed to act as rectifiers in the various HT supply units. All told, therefore, television receiving equipment requires about twenty valves, so that it is just as well that valve prices have been reduced.

It is in the time-bases and synchronising apparatus that the chief receiving problems lie, for unless the time-bases operate consistently at exactly the correct frequencies no intelligible picture will be obtained. Defects in the receiver proper are likely to have no worse effect than in



A view of the Cossor sound and vision receiver chassis which was shown at Radiolympia. The mains equipment can be seen at the bottom with the receiver in the middle, and the time-bases on the top deck grouped around the cathode-ray tube.

ceiver will include many valves. If designed on the lines just discussed, it will have about ten valves, apart from the HT rectifier, and its sensitivity will be of the same order as that obtainable with, perhaps, four valves in a sound receiver. The need for the greater number of valves is brought about entirely by the necessity for passing a much wider band of frequencies, since this band can be passed only by sacrificing the amplification obtainable in each stage.

If the reproducing equipment of television apparatus were truly comparable with the loud speaker of sound gear, no

Television Reception—

the case of a sound receiver. A loss of the upper modulation frequencies, for instance, will reduce the clarity of the picture, just as it renders sound reproduction muffled, but it will not make it unintelligible. A fault in a time-base, however, may prevent any sign of a picture from appearing on the screen of the cathode-ray tube, or if its effects are less drastic than this, it may make the subject of the picture quite unrecognisable.

Those who set out to take an interest in television reception, therefore, must regard themselves somewhat in the light of adventurers in an unmapped land. Their experience in the familiar ways of sound

receiving equipment will serve them in good stead when dealing with vision receivers proper, but it will provide no more than a basis of experience in the handling of electrical apparatus when it comes to the adjustment of the reproducing equipment itself. It is probable that this greater difficulty in handling apparatus will to many be not a deterrent but an incentive to construct it, and when they have overcome the difficulties they will, by reason of those very difficulties, feel the greater pride in their handiwork. And if at times they are discouraged, they will be spurred on by the remembrance of the well-known dictum: "What one fool can do, another can."

nouncement on the great board of the "Olympia" Stadium, transmitted by the intermediate-film process. Apart from the "direct" television transmissions during the daytime, the Olympic events of the day were regularly transmitted in the evenings by a long film transmission. The beginning of such an evening programme is recorded in Fig. 3. A characteristic title from an evening survey is seen in Fig. 4.

A high percentage of all the pictures

Television at the Olympic Games

CRITICISM OF AN EARLIER REPORT

By **MANFRED VON ARDENNE**

IN the issue of August 25th of *The Wireless World* there appeared a report on television at the Olympic Games which, in the present writer's opinion, did not give quite an accurate view of the results obtained. The quality of the "direct" television transmissions improved during the early stages of the Games almost from day to day, so that by about the middle of the Games, thanks to the accumulated experience in practical transmission technique,

quality of the moving pictures, which always seems—and actually is—better than that of



Fig. 1.—Iconoscope image of a swimmer just before the gun (a second competitor is just visible at the bottom corner).

quite a useful picture quality was attained—not quite up to the standard of the ordinary film transmissions but noticeably approaching this.

In order to have, in later days, an objective record of the results of the first official "direct" television transmissions using today's regulation 180 lines per picture, some characteristic fluorescent-screen images of the transmissions were photographed in the writer's laboratory. These are here reproduced without any retouching.

Fig. 1 shows swimmers at the starting point in the swimming stadium, just before the starting gun was fired. The picture was "taken" with the Iconoscope in cloudy weather. During all the transmissions it was possible to follow all the phases of the contest and also, at the end, to read the result clearly on the announcement board. The

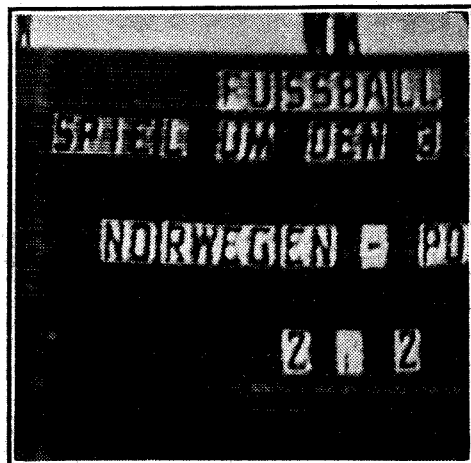


Fig. 2.—Image of a notice on the big announcement board.

the photographic reproduction, is quite good enough to sustain a keen interest in the details of the contest. When it is remembered that the practical tests on the transmission of open-air scenes through the Berlin transmitter were only able to extend over a few weeks, the results must be considered remarkably good.

Fig. 2 shows a received image of an an-

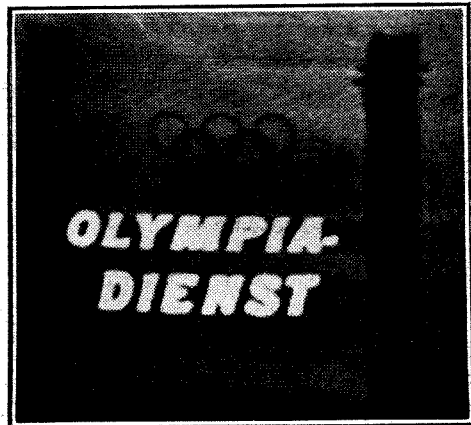


Fig. 3.—Title at beginning of evening survey.



Fig. 4.—Typical sub-title in the evening survey ("The ill-luck of the German Women's Relay team: after a brilliant lead, the baton dropped. Won by U.S.A., with Great Britain second").

transmitted from the Olympic Games showed "crowd" scenes. In judging the received images of such scenes it must always be remembered that with the 40,000 picture elements corresponding to 180-line scanning it is impossible to deal with 100,000 persons in the scene! The experience in receiving these Olympic Games transmissions, and particularly those of the evening films (which were not specially selected for television purposes) confirms one's opinion that an analysis of 180 lines is not good enough for a general introduction of television. At the time I am writing, therefore, everyone is awaiting with special interest the Berlin Exhibition and Radio-olympia, where a high proportion of the transmissions will employ a number of elements three to four times as great.

TELEVISION LECTURES

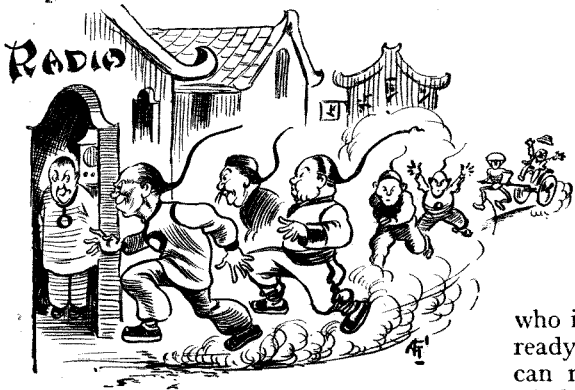
RADIO engineers and service men will be interested to know that a course of television lectures at the Borough Polytechnic, Borough Road, S.E., begins on Thursday, October 1st, at 8 to 9.30 p.m., and ends with the examination in May next.

At the Morley College, 61, Westminster Bridge Road, S.E., television classes will be held for beginners commencing Friday, September 25th, at 7 to 8.30 p.m. A more advanced class will be held on the same night at 8.30 to 10 p.m.

All these lectures will be fully illustrated by slides, experiments and demonstrations.

NORTHAMPTON POLYTECHNIC

COPIES of the prospectus for the coming session of the Northampton Polytechnic, St. John's Street, London, E.C.1, have been received and give details of courses of study, including mechanical, civil, aeronautical and electrical engineering. Particulars can be obtained on application to the Polytechnic, and intending students should note that enrolment is from Monday, September 14th, to Friday, the 18th. Session begins September 21st.



A wild rush to buy sets.

In Old Cathay

AS diligent readers will have observed, there has recently been a great outcry among listeners and wireless dealers in China because the Government has unfairly seized an hour of the programme time each evening so that one of their spokesmen may pour out suitable propaganda into the ears of listeners every day. All stations in China are affected by the order, and wireless dealers are as much up in arms over the matter as the ordinary listening public, as they declare that it is bound to affect their sales of receivers. This protest on the part of the wireless dealers is, of course, all eyewash, as I am confidentially informed by my Nanking correspondent that it was the dealers themselves who clubbed together and bribed the Government officials to make this decree.

The idea is not far to seek, since hitherto dwellers in China have contented themselves with simple inexpensive receivers capable of bringing in only the local station and dealers were becoming desperate at their inability to induce their customers to buy new sets. The result of the Government action has, of course, been to bring about a wild rush to buy sets in order to receive foreign stations during the time that the Government spokesman is on the air.

This little piece of Oriental subtlety on the part of the dealers has its counterpart in this country, although I would hasten to add that it has nothing to do with the bribing of Government officials, whose ideas of remuneration for services rendered are on a far loftier plane than that of their counterparts in the East. The idea, so far as this country is concerned, arose in the days when the B.B.C. was still a limited liability company and had not yet acquired the dignity and pig-headedness of a semi-Government department.

Most of you will remember that in the old days when broadcasting first started programmes were bright and breezy and there was a delightful air of informality associated with everything, even the announcers behaving like human beings instead of like etymological automatons as they do now. Wireless receivers naturally sold like hot cakes and everything in the garden was lovely, but after a time the novelty wore off and almost everybody

UNBIASED

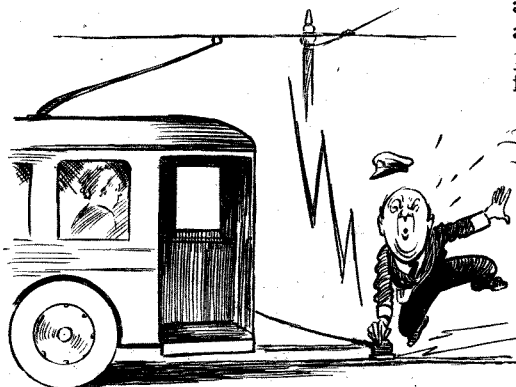
who intended to buy a wireless set had already equipped themselves with one. It can readily be seen, therefore, that the wireless manufacturers and dealers were somewhat at a loss to know what to do to remedy this unfortunate state of affairs.

At last, however, a great idea occurred to them, for they suddenly woke up to the fact that they had a very powerful weapon in their hands, since it was their money which the B.B.C. was using as capital and consequently they were in a position to call the tune. This being so a very rapid overnight change came over the B.B.C.'s tune, which changed from merry and bright to *doleful dirgo con molto miserioso*. The result of this, of course, was that people who had hitherto been content to listen to the B.B.C.'s cheerful efforts with their out-of-date crystal sets and small valve sets at once clamoured for receivers sensitive enough to bring in the so-called gaities of Paris and other Continental stations.

This has resulted in a truly Gilbertian situation, for the ultra-sabbatarian type of programme, which wireless manufacturers and dealers originally inspired for their own base ends, cannot be stopped now that it has outlived its usefulness, for, of course, the B.B.C. is now no longer under their control. The Frankenstein monster which they themselves created has turned on them.

Trolley Troubles Trebled

THE City Fathers of most of our large centres of population are slowly waking up to the fact that trams are archaic and cumbersome things and it is



You don't 'arf cop a packet.

high time that they ceased to clutter up the King's Highway. It is not surprising to find, therefore, that throughout the country a gradual change is being made from the tram to the trolley bus.

In one particular hamlet nestling on the

banks of the Humber, however, the City Fathers have evidently decided that the provision of a second trolley arm and another pair of overhead wires is a sinful waste of money, and so they have hit upon the entirely novel method of providing an earth return by trailing a heavy-gauge cable over the highway, thus literally providing an *earth* return.

By

FREE GRID

I am, perhaps, not strictly accurate in stating that the actual earth is employed for the return, for the cable terminates in a sort of metal "shoe" which skids merrily along the trough of one of the running rails of the old trams which have been left in position. The display of pyrotechnics produced by this primitive arrangement has to be seen to be believed, whilst the accompanying electrical disturbance drowns out everything on the loud speaker, not even excepting chamber music, with which the local yokels in their lack of musical knowledge have often confused the noise. In common fairness to them I must point out that the interference is fully treble that given by an ordinary trolley bus, and might easily be mistaken for chamber music by those not having sufficient musical education to distinguish between the two.

I sought an early opportunity of having a chat with a conductor of one of these astonishing vehicles when I made a special journey up there the other day and I found that he was loud in his condemnation of the system. He told me that he and his mates had been specially imported from London owing to the fact that the native-born conductors were all keen wireless listeners and had refused to have anything to do with the system. He furthermore informed me that I had by no means seen the worst of the system as the "shoe" frequently jumped the rails and it was his duty to replace it. "And," he concluded with some feeling, "you don't 'arf cop a packet if the driver fergits ter switch orf."

They certainly seem addicted to this sort of thing up North, for I remember stumbling across something similar in a town near Liverpool when on a holiday tour way back in 1932.

The Detector

By "CATHODE RAY"

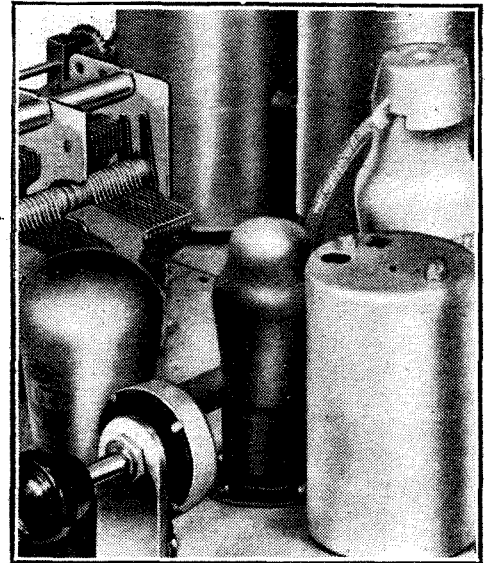
PEOPLE who write articles describing the action of radio circuits have to take some things as understood, otherwise their stories would be puffed out to impossible dimensions by sub-explanations, intensely irritating to readers who know it all. A set review which didn't mention a valve or a condenser without explaining what a valve or condenser is and why it is used in such a way would no doubt be highly instructive, but it would also be very bad as a set review. So the writer must take for granted a knowledge of many things. The trouble arises when readers who have not followed the game from the kick-off keep coming across statements that they are obliged to accept without understanding the reasons.

For example, a reader who seems to have collected quite a lot of radio knowledge in his reading complains that he is constantly encountering statements that

PROCESS OF SIGNAL RECTIFICATION SHOWN IN SLOW MOTION

rectifies the HF!" is no explanation. It is a phenomenon that most of the books either make very complicated or else gloss over with a partial or misleading account. I shall therefore make an attempt to fulfil the purpose of the cathode ray, viz., to depict clearly the action of electrical phenomena.

To see exactly what happened when Schmeling knocked out Louis it is necessary to reproduce it in slow motion. How much more is this aid needed, then, when things are happening millions of times a second. We start off with a picture of a carrier wave from a station working on



sample of this programme lasting only a hundredth of a second contains ten complete cycles of the tuning note, and a picture of it would look like Fig. 1 (a). These are different from the original ten cycles of sound (b) which are directly audible, because each one consists of 1,000 carrier-wave cycles, which alternate far too rapidly either to be reproduced by a loud speaker or heard by an ear. They are not even visible in a picture covering such a small space of time, being packed too closely together at (a) to be separately distinguished; so taking a very considerable step further in slowing the motion, we show at (c) what takes place in a hundred-thousandth of a second.

This comprises a hundredth of one single audible cycle, and ten carrier-wave cycles, which are selected at a moment when their amplitude is increasing (as, for example, at A in (a)). If the tuning note were cut off, or the soprano came to the end of her song, these carrier-wave cycles would follow one another at an average and unvarying amplitude.

The Detector Circuit

To get at last to our diode, it is necessary to increase the scale still further and consider only a millionth of a second—one carrier cycle (d). In Fig. 2, L C is the tuned circuit across which the carrier voltage appears. For the sake of argument the amplitude can be taken as 10 volts when unmodulated. Then, if the modulation is 30 per cent., each cycle of the tuning note sends it down to 7 volts and up to 13 (see Fig. 1 (a)).

K is the cathode of the diode valve, which may be directly or indirectly heated; and A is the anode. *Exactly the same explanation applies to the ordinary grid-leak detector if for A you read*

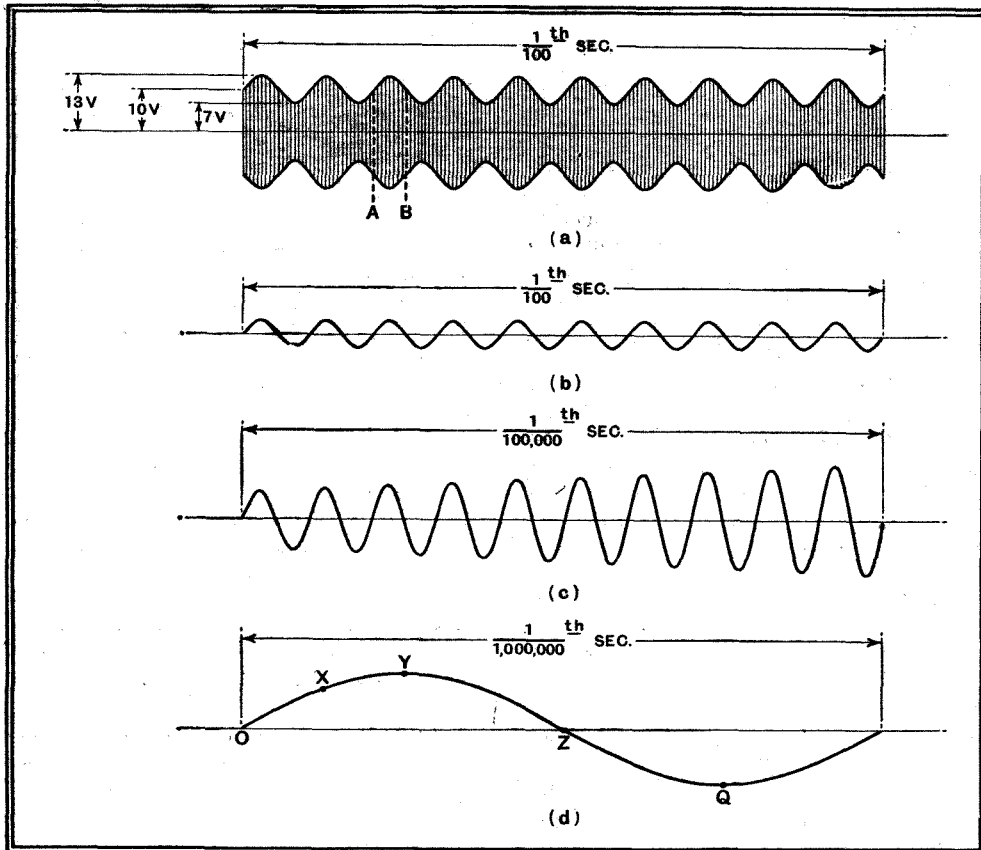


Fig. 1. (a). Picture of what is received from a broadcast station during one-hundredth of a second of tuning note. (b). Picture of the tuning note itself, showing how it differs from the modulated carrier wave (a). (c). Close-up of the portion A in (a). (d). Closer-up of one of the ten cycles in (c).

the anode of a diode detector runs negative on the application of an HF voltage, but that he has yet to come across any explanation of why such a thing happens. Merely saying, "Oh, of course, the diode

300 metres (because this gives a good round figure of 1,000,000 cycles per second), modulated by a tuning note (or a non-wobbling soprano) at the audible frequency of 1,000 cycles per second. A

The Detector—

"grid." For reasons which will appear later R is usually chosen to be about 1 megohm and C1 0.0001 microfarad. The function of K is to release a cloud of negative electrical particles (electrons) which by their nature are attracted by positive electricity and repelled by negative. (Please don't ask me to explain that!)

Step by Step

Starting at zero of our selected millionth of a second (O in Fig. 1 (d)) there is at first no voltage across L, none therefore at A (relative to K), and the electrons at K being neither attracted nor repelled just idle about near their base. As time wears on—say a ten-millionth of a second later, at X—A is becoming more and more positive, and electrons are being attracted across to it. Where do they go? Some try to go through R, but this being such a high resistance allows only a few to pass through it under the pressure of a moderate voltage; the majority go to charge up C1; which may be considered as a sort of storage balloon that releases its contents when the external pressure is no longer maintained. Either way it is clear that part of the 6 volts or thereabouts that LC is exerting at that instant are lost in driving electrons through R or in battering them down under the hatches of C1. The residue is required to form the bait at A. If this is not clear, then perhaps my earlier article on "Ohm's Law"¹ will help to make it so.

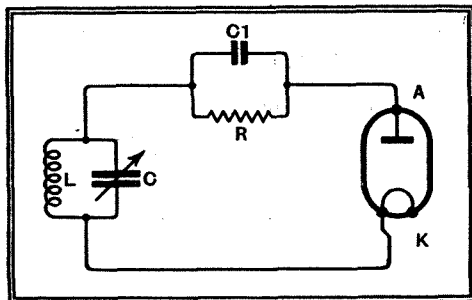


Fig. 2. Simple diode detector circuit.

This process continues until, after the lapse of one four-millionth of a second in all (Y in Fig. 1 (d)), the voltage coming from LC reaches the full 10 (I am assuming a cycle of average amplitude). Here there is a bit of a lull while laggard electrons cross the valve, and so many have now charged into C1 that the pressure across it has risen to a fairly large proportion of 10 volts. The voltage left at A is still enough to attract a stream of electrons, but in the meantime the relentless passage of time has brought us past the peak of the cycle, which is now on the decline. The voltage drops until it is no greater than that due to the charge in (or on) C, and there is nothing left over for electron bait. Electrons from K therefore cease to move towards A. As the cycle voltage drops still more there is not enough to keep the electrons in C under

cover, and they start coming out. Where can they go? They cannot return to K, because to cross a vacuum they need heat to give them a kick-off. The only path is through R. You will note that they go through it in the same direction as they did previously when driven by the cycle voltage from LC; now they continue when the cycle voltage falls to zero (at Z), and even when it reverses (Q). The action is identical with that of the well-known bagpipes, which keep on sounding (worse luck!) while the performer takes his breath. The resistance of R and the capacity of C1 are both sufficiently large to prevent the flow of electrons from being anything like exhausted at the end of the first complete cycle.

What we have at the start of the second cycle, then, is a negative voltage at the right-hand side of C1 and R (and, of course, A too), causing a current to leak slowly through R. There may be perhaps 5 volts left at this moment. Until the second cycle reaches 5 volts (less what has leaked through in the meantime) A is still negative with respect to K—and no further current flows across the valve. As the cycle reaches its peak there is a further gush of electrons in C1, making good the leakage, and going beyond that to a more complete charge than time allowed during the previous cycle. Gradually, during subsequent cycles, the charge in C reaches very nearly the full 10 volts, and current flows through the valve only at the very peak of the cycle; just enough to replenish the loss due to leakage.

Result: a negative voltage at A slightly less than 10, kept very nearly steady by the bagpipe action of C1. This negative voltage may be used for AVC purposes, because it is proportional to the carrier-wave strength, and exists even during programme intervals.

Effect of Modulation

The situation when the tuning note (or any other broadcast) comes on is the next thing to think about. And here we can speed our motion up again. At A in Fig. 1 (a) (shown enlarged in Fig. 1 (c)) the successive cycles of carrier wave are increasing, causing the negative anode voltage to increase. A two-thousandth of a second later, at B, the cycles are diminishing, and it might be supposed that the bagpipe condenser C is holding the anode voltage steady at nearly 13. But this is where the choice of C1 and R comes in. The capacity of C1 is made large enough (in conjunction with the rate of leakage through R) to hold an almost steady voltage between the separate carrier-wave peaks, but not so large as to iron out such a comparatively slow up-and-down variation as that caused by sounds made in the studio. As the highest frequency sound to be taken account of is rather less than ten times that taken here as an example, R and C1 are selected to follow that reasonably well, and of course all lower frequencies are all right.

It is perhaps rather rash to say that R and C1 are selected on this basis. Sometimes they are. But perhaps more often they are chosen not because of the deep thought that we have just been giving to the matter but because somebody else used those values. The somebody else is quite likely to have used such large values of C1 and R that 10,000-cycle notes are glossed over, and even 5,000 cycles per second badly treated. Designers who are very particular about saving the top notes bring R and C1 down as low as 0.1 megohm and 0.00005 microfarad; 0.25 or 0.5 and 0.0001 are fairly common values;

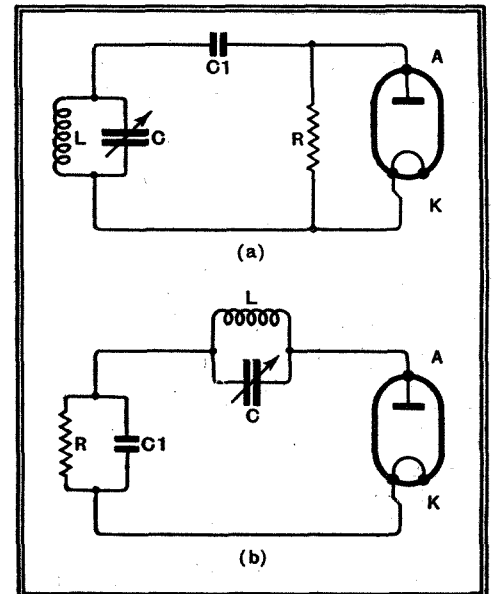


Fig. 3. Alternative methods of arranging a detector circuit.

while 2 megohms and 0.0005 microfarad are still sometimes found. The last combination causes some loss even of our 1,000-cycle tuning note (or soprano), but of course many listeners may be prepared to face such loss quite calmly. However, it is definitely unhelpful when listening to speech, which requires plenty of high notes for good intelligibility.

Returning to the diode used for AVC, does its voltage also pop up to 13 (or whatever it may be) when the programme starts? No, it does not; because an extra R and C are connected in between the diode and the grids of the controlled valves, with such a large bagpipe action as to keep the voltage practically steady at its average, whether the carrier is being modulated or not.

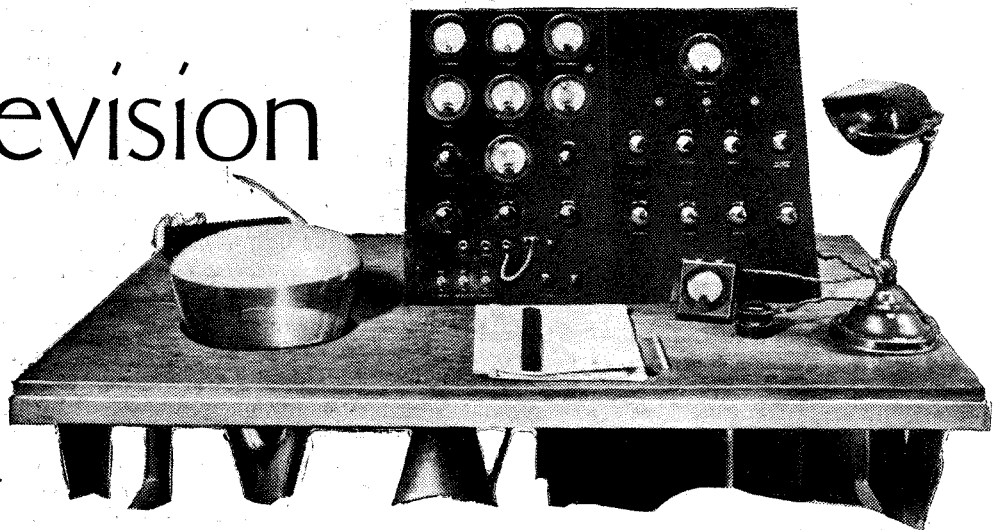
Incidentally, just to make things complete, it should be obvious that the anode voltage at the signal or programme diode follows the rise and fall of Fig. 1 (a) in such a way as to bring it into the same form as (b), the original sound wave.

Lastly, the actual circuit is often varied as shown in Fig. 3 (a) or (b), but the action is identical, except that in Fig. 3 (a) a greater proportion of the original carrier voltage appears across R and has to be got rid of (rather expensively) in case it causes trouble by passing through to the amplifier along with the programme-frequency voltages.

¹ *Wireless World*, February 21st, 1936.

Cathode-Ray Tubes in Television

SOME CONSIDERATIONS
IN TESTING
AND PERFORMANCE



THE Cathode-Ray tube, now so widely to be used in television receivers, brings the manufacturer face to face with some new problems of manufacture, some of which are touched upon in this article.

By G. PARR

(The Edison Swan
Electric Company)

Test board for recording characteristics of cathode-ray tubes.

DURING the next few months the cathode-ray tube will be introduced to some hundreds of people to whom it has hitherto been only a name applied to a complicated scientific instrument. The radio engineer will only see a larger edition of the tube which he has been accustomed to use for checking various operations in the factory or laboratory, and he may even be so used to handling them that he will find it hard to appreciate the immense amount of time and research which has been spent in producing a device which has made modern high-definition television possible.

Consider how the technique of ordinary valve manufacture has had to be adapted to the more complex mounting of the electrodes, and how the development of suitable luminescent material for the screen has occupied the time of research chemists in all countries, and has produced a flourishing sideline for many chemical manufacturers. The testing of these materials alone has involved the making up of innumerable tubes and the life-testing for hundreds of hours to determine the staying power of the compound. The mass production of large glass bulbs of greater thickness than that required for ordinary transmitting valves has presented its own problems of glass strains and non-uniformity of bulb wall. A simple calculation will show that the pressure on the domed end of a 12in. cathode-ray tube is over $\frac{1}{2}$ ton, and to ensure that the tube will withstand this pressure with safety it is usual to test the bulb at at least three atmospheres. The final tests of the tube cannot be made until it is completed and ready for use, and rejected tubes

therefore represent so much waste of material and labour.

The production of the television line screen can be considered as the most exacting test to which a tube can be subjected. For ordinary wave-form observations a slight flaw in the screen material can be so insignificant as to be unnoticed, but when the whole surface of the screen is covered by scanning lines the picture is marred by any trace of contaminating material or imperfect mixing of the compound.

The testing of the finished tube is therefore concerned both with the electrical performance, in which is included the sensitivity; modulation characteristic, and sharpness of spot focusing, and the appearance of the screen, which can only

be controlled by careful control of the processes in the factory.

The sensitivity of the tube is determined by the geometrical construction and, once settled, need only be checked by applying a known voltage to the deflecting system and observing the movement of the beam. The focusing of the spot is also dependent on the electrode construction and assembly and can be checked by visual observation. This needs to be carefully made, since an undeflected spot of high intensity may rapidly ruin the screen material. For determining how the tube will behave as a reproducer of pictures the modulation characteristics are measured, and these are governed by limits in the same way as the testing of ordinary valves.

Tube Characteristics

In the tube the current in the beam corresponds to the anode current of a triode, and is subject to the same control by the grid potential if the anode voltages are fixed. The first characteristic to be considered is, therefore, the beam-current grid volts, which takes a similar form to that of the triode (Fig. 1). The value of the beam current can usually be measured sufficiently accurately by connecting all the deflector plates together and to the final anode through a microammeter. If the potential of the first anode is varied while the final anode is kept constant, a second series of curves is obtained similar to those of Fig. 1, but without exhibiting saturation. While these characteristics are of use in checking emission and uniformity of tube electrodes they give no information about one of the most important factors in the efficiency of the tube as a television reproducer—the brightness of the screen.

In order to measure screen brightness some form of photometer is required mounted at a fixed distance from the

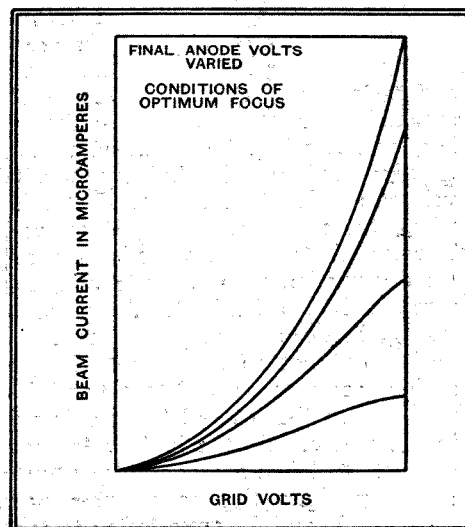


Fig. 1.—Typical beam current characteristic of high-vacuum tube.

The Cathode-Ray Tube in Television—

screen. A flicker photometer is the most accurate instrument for measurements, but as in most cases it is a question of comparing a tube with a predetermined standard an ordinary "light-meter" can be used in factory checking. In making observations the beam is made to scan the screen at a given frequency over a given area, say, 10 sq. cms., and the luminosity observed at a standard voltage and beam current.

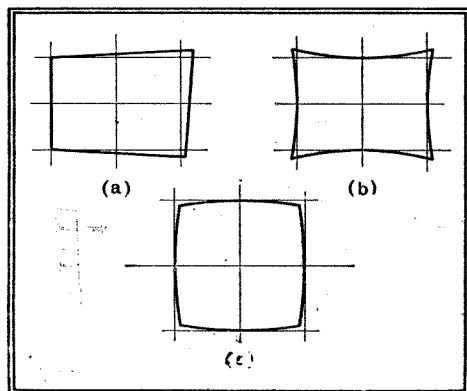


Fig. 2.—Illustrating three types of line screen distortion : (a) trapezium (b) pincushion (c) barrel.

Coloured screens may require a compensating filter interposed between screen and photometer. If the screen material has an appreciable "after-glow," i.e., the luminescence persists after the beam has been switched off, the degree of persistence is more difficult to measure, and a special set-up is required. A method of measuring after-glow by using another tube to record the decay of luminescence has been described by Puckle.¹

Distortion of the line screen formed on the end of the tube may be due either to the scanning circuit or to defects in the tube itself. The commonest forms of distortion are:—

Non-rectilinear pattern.

Defocusing of the spot when deflected.

To eliminate the more obvious distortions caused by non-linearity of the time-base circuit

¹ *The Wireless Engineer*, May, 1935, p. 251.

the wave-form of the deflecting potential is checked by observation on the screen and the balance of the output stage of the time-base circuit has also to be checked.

Distortion

When the beam is deflected to cover the whole of the fluorescent screen three kinds of irregular pattern may be produced, to which the explanatory names "trapezium," "pincushion," and "barrel" distortion have been given (Fig. 2). In the first the rectangle is extended at one corner to form a characteristic trapezoidal figure, and, assuming perfect scanning deflection, a want of symmetry in the deflecting system is usually indicated. When each corner of the rectangle is extended to form a pincushion shape the cause is usually to be found in the deflecting field, particularly when magnetic deflection is used. The inherent curvature at the fringe of the field introduces a horizontal component into the vertical deflecting force, with the result that the beam is deflected more towards the extremes of its travel—at the corners of the pattern. Barrel distortion is the reverse of this effect in which the horizontal component acts in the opposite sense to compress the travel of the beam at the edges of the rectangle. Both these irregular patterns may be caused by warping of the deflector plates during manufacture—a defect which is not always visible on inspection.

Assuming the beam to be properly focused at the centre of the screen, the application of the scanning voltage often

results in loss of focus at the edges of the screen. With a beam of appreciable cross-section the defocusing is due to the same cause that produces pattern distortion, a horizontal unwanted component of the deflecting field. If the beam is being de-

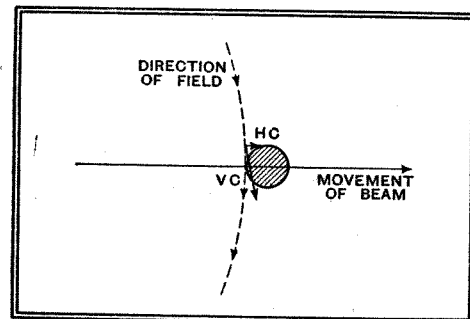


Fig. 3.—Showing how the horizontal component of a curved field distorts the beam.

flected in a horizontal plane by a magnetic field the direction of the horizontal component of the field will be such as to pull it out vertically and make the circular spot into an ellipse (Fig. 3). Correction of this by refocusing will result in loss of focus at the centre where the deflecting force is uniform.

These distortions are naturally more prone to occur with magnetically focused and magnetically deflected tubes, although they are not negligible in electrostatically controlled ones.

Tube Life

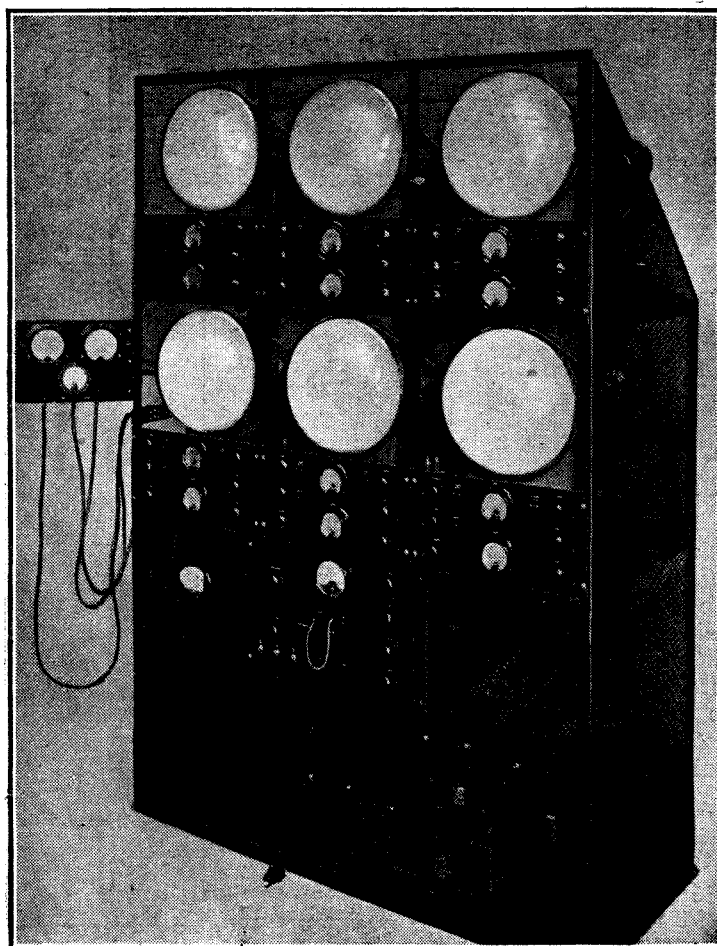
The question of the life of the cathode-ray tube is always a debatable point, especially with those users who would like to see a written guarantee of operating hours accompany each tube bought.

To-day a figure of 1,000 hours is quoted by some valve engineers as the probable life of a triode, but this figure is more often than not exceeded in practice. In fact, if exhaustive enquiry could be made the results would probably surprise those who think that this figure represents the maximum to be hoped for.

If it is impossible to assess the life of a valve accurately, how much more difficult is the task of the manufacturer in giving an estimate of the life of a cathode-ray tube, over which he has no control when it has left his hands. Admittedly, the tube will be mounted and used under approved conditions in most cases, but greater facilities for control will be fitted as an integral part of television sets, and these controls are liable to abuse.

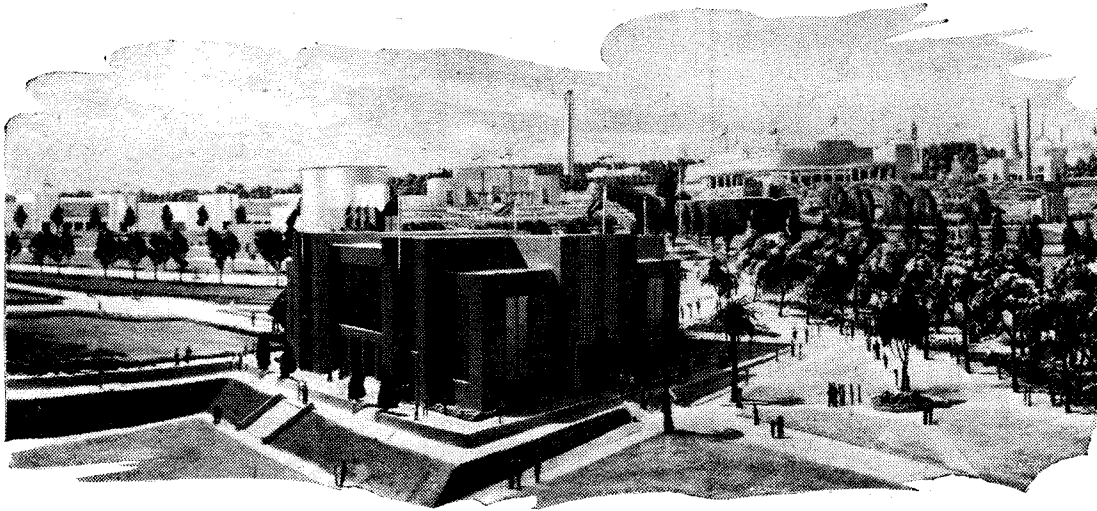
Again, the voltages used are considerably higher than those to which the majority of valve users are accustomed, and it is surprising the amount of damage that a high voltage can do in a few microseconds.

The only available course is for the manufacturer to assure himself by continual life tests that a reasonable amount of service can be expected from the tube under normal conditions. How far the art has progressed can be judged when we remember that the life of the early gas-focused tubes was estimated at 24 hours!



Life-test rack for experimental cathode-ray tubes.

Listeners' Guide for Outstanding



JOHANNESBURG EMPIRE EXHIBITION. The above reproduction is of the diorama of the exhibition grounds by Herbert H. Cawood, which is on view at South Africa House, Trafalgar Square, London.

THE opening of the great Empire Exhibition at Johannesburg will mark a new era in the history of South Africa. This Exhibition coincides with the Golden Jubilee of Johannesburg and has, therefore, a double significance, it being the first Empire Exhibition since that held at Wembley. On Tuesday at 2 National listeners will hear His Excellency, the Governor General of South Africa, Lt.-Col. the Rt. Hon. the Earl of Clarendon, G.C.M.G., when he opens the Exhibition. The Prime Minister of South Africa, General the Rt. Hon. J. B. M. Hertzog, will speak, and recorded messages from the Premiers of the United Kingdom, Canada, Australia, New Zealand and Southern Rhodesia, will also be broadcast.

CONTINENTAL RELAYS

Two relays from the Continent are included in this week's programmes. To-night (Friday) at 9.10 (Nat.) from Turin comes a programme of modern Italian songs and folk music given by a symphonic jazz orchestra and choir.

On Thursday from 8 to 8.40 (Reg.) will be heard dance music from Berlin given by the Deutschlandsender light orchestra and Willy Glahe's Dance Orchestra.

FROM THE QUEEN'S HALL

EXCERPTS from the Promenade Concerts are included in the programmes each night this week. This evening Stiles-Allen and Nicholas Medtner

are the soloists, the latter playing Beethoven's Third Piano-forte Concerto during the broadcast at 8 (Nat.).

Saturday's relay includes the "William Tell" Overture, Francis Russell singing "The Flower Song" (Carmen) and Pouishnoff playing Chopin's First Piano-forte Concerto.

Two duets from Wagner's "Siegfried" are the chosen items from Monday's Prom. to be broadcast at 8.30 (Nat.). Moiseiwitsch plays Tchaikovsky's Piano-forte Concerto No. 1 during Tuesday's relay to be given Regionally at 8.

From the Bach-Handel concert on Wednesday to be relayed at 8 (Nat.) the soloists will be Isobel Baillie and Myra Hess. Vaughan Williams' "London Symphony" is the only part of Thursday's Prom. to be broadcast, and this comes at 8.55 (Reg.).

EDUCATION

A TALK by the Rt. Hon. Oliver Stanley, M.C., M.P., is scheduled for Monday at 8.15 (Nat.). His subject is to be "The Facilities for Continued Education," and as President of the Board of Education he is just the man to enlighten Mr. Everyman on this much-talked-of subject.

"THE SEASIDE IN SONG"

THIS is the title given to a programme devised by Willson Disher to be given on Wednes-

day at 6.40 (Nat.). It comprises a collection of holiday ballads from old music-halls. Among those who will be singing are Ray Wallace, Dan Leno, Jnr., Walter Williams and Marjorie Essex. The Variety Orchestra and the Revue Chorus will be in attendance.

SAXOPHONE RECITAL

MANY people despise the saxophone, thinking it to be a modern American invention, but this is entirely wrong for it was first introduced about ninety years ago by its inventor, Adolphe Sax, a Belgian. To some the saxophone implies jazz and nothing more, but not so to Sigurd Rascher, who on Sunday at 7 (Reg.), with George Parker (baritone), will give a recital during which he will show how well it is suited to serious music.

SIR HENRY WOOD, who takes up the brush when the baton is laid aside, at work by the shore of Lake Lucerne on a painting which includes the house where Wagner wrote "Die Meistersinger" and the second act to "Tristan und Isolde."

GANGSTERS

JOHN DIGHTON's latest farce is to be produced by Max Kester on Monday at 8.30 in the Regional programme. The plot concerns a retired Chicago racketeer and his socially ambitious wife. The title is "Cracked Ice" which is gangster slang for diamonds, so now you know what to expect.

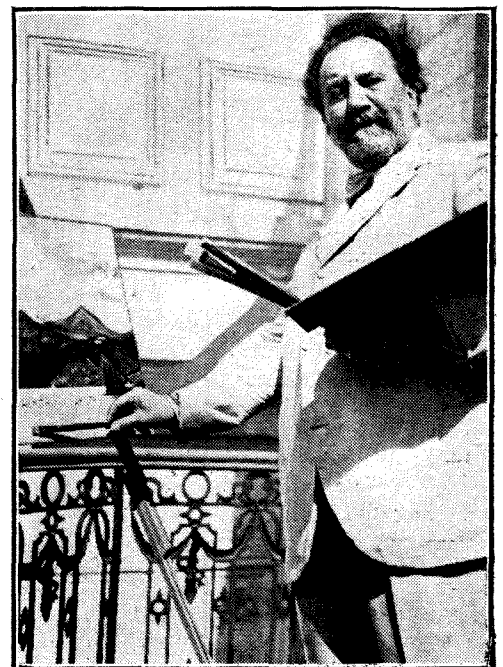
Among the cast will be Ronald Simpson and Fred Duprez.

EQUALITY

A DISCUSSION is timed for 8.15 in the National programme on Thursday which should prove very interesting. It is on the much discussed topic of women's equality with men in business. The title is "Should Men and Women Get Equal Pay for Equal Work," and the two combatants are Dorothy Evans and Gladys Bouiton.

HILL CLIMBING

A MOTORING event again comes into the programmes. This time it is the famous Shelsley Walsh Hill Climb. Earl Howe and F. J. Findon will be on the spot, the first at a sharp bend about half way up and the latter at the start, to tell Regional listeners at 4.15 on Saturday the progress



the Week

Broadcasts at Home and Abroad

SIGURD M. RASCHER, who with George Parker, will give a recital on Sunday, is the foremost exponent of classical saxophone music.



on the 1,000-yard course, which has an average gradient of about 1 in 10, the steepest being 1 in 6.25. Being such a short course the ascent of each competitor can be followed by the roar of the exhaust picked up by the microphone.

MORE COMIC OPERAS

THE SEVENTH in the series of programmes compiled by Gordon McConnel from comic operas will be heard by National listeners at 8.40 on Thursday and repeated in the Regional programme the following evening.

Marie Burke is included in the cast which will give songs and scenes from the following operas: "The Emerald Isle," "The Grand Duchess," and "Véronique."

"PLUCKING AND SINGING"

THIS is the title given to a programme which comes from Stuttgart at 8 on Thursday. The Station Choir with balalaikas and guitars will be giving the concert.

THE NORTH SEA ROUTE

FOR centuries explorers have attempted to open up what is now known as the North Sea route between Europe and Asia, but it is only within the last decade that such a development has been possible. With the co-operation of sea and air exploration, linked up with radio communication, this route was finally opened, and it now carries increasing quantities of freight each year. The

story of this development will be given in an English talk from Moscow on Wednesday at 9.

OPERA

THIS week's opera broadcasts are by no means plentiful. To-night's highlight is a performance of Wagner's "The Dusk of the Gods," which comes from the State Opera House and will be relayed by Vienna between 5.55 and 11.15.

On Saturday we have that gem of Leoncavallo's, "I Pagliacci," from Milan at 8.45. Those who listen-in until the small hours will probably tune in Stuttgart for Sunday's midnight to 2 a.m. programme of Puccini's "La Tosca." This will be recordings of a performance in La Scala, Milan. Warsaw is relaying from the Grand Theatre, Lwow, from 8 to 11 on Tuesday, Gounod's "Faust."

Another opera recording is to be given, and this time it is "The Mastersingers," which comes from Breslau at 8.10 on Thursday.

Under the heading of opera might also be included Thursday's midnight programme from Stuttgart, when selections

HIGHLIGHTS OF THE WEEK

FRIDAY, SEPTEMBER 11th.
 Nat., 6.30, Students' Songs: Men's Chorus. ¶Sports Talk: Shove-ha'penny. 8, Prom. 9.10, Relay from Milan.
 Reg., 8, Theatre Orchestra and Ernest Butcher (baritone). 9.30, Sonata Recital: May Harrison (violin) and John Ireland (piano).
Abroad.
 Budapest, 9.35, Budapest Concert Orchestra.
SATURDAY, SEPTEMBER 12th.
 Nat., 7, Band of the 2nd Batt. The King's Own Royal Rifle Corps. 8, "The Full Story"—Part III. 8.30, Variety.
 Reg., 4.15, Shelsley Walsh commentary. 8, Prom. ¶"Is That the Law?"—The Journalist's Case. 10.30, Henry Hall's Hour.
Abroad.
 Milan, 8.45, "I Pagliacci."
SUNDAY, SEPTEMBER 13th.
 Nat., 9, Leslie Jeffries and the Grand Hotel, Eastbourne, Orchestra. ¶"Four Meetings," adapted from short story by Henry James.
 Reg., 6, Theatre Orchestra and Rose Brampton (contralto). 7, Recital: Sigurd Rascher (saxophone) and George Parker (baritone). ¶Organ Recital: Aileen Branden.
Abroad.
 Strasbourg, 8.30, Chabrier Commemoration Concert.
MONDAY, SEPTEMBER 14th.
 Nat., 7.30, B.B.C. Dance Orchestra. 8.15, Educational Talk: The Rt. Hon. Oliver Stanley. 8.30, Prom.

Monday Sept. 14th (continued)
 Reg., 6, Reginald King and his Orchestra. 8.30, "Cracked Ice." ¶Peggy Cochrane—a tune a minute.
Abroad.
 Radio-Paris, 8, Russian Music by the Potorjinsky Ensemble.
TUESDAY, SEPTEMBER 15th.
 Nat., 2, Johannesburg Empire Exhibition Opening. 7.40, "Music from the Movies." 8.10, "The Black Eye," Comedy by James Bridie.
 Reg., 6.40, From the London Theatre. 7.30, English Folk Songs, the B.B.C. Singers. 8, Prom. 9, Variety.
Abroad.
 Warsaw, 8, "Faust."
WEDNESDAY, SEPTEMBER 16th.
 Nat., 6.40, "The Seaside in Song." 8, Prom. ¶Theatre Orchestra.
 Reg., 7.30, Maurice Winnick and his Orchestra. 8, "The Black Eye." ¶Recital: The Lyra Quartet.
Abroad.
 Eiffel Tower, 8.30, Vichy Casino Concert.
THURSDAY, SEPTEMBER 17th.
 Nat., 7.15, "Night Music," the B.B.C. Orchestra (C). 8.15, Discussion. 8.40 Comic Operas.
 Reg., 6, Salvation Army Band and Tudor Davies. ¶Variety. 8, Dance Music from Berlin. ¶Cipsy Music: Talk by P. Thurston Holland. 8.55, Prom.
Abroad.
 Radio-Paris, Symphony Concert by the National Orchestra.

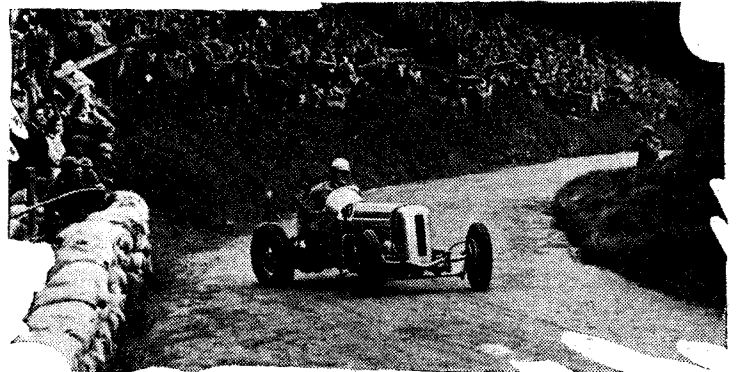
from well-known operas will be given under the heading, "Multi-coloured is the World of Opera."

OPERETTA

ON two evenings this week Strasbourg is giving Lehar's famous three-act operetta,

Lille PTT at 8.30 on Wednesday.

Two concerts of operetta music which will include many popular favourites are to be given this week. The first comes from Breslau at 6 on Sunday, and the second from Lille PTT at 5.30 on Tuesday.



SHELSELY WALSH HILL CLIMB will be described for listeners on Saturday. Skidding turns, such as that shown, give plenty of material for the commentator.

"The Land of Smiles." This will be at 8.30 on Saturday and Wednesday. From Bordeaux on Saturday at 9.15 will be given a concert version of Adam's "The Nürnberg Doll." Messenger's favourite, "Véronique," will be heard from

MEMORIES

ON Tuesday, at 7.30, Stuttgart provides a programme, entitled "Do You Remember?," of songs and dance music which has almost passed into the realm of the forgotten. THE AUDITOR.

"Diallist" Looks at the Show



ON my way to the Exhibition I couldn't help musing over its own particular poster, which met my eyes at every turn. It is the way of posters to convey both pictorially and in words—but especially pictorially—something about the good things that they advertise. What, then, could one about to visit Radiolympia deduce of the show from an inspection of the hoardings? Could it be that the temperature inside was likely to be so high that the ladies would find it necessary to remove their clothes? And what was the significance of the trio portrayed having but a single eye apiece? A One-eyed Show? Perish the thought! As the only wireless object delineated was a microphone, was it to be an exhibition of microphones?

Very puzzled, I passed in and immediately all doubts were set at rest. It was certainly warm at Radiolympia, but at no time was the temperature high enough for clout-casting to become necessary. Everybody that I saw appeared to have the normal number of eyes and there was only an odd microphone to be seen here and there.

First Impressions

In fact I had a very pleasant surprise on entering, for I had expected Radiolympia of 1936 to look very much like Radiolympia of 1935. There was then a kind of sealed pattern for stands, exhibitors being required to conform pretty closely to the general specification and having little scope for the display of their tastes or ingenuity. This year the ban on individual ideas was lifted (save, for some queer reason, as concerned stands under the gallery) and exhibitors have been able to let themselves go, blossoming out into a pleasing variety of designs and colours. As is my wont, I made a first quick tour of the exhibition in order to obtain some general impressions. These came quick and fast. Cabinet design has improved considerably, though many wireless sets still look like wireless sets, if you follow me. A great deal of attention has been given to tuning dials, in many instances with very happy results. The big set, as distinct from the radiogram, has arrived, though it is still neither so big nor so commonly seen as I should like. The "all-wave" receiving set was as much in evidence as one had expected. There wasn't a crystal set to be seen and I saw no receivers with less than three valves.

Such were the first general impressions. Subsequent more detailed inspection showed that they were, perhaps, the most important. Cabinet design has long been a matter of criticism with me—or a bee in my bonnet, if you so prefer it. I can't help feeling that in general radio sets are still in much the same position as the railway carriage was for many years when it couldn't entirely forget the influence of the landau and the barouche. Or the motor

car, before it had quite ceased to be a horseless carriage. There's still, in my humble view, too much of a tendency to make a box-like cabinet, usually of mahogany or walnut, rounded at the top corners. You put the loudspeaker fret, with a screen of cringly stuff behind it, at the top, the tuning dial just below, neatly arranged knobs at the bottom—and there is your wireless set. Very attractive, because they struck an original note and did seem to be making some attempt to break away from the fetters of tradition, were the R.I. cabinets, which were to be seen in a large variety of beautiful woods. Maple was my pick. Some of them, again, bore hand-painted designs—Wedgwood, chintz and so on. One fearful example of what a cabinet should not be was on another stand. It was a huge console affair with the tuning controls about a foot from the ground. Just imagine your stout Aunt Jane tuning in the London Regional!

Many firms have laid themselves out to produce dials that really are dials. McMichael's, for instance, have three or four different types, all of which I found attractive. One of these is about the size of a breakfast plate, though it is quite unobtrusive, being hidden away beneath a lid when not in use. The scale used in the bigger Bush superheterodynes also took my fancy for its size and clearness. Then there is the Ferranti Magnascope, with its clever optical arrangement, which makes the effective length of the dial intended for calibration or fine tuning something like six feet. The Philips dial, the position of which you can adjust according to whether you are sitting down or standing up, is another example of the many excellent ideas that were to be seen.

All-wave Receivers

An inspection of a good number of "all-wave" sets on the stands showed that a considerable proportion of them were without a signal-frequency amplifying stage in front of the first detector. This must, of course, be so in the low-priced "all-waver" but I am wondering what will be, what our American friends would call, the reactions of the public when they come to use them, especially if they have been led to believe that they can hear Australia or the East Indies almost as easily as their local medium-wave stations. The "all-wave" receiver *should* be a very popular kind of receiving set; but I venture to doubt the wisdom of offering low-priced superheterodyne models covering a distinctly limited band of short wavelengths.

It is refreshing to see much more ambitious "all-wave" sets on some of the stands. The Pye 10-valve Empire model is a good example. I was interested, too, in the H.M.V. "all-wave" set with its five tuning bands and its ability to tune down to the wavelength used for sound in the television transmissions.

There are a great many very fine "all-wave" chassis such as that which R.G.D. build into their 120-guinea radiogram. But the trouble is that they *are* part of radiograms and are not offered as purely wireless sets. It is as true this year as it has been for some years past that if you want the best wireless set that can be made and are prepared to spend £50 or more upon it, you cannot have it unless you desire it to be made up as a radiogram.

I was glad to see many really useful visual tuning indicators; indicators, I mean, that still do their business even if the incoming transmission is on the weak side. Those that "pack up" unless the signal is enormously strong are not much in use for calibration purposes. Two other improvements that appear in some sets of quite surprisingly modest price are variable selectivity, which was seen in only a few instances last year, and devices for the suppression of between-station noises when you don't want them.

Television Receivers

Naturally the television display attracted an enormous amount of interest; in fact the commissionaires on duty inside the main entrance became so used to answering one and the same question that they automatically said "Straight round to the left," almost before you'd opened your lips. When I saw the demonstration on the opening day I was, I confess, rather disappointed, not with the quality of the reception but with the subjects selected. You see, you couldn't stay and watch the whole programme, but were kept moving along quite fast. This, as a matter of fact, was entirely unnecessary on the opening morning at any rate, for when I was there at about half-past twelve, there weren't more than a handful of people in the booths. On my next visit I was luckier, for instead of a film consisting largely of still pictures I saw and heard a show from one of the Alexandra Palace studios. I can't say that I was enormously attracted by the appearance of the television receivers shown on the stands. It is a difficult job, of course, to fit in a huge thing like a cathode-ray tube; but at the same time the large cabinets required should give the designer ample scope to display his talents.

On the whole it was the best radio exhibition that we have had for some time for, despite the poster, it was a genuine radio show devoid of stunts. I had begun to wonder some time ago whether the 1936 exhibition would not be the last. But after seeing it, I am quite sure that it won't!

Television Comparisons

By L. MARSHLAND GANDER

LONDON AND
BERLIN

"SPACE" probably sums up in a word the chief difference between the London and Berlin Radio Exhibitions. Berlin's great exhibition, financed by the Nazi State, sprawls through eight vast halls grouped round the Witzleben television tower. Not satisfied with this accommodation, the Government are building yet another hall the skeleton of which, already complete, is nearly as large as Cologne Cathedral! These buildings are, of course, used not only for the Radio Exhibition but for all national exhibitions held in Berlin.

In these circumstances superior showmanship becomes inevitable, though I was speedily convinced that Berlin's interminable stands did not hold as much interest as the more crowded ones of Olympia.

The most striking contrast was probably in the television exhibits of the two shows. The Television Hall in Berlin was somewhat smaller than the others. I should estimate that it was about half the size of the National Hall at Olympia. Here was an exhibition within an exhibition. Visitors could walk at leisure round the various stands, see thirty or forty television receivers of various makes working, or enter three little theatres to see big screen television, the home "talkies" of the future.

Making due allowance for the hurried arrangement of the Olympia television exhibit and the desire of manufacturers to emphasise its experimental character, I think it fair to say that it was a "peep show" more than an exhibition. Visitors waited in long queues and were hurried through darkened booths.

Strange that in Germany, land of tramping legions, Nazi salutes and martial ardour, the public should be shepherded less (on this particular occasion) than at Olympia. There was also no secret about the manufacture of the various sets being demonstrated. But no doubt there was considerable confusion in the minds of non-expert visitors as to which items were being picked up by wireless link and which were being televised from room to room in the exhibition itself.

First Public Service

Since last year Germany has made considerable progress with television experimentation, but none with its public service. Britain therefore is unique as the only country in the world where a public television service is about to be inaugurated. Visitors to the Olympia "peep show" knew that they were seeing pictures which they will shortly be able to receive in their own homes in the London area.

Meanwhile, in Germany the only service

continues to be that on 180-lines at 25 pictures a second from the Witzleben tower. No sets are being sold to the public. However, 25 public demonstration booths have now been installed in various parts of Berlin to begin the television education of the public.

Among the six or eight firms exhibiting in the Television Hall Fernseh and Telefunken appeared to be leading the field. These two and the German Post Office had the largest sections.

While the German Post Office exhibit consisted of receivers for viewing the Witzleben 180-line broadcasts, both Fernseh and Telefunken were showing room to room television on 375-lines at 50 pictures a second, with interlaced scanning. In each case visitors could see the whole process of television—artists performing in the studio before the television camera and their images produced on screens large and small.

This was particularly interesting in the case of the Telefunken Co. When I was there two tap dancers were performing in a sound-proof glass-walled studio flooded with green light. Two television cameras

Fernseh were showing projected cathode-ray pictures on a screen measuring about 4ft. by 2ft. To this the same criticism applies in a lesser degree, but the only fair comparisons possible are between pictures on the ordinary television receiver screen.

Fernseh's picture was, marvellous to relate, produced by scanning disc. The net result was that the cross lines seemed more prominent than on the Telefunken picture. But personally I inclined to the belief that neither picture was as good as those we have been seeing broadcast to Olympia.

Rather curiously, the vast majority of the receivers showing gave a direct view of the picture on the end of the cathode-ray tube and not the reflected picture favoured by some British manufacturers. This may be because Germany has hardly begun to consider the commercial application of television and to adapt the shape of receiver to domestic requirements. Dr. Goertz, one of the Nazi leaders of the broadcasting industry, told me he considered that the science was not sufficiently advanced for receivers to be sold to the public. Sets would cost about 2,500 marks each.

At the current rate of exchange this is more than £200. There would be no wide demand in Germany to-day for a luxury article at this price.

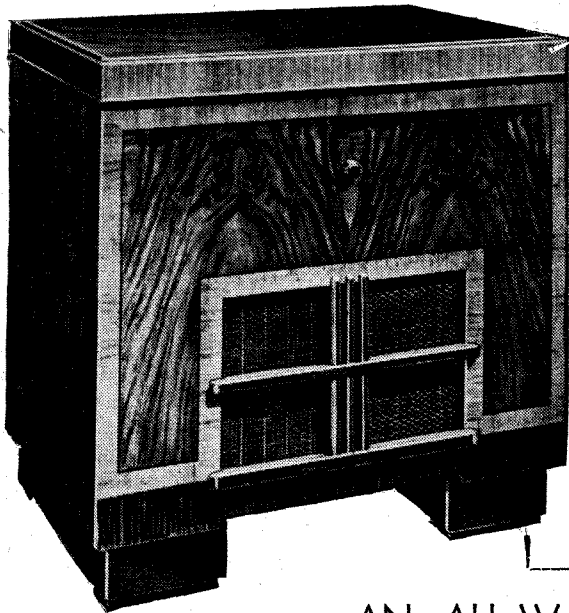
Tekade were the only remaining adherents of mechanical scanning in the show. But they added considerably to the interest by

showing some old thirty-line disc-scanning apparatus. If any thought that progress in the last ten years has been slow they had only to look at that dancing shadowgraph, viewed through a glass darkly, and then compare it with the remarkable 375-line pictures at the other end of the room.



Two types of direct transmitting television cameras seen at the Berlin Show.

pointed at them—one I understood was on the Farnsworth principle and the other resembled the Iconoscope. In a neighbouring large screen theatre a cathode-ray projector threw a picture on to a screen measuring 6ft. 6in. by 4ft. While this was the best big screen picture I have yet seen, it was still rather dim and imperfect.



H.M.V.

MODEL 485A

FEATURES.—*Type.*—Superheterodyne all-wave radio-gramophone with automatic record-changer. **Waveranges.**—(1) 7-16 metres ; (2) 16.7-51 metres ; (3) 46-140 metres ; (4) 185-560 metres ; (5) 750-2,200 metres. **Circuit.**—Var.-mu pentode and HF amplifier—triode-hexode frequency-changer—var.-mu pentode IF amplifier—double-diode-triode second detector—pentode output valve. **Full-wave valve rectifier.** **Controls.**—(1) *Tuning.* (2) *Waverange.* (3) *Radio-gramo. switch.* (4) *Bass tone control.* (5) *Treble tone control.* (6) *Volume control.* (7) *Mains on-off switch.* **Price.**—Model 485A . . . 36 guineas. Model 581 . . . 48 guineas. **Makers.**—The Gramophone Co., Ltd., 98-108, Clerkenwell Road, E.C.1.

AN ALL-WAVE RADIO-GRAMOPHONE COVERING THE TELEVISION AND SOUND TRANSMISSIONS

THE receiver chassis incorporated in this instrument is based on that of the Model 480 which has already established for itself a reputation for the efficiency of its two short-wave ranges. The addition of a third band extending the range downwards from 16 to 7 metres is of special interest in view of the new television service from Alexandra Palace.

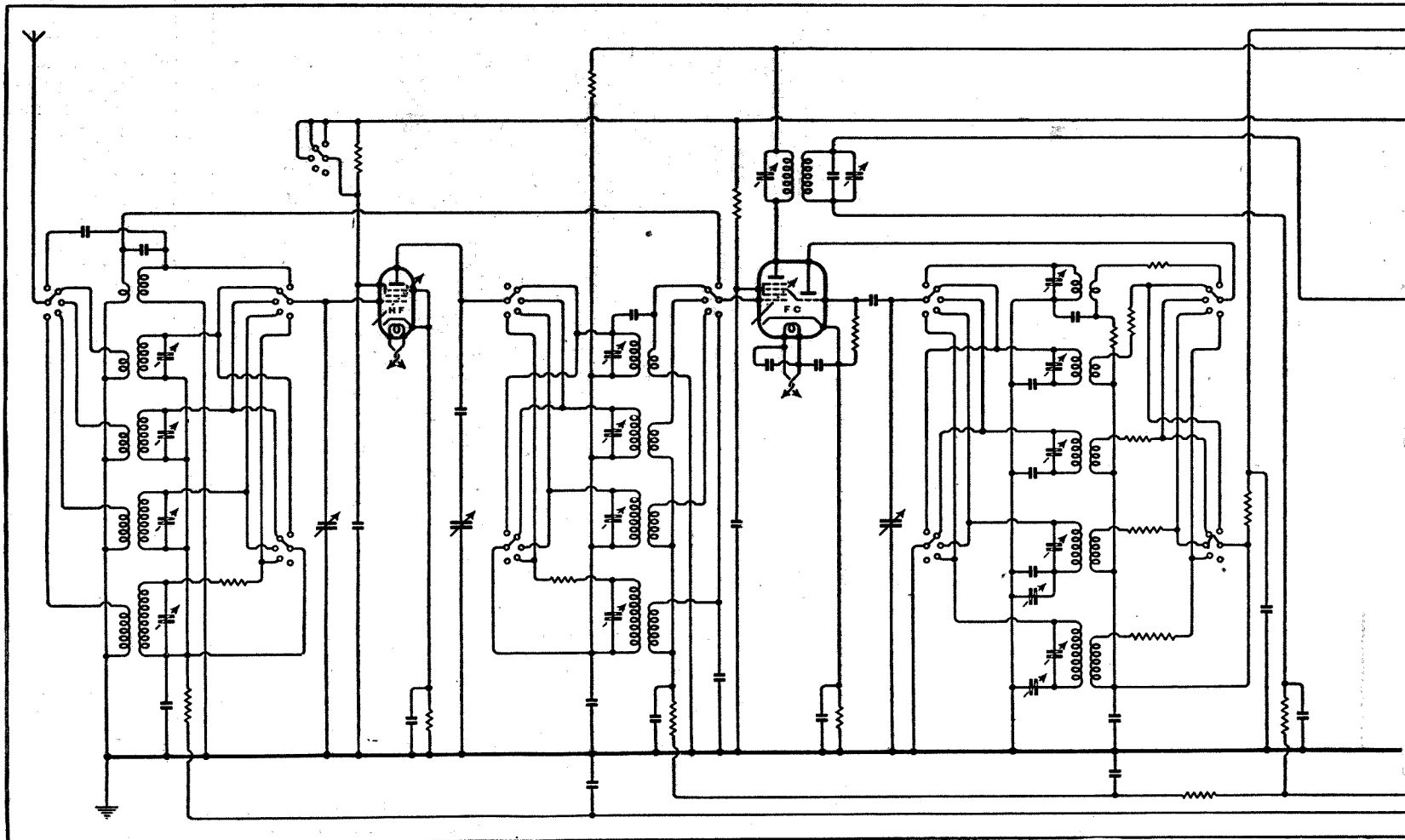
Circuit design at these high frequencies is not without its difficulties. The diagram shows that the coupling transformers on this band differ from those of the higher

wavebands in that they make use of a combination of inductive and capacitive coupling. In the case of the circuit associated with the local oscillator it will also be noticed that additional decoupling has been provided. The oscillator HT supply is taken direct from the rectifier on all wavebands and it is probable that better

frequency stability is obtained in this way. Another point of interest is that the transformer coupling is tuned on the primary on all wavebands.

The HF and IF amplifying valves are the usual variable-mu pentodes, and the frequency-changer is a triode-hexode. The double-diode-triode valve, in addition to

Transformers with a combination of capacity and inductance coupling are used on the 7-16 metre waveband. On this range the HF amplifying stage is omitted, the input being taken directly to the frequency-changer.



performing its primary function as a signal rectifier, supplies AVC bias, and the triode also serves as a first amplifier for the output from the gramophone side of the equipment.

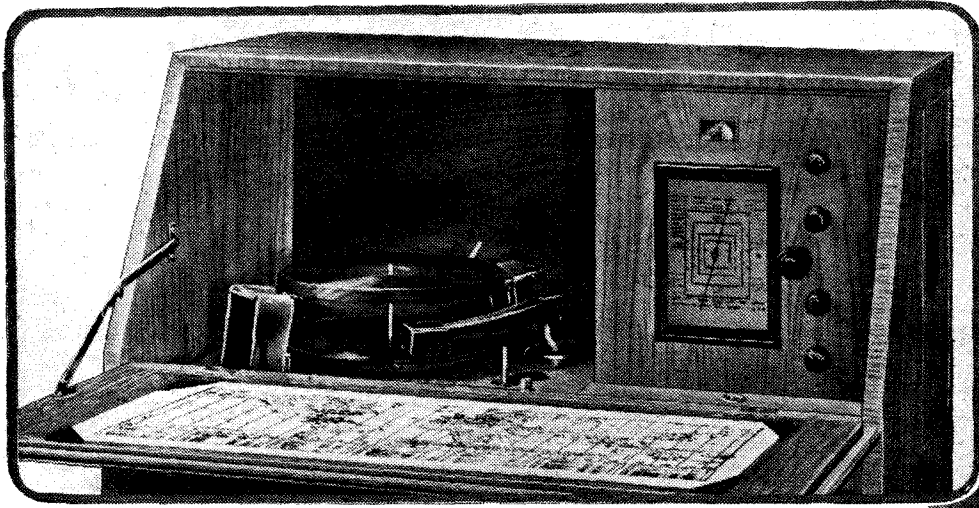
The change-over switch from radio to gramophone is a separate control and the waverange switch, already complicated by the necessity of separating five wave-

ables either the internal or external loud speaker or both to be retained in circuit.

The chassis and the automatic record-changer unit are housed in a cabinet of characteristic H.M.V. quality. Both the chassis and the motor-board are carried on resilient mountings and are secured by screws which must be removed before the receiver is put into service. Access to the

in shape and is mounted horizontally to the right of the gramophone turntable. The five waverange scales are covered by a double-ended pointer, and each scale is identified by a colour code disc. The appropriate waverange is indicated by another coloured disc appearing in a small window at the side and operated by the waverange switch.

The controls, which are situated to the right of the tuning scale, include a two-speed tuning knob, the separate radio-gramophone switch and the two tone controls. The mains on-off switch is immediately below the tuning dial and is of the tumbler type. It is sunk

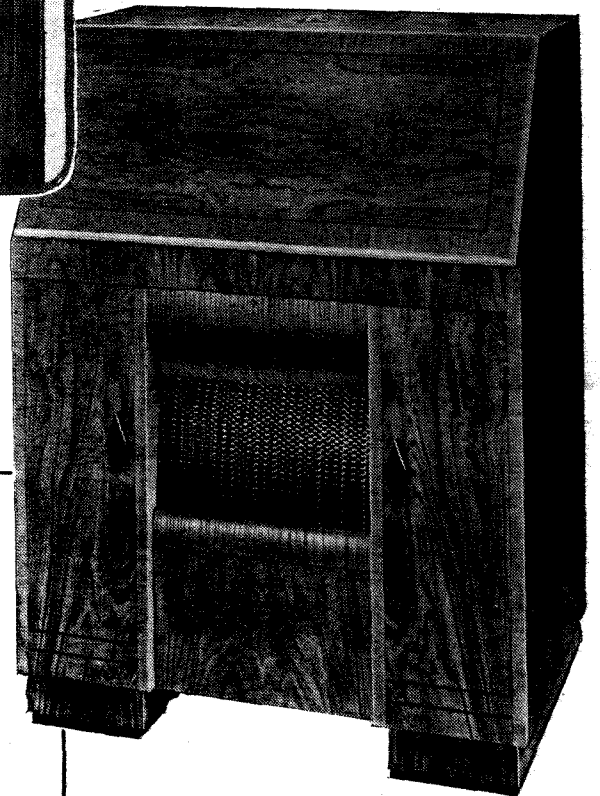


The same equipment is available in a bureau cabinet (Model 581), with storage space for records.

ranges, is relieved of this extra responsibility. There are separate tone controls for bass and treble, the former varying the coupling capacity to the output pentode valve, and the latter consisting of a series of shunt capacities across the primary of the output transformer. There is provision for an external loud speaker, and a three-way switch at the back of the cabinet en-

inside of the chassis is readily obtained by removing the panel in the right-hand side of the cabinet. Mechanical noise and needle scratch from the pick-up is kept within the closed cabinet by a "flock-sprayed" lining inside the lid.

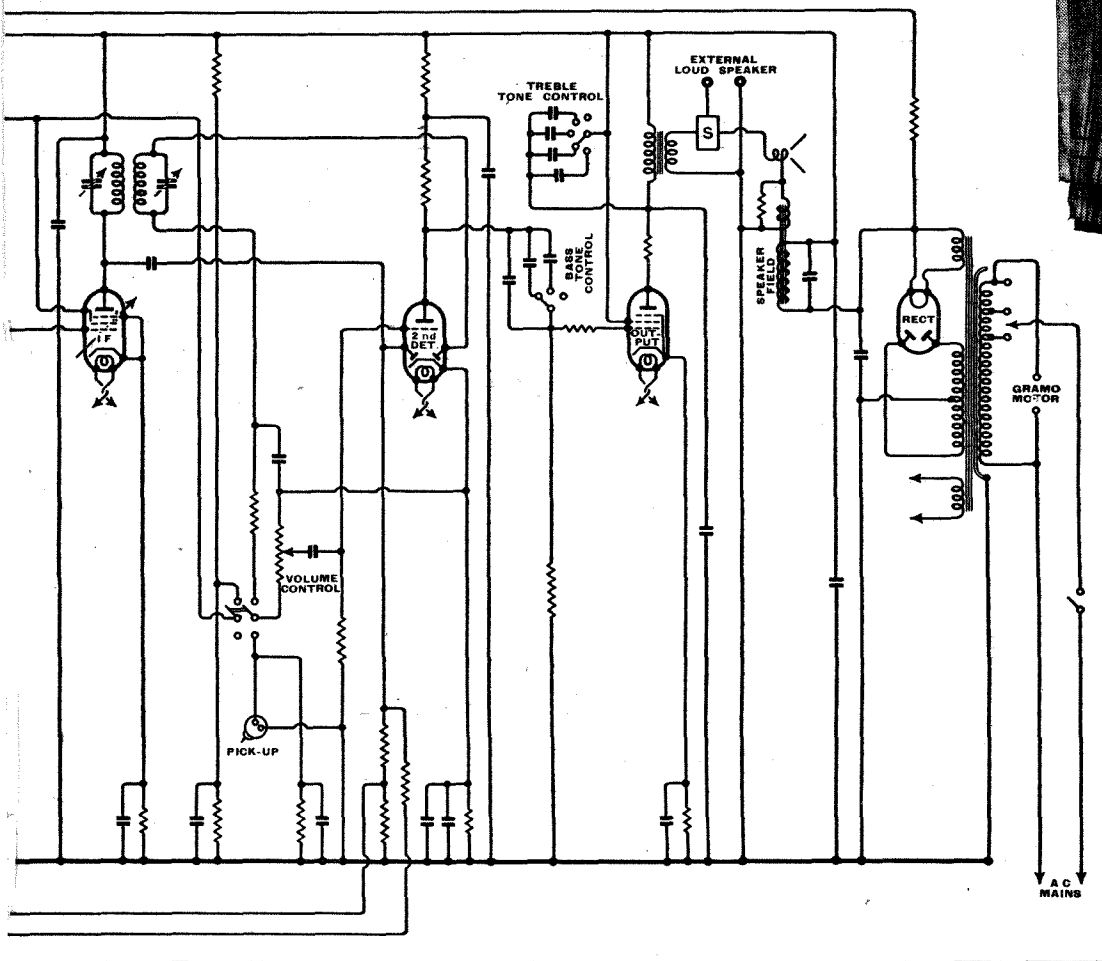
The tuning scale is rectangular



below the surface of the panel and is somewhat difficult to operate.

The same chassis and record-changer equipment are available in an alternative cabinet design which resembles in many respects a writing bureau. This is the Model 581 and it seems to us to be an ideal design for the short-wave enthusiast. The chassis is mounted vertically, thus bringing the controls easily to the hand, and the record-changer is neatly stowed in the space which would normally be occupied by stationery. The open lid forms a natural arm-rest and might conveniently be covered by a map showing the short-wave stations of the world. The loud speaker grille is designed to throw the sound upwards and at each side of it there are cupboards with ample storage space for records.

Of the three short-wave ranges, that covering wavelengths from 16.7 to 51 metres was at the time of the test the most productive of interesting signals. Accord-



H.M.V. Model 485A—

ingly the waverange switch was set to this range and the set switched on. As the valves warmed up a familiar interval signal was heard and we were just in time to hear the station announced as WJZ. A glance at the wavelength scale showed that we were listening to the relay through W3XAL on 16.8 metres. Without touching any of the controls this programme was enjoyed for a considerable time at excellent volume. While we do not wish to suggest that the receiver is always capable of picking out American stations for itself in this way, the efficiency of the circuit is such that very little effort is required on the part of the operator to tune in transatlantic programmes when atmospheric conditions are favourable. The subsidiary fine tuning pointer at the centre of the scale makes an important contribution to the ease of handling of this set, and with the movement of the tuning condenser so magnified the absence of a tuning indicator is hardly noticed.

The efficiency of the set on this waveband is not without its drawbacks and the inter-station noise would seem to justify the introduction of some form of quiet tuning device. By comparison with the 16.7-51 metre range, the new ultra-short-wave band at first appears to be flat. However, this only serves to show that the HF amplifier makes an important contribution to the over-all magnification when it is in operation, for as the circuit diagram shows it is out of action on the lowest waveband. The signal strength of one or two low-powered experimental transmissions picked up in the region of 7 metres was quite comfortable, and although at the time of the test no modulated signals from Alexandra Palace were available, we have no doubt whatever, judging from the strength of the carrier, that a handsome reduction of the volume control will be necessary when this station goes into service.*

With the difficulties of short-wave reception so successfully overcome, it is only to be expected that an outstandingly good performance has been provided on the normal broadcast wavelengths. The range is such as can only be obtained with a signal-frequency HF amplifier preceding the frequency-changer, and the selectivity is fully in keeping with the demands made by the sensitivity of the set. The Deutschlandsender cannot be

* The "Radiolympia" transmissions have subsequently confirmed this prediction. Best results are obtained with the bass tone control reduced, otherwise microphonic feed-back may set up a howl at full volume.

quite cleared of sideband interference from its neighbours, but on the medium-wave band the Brookmans Park transmitters are easily approached to within one channel with the set working in Central London.

After the usual form of tone control, which is merely a top-cutting device, it is a great pleasure to handle a set with in-

dependent tone control. It is easy to find settings which give a proper balance of tone; or one can indulge in judicious emphasis when the character of the transmission calls for this form of minor caricature. Although the moving-coil loud speaker is small, it gives a volume of sound fully in keeping with the substantial proportions of the cabinet.

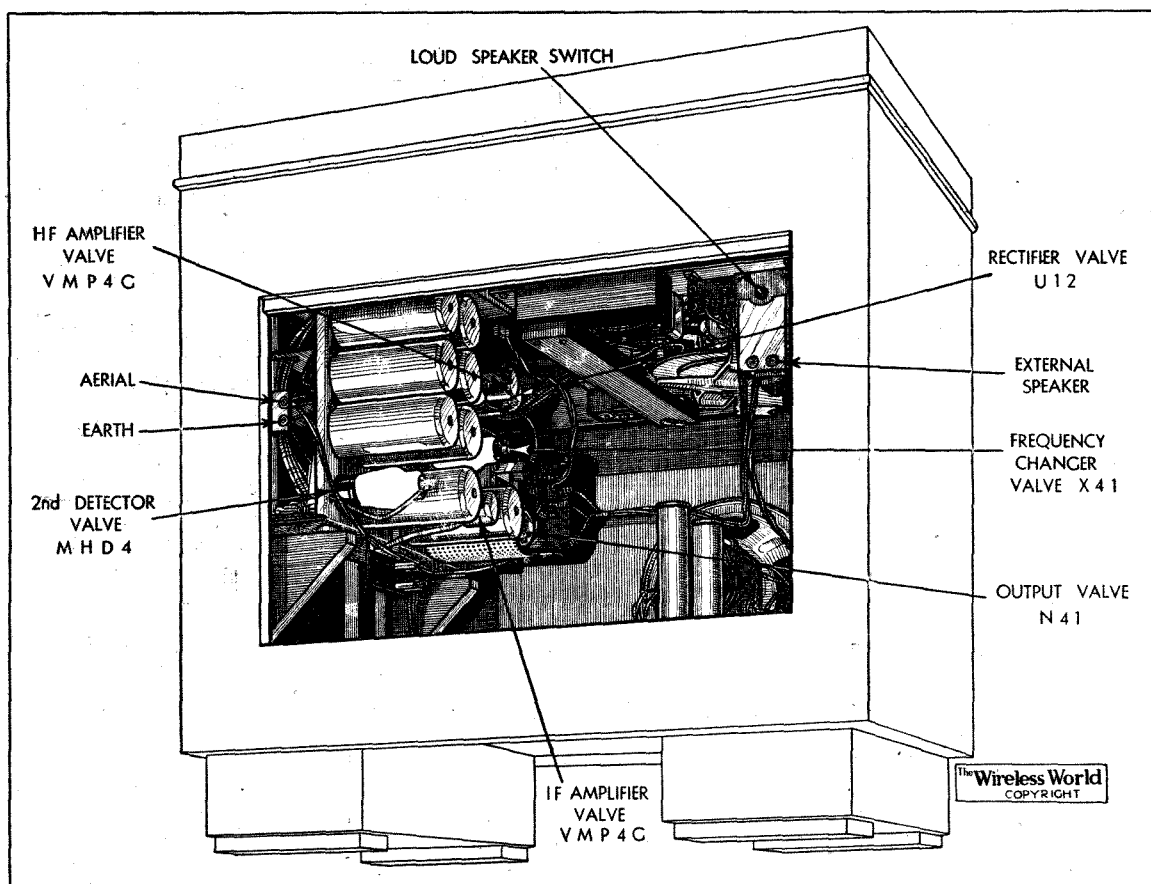
Letters to the Editor

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

Television Interference

IN *The Wireless World* of August 28th, Mr. Browning describes interference which he attributes to the reception of ex-

arrangement would probably have been better inasmuch as it would not have altered the tuning so much. As my set is an "old stager" with independent tuning



The chassis is mounted vertically and access to the underside is readily obtained by removing the panel at the side of the cabinet.

perimental television transmissions from Alexandra Palace.

Mr. Browning is quite correct in his surmises, I having experienced something very similar myself. My home is within a few minutes' walk of the Crystal Palace tower, in which Bairds make their experiments. While these are in progress we receive a high-pitched modulated whistle or other noise according to the transmission in hand. I have established beyond doubt that the interference emanates from the short-wave transmitter, and it has been a considerable nuisance in this neighbourhood.

In my own case the interference persisted even when the aerial was disconnected, and is apparently picked up by the lead to the detector. On my set I have cured the trouble by fitting a by-pass condenser across the detector. A resistance condenser

controls, this did not matter in this instance.

I would add that Mr. Browning may consider himself lucky in picking up a rehearsal of a real dance band. During Baird's experimental transmissions the interfering programme usually consisted of one gramophone record repeated *ad nauseam*.

London, S.E.19. P. G. A. H. VOIGT.

Demonstrations at the Show

ONE'S conclusion on reading the article by Mr. Hartley, in your issue of July 31, is that Mr. Hartley's products will not get a fair "do" when demonstrated under Exhibition conditions, and with this I am sure everyone will agree, but I must protest at his unfair comparison with other speakers, as it is obvious that the majority of speaker manufacturers are at a far bigger disadvantage than Hartley.

Letters to the Editor—

If we assume Mr. Hartley's speaker is linear and it is fed with a linear input, then surely his "grouse" is limited to the fact that his power input is absurdly small.

Ninety per cent. of the speakers demonstrated in the Show will be built to operate in conjunction with wireless sets which, of necessity, attenuate the higher frequencies, although not to anything like the extent that Mr. Hartley would have us believe, but by using a speaker with a rising characteristic the effect of this attenuation is very greatly reduced and a satisfactory overall response up to 6,000 or 7,000 cycles is not unusual.

Such speakers are very far from flat, and when fed from a straight line amplifier the results must necessarily be most unpleasant, so that on this point, which is a major one, exhibition conditions are very much in Mr. Hartley's favour.

The second point concerns harmonic distortion. The energy supplied from the B.B.C. lines is a nominal watt, and if previous exhibitions are any criterion it is usually far below this figure. There are very few mains sets on the market to-day which will not deliver at least three times this output with negligible harmonic distortion, so that a visitor to the Exhibition can reasonably expect more power and better frequency response from his receiver than he will hear in the Exhibition.

It is also difficult to understand how har-

monic distortion over 4,000 cycles preponderates, as overloading almost invariably occurs at the lower frequencies, due to the inadequate primary inductance of the average output transformer, and if the set is kept within limits of overloading from this cause high frequency distortion will be negligible.

I am sure that the majority of manufacturers would welcome the adoption of Mr. Hartley's suggestions on soundproof rooms, etc., but in the meantime one must object to his almost complete inversion of the facts as they affect the average exhibitor.

For Grampion Reproducers, Ltd.,
Surrey.
A. R. WILLIAMS.

Biassing the Output Valve

WITH reference to Mr. L. C. Irvine's letter on the above subject, I was very interested in Mr. Bonavia-Hunt's letter to which Mr. Irvine replies, as I had had the same experience as described by Mr. Bonavia-Hunt, in respect of using electrolytic condensers for the purpose of auto-biasing the output valve. I had previously been using electrolytic condensers of 100 mfd. capacity, and found the momentary initial leakage to be very great indeed when the set was first switched on, causing the output valve, a DO/25, to consume temporarily 50 per cent. anode current above the normal rating, which I con-

sidered endangered the auto-bias of the valve. I therefore abandoned the auto-bias in favour of a separate grid bias eliminator, which embodies a H50 Westinghouse rectifier of quite small compass, and is completely satisfactory.

H. WIGHTMAN HARRIS.
London, S.E.4.

"Stage" Ratings

IN the issue of *The Wireless World* of August 21st, on page 168, you give the impression that Ekco were pioneers of the "stage" ratings. It seems to me that B.T.H. were much earlier in the field with the method, a notable example of which was the "two-stage" receiver, a set which used a double valve and resistance capacity coupling.
R. HAYWOOD.
Coventry.

Place Name Pronunciation

A BELATED comment regarding your "Editorial Comment" in your June 19th, 1936 issue. I was very much surprised to note that your announcers had so free a hand in pronunciation of various cities' names. As you probably know, our announcers here are held very strictly to accepted pronunciation as given in English dictionaries.
EARL P. CARTER,
Director of Sound Recording,
American Printing House for the Blind,
Louisville, Ky.

Professor Appleton Returns to Cambridge.

PROF. E. V. APPLETON, F.R.S., the distinguished physicist, best known to *Wireless World* readers for his valuable and original work in connection with investigations of the upper atmosphere, has been appointed to the Jacksonian Pro-



Prof. E. V. Appleton, F.R.S.

fessorship of Natural Philosophy at Cambridge.

For the last twelve years Prof. Appleton has held the Wheatstone Chair of Physics at the University of London. He is now being welcomed back at Cambridge, where he was made a Fellow of St. John's, his old college, when he was demobilised after the war in 1919. In 1920

NOTES AND NEWS

he became Assistant Demonstrator in Experimental Physics at the Cavendish Laboratory under Lord Rutherford, and for two years he was a lecturer at Trinity College.

Demand for Television Receivers

ALTHOUGH regular public transmissions from the Alexandra Palace have not yet commenced, there appears to be no lack of demand for television receivers; one prominent manufacturer had enquiries for a hundred instruments during the first five days of the Show. The enquirer for the hundredth instrument was Sir Thomas Beecham, and we may, therefore, hope that he will be as candid in his criticisms of the vision programmes as he has been in the case of sound.

For a Good Cause

AN appeal for used or surplus radio components, addressed especially to wireless manufacturers and dealers as well as to the general public, is being made by the Stoke Newington Occupational and Recreational Centre for Unemployed Men. The Centre (6, Palatine Road, London, N.16) aims at giving its unemployed members a chance to use their enforced leisure in a useful manner, and already has a fully

qualified wireless instructor; only lack of means prevents the purchase of components for starting instructive experimental work.

Wireless Operators Wanted

OWING to the expansion of the R.A.F. there are, among other posts, many vacancies in the ranks of wireless operators. Six years is the period for which men are required to enlist. Full particulars concerning pay and conditions of service can be obtained from the R.A.F. Recruiting Depot, Victory House, Kingsway, London, W.C.2.

A Royal Enthusiast

AMONG the many radio enthusiasts is the ex-King of Siam, who owns a large number of radio receivers of various types. During the recent Olympia Exhibition he made a personal visit and added yet another receiver to his collection.

Air Ministry Appointment

MR. R. A. WATSON WATT vacates his appointment as Superintendent of the Radio Department of the National Physical Laboratory to take up the position of Superintendent of the Air Ministry Research Station. Mr. Watson Watt began his Civil Service career in the

Meteorological Office, and later was appointed Superintendent of the Radio Research Stations of the Department of Scientific and Industrial Research at Aldershot and Slough.

He became Superintendent of the Radio Department of the National Physical Laboratory when it was formed in 1933. In



Mr. R. A. Watson Watt.

this post he has been responsible for an increasing amount of important work for the Air Ministry, especially in connection with radio direction finders and beacons. His present appointment arises from a decision by that department to establish a research station to continue this work.

RANDOM RADIATIONS

The Range of "A.P."

IT will be very interesting to see how the service area of the London television station works out. Twenty-five miles is the most usual estimate for its radius, though some forecast forty. I am told that good reception has been obtained at Rugby, over eighty miles away, though this may have been a freak occurrence. I live just under twenty-five miles north-west of Alexandra Palace, and I fear that my district will not be of much use for television reception, probably on account of the screening effect of the hills. Several times lately I have tried for the "sound" transmission with a big superhet which tunes down a long way below 7 metres. So far I've not been able to pick up A.P. at all. The aerial, however, may be to blame. Alterations are to be made, and when they have been carried out one will be able to tell whether or not one is living in a blind spot as regards Alexandra Palace.

■ ■ ■

Cathode-ray Tube Life

WHAT, I wonder, is going to be the life of the cathode-ray tubes used in television receivers? I put the question to several people who have had practical experience of them and received widely different estimates. One man said 700 hours; two or three predicted an average life of 1,000 hours or rather more; one was bold enough to make it 3,000 hours. What sort of guarantee will makers give with them? That is a question that will have to be decided soon, and it's an important one from the purchaser's point of view. From that of the manufacturer the cathode-ray tube presents less difficulties than the mere valve. Since "sound" broadcasting can be heard with an "all-wave" set at any hour of the twenty-four, the radio set may—and often does—get an enormous amount of use. Hence, a three-months' guarantee for valves is all that can be expected. But with definite hours of television transmission and little or no chance of the "looker" reaching out for other stations, the maximum number of hours that a television receiver can be used is easily worked out, and a long guarantee should be given.

■ ■ ■

A Decimal Point

HERE'S a story that came my way the other day. A certain expert, who always worked out everything that came his way mathematically, was given a job of designing an audio-frequency inter-valve transformer. Out came the slide rules, the log tables and what not, and as hour followed hour sheets of intricate calculations were made. Eventually the job was done and the figures were passed on to the factory for the first model to be made. Some days later the manager asked the designer to come along to his office to see the transformer, which was on its way to him. They had been chatting but a moment or two when bumps and thumps and groans and grunts were heard in the passage without. The door opened, and two straining and perspiring workmen staggered in bearing between them a transformer about the size of a cabin trunk. Subsequent investigation of the calculations showed that a decimal point had gone astray!

By "DIALLIST"

Brighter Broadcasting

MORE than once I've referred a little sadly to the unruffled calm, the complete absence of adventure, with which the business of broadcasting is conducted in this country. Abroad, men burn down broadcasting stations as a protest against the quality of their programmes, bump off neighbours whose loud speakers are too loud and do all kinds of exciting things. Here's a true account of a recent happening in the studios of one of America's most important stations. Whilst a rehearsal of a play was in progress, the door was suddenly flung open and in rushed a squad of police, armed to the teeth and crying, "Hands up!" The artists began to laugh, thinking that it was a surprise stunt. However, they soon found that the police were the genuine articles, convinced that a murder had been committed and demanding the instant production of corpse and criminal.

Revolver Shots

Shots had been heard. A man had been seen brandishing a revolver at a window. Alarmed passers-by had at once called the police. By this time the producer had recovered his wits and was able to explain. A revolver required early in the play had refused to function, so an expert in firearms was called in to set it right. Having put it into working order he thought that he had better give it a test, just to make sure. He opened the window and fired half a dozen shots into the air. Just imagine this happening in Langham Place! Imagine, too, the descent of the Flying Squad on Broadcasting House. This is just one of the possible ways of brightening programmes. I hand the suggestion free, gratis and for nothing to the B.B.C.

■ ■ ■

A Recollection

WHILST I was chatting the other day with a very old hand at wireless, whom I have known for many years but had not met for some time, he reminded me of one of the wittiest things ever written by a radio critic. It was at a time when one of those responsible for the programmes had rather a reputation for pouring cold water on each and every idea that was put up to him. "There he sits," wrote P. P. Eckersley, "like a kind of inverted Micawber, waiting for something to turn down!" I'm not sure that the B.B.C. is entirely free from inverted Micawbers even to-day.

■ ■ ■

Still at It

THE Exhibition was responsible for one or two quite good efforts on the part of our old friend the lay reporter. The first that caught my eye was an analysis of the sales and orders at Radiolympia. "My enquiries showed," wrote the scribe, "that of the sets ordered, 35 per cent. were battery, 40 per cent. mains and 25 per cent. all-wave." What I've been looking for for a long time is the "all-wave" set that needs neither batteries nor mains! And how about this? "On the — stand both battery sets and superhets were most attractive." The real truth about the percentages

of sets ordered is, of course, as follows:—Radio sets, 10 per cent.; battery sets, 10 per cent.; mains sets, 25 per cent.; superhets, 18 per cent.; all-wave sets, 22 per cent.; straight sets, 5 per cent.; wireless sets, 10 per cent.; total, 100 per cent.

G.E.C. TELEVISION

Demonstration of Receiver Stability

LAST week, by invitation of the General Electric Company, *The Wireless World*, in company with a number of other visitors, was present at a demonstration of television reception at the Research Laboratories of the company at Wembley.

An entirely satisfactory demonstration of reception from the Alexandra Palace of vision and sound transmissions was given on a number of standard G.E.C. television receivers, which were switched on at the commencement of the demonstration and left untouched throughout the performance, so giving a very convincing idea of their reliability and stability.

The visitors listened to a stimulating address by Lord Hirst, the chairman of the company, and the part which the G.E.C. is playing in television development was touched upon by the vice-chairman, Mr. M. J. Railing, whilst Mr. C. C. Paterson, head of the Research Laboratories, Mr. G. C. Marris and Mr. M. M. McQueen discussed the technical aspects of television and described the G.E.C. receivers. The visit concluded with an inspection of the television laboratories and apparatus.



Chassis of a G.E.C. television receiver.

It is hoped to supplement the description of the G.E.C. television receivers already given on page 235 of *The Wireless World* of August 28th, and on page 247 of the issue of September 4th, with some further details with illustrations in an early issue.

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

(This list is included in the first issue of each month. Stations with an Aerial Power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Mètres.	kW.	Station.	kc/s.	Tuning Positions.	Mètres.	kW.
Ankara (Turkey)	153		1961	5	Bucharest (Romania)	823		364.5	12
Kaunas (Lithuania)	153		1961	7	Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832		360.6	100
Brasov (Radio Romania) (Romania)	160		1875	150	Agen (France)	832		360.6	0.5
Hilversum No. 1 (Holland) (10 kW. till 7.40 p.m. G.M.T.)	160		1875	100	Berlin (Germany)	841		356.7	100
Lahti (Finland)	166		1807	150	Norwegian Relay Stations	850		352.9	—
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172		1744	500	Sofia (Bulgaria)	850		352.9	1
Paris (Radio Paris) (France)	182		1648	80	Valencia (Spain)	850		349.2	3
Istanbul (Turkey)	185		1622	5	Simferopol, RW52 (U.S.S.R.)	859		349.2	10
Irkutsk (U.S.S.R.)	187.5		1600	20	Strasbourg (France)	859		349.2	100
Deutschlandsender (Germany)	191		1571	60	Poznan (Poland)	868		345.6	16
Droitwich	200		1500	150	London Regional (Brookmans Park)	877		342.1	50
Minsk, RW10 (U.S.S.R.)	208		1442	35	Linz (Austria)	886		338.6	15
Reykjavik (Iceland)	208		1442	16	Graz (Austria)	886		338.6	7.5
Motala (Sweden)	216		1389	150	Helsinki (Finland)	895		335.2	10
Novosibirsk, RW76 (U.S.S.R.)	217.5		1379	100	Limoges, P.T.T. (France)	895		335.2	1.5
Warsaw, No. 1 (Poland)	224		1339	120	Hamburg (Germany)	904		331.9	100
Luxembourg	232		1293	150	Dnepropetrovsk (U.S.S.R.)	913		328.6	10
Leningrad, No. 1 RW53 (Kolpino) (U.S.S.R.)	232		1293	100	Toulouse (Radio Toulouse) (France)	913		328.6	60
Kalundborg (Denmark)	240		1250	60	Brno (Czechoslovakia)	922		325.4	32
Vienna, No. 2 (Austria)	240		1250	0.5	Brussels, No. 2 (Belgium)	932		321.9	15
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25	Algiers (Algeria)	941		318.8	12
Oslo (Norway)	260		1153.8	60	Göteborg (Sweden)	941		318.8	10
Moscow, No. 2, RW49 (Stehelkovo) (U.S.S.R.)	271		1107	100	Breslau (Germany)	950		315.8	100
Tromsø (Norway)	282		1063.8	10	Paris (Poste Parisien) (France)	959		312.8	60
Tiflis, RW7 (U.S.S.R.)	283		1060	35	Bordeaux-Sud-Ouest (France)	968		309.9	30
Finmark (Norway)	347		864.6	10	Odessa (U.S.S.R.)	968		309.9	10
Rostov-on-Don, RW12 (U.S.S.R.)	355		845.1	20	Northern Ireland Regional (Lisburn)	977		307.1	100
Budapest, No. 2 (Hungary)	359.5		834.5	18	Genoa (Italy)	986		304.3	10
Sverdlovsk, RW5 (U.S.S.R.)	375		800	40	Torun (Poland)	986		304.3	24
Boden (Sweden)	392		765	0.6	Hilversum No. 2 (Holland). (15 kW. till 7.40 p.m. G.M.T.)	995		301.5	60
Banska-Bystřica (Czechoslovakia)	392		765	100	Bratislava (Czechoslovakia)	1004		298.8	13.5
Geneva (Switzerland)	401		748	1.3	Midland Regional (Droitwich)	1013		296.2	70
Moscow, No. 3 (RCZ) (U.S.S.R.)	401		748	100	Chernigov (U.S.S.R.)	1013		296.2	5
Ostersund (Sweden)	413.5		726	0.6	Barcelona, EAJ15 (Spain)	1022		293.5	3
Voroneje, RW25 (U.S.S.R.)	413.5		726	10	Cracow (Poland)	1022		293.5	2
Oulu (Finland)	431		696	1.2	Oviedo (Spain)	1022		293.5	0.7
Ufa, RW22 (U.S.S.R.)	436		688	10	Königsberg No. 1 (Heilsberg) (Germany)	1031		291	100
Hamar (Norway)	519		578	0.7	Pareda (Portugal)	1031		291	5
Innsbruck (Austria)	519		578	1	Leningrad, No. 2, RW70 (U.S.S.R.)	1040		288.5	10
Tartu (Estonia)	522		585	0.5	Rennes-Bretagne (France)	1040		288.5	120
Ljubljana (Yugoslavia)	527		569.3	6.3	Scottish National (Falkirk)	1050		285.7	50
Viipuri (Finland)	527		569.3	10	Bari No. 1 (Italy)	1059		283.3	20
Bolzano (Italy)	536		559.7	10	Paris (Radio Cité) (France)	1068		280.9	0.8
Wilno (Poland)	536		559.7	16	Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
Budapest, No. 1 (Hungary)	546		549.5	120	Bordeaux-Lafayette (France)	1077		278.6	12
Beromünster (Switzerland)	556		539.6	100	Zagreb (Yugoslavia)	1086		276.2	0.7
Athlone (Irish Free State)	565		531	60	Falun (Sweden)	1086		276.2	2
Palermo (Italy)	565		531	3	Madrid, EAJ7 (Spain)	1095		274	5
Stuttgart (Germany)	574		522.6	100	Vinnitsa (U.S.S.R.)	1095		274	10
Alpes-Grenoble, P.T.T. (France)	583		514.6	15	Madona (Latvia)	1104		271.7	50
Riga (Latvia)	583		514.6	15	Naples (Italy)	1104		271.7	1.5
Vienna No. 1 (Austria)	592		506.8	100	Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Rabat (Morocco)	601		499.2	20	Fécamp (Radio Normandie) (France)	1113		269.5	10
Sundsvall (Sweden)	601		499.2	10	Alexandria, No. 1 (Egypt)	1122		267.4	0.25
Florence (Italy)	610		491.8	20	Newcastle	1122		267.4	1
Cairo, No. 1 (Egypt)	620		483.9	20	Nyiregyhaza (Hungary)	1122		267.4	6.25
Brussels, No. 1 (Belgium)	620		483.9	15	Hörby (Sweden)	1131		265.3	10
Lisbon (Portugal)	629		476.9	15	Turin, No. 1 (Italy)	1140		263.2	7
Trøndelag (Norway)	629		476.9	20	Trieste (Italy)	1140		263.2	10
Prague, No. 1 (Czechoslovakia)	638		470.2	120	London National (Brookmans Park)	1149		261.1	20
Lyons, P.T.T. (France)	648		463	100	North National (Slaithwaite)	1149		261.1	20
Petrozavodsk (U.S.S.R.)	648		463	10	West National (Washford Cross)	1149		261.1	20
Cologne (Germany)	658		455.9	100	Kosice (Czechoslovakia)	1158		259.1	10
North Regional (Slaithwaite)	668		449.1	70	Monte Ceneri (Switzerland)	1167		257.1	15
Sottens (Switzerland)	677		443.1	100	Copenhagen (Denmark)	1176		255.1	10
Belgrade (Yugoslavia)	686		437.3	2.5	Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Bodø (Norway)	686		437.3	0.5	Nice Corse (France)	1185		253.2	60
Paris, P.T.T. (France)	695		431.7	120	Frankfurt (and Relays) (Germany)	1195		251	25
Stockholm (Sweden)	704		426.1	55	Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Rome, No. 1 (Italy)	713		420.8	50	Lille, P.T.T. (France)	1213		247.3	60
Kiev, RW9 (U.S.S.R.)	722		415.4	35	Bologna (Radio Marconi) (Italy)	1222		245.5	50
Kharkov, No. 1, RW20 (U.S.S.R.)	722		415.4	10	Narvik (Norway)	1222		245.5	0.3
Tallinn (Estonia)	731		410.4	20	Gleititz (Germany)	1231		243.7	5
Madrid, EAJ2 (Spain)	731		410.4	3	Cork (Irish Free State)	1240		241.9	1
Seville (Spain)	731		410.4	5.5	Saarbrücken (Germany)	1249		240.2	17
Munich (Germany)	740		405.4	100	Riga (Latvia)	1258		238.5	10
Marseilles, P.T.T. (France)	740		400.5	90	Rome, No. 3 (Italy)	1258		238.5	1
Pori (Finland)	749		400.5	1	San Sebastian, EAJ8 (Spain)	1258		238.5	1
Sortavala (Finland)	749		400.5	0.25	Nürnberg (Germany)	1267		236.8	2
Katowice (Poland)	758		395.8	12	Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	2.7
Scottish Regional (Falkirk)	767		391.1	50	Christiansand (Norway)	1276		235.1	0.5
Stalino (U.S.S.R.)	776		386.6	10	Stavanger (Norway)	1276		235.1	0.5
Toulouse P.T.T. (France)	776		386.6	120	Dresden (Germany)	1285		233.5	0.25
Fredrikstad (Norway)	776		386.6	1	Aberdeen	1285		233.5	1
Leipzig (Germany)	785		382.2	120	Klagenfurt (Austria)	1294		231.8	5
Barcelona, EAJ1 (Spain)	795		377.4	7.5	Vorarlberg (Austria)	1294		231.8	5
Lwow (Poland)	795		377.4	16	Danzig	1303		230.2	0.5
West Regional (Washford Cross)	804		373.1	70	Swedish Relay Stations	1312		228.7	—
Milan, No. 1 (Italy)	814		368.6	50	Magyarovar (Hungary)	1321		227.1	1.25

Station.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	kc/s.	Tuning Positions.	Metres.	kW.
German Relay Stations	1330		225.6	—	Paris (Eiffel Tower) (France)	1456		206	5
Montpellier, P.T.T. (France)	1339		224	1.2	Pecs (Hungary)	1465		204.8	1.25
Lodz (Poland)	1339		224	2	Antwerp (Belgium)	1465		204.8	0.1
Dublin (Irish Free State)	1348		222.6	0.5	Courtrai (Belgium)	1465		204.8	0.1
Rjukan (Norway)	1348		222.6	0.15	Bournemouth	1474		203.5	1
Salzburg (Austria)	1348		222.6	2	Plymouth	1474		203.5	0.3
Tampere (Finland)	1348		222.6	0.7	Binche (Belgium)	1487		201.7	0.1
Cairo No. 2 (Egypt)	1348		222.6	0.5	Chatelineau (Belgium)	1492		201.1	0.1
Königsberg (Germany)	1348		222.6	2	Wallonia (Belgium)	1492		201.1	0.1
Nottoden (Norway)	1357		221.1	0.15	Nimes (France)	1492		201.1	0.7
Italian Relay Stations	1357		221.1	—	Albacete (Spain)	1492		201.1	0.2
L'Île de France (France)	1366		219.6	0.7	Radio Alcoy (Spain)	1492		201.1	0.1
Basle (Switzerland)	1375		218.2	0.5	Santiago (Spain)	1492		201.1	0.5
Berne (Switzerland)	1375		218.2	0.5	Liege (Radio Cointe) (Belgium)	1500		200	0.1
Warsaw, No. 2 (Poland)	1384		216.8	2	Verviers (Belgium)	1500		200	0.1
Lyons (Radio Lyons) (France)	1393		215.4	25	Pietarsaari (Finland)	1500		200	0.25
Beziers (Radio Midi) (France)	1429		209.9	0.3	Radio Alcalá (Spain)	1500		200	0.2
Alexandria, No. 2 (Egypt)	1429		209.9	0.5	Karlskrona (Sweden)	1530		196	0.2
Turku (Finland)	1429		209.9	0.5	Liepāja (Latvia)	1737		173	0.1
Miskolc (Hungary)	1438		208.6	1.25					

SHORT-WAVE STATIONS OF THE WORLD

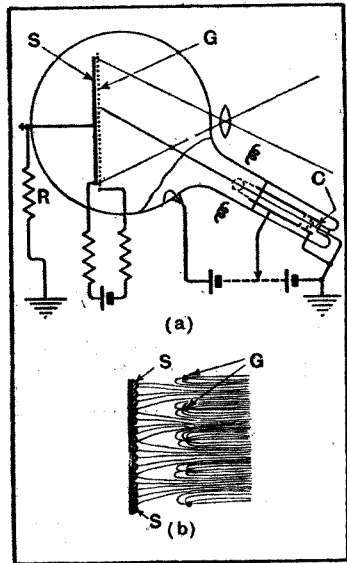
Station.	Call Sign.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	Call Sign.	kc/s.	Tuning Positions.	Metres.	kW.
Ponta Delgada (Azores)	CT2AJ	4,000		75.00	0.05	Jeløy (Norway)	LKJI	9,530		31.48	1
Kharbarovsk (Russia)	RV15	4,273		70.20	20	Schenectady (U.S.A.)	W2XAF	9,530		31.48	30
Sourabaya (Java)	YDB	4,470		67.11	1	Zeesen (Germany)	DJN	9,540		31.45	5
Caracas (Venezuela)	YV2RC	5,800		51.72	1	Zeesen (Germany)	DJA	9,560		31.38	5
San Jose (Costa Rica)	YIX	5,820		51.52	1	Bombay (India)	VUB	9,565		31.36	4.5
Maracaibo (Venezuela)	YV5RMO	5,850		51.28	1	Millis (U.S.A.)	W1XX	9,570		31.35	10
Vatican City (Vatican State)	HVJ	5,969		50.26	10	Daventry (Gt. Britain)	GSC	9,580		31.32	15
Trujillo (Domenica)	HIX	5,980		50.16	0.2	Lyndhurst (Australia)	VK3LR	9,580		31.32	1
Mexico City (Mexico)	XEBT	6,000		50.00	1	Buenos Aires (Argentina)	LRX	9,580		31.32	5
Moscow (Russia)	RW59	6,000		50.00	20	Philadelphia (U.S.A.)	W3XAU	9,590		31.28	1
Drummondville (Canada)	CFCF	6,005		49.96	50	Sydney (Australia)	VK2ME	9,590		31.28	20
Havana (Cuba)	COCO	6,010		49.92	0.5	Eindhoven (Holland)	PCJ	9,590		31.28	20
Singapore (Malaya)	ZHI	6,018		49.85	0.09	Prangins (Radio-Nations) (Switz'l'd)	HBL	9,595		31.27	20
Bogota (Colombia)	HJ3ABH	6,018		49.85	1.6	Rome (Italy)	2RO	9,635		31.13	25
Zeesen (Germany)	DJC	6,020		49.83	5	Lisbon (Portugal)	CT1AA	9,655		31.07	2.5
Panama City (Panama)	HP5B	6,030		49.75	0.1	Lisbon (Portugal)	CTICT	9,677		31.00	0.5
Calgary (Canada)	VE9CA	6,030		49.75	0.1	Madrid (Spain)	EAQ	9,860		30.43	20
Boston (U.S.A.)	W1XAL	6,040		49.67	10	Bandoeng (Java)	PMN	10,260		29.24	10
Miami (U.S.A.)	W4XB	6,040		49.67	2.5	Ruyselede (Belgium)	ORK	10,330		29.04	9
Pernambuco (Brazil)	PRA8	6,040		49.67	3	Tokio (Japan)	JVN	10,710		28.01	20
Barranquilla (Colombia)	HJ1ABG	6,042		49.65	0.15	Tokio (Japan)	JVM	10,740		27.93	20
Daventry (Gt. Britain)	GSA	6,050		49.59	15	Medellin (Colombia)	HJ4ABA	11,710		25.62	1
Cincinnati (U.S.A.)	W8XAL	6,060		49.50	10	Winnipeg (Canada)	CJRX	11,720		25.60	2
Philadelphia (U.S.A.)	W3XAU	6,060		49.50	1	Paris (Radio-Colonial) (France)	TPA4	11,720		25.60	12
Skamlebaek (Denmark)	OXY	6,060		49.50	0.5	Daventry (Gt. Britain)	GSD	11,750		25.53	15
Manizales (Colombia)	HJ4ABL	6,067		49.45	0.15	Zeesen (Germany)	DJD	11,770		25.49	5
Vienna (Austria)	OER2	6,072		49.41	1.5	Boston (U.S.A.)	W1XAL	11,790		25.45	10
Penang (Malaya)	ZHJ	6,080		49.33	0.05	Rome (Italy)	2RO	11,810		25.40	25
Chicago (U.S.A.)	W9XAA	6,080		49.33	0.5	Daventry (Gt. Britain)	GSN	11,820		25.38	15
Nairobi (Kenya)	VQ7LO	6,083		49.31	0.5	Wayne (U.S.A.)	W2XE	11,830		25.36	1
Bowmanville (Canada)	CRXC	6,090		49.26	0.5	Lisbon (Portugal)	CT1AA	11,830		25.36	2
Johannesburg (South Africa)	ZTJ	6,097		49.20	5	Daventry (Gt. Britain)	GSE	11,860		25.29	15
Bound Brook (U.S.A.)	W3XAL	6,100		49.18	35	Pittsburgh (U.S.A.)	W8XX	11,870		25.27	40
Chicago (U.S.A.)	W9XF	6,100		49.18	10	Paris (Radio-Colonial) (France)	TPA3	11,880		25.23	12
Belgrade (Yugoslavia)		6,100		49.18	1	Addis Ababa (Abyssinia)	ETB	11,955		25.09	3.5
Manizales (Colombia)	HJ4ABB	6,105		49.15	1	Moscow (Russia)	RW59	12,000		25.00	20
Daventry (Gt. Britain)	GSL	6,110		49.10	15	Lisbon (Portugal)	CTICT	12,082		24.83	0.5
Calcutta (India)	VUC	6,110		49.10	0.5	Reykjavik (Iceland)	TFJ	12,235		24.52	7.5
Medellin (Colombia)	HJ4ABE	6,110		49.10	1	Parade (Portugal)	CTIGO	12,396		24.20	0.35
Wayne (U.S.A.)	W2XE	6,120		49.02	1	Suva (Fiji)	VPD	13,075		22.94	1
Havana (Cuba)	COCO	6,130		48.92	0.25	Warsaw (Poland)	SPW	13,635		22.00	10
Halifax (Canada)	VE9HX	6,130		48.92	0.07	British Amateurs		14,005		21.42	0.01
Pittsburgh (U.S.A.)	W8XX	6,140		48.86	40			to		to	
Winnipeg (Canada)	CJRO	6,150		48.78	2			14,395		20.84	
Lisbon (Portugal)	CSL	6,150		48.78	0.51	Vatican City (Vatican State)	HVJ	15,123		19.84	10
Caracas (Venezuela)	YV3RC	6,150		48.78	1	Daventry (Gt. Britain)	GSF	15,140		19.82	10
Parade (Portugal)	CT1GO	6,198		48.40	0.5	Daventry (Gt. Britain)	GSO	15,180		19.76	15
Trujillo (Domenica)	HIZ	6,316		47.50	1	Zeesen (Germany)	DJB	15,200		19.74	5
Caracas (Venezuela)	YV4RC	6,375		47.05	1	Pittsburgh (U.S.A.)	W8XX	15,210		19.72	40
San Jose (Costa Rica)	TIPG	6,410		46.86	0.5	Eindhoven (Holland)	PCJ	15,220		19.71	20
Barranquilla (Colombia)	HJ1ABB	6,447		46.52	1	Paris (Radio-Colonial) (France)	TPA2	15,243		19.68	12
Cali (Colombia)	HJ5ABD	6,490		46.21	0.1	Daventry (Gt. Britain)	GSI	15,260		19.66	10
Valencia (Colombia)	YV6RV	6,520		46.00	0.5	Wayne (U.S.A.)	W2XE	15,270		19.65	1
Riobamba (Ecuador)	PRADO	6,620		45.31	1	Zeesen (Germany)	DJQ	15,280		19.63	5
Guayaquil (Ecuador)	HC2RL	6,667		45.00	0.2	Buenos Aires (Argentina)	LRU	15,290		19.62	5
British Amateurs		7,000		42.86	0.01	Daventry (Gt. Britain)	GSP	15,310		19.60	15
		to		to		Schenectady (U.S.A.)	W2XAD	15,330		19.57	18
		7,300		41.10		Szekersefehar (Hungary)	HAS3	15,370		19.52	20
Georgetown (British Guiana)	VP3MR	7,080		42.86	0.15	Zeesen (Germany)	DJE	17,760		16.89	5
Tokio (Japan)	JVP	7,510		39.95	20	Wayne (U.S.A.)	W2XE	17,760		16.89	1
Prangins (Radio-Nations) (Switz'l'd)	HBP	7,797		38.48	20	Huizen (Holland)	PHI	17,770		16.88	23
Quito (Ecuador)	HCKB	8,214		36.50	0.25	Bound Brook (U.S.A.)	W3XAL	17,780		16.87	35
Hong Kong (China)	ZCK3	8,750		34.29	0.5	Daventry (Gt. Britain)	GSG	17,790		16.86	10
Budapest (Hungary)	HAT4	9,125		32.88	5	Bandoeng (Java)	PLE	18,830		15.93	60
Havana (Cuba)	COCH	9,428		31.80	1	Daventry (Gt. Britain)	GSH	21,470		13.97	10
Rio de Janeiro (Brazil)	PRF5	9,501		31.58	5	Wayne (U.S.A.)	W2XE	21,520		13.94	1
Daventry (Gt. Britain)	GSB	9,510		31.55	15	Daventry (Gt. Britain)	GSJ	21,530		13.93	10
Melbourne (Australia)	VK3ME	9,510		31.55	1.5	Pittsburgh (U.S.A.)	W9XX	21,540		13.93	40

Recent Inventions

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

TELEVISION SYSTEMS

A CATHODE-RAY television transmitting tube is provided with a sensitised surface S built up of a number of minute photo-sensitive cells. This is faced by a fine-wire grid G, which is maintained at approximately the same potential as the cathode C of the tube. The image to be transmitted is focused on to the surface S and is then scanned by the electron stream from the "gun" part of the tube. The arrangement is such that the positive potential acquired by the elements is never sufficiently high to raise the velocity of the electron stream



Details of special CR tube developed for television transmission.

to the point where the impact is liable to damage the sensitive screen S.

At (b) is shown the disposition of the lines of force about the grid G, and in the space between the grid and the screen S. The charge built up on each of the photo-sensitive cells as the picture is focused upon them is discharged by the scanning action of the electron stream from the cathode as in sketch (b), and the resulting output voltages across the resistance R form the picture-signals.

J. D. McGee. Application date September 20th, 1934. No. 446664.

LOUD SPEAKERS

THE moving coil is wound on the former, the two ends of the wire being first clamped by a layer of silk thread, and then laced through holes formed in a flat plate pierced to surround the end of the cone. The arrangement holds the coil rigidly centred in the gap, whilst permitting freedom of movement through the plane of the gap. The input connections to the speech coil are also arranged in such a way as to avoid "chattering."

Ferranti, Ltd., and A. Bennett. Application date October 31st, 1934. No. 446673.

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

MOTOR CAR RADIO

ALTHOUGH the roof is a favourite place to mount the aerial for a motor car, this position is not available in cars having a drop-head or sliding roof. According to the invention one or more of the bumper-bars are used instead. The aerial wire is strung between supports at each end, so that it lies inside the convex face of one of the bumpers; or a wire may be similarly strung inside both the front and rear bumpers, and the two connected together by a horizontal wire to form a T-aerial.

Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. Application date November 3rd, 1934. No. 446680.

TRANSMITTING CIRCUITS

IN order to prevent interaction between the input and output circuits likely to affect the carrier-wave frequency, a separate oscillator valve is usually employed to drive a power amplifier. In the case of transmitters designed for aircraft or other mobile use, where space and weight are important factors, the separate oscillator valve and the power it consumes have to be taken into consideration.

According to the invention the oscillation generator and amplifier are combined in a single tube with two anodes and a common control grid and cathode. One anode is coupled to the generator circuit, whilst the second anode feeds the amplified oscillations to an output circuit. The two circuits are, of course, intercoupled through the common grid, which is so constructed, e.g., by varying pitch or mesh, that the same applied grid-bias sets the generating circuit to the point of cut-off, and the amplifying circuit beyond that point.

The Plessey Co., Ltd., and A. D'A. Hodgson. Application date September 25th, 1934. No. 446497.

TELEVISION TRANSMITTERS

IN the Iconoscope transmitter the picture to be televised is projected on to a mosaic surface of light-sensitive cells, which are afterwards scanned by the electron stream from the anode part of the cathode ray tube. The direct impact of the stream is liable to damage the light-sensitive cells, and the object of the invention is to prevent this.

Accordingly the mosaic cell electrode is replaced by a "storage" electrode consisting of a plate of insulating material in which there is embedded a large number of small rod conductors. For instance, the plate can be prepared by cutting a section through a bunch of parallel fine-gauge wires held together by an insulating binder. One face of the section is covered with small globules of photo-sensitive material, and the

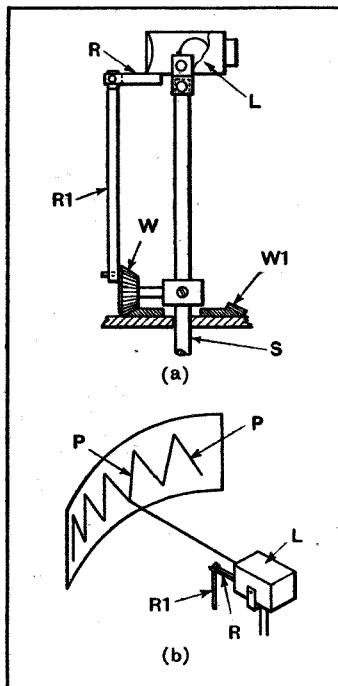
image of the picture to be televised is focused upon it. A scanning spot of light is then traversed over a transparent photo-electric surface arranged close to the opposite face of the storage plate, and the resulting discharge currents are collected by a ring-shaped anode.

D. M. Johnstone and Baird Television, Ltd. Application date November 6th, 1934. No. 446585.

TUNING SCALES

TO secure a more "open" scale, so that a large number of stations can be shown in a relatively small space, a lamp mounted on an extension of the tuning shaft is automatically rocked to and fro so that it traces out a zig-zag path on the scale instead of a straight one.

As shown at (a) in the drawing the lamp L is pivoted at one end of the tuning shaft S, and is rocked up and down, as the shaft is rotated, through links R, R1, and a wheel W which engages with



The tuning dial described in Patent No. 446749.

a planet wheel W1. At (b) is shown the resulting path P of the spot of light thrown on to the indicator dial.

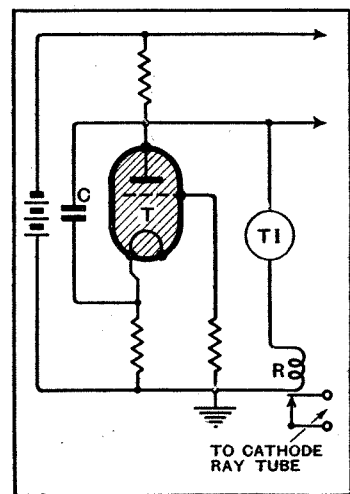
B. Hesketh. Application date November 1st, 1934. No. 446749.

CATHODE-RAY TELEVISION RECEIVERS

THERE is danger, when starting up the cathode-ray tube, of burning the delicate material of the fluorescent screen if the electron stream through the tube is kept stationary. The object, therefore, is to prevent the tube

from being switched into operation until such time as the time-base is functioning, and the scanning-voltages are ready to be applied.

As shown in the figure, the saw-toothed oscillation circuit consists of a gas-filled tube T shunting a condenser C. Both are in turn shunted by a safety tube T1, which is in series with a relay R. The triggering-voltage of the tube



Delay action switch for cathode ray tubes.

T1 exceeds that of the tube T when the cathode of the latter has warmed up to normal working condition. But until this condition is reached the triggering-voltage of T1 is lower than that of T, so that a discharge current passes through it and energises the relay R to prevent the associated cathode ray tube from being switched on. As soon as the saw-toothed scanning voltages are well established, the ignition potential of tube T1 rises above that of T, the discharge ceases, the relay drops, and the cathode ray tube can safely be brought into use.

Radio Akt. D. S. Loewe. Convention dates (Germany) February 12th and April 19th, 1934. No. 446547.

DIRECTION FINDING

THE signal pick-up from a pair of constantly rotating frame aerials is fed, after amplification, to the electrodes of a neon-tube, where it produces a glow discharge of a length proportional at all times to the received signal strength. The neon-lamp indicator is rotated in synchronism with the aerial system. The speed is such that a permanently visible outline is formed, by persistence-of-vision effect, of the well-known figure-of-eight response curve due to the frame aerial. The maximum and minimum points of the curve are clearly indicated, and serve to show the position of the radio beacon station relative to the course of the moving ship or aircraft.

J. Marique and Soc. Internationale de Telegraphie Sans Fil. Convention date (Belgium) January 4th, 1935. No. 447238.

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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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EDITORIAL COMMENT

Telephone Listening

A Return to Favour

A YEAR ago we drew attention to a change of circumstances since loud speakers were first welcomed as providing a wonderful improvement in reception conditions as compared with listening by means of telephones. At the time that the loud speaker appeared broadcasting was still very much of a novelty, and every member of the family was prepared to spend many hours listening in. In those days there was little choice in the way of alternative programmes and very little criticism of them, because to receive anything at all was looked upon as very wonderful and entertaining.

As time went on, listening to wireless became less and less of a family affair and personal preferences reasserted themselves, so that a programme selected by one member of the family was not necessarily acceptable to others.

The time has now come, we believe, when receivers providing for telephone listening as an alternative to the loud speaker would be very generally welcomed, and it is a matter which we believe is well worth the consideration of the set manufacturers. At little additional cost or trouble, plug sockets could be provided to enable phones to be used with any set if desired and provision made for disconnecting the loud speaker meanwhile.

A year ago, in discussing this subject, we said that telephone quality was very good, and although not, perhaps, up to the standard of the best modern loud speakers, there was no reason why telephones should not be improved.

Even without any special stimulation, the past year has seen remarkable improvements in the design of the telephone, as an article published in last week's issue will have indicated to our readers, and we can foresee that if the use of telephones returned to favour generally, and it became worth while for manufacturers to devote special attention to their design,

further important progress might be made. From many points of view it is easier for a set designer to design to a given quality with earphones than it is with the loud speaker, because the conditions for reception are less variable than they are where the designer has no knowledge of the acoustic properties of the room where the set provided with a loud speaker is to be accommodated.

Among the several advantages it is well known that it is possible to concentrate much more easily on a programme when listening with headphones than it is with a loud speaker. Volume can be conveniently controlled to suit the individual, whilst means for limiting the strength of signals are now available. In any sets where the loud speaker was dispensed with the audio-frequency amplifier could also disappear, and so cost and, in some cases causes of distortion, too, would be reduced.

Television

The Programme Side

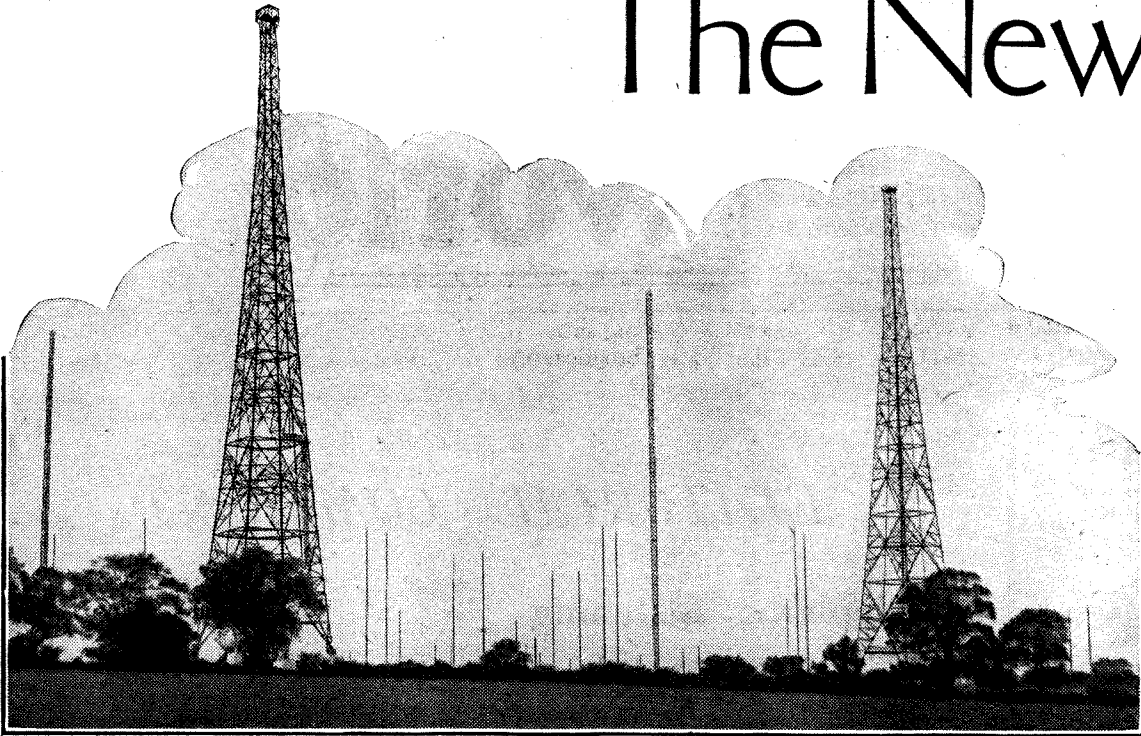
WHEN the television transmissions to Olympia started we criticised the choice of programme material and expressed regret that more attractive matter had not been chosen for the initial broadcasts. We are glad to be able to record that, in our view, a very pronounced improvement in the transmissions occurred as these continued through the period of the Show, and, in particular, the skill which the B.B.C. acquired in using the Marconi-E.M.I. camera indicated how much more may be expected as the production staff becomes accustomed to the new tools available.

Some means has yet to be devised for making the intensity of the sound proportional to the size of the picture. It is obviously absurd to have speech from a small figure in the distance producing at the same volume as when the subject appears as only a few paces from the listener.

The New Empire

By **LESLIE BAILY**

THE immense scale of the expansion work now being carried out at the Empire Broadcasting Station is revealed in this exclusive interview given by the B.B.C.'s Chief Engineer to our contributor



A photograph, taken last week, of the existing Empire aerial system at Daventry. All the aërials are at present carried on four masts, the old 500 ft. 5XX masts being used for some of them, while others are supported on two trellis towers. The new station will have 12 masts.

BY the early summer of next year a new and stronger Voice of Britain will have made itself heard in every distant corner of the world, and, if all goes well, there will no longer be cause for Britishers in certain of the more remote backwoods of Empire to complain that the German and American short-wave transmissions are stronger and clearer than the British ("not that they are normally," says the B.B.C.).

How determined the B.B.C. is to bring the Empire broadcasting service up to the highest pitch of efficiency was revealed when Sir Noel Ashbridge, the Chief Engineer, discussed with me the work which is now going forward at Daventry.

My first impression was one of surprise at the magnitude of this work; the brief official statements issued by the B.B.C. about the extensions to the Empire station have given small idea of this bold scheme, the cost of which has not been disclosed but must run up to a pretty penny. Now that the Ullswater Committee has emphasised the importance of what it called "the projection of Britain" through Daventry, and now that the new B.B.C. Charter is expressly to authorise the Empire service, and to provide the B.B.C. with extra revenue so that this expansion (among others) may be carried out, the B.B.C. means to get down to the job with characteristic thoroughness.

Broadcasting Our Point of View

Governments, for obvious reasons in these times, attach great importance to long-distance broadcasting services by short waves. The Germans, it is understood, are carrying out extensive improvements. It is important, in understanding the new status of the British service, to realise that the old idea that this was a

benevolent private gesture by the B.B.C.—with a pious hope that the Dominions and Colonies would contribute to the cost—has been left aside; now the Empire service is recognised officially (to quote the Ullswater Report) "as an important normal function of the broadcasting organisation of this country."

The existing transmitters at Daventry have done extremely valuable pioneer work during the past three-and-a-half years, and even now are supplying a reasonably good service to a large area of the globe. The new aim is to extend that area, to increase strength of reception, probably to augment the programme hours (already over 16 hours daily), and possibly, on special occasions, to provide more than one programme at a time. To achieve any or all of these objects, new transmitters and aërials are the first necessity of the Empire Service.

"The present state of progress on the new station is up to our every expectation," the Chief Engineer told me, "and I hope we shall be able to go on the air with tests in the late spring of next year. The building which we are putting up at Daventry to house the new equipment is two-thirds finished. The roof is partially on. It is quite a large building—the ground area, in fact, is greater than that of the Droitwich station. Indeed, in every respect this will be a bigger station than Droitwich."

This is an impressive statement, especially if you have visited the spacious Droitwich station. It will not be necessary for a short-wave station to have masts so high as the 700ft. towers at Droitwich, but the New Daventry will

have no fewer than twelve masts of varying heights up to 325ft., supporting a spectacular array of aërials. It has been necessary to buy an additional eighty acres of land, making 150 acres in all.

The single-storey building has been designed to accommodate four transmitters, though only three have been ordered.

Eventually, in the total power of its new transmitters, Daventry will certainly beat Droitwich, but the individual power of each is not yet being revealed. Two transmitters are now being constructed in the works of the Standard Telephones and Cables Company, and one by the Marconi Company.

"They will be going into the building towards the end of the year," said Sir Noel

Plans for More Effective "Projection of Britain"

Ashbridge. "The transmitting circuits are of new design, quite different from those of the present two short-wave transmitters at Daventry, which work on the low-power choke-control system. Two of the new transmitters will be 'high power Class B' instruments. The third will use high-power series modulation, which is similar to the system used at Droitwich.

"Power will be taken from the mains, but we are building a separate emergency power house containing two 750 horse-power six-cylinder Diesel engines driving alternators, in case of breakdown of the power supply.

"The new aërials and masts are all on order, and erection will start in about a month's time. All the eight new masts we are going to put up are of the stayed

Station

type, varying in height from 150 to 325ft. In addition, we shall make use, in the new scheme, of the existing two self-supporting 350ft. masts which were built for the Empire station about two years ago, and also the two old '5XX' masts, each 500ft. high. These last four masts which I have mentioned are all used just now for various Empire aerals, which are draped around them and between them until they look almost like Christmas trees! But an entirely new aerial scheme has been worked out, embracing all twelve masts."

Twenty-five Aerials

The Chief Engineer emphasised that this aerial scheme has been planned comprehensively. The existing aerals will be modified to take their place in the new network, which, when finally slung up between those dozen masts on Borough Hill, will consist of about twenty-five different aerals. The transmissions will be directional, and will bear on eleven different directions instead of the present six. Sir Noel humorously remarked that the whole thing looked on the plans rather like a "wild spider's web." All the directions have been worked out to the best possible bearings, and the designs of the aerals are based on extensive trials carried out during the last two years.

This big increase in the number of aerals does not necessarily imply that the B.B.C. will wish to use a larger number of wavelengths than at present. In fact, I rather gathered that the B.B.C. is already using all the waves it is likely to

need for quite a long time. The new arrangement will permit much greater flexibility in the combination of wavelengths with directions to suit the time of day.

"All this means better coverage," said Sir Noel. "There will be stronger signals everywhere, but, of course, it will be more noticeable in some places than in others. This re-planning will bring a lot more territory into really good service. But, in considering where especially to apply our better signals, we have to compromise, of course. We considered the big cities of the Dominions—the local broadcasting authorities want to relay us a lot, therefore they have a good claim for the best possible signal we can give them. Then we considered people who live in remote parts of the Dominions and Colonies where there is no local service—there are not so many of these listeners, but their individual need is greater; they also deserve a good service from the Home Country. We hope our new plan provides as far as possible for everyone the Empire over.

"Incidentally, we shall be in no doubt as to how the new station does work, for there are keen listeners throughout the Empire who are in regular touch with us. A good number of them send in carefully prepared charts of reception strength. From the broadcasting authorities in Canada, America, Australia, and elsewhere we also get field-strength measurements. If any unexpected snag developed we might send one of our own men to investigate reception conditions, but I don't anticipate that for a moment.

"The increased strength we hope to give raises another interesting point. It is not generally known that the present Empire station does not use the same dynamic range as our home transmitters.

There is not the same range from loud to soft as you get from your local station. We sacrifice fidelity for intelligibility, because when you are transmitting over long distances and you have fading and mush to contend with, it is better to concentrate on being heard clearly. So we don't let the soft passages in music go so low as in home programmes. This is done automatically, by what we term a compressor. It is an adjustable device. With the increased power from the new transmitters we hope that it may no longer be necessary to use the volume compressor."

So the New Daventry means better quality as well as increased volume. I asked Sir Noel what he intends to do with the Old Daventry.

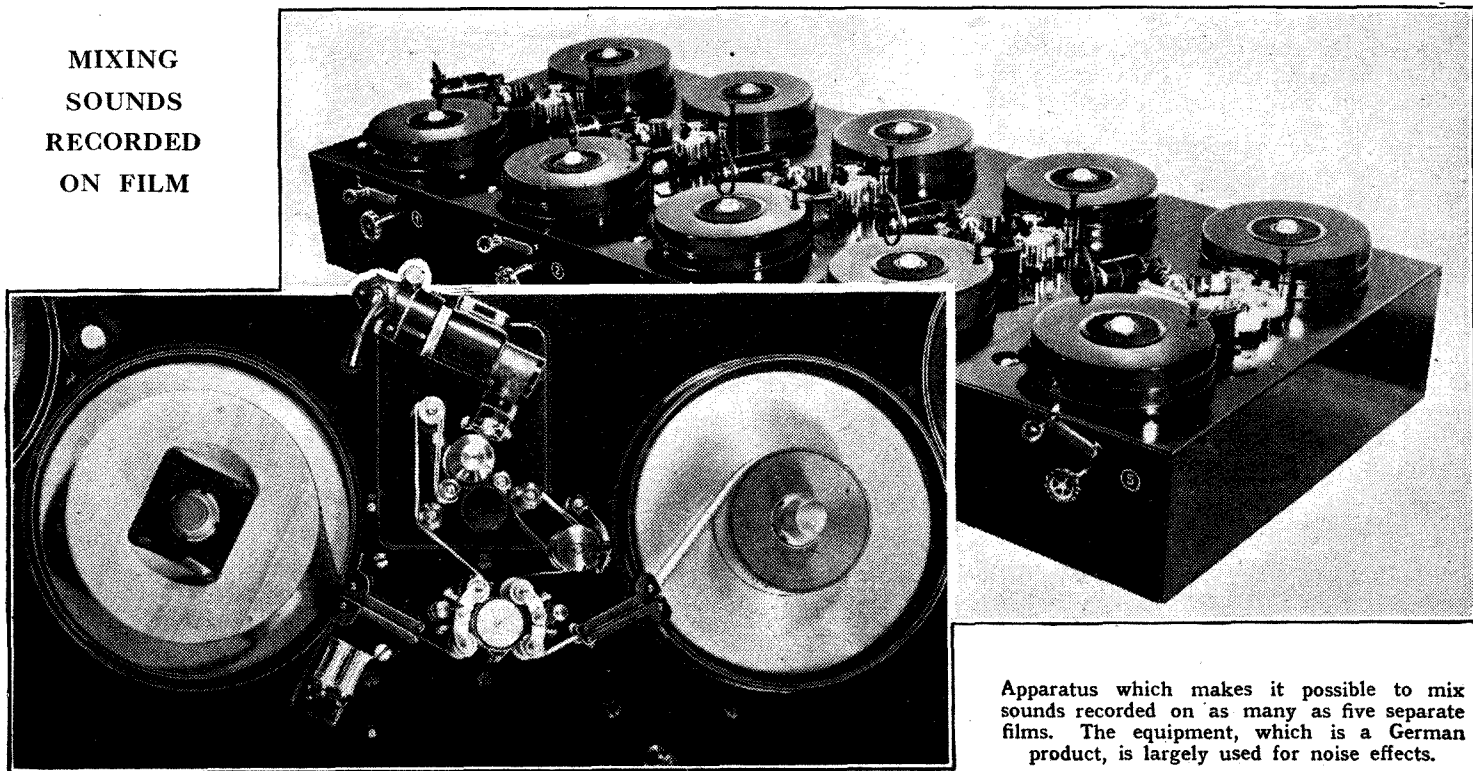
The Fate of "Old Daventry"

"The two short-wave transmitters which were opened in 1932 will probably stay as they are," he said, "but they may be combined into one. It depends whether, in consultation with our Empire programme people, we ultimately decide to go for increased power all round, or for a larger number of transmissions. The latter is the more likely. It will give us five transmitters—the three new ones and the present two. Whether they will all go on the air together depends on programme developments.

"Actually, we are using three transmitters at present, the old 5SW set still being in service. This will be kept permanently, but only for test purposes. It is useful to have such a transmitter handy for lining-up aerals."

Finally, I asked the Chief Engineer what all this will mean in terms of staff. He said that it will add fifteen to the present Daventry staff of twenty-five engineers.

MIXING
SOUNDS
RECORDED
ON FILM

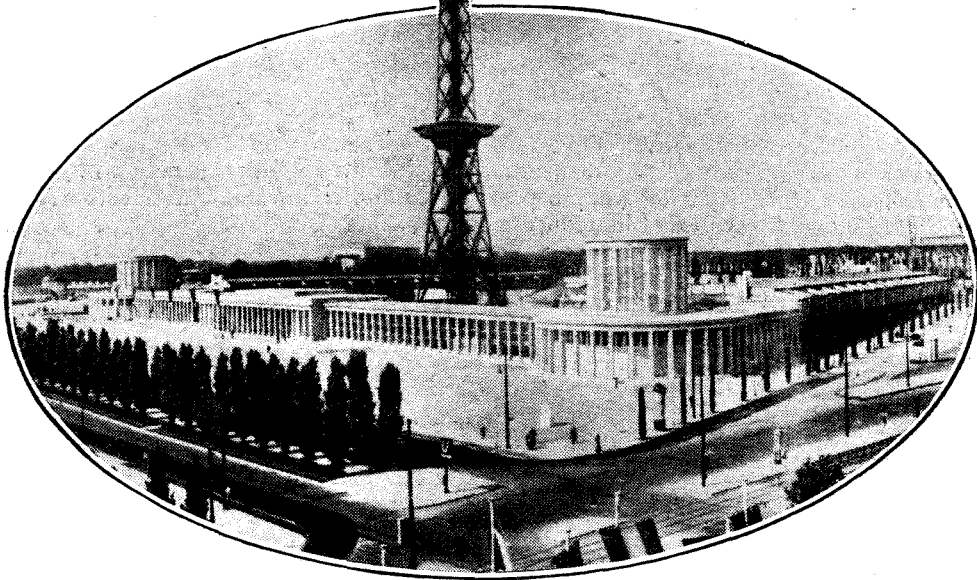


Apparatus which makes it possible to mix sounds recorded on as many as five separate films. The equipment, which is a German product, is largely used for noise effects.

Berlin Radio Show

GERMAN NATIONAL EXHIBITION REVIEWED

BY OUR SPECIAL
REPRESENTATIVE AT THE
SHOW

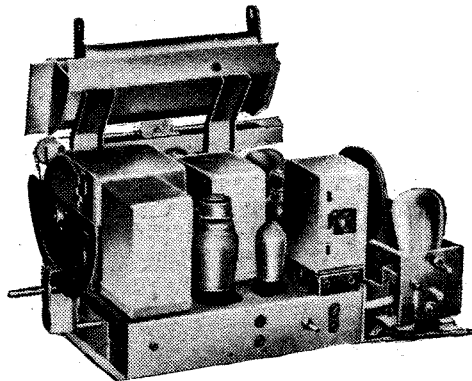


FOLLOWING the usual practice, the Exhibition was divided into two main sections—the General Exhibition and the Industrial Show. The former included the Post Office exhibit and the television demonstration, and the latter the products of the German radio industry. The number of exhibitors (184 firms) was slightly below last year's figure, for certain small manufacturers of components confined themselves this year to the Leipzig Autumn Fair.

The total output of the industry during the past "radio year" was less by about one-third than that of the year 1934-1935. 470,743 People's Receivers were sold, a drop of about 40 per cent. Other receivers had a sale of 827,839, against about one million for last year—a 20 per cent. drop. Listeners increased by about one million, so that the total number of new receivers sold (about 1.3 millions) exceeded by

about 25 per cent. the number of new listeners.

For some years the majority of receivers have been of the two- and three-valve, one- and two-circuit type. Although such sets were still prominent this year at prices



The Nordmark 237 three-valve receiver includes AVC and has constant reaction over the tuning range. It is of the two-circuit type.

ranging from 140 marks upwards, there was evidence of the increasing popularity of larger receivers of the superheterodyne type.

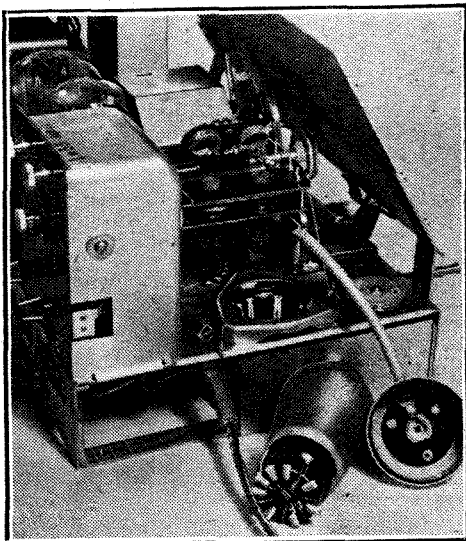
Considerable improvement has been made in the quality of reproduction, largely through the use of new types of output pentodes, while in the big superheterodynes we find the AD1 triode much in evidence, either alone or in push-pull. The loud speaker flux density has been greatly increased, up to 10,000 gauss, and in one model a diaphragm stiffened by ribs is used, and it is claimed that this considerably decreases non-linear distortion. In several big receivers, and also in one of the two-circuit type, two loud speakers are provided for the high and low notes.

Tuning is facilitated by the widespread use of the "quick-tuning" scale in conjunction with the "fine-tuning" scale. This arrangement is found not only in most

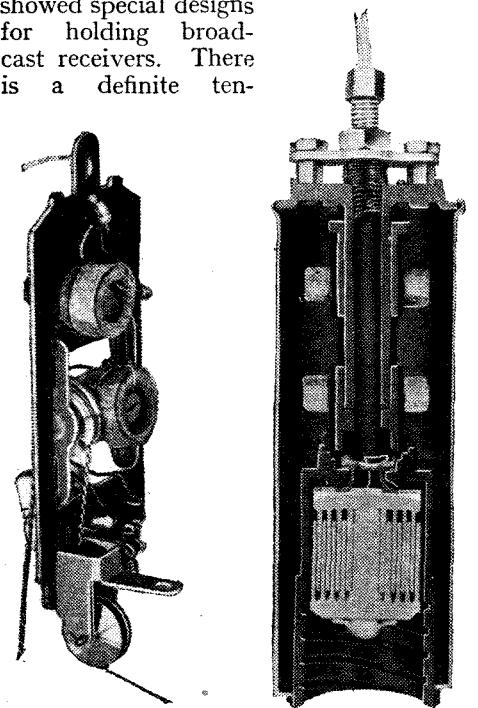
superheterodynes but even in two-circuit receivers.

Quality is improved in most of the superheterodynes, but also in some two-circuit receivers, by variable selectivity—either continuously variable or, in a few models, by steps. This band-width adjustment was seen last year in a few receivers, but is now much more common. Short-wave reception is almost entirely confined to superheterodynes. Only one maker provides it in a smaller set.

As regards external design, the loud speaker is nearly always mounted at the side of the receiver; a loud speaker above or below the receiver is seldom seen. A surprising number of radiogram combinations were in evidence this year; and several furniture and cabinet-making firms showed special designs for holding broadcast receivers. There is a definite ten-



The Telefunken T612 single-circuit two-valve receiver which includes a mains transformer although designed for AC/DC operation.

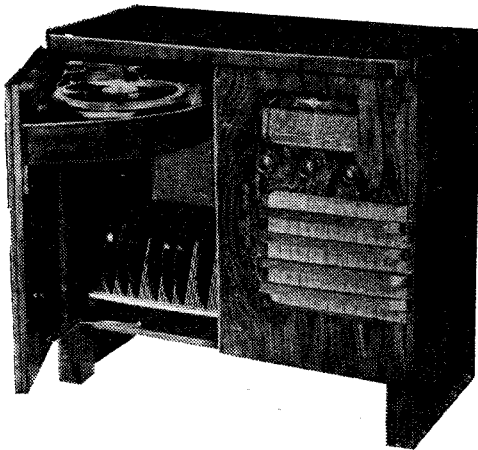


Two types of variable-selectivity IF transformer. The one on the left is used in the Telefunken receivers and the moving-coil is controlled by a cord-drive, while the right-hand transformer is used by Philips and a Bowden-wire type control is employed.

Berlin Radio Show—

dency towards the modern in cabinet design.

Among the very popular "universal" receivers special interest attaches to the



The Stassfurt Broadcasting Company's "Music Cabinet" which includes a four-valve superheterodyne. Two loud speakers are fitted and a triode output valve is used.

designs of Telefunken and of Körting, in which a mains transformer is used, so that good results are ensured on mains of only 110 volts. When the set is used on DC supplies, however, the transformer functions as a choke. Among other firms making universal models, Philips provide a "converter" unit for use on DC mains. This is of the vibrator type, as used in car sets. Even the small portable receivers of Braun and of Wego can be adapted to "universal" supply.

Among miscellaneous points it is to be noticed that the practice of combining the "on-off" switch and volume control has been discontinued. Many firms have some form of visual tuning indicator, and some—Körting and Ideal-Blaupunkt—have provided their big superheterodynes with a switch for transforming them into straight sets for local reception. An exceptionally high standard of reproduction is claimed. Even two-circuit receivers have, for the most part, excellent AVC, or fading compensation as it is called in Germany.

Reflex Circuits

Nearly all the two-valve one-circuit receivers use the new pentode AL4 because of its high amplification and low distortion. These receivers give remarkably good reproduction in almost every case, and they can no longer be looked upon as local-station receivers only. Various devices for giving accurate scale calibration and easy tuning, for a large number of stations, are embodied.

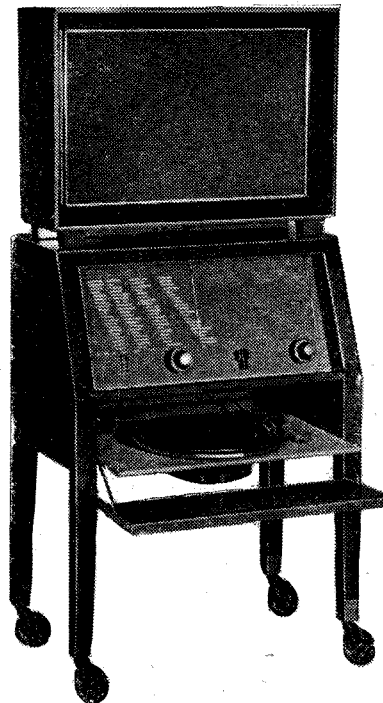
Among single-circuit types, the "Union" receiver, made by a combination of six firms (including Brandt, Braun-Radio, Schaleco, and Wego), is remarkably cheap at 137.50 marks. The "Rügen," of Detewe, has a permanent-magnet MC loud speaker, and consumes only 15-17 watts from the mains.

The Lorenz "Tefadyn 162" and "Tonmeister II" are two-valve reflex receivers

distinguished by their ability to give good distant reception. Saba has a very useful single-circuit model, with its medium waveband in two sections to facilitate tuning.

The two-circuit receivers fall into two classes—with and without fading compensation. They are good distant-reception receivers, and many have variably coupled input band-filters. Five types have fading compensation.

The trend towards superheterodynes is unmistakable this year, and the four-valve type in particular is attracting great interest. This is partly because of its reduced price and partly because of the greater advantages it has over the three-valve superheterodynes. On the other hand, the latter have been improved by the new pentodes AL4 and CL4, with their high amplification and low distortion; they now possess IF amplification (which the last year's type did not), and have the same advantages as the four-valve type as regards selectivity and fading compensation; they have, however, one LF stage



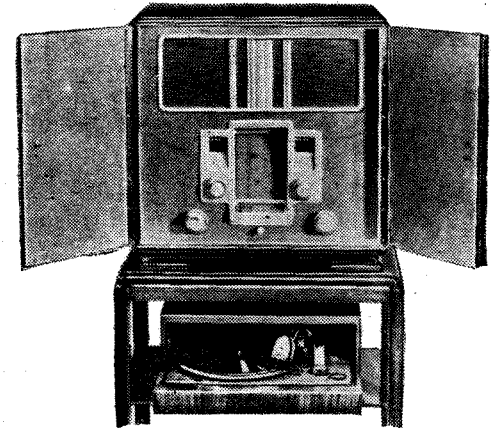
The Telefunken "T686 Trolley De Luxe" is a nine-valve superheterodyne with a push-pull output stage and variable selectivity. It is of the all-wave type and is provided with a 9 kc/s whistle filter.

less. But the high amplification of the AL4 and CL4 nearly compensates for this.

The cheapest three-valve superheterodyne is the Blaupunkt "3W56" with five circuits and band-width variation in two steps. The Saba "341 WL" has six circuits, band-width variation, and "darkening" tuning scale; it also has an input band-filter. Several four-valve superheterodynes have been designed, so that a remarkably good performance is secured with only five circuits in place of the usual six, thus reducing the price. In some cases optical tuning has been omitted, but in most designs band-width variation (in the IF circuit) is included.

In the four-valve superheterodyne with

six circuits the sixth circuit is in the IF portion, so that the receiver has two IF band filters. The seven-circuit type has three band-filters. Most of the four-valve superheterodynes have an LF amplifier valve between the duo-diode and the output valve, but the Saba "441 WL" has an input amplifier and only one LF amplifier, namely, the output valve.



The Körting "Ultramar 37" is an all-wave set with two short-wave ranges. It is a superheterodyne, but can be switched to a straight set for local reception.

Almost all the firms making four-valve superheterodynes are showing two models, one with more circuits than the other. The model with the greater number of circuits is generally provided with a short-wave band. Braun turns out three models, with five, six, and seven circuits respectively, all with band-width adjustment and optical tuning, and some with a short-wave band and a gramophone unit. "Ideal" shows six- and seven-circuit types for AC and five- and seven-circuit for "universal" operation. To give a wide range of fading compensation, the LF stage is brought in to amplify the regulating voltage. All "Ideal" receivers have the "flywheel" drive for quick tuning, and also an automatic waveband switching device.

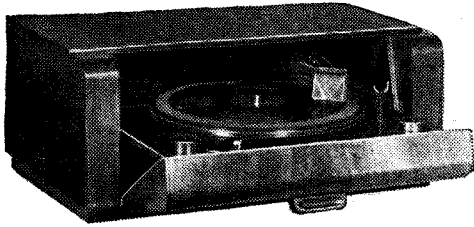


The Körting five-valve six-circuit portable receiver has a built-in frame aerial. It is a battery set.

Körting shows the five-circuit "Etos" and the seven-circuit "Supra-Selector 37." The former has an IF band filter, and the latter an input band filter in addition. Both have band-width adjustment, the seven-circuit model also having optical

Berlin Radio Show—

tuning. The short-wave range of the larger set is subdivided, and extends from 13 to 65 metres. The Loewe "universal" model



The Telefunken "Bayreuth 360" playing desk is designed to form a base for the receiver.

is built also for a main frequency of $16\frac{2}{3}$ cycles per second! Specially noticeable is the seven-circuit four-valve superheterodyne of Neufeldt and Kuhnke, in which the "automatic telephone" method of station selection (first seen last year) is used.

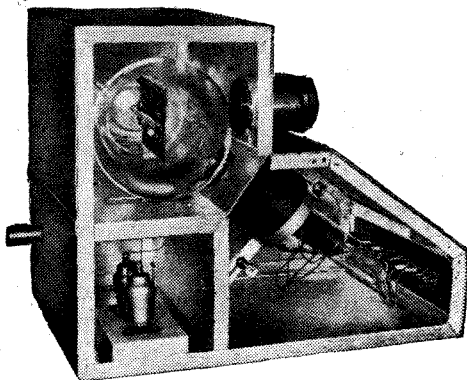
It may be remarked that automatic tuning correction, contrast expansion, automatic noise suppression by rapid AVC, frequently met with in other countries, are not yet to be found in Germany. Large superheterodynes, however, are shown in greater numbers than before. They have from five to nine valves, and give pre-eminently good performance with—in many cases—very reasonable prices.



The T.O. 1000 pick-up of Telefunken has a sapphire needle and will reproduce up to 10,000 c/s.

Battery receivers are made by some six firms. Car receivers are made by three firms; they are five- and six-valve superheterodynes, and cost from 332 to 450 marks. The Körting model is specially insensitive to interference; it has seven circuits and a push-pull output stage.

Portable receivers were more numerous than in previous years. The "Olympia" was the winning design in a competition got up by the Radio Wholesalers' Association, for a very light, small portable for owners who have no motor car to carry it about in. It is $34 \times 36 \times 11$ cm. in dimensions.



An interior view of the Telefunken television camera which employs the Zworykin tube.

The permanent-magnet type loud speaker with 10,000 gauss flux density (Oerstit) wins more and more ground in Germany in view of the desire for small mains current consumption and for extension loud speakers. Whenever such economy in mains current is referred to (for instance, in the "current economising" arrangements in certain receivers) it must be remembered that in Germany the price of mains current is often very high.

Since public address systems are becoming more and more important nowadays in Germany, most of the loud-speaker manufacturers, together with Telefunken and Körting, have brought out "mushroom" types. Some of these show new developments; thus, in some types (Telefunken and others) the quality of speech reproduction is particularly good—a combination of mushroom MC speaker, which is good for low notes and fair for high, with one or more high-note loud speakers above the "mushroom" top, radiating directly into space, is used. For the Olympic Games,

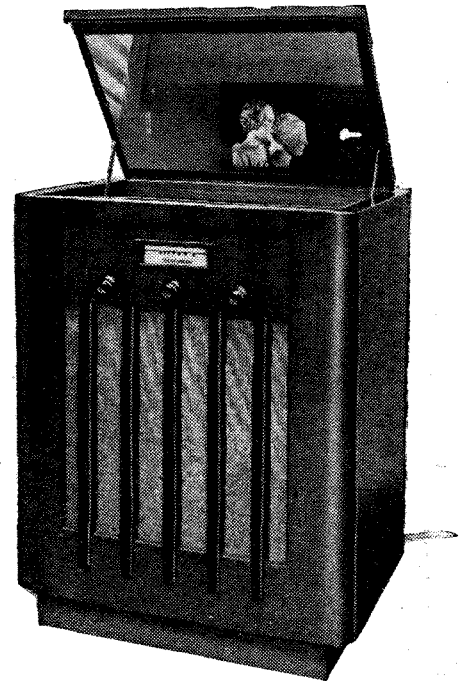


A television receiver designed for the projection of pictures. It is made by Telefunken.

Telefunken also developed the "quenching" loud speaker, consisting of two "mushrooms," one above the other, with their circuits so connected in parallel that one diaphragm is being bent *in* while the other is being bent *out*. Through the interference produced by this phase displacement, "dead" zones are formed in a plane between the two "mushrooms." The great advantage of this arrangement is found in a tiered sports-ground "grandstand" with another series of seats on the other side of the terrace for an audience watching a different contest; if, as often happens, the loud speaker has to be erected in a rather high row of seats it is impossible to prevent the sound from reaching the other side of the grandstand unless such a "dead" zone is formed.

The Telefunken 1,000-watt amplifier was designed for the Olympic Games, but

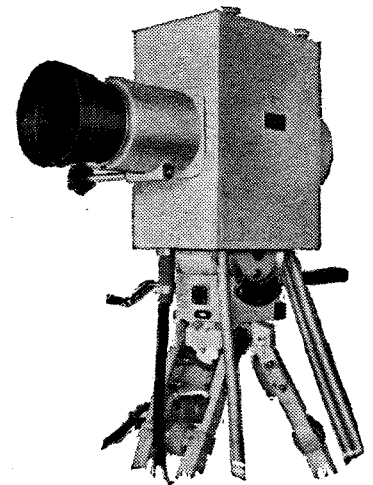
naturally has many other applications; in common with the new Te-Ka-De 150- and 300-watt amplifiers, it uses Class B ampli-



The Telefunken home-television receiver in which the picture is viewed through a mirror. It also provides sound reception.

fication. In the Te-Ka-De amplifiers a glow-discharge lamp keeps a guard on over-modulation.

In the remarkable sound-recording and reproducing equipment known as the "Tefi-phon," an ordinary celluloid cinema film is used. The record is not made photographically, however, but by cutting into the celluloid to form very narrow sound tracks, a number of which can run side by side across the film. It can be used for recording telephone conversations, for dictating, and for re-



The television camera of Fernseh employs the Farnsworth tube.

recording broadcast programmes, etc. The reproduction is said to be very free from needle scratch and the playing time is enormous.

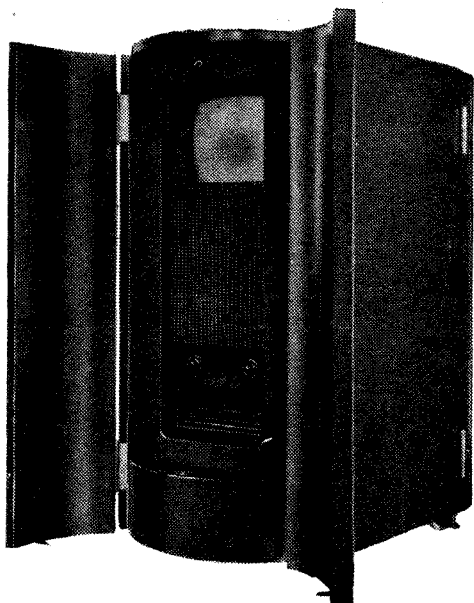
Among the gramophone equipment the Telefunken T.O.1000 pick-up is worth a mention. The weight on the record is less than an ounce, and the frequency response extends up to 10,000 c/s. The needle is

Berlin Radio Show—

a sapphire crystal ground, not to a point, but to a flat edge, and has a life of about 20,000 playings. Even then it can still be used if a response higher than 5,000 c/s is not needed.

The home constructor, as well as the industry, is well provided with low-loss coils, "Calit" being much used for the formers. Havenith make a neat aerial coil coupler in which a special drive device allows the coils to be raised or lowered. Görler makes short-wave plug-in coils on "Calit," while Mozar, in Düsseldorf, has a very good barrel switch.

Various aerials were shown, including the "Kapa" communal aerial with aperiodic pre-amplifier. Siemens make a



The television receiver produced by Fernseh gives a picture of 31 cm. by 36 cm. The tube is mounted vertically.

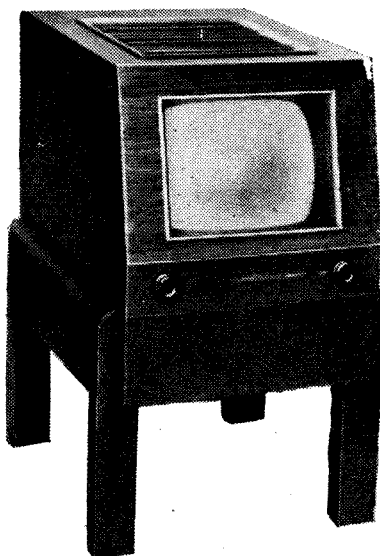
simplified communal aerial without pre-amplifier for a small number (say, five) of participants, each having an aperiodic transformer (with "Sirufer" core) which has an attenuation variation of only ± 0.1 neper over a frequency range of 150 kc/s to 1,500 kc/s.

All the firms interested in German television took part in the Exhibition: Telefunken, Fernseh Company, Philips, Loewe, Lorenz, and Te-Ka-De.

The present position in Germany is that television is on the brink of changing from 180 to 375 or 405 lines. Philips and Loewe have already, therefore, built their receivers so that they can be adapted to these numbers—in the Philips receiver simply by a switch movement.

All except Te-Ka-De again confined themselves to cathode-ray tube receivers, and in some cases the size of the fluorescent screen has been greatly increased, so that direct images 19 cm. by 23 cm. are obtainable. Others use projector tubes with small images on a 5 cm. \times 6 cm. screen, so extremely bright (by use of very high vacuum and very high voltages—20,000 volts) that they can be projected to a size 1 m. \times 1.20 m. One development has been the decrease in size of the home-television receiver.

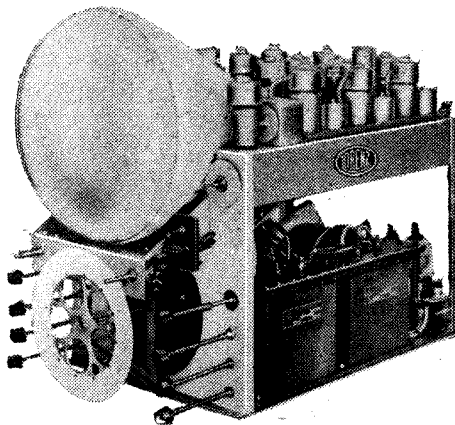
Open-air television (as at the Olympic Games) is being demonstrated by Telefunken, using an electron camera on the Zworykin principle, and by Fernseh,



The Loewe television receiver is designed for 375 and 405 lines and gives a picture of 22 cm. by 26 cm.

who employ an electron camera operating on the Farnsworth principle. Several firms this year use interlaced scanning as well as ordinary scanning, and the Fernseh 375-line interlaced scanning is entirely free from flicker. This company was not demonstrating its intermediate-film system this year.

Te-Ka-De showed a new projecting receiver using two mirror wheels at right-angles and their crystal light-control cell;

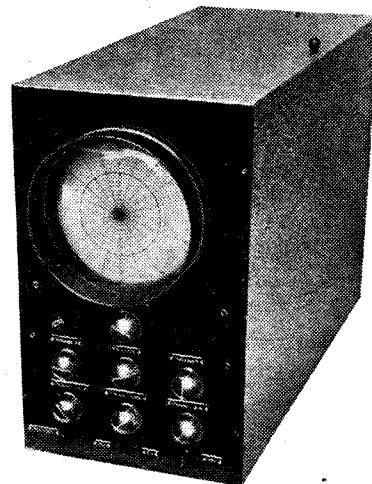


The chassis of the Lorenz television receiver. The mains equipment is mounted in the base.

very good pictures 50 cm. \times 60 cm. were shown on wireless reception from Witzleben (180 lines). They also showed a projecting receiver using their well-known mirror-screw in a new way, projecting its image by a line system on to a screen so that the picture can be seen well even from the side. They make use of interlaced scanning.

Loewe have also developed a projecting tube in which, however, the images are not formed on a flat screen in the tube but on a glass lens mounted in the tube with its rear surface carrying the fluorescent material, so that the light begins its travel through glass, and only emerges at

the curved surface of the lens. Refraction here ensures that the whole of the light emerging from the tube falls on the projecting lens mounted behind the tube; a picture three or four times as bright is obtained with this arrangement. In a home receiver, Loewe have mounted a deflecting mirror inside the cabinet to reflect the upward-directed image on to a ground-glass screen in the front of the cabinet. Loewe have also altered the time-base system; whereas other firms use electromagnetic deflection, they use electrostatic, obtaining their saw-tooth potentials from simple transformers instead of from valves consuming a great deal of power. The

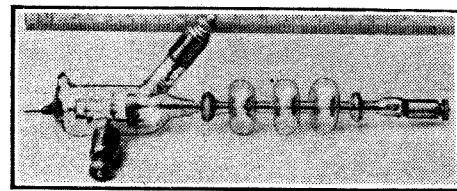


The Leybold-von Ardenne Polar-Co-ordinate oscillograph with rotating field ray path.

total consumption of the receiver is thus reduced from 250 to 150 watts.

The Philips KO70 oscillograph is particularly handy and cheap. A mains unit is included, and two stages of amplification can be used for frequencies of 10-500,000 c/s.

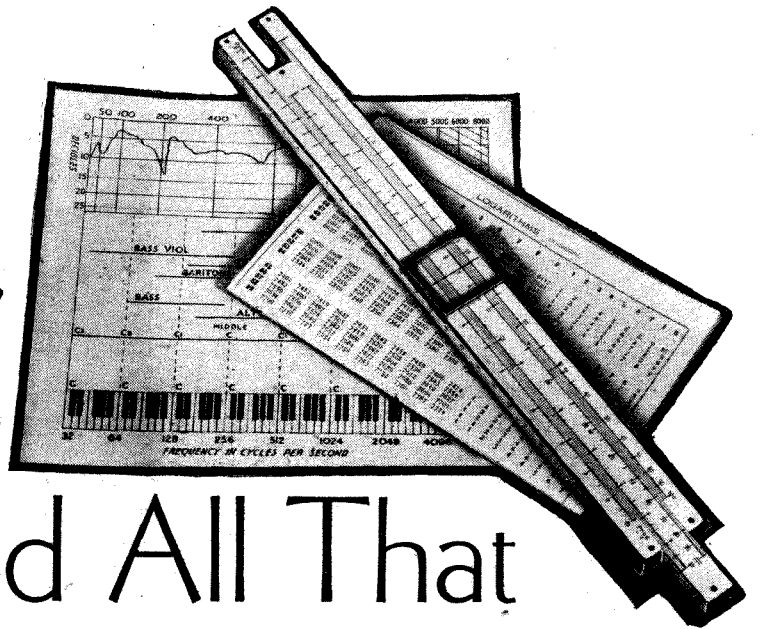
The Leybold-von Ardenne "polar-co-ordinate" oscillograph has a circular scale length of 300 mm., and the quickest rotation takes $1/200,000$ sec., so that 1 mm. on the oscillograph corresponds to $1/60,000,000$ sec. The longest time value measurable is $1/600$ or $1/50$ sec. Leybold-von Ardenne also show a tube giving two cathode rays simultaneously, each acting independently of the other.



The Leybold-von Ardenne diode with adjustable anode-cathode spacing for measurements at decimetre wavelengths.

A special diode for a mains-driven diode-voltmeter, for frequencies up to 1.5×10^9 c/s was shown by this same firm. The glass "spring" can be compressed by a kind of microscope drive so that an electrode-gap of as little as $5/1,000$ mm. can be accurately obtained. The transit time of the electron can thus be made extremely small, and voltage measurements at decimetre wavelengths can be made.

Decibels, Slide-Rules, Logarithms, Octaves, and All That



By "CATHODE RAY"

IN settling down into a new town or district one usually experiences a phase at which there is a jumbled mental impression of a number of known places or streets. It may come as quite a surprise to find that what were noted as two separate streets are really one and the same approached from different directions. At this stage it is a good idea to get out a map and weld these disconnected viewpoints into a properly related system.

The ideas conveyed by the title of this article, and others with them, may similarly be floating about in the minds of some readers, to whom it may not have occurred that they are all different aspects of the same thing. That thing is one that it is advisable to have tidily disposed in the mind, in order to make the best of much that appears in *The Wireless World* and elsewhere.

"To measure is to know," said some great scientist (or was it a disillusioned housewife?), and the first scale of measurement, which must have been devised somewhere around the Stone Age, was based on equal intervals. This is still adopted for most commonplace measuring instruments, such as the foot-rule or the clock. Curiously enough, the scale constituted by the keys of a piano, which I believe is termed a scale of equal intervals, is really nothing of the kind, but is actually the single popularly used example of the second sort of scale.

Its merits were first clearly recognised about 300 years ago by Napier of Merchiston (not to be confused with Napier of Magdala), the inventor of logarithms.

Multiplication by Addition

Unless schooldays have entirely faded from the mind, the subject of logarithms may perhaps be assumed to be one of the familiar landmarks in the city of knowledge. I merely remind those who were educated on the Classical side that to every number there corresponds another number, called its logarithm (or, more popularly, log); and that when you wish to *multiply* any two or more

numbers you have the option of *adding* their logs. Addition being, in general, a less tedious process than multiplication as ordinarily practised, the utility of logarithms is obvious.

There is one catch in it; the memorising of the logarithm table being quite impracticable to anyone other than Mr. Datas, it is necessary to have a log table handy, and to look up in it the logs of all the numbers concerned, and again the number corresponding to the log of the answer. By this time you might almost have done the multiplication some other way if, as is usual, only a few "significant figures" were needed.

When it is essential to have the answer correct to a great many figures, logs are still the easiest way of getting there. But the engineering student who uses his experimental data, which he is unlikely to be sure of within 1 per cent., to calculate the result to about six places of decimals, deserves to be harshly blue-pencilled.

When Sir Malcolm Campbell performed his record speed the result was published to as many as four decimal places, which implied that the distance was

measured to $\frac{1}{10000}$ of an inch and the time

to $\frac{1}{500,000}$ of a second! Pukka engineers are usually content with a three-figure approximation, and log tables are abandoned in favour of the slide-rule.

This is where the log system appears literally as a *scale*. The distances along each scale are made proportional to the logs of the numbers appearing on it, and addition is carried out simply by sliding one scale along beyond another, so that the result is obtained without having to know the actual distances and (hence) the logs themselves. This really is a boon and a blessing to technical men, for they can read off the answer before other people have had time even to write down the data.

So, although looking at it, a slide-rule (or log) scale appears to be much less simple and natural than the ordinary foot rule (or linear) scale, there evidently must be some fundamental merit about it. The two scales are, in fact, related in the same way as the fundamental operations of addition and multiplication. Each step on a foot rule represents an addition of so much; each step (in distance) on a slide-rule represents a multiplication. Steps backward, of course, represent subtraction and division respectively.

When drawing graphs to show how things happen people who are not mathematically minded always use linear scales. In this they are (accidentally) quite right when relating such things as distance and speed, or time and rainfall. But there are some things in life that work naturally according to a log scale; and

"To Measure Is To Know"

although it is possible to plot them on a linear scale, this is a distortion which prevents one from getting a clear picture of the thing. It is like a map of the World on Mercator's Projection, which is all very well for making out Canada to be about twice as large as the United States, but not for giving a true and well-proportioned picture of what it is supposed to show.

At the beginning I mentioned the piano scale. This is so naturally a log scale rather than a linear one that musicians can't help working to it, perhaps unconscious of the fact. The human ear existed before Napier, and while it is pleased by combinations of sounds whose frequencies are connected by certain ratios, it can find no significance in any particular additive intervals. The musical intervals—semi-tones, tones, and octaves—are logarithmic or multiplying intervals. An octave does not correspond to an addition of so much frequency; it

Decibels, Slide-Rules, Logarithms and All That— multiplies the frequency by 2. It is equivalent to about 3 inches on the A and B scales of a 10-inch slide-rule; so these scales include just over 3 octaves. The C and D scales are over 6 octaves.

When electrical sound-reproduction first began to be quantitatively studied, graphs showing the performance of intervalve transformers, loud speakers, etc., were drawn on a linear scale. From 1,000 to 2,000 cycles per second was given the same room as from 0 to 1,000, regardless of the fact that it is only one octave while the latter is an infinitely large number of octaves. Now we know better, and always use a log scale for frequency.

The vertical scale, devoted to sound or its equivalent in electrical units, refers to something of which the ear again is the judge. And again the ear rejects the linear scale, and is fitted more naturally by a log scale. The octave unit has been bagged for frequency; the sound or electrical unit is the decibel, which is about a third of an octave; or 26 per cent. instead of 100 per cent. If you protest that 3 times 26 is not 100, you are hopelessly foot-rule minded. It may be quite difficult, having been brought up to think exclusively in terms of additive scales, to get used to multiplying scales.

With regard to decibels, it is always rather helpful at first to hold on to the idea that one db. is about the least rise or fall in sound intensity that the ear can distinguish. I must add here that the ear (as interpreted by the brain) is not perfectly logarithmic in its action, but nearly so except for very loud or very weak sounds.

Voltage, Current and Power Ratios

A little trick about decibels that is apt to cause confusion is that a voltage or current decibel is a smaller ratio than a power decibel. This does not really mean that there are two sizes of decibels, like avoirdupois and troy ounces; the distinction is more like that between a linear foot and a square foot, which are respectively three and nine to the yard. Decibels are fundamentally *power* ratios, and power is proportional to the square of voltage or current. Doubling the power is approximately 3 db, as already stated; but doubling the voltage (which implies double current also) means four times the power, and therefore 6 db. So the ordinary slide-rule scale, if it is used for voltage or current ratios, is 20 db long, and not 10.

My slide-rule bears a uniformly divided scale (0 to 10) below the A scale, and I have marked it "db (P)" together with extra figures from 0 to 20 labelled "db (V or C)," so that when, for example, the result of a certain experiment shows an increase in signal voltage from 15 to 24,

I can read off not only the ratio, 1.60 (giving the percentage increase, 60), but also the decibels, just over 4.

When mentally converting the log scale of a graph into a linear one, or vice versa, it is useful to know one or two equivalent points. Fig. 1 shows the two together, and 2 on the upper comes near enough to 3 on the lower to be taken as practically

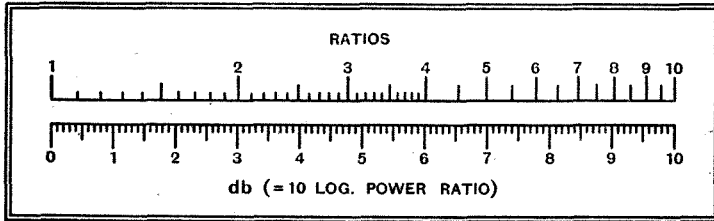
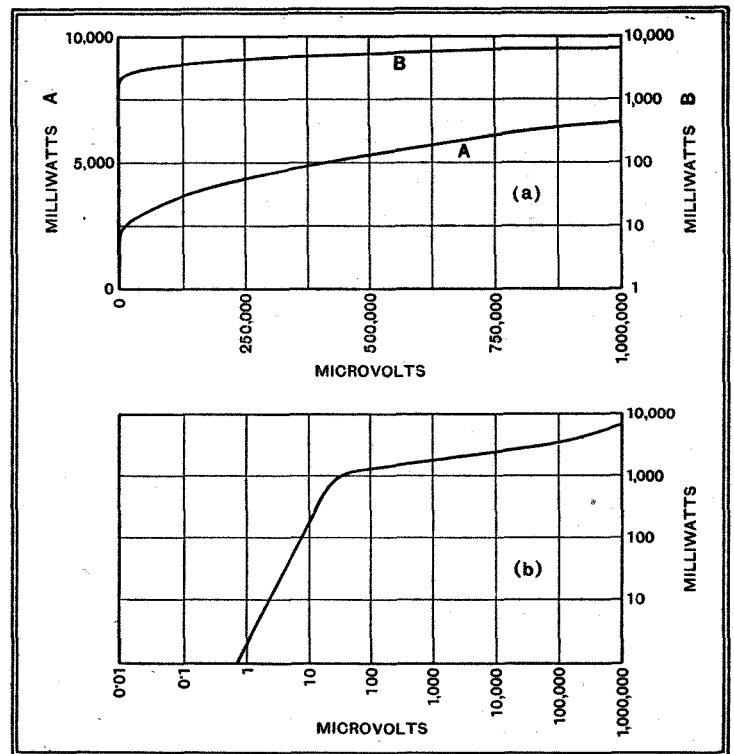


Fig. 1.—Comparison of log and linear scales.

equivalent. The correspondence of 3 and 5 is not so exact, but useful to know. Almost dead opposite one another are 5 and 7, and with these three points, and the ends, it is possible to construct a rough log scale on ordinary squared paper. Special log paper is obtainable, but not always handy.

As we have seen, there are certain quantities, including some of special importance in radio, that are intended by Nature to be measured logarithmically. But even when one cannot invoke such high authority in defence of the procedure, it is sometimes a useful dodge for getting a curve nicely in. Suppose it is desired to illustrate the action of an AVC system in the usual manner by drawing a curve of milliwatts output from the receiver against microvolts input. The signal may be taken up to 100,000 or even 1,000,000

Fig. 2 (a).—The A.V.C. curve of a receiver plotted on linear scales would tell one nothing about the behaviour with weak signals. Curve A is drawn with both scales linear; B is plotted to a log milliwatt scale. By making both logarithmic (b) a complete picture is given of the action.



microvolts, and if this were plotted on a linear scale anything less than some thousands of microvolts would occupy such a small part of the whole as to be indistinguishable. This would probably include the most important part of the diagram.

The difficulty might be avoided by plotting the curve in sections on different linear scales; but besides being clumsy this would prevent one from judging the

curve as a whole. The best solution is to plot on a log scale, which gives equal prominence to both weak and strong signals (see Fig. 2). The milliwatt scale would be log in any case, we hope, but curve A shows what it looks like with a linear scale, too.

There is one circumstance that rules out this sort of treatment, and that is when the quantity concerned goes to zero. There is no zero on a log scale. You can get nearly, but never quite, there.

This is not intended to be a complete exposition of logs or db. as such—only a map of the connections—but while referring to their advantages for graphical scales I may as well include one feature that is pretty well known and understood by now; namely, that the shape of a curve plotted on a log scale is unaffected if the scale is multiplied. It merely slides bodily up or down.

The linear scale, on the contrary, is as if an object changed shape when a telescope was used to magnify it. The effect on a given frequency characteristic curve of adding a uniform stage of amplification appears on a decibel graph as a change in level but not in shape of the curve. Which is as it should be. It is a change in loudness but not in balance of tone.

Actually the matter of sound is a little bit more complicated and controversial than this. But the db. scale is much nearer the truth than the linear sort.

INSTITUTE OF PUBLIC ADDRESS

We are asked to say that many letters have been received by the Acting Secretary of the proposed Institute of Public Address as a result of the note which appeared in *The Wireless World* of August 28th. All letters will be replied to when particulars of the proposed Institute are available to send out; in the meantime, enquirers are asked to accept this intimation of the receipt of their letters.

The Acting Secretary is Mr. L. B. Candfield (Ross and Robinson, Ltd.), 8, Western Circus, London, W.3.

UNBIASED

A Dastardly Plot

FOR no apparent reason I seem to be pestered by babies this week, but I've simply got to put up with it, and so will you, as the following information has only just reached me, and the ordinary feel-

Garden City Life

IT has been said by somebody or other that even the finest invention of man can be put to base uses by people whose minds are inclined that way, and I must admit that there is considerably more truth in this statement than there is usually in the wisecracks uttered by our great thinkers. A very illuminating instance of its truth has recently occurred in one of our Garden Cities, those earthly paradises where, as Heber truly said, "Every prospect pleases, and only man is vile."

The trouble, I am sorry to say, arose through the activities of one of those ether-hogs who persist in dragging the loud speaker out into the garden and sully the fair evening air of summer with horrid swamp songs and other negroid noises dished up by many so-called dance bands. Unfortunately for the particular ether-hog in question, a by-law has recently been passed against this sort of thing by the authorities of the county in which this Garden City is situated. The result was that after a mild protest had been tried without effect, the strong arm of the law was invoked and the offender received the just reward of his misdeeds, an injunction being obtained restraining him under heavy penalties from causing further annoyance in this manner.

Now, as many of you may know, among the other pests which infest garden cities, as well as less exotic centres of population, are babies, and this particular place was no exception, the night being rendered hideous by their yells and screams. The vanquished loud-speaker owner thought, therefore, that he would have his own back by suing the owners of the more irascible infants for neglecting to fit them with suitable silencers, but, unfortunately for himself, he learnt that babies are privileged persons who are allowed to yell their heads off and keep the whole neighbourhood awake without incurring the wrath of the law.

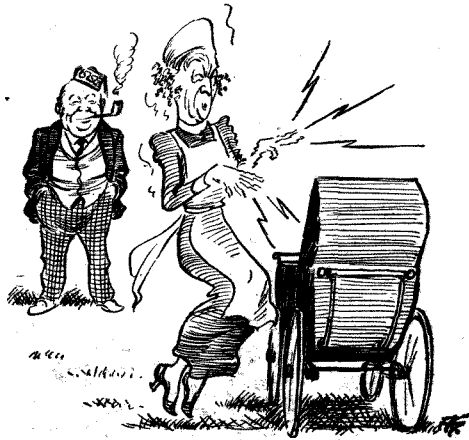
Enfants Terribles

The next move in this little ultra-suburban drama occurred a few evenings later, when the twice-vanquished loud-speaker owner—a hardened old bachelor—appeared in his back garden trundling a smart new pram from which truly prodigious infantile caterwaulings were emanating. The yells were, in fact, such as would be quite beyond the lung power of any single baby, and so twins, or even triplets, were indicated, this being borne out by the size of the pram, which was of unusual dimensions. The many and varied speculations as to the origin of the children which were indulged in

By FREE GRID

by the neighbours were speedily merged into the certainty that they had been obtained at a reduced price from some orphanage, and were being deliberately ill-treated in order to annoy other residents, as the strength and consistency of the cries were such that no other explanation was possible.

Needless to say, allegations of cruelty were quickly made to the authorities, with the result that the full majesty of the law arrived, together with an ambulance in charge of an officious-looking nurse, to remove the ill-used children to a home.



The ill-used children proved to be bright young sparks.

Before the representatives of the law could make their investigation and question the offender the nurse officiously thrust her arms into the pram to remove the contents and speedily withdrew them to the accompaniment of a yell of her own production which completely drowned those emanating from the pram.

It appeared that the good lady had received a somewhat hefty electric shock, and small wonder, since it turned out that the pram contained an outsize in amplifiers operated from a car battery and a vibratory transformer, the former also supplying juice to a gramophone turntable and an automatic arrangement which kept it continually repeating a record which had apparently been specially made for the occasion.

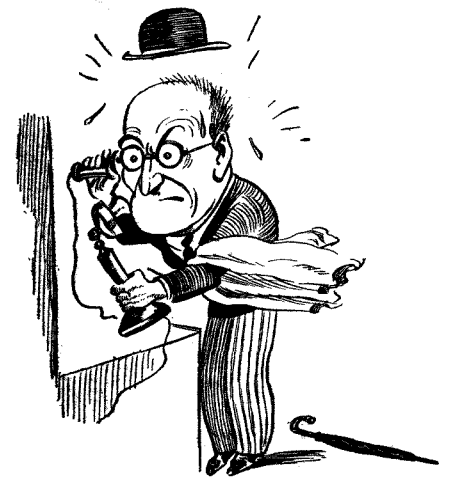
There was, of course, nothing for it but for the law to retire as gracefully as it could. The offender has not, however, got off scot-free, and at present stands charged with disobeying the original injunction of the Court restraining him from causing annoyance with a loud speaker. As the matter is still *sub judice* I must not say any more at present.

ings of humanity compel me to give it immediate publicity.

As you know, it is not often that I permit myself to indulge in comments upon radio matters other than those of a technical nature, but certain happenings have been brought to my notice which are so serious, involving as they do the well-being of certain members of the rising generation, that I have no option.

As many of you may know, the danger of Transatlantic telephone conversations being overheard by unscrupulous eavesdroppers is prevented by a very simple method, the speech being "scrambled" at the transmitting end and duly "unscrambled" at the receiver. I do not propose to go into the technical details concerning the method by which the scrambling and unscrambling are done as, for one thing, the P.M.G. wouldn't like it, and my respect for authority prevents me from flouting his wishes in any way. It must therefore suffice for you to know that this scrambling process exists. If you listen to it you will find it strangely reminiscent of certain Oriental languages.

Now, quite naturally, the Transatlantic telephone service is used considerably by stockbrokers, book-makers, and other collectors of our superfluous cash, and there are many evilly disposed persons who would be in a position to make a considerable amount of ill-gotten money were they only able to overhear these conversations and the important financial secrets which they contain.



"The plot was whispered to me over the 'phone."

It would be well-nigh impossible for anybody to construct a successful "unscrambler" without obtaining the necessary blueprint from the G.P.O., but, alas!

such is the waywardness of human nature that realisation of this fact has not prevented a great deal of misplaced ingenuity from being applied to the solution of the problem and, if the details of the plot that were whispered to me over the telephone hold any truth, a truly diabolical solution has been found.

In brief, a gang of unscrupulous hangers-on of our stock exchanges have got together and put up the necessary capital for the adoption and upbringing of a large number of babies, and these hapless infants have been incarcerated with their nurses in a large country mansion surrounded by a high wall which is situated somewhere in the Home Counties. A wireless receiver has been installed which is permanently tuned to one of the main Transatlantic wavelengths, and this feeds its output into loud speakers which have been lavishly distributed all over the house and grounds.

The idea, of course, is that by constantly hearing this "scrambled" speech and nothing else—for all the nurses are deaf and dumb—the wretched infants will adopt it as their normal language just as

ordinary children grow up to speak the language of their parents through hearing it constantly used in their presence. After the children have reached a sufficient age for this language to be indelibly impressed upon their young minds, they are to be taught English by normal methods and will naturally be in a position to interpret the "scrambled" speech for their heartless captors.

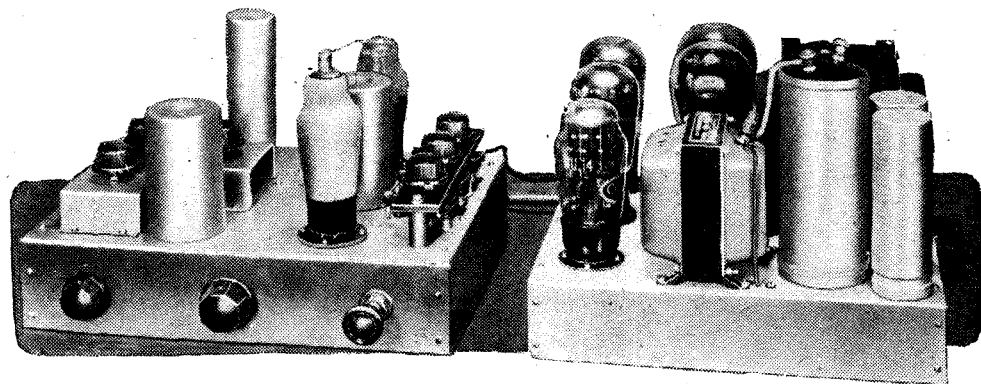
Of course, all this will take considerable time—several years, in fact—but the people responsible for these dastardly doings are quite prepared to wait for the final harvest which, when it is reaped, will be truly abundant.

I can, of course, only present to you these facts as they have been given to me in the hope that if any of you living near a large, secluded mansion should see or hear of anything suspicious, you will let me know at once. Needless to say, if any of you receive a tempting offer for your offspring you should communicate with the nearest police station, since, I am informed, these rogues are on the alert to approach parents in the early morning after a particularly bad "teething" night.

In Next Week's Issue

THE WIRELESS WORLD

Pre-tuned Quality Receiver



THE highest standard of quality of reproduction demands a flat overall frequency response characteristic from the receiving equipment and an adequate undistorted output. Experience shows that an output of some 4 watts which is truly undistorted is adequate for practically all domestic requirements and is best obtained from an amplifier embodying push-pull triodes throughout.

The requirements as regards frequency response are more difficult to meet because of the necessity for avoiding interference, and it is only in local reception that it is possible to obtain a close approach to perfection.

The Pre-tuned Quality Receiver, therefore, is essentially a local-station receiver, and is capable of giving almost perfect reproduction. The tuned circuits

are of simple nature and controlled by a switch so that three alternative programmes may be obtained. The circuits are tuned to the three desired stations when initially setting up the receiver, and thereafter the wanted programme can be selected by setting the switch appropriately.

LIST OF PARTS

Certain components of other makes but of similar characteristics may be used as alternatives to those given in the following list.

RECEIVER

- 1 Aerial coil Bulgin C6
- 1 HF transformer Bulgin C7
- 1 HF choke Kinva Standard Type
- 6 Reaction condensers, 0.0005 mfd. Polar "Compax"
- 1 Reaction condenser, 0.0003 mfd. Polar "Compax"
- 1 Valve holder, 7-pin (without terminals) Clix Chassis Mounting Standard Type V2

- 1 Valve holder, 5-pin (without terminals) Clix Chassis Mounting Standard Type V1
- Condensers:—
 - 5 0.0001 mfd. mica Dubilier 665
 - 3 0.1 mfd. tubular Dubilier 4513
 - 1 50 mfd. 12 volts, electrolytic Dubilier 3013
 - 1 8 mfd. 500 volts, electrolytic Dubilier 0281
- Resistances:—
 - 1 200 ohms, ½ watt Bulgin HW39
 - 1 2,000 ohms, ½ watt Bulgin HW5
 - 2 10,000 ohms, ½ watt Bulgin HW15
 - 3 25,000 ohms, ½ watt Bulgin HW20
 - 1 250,000 ohms, ½ watt Bulgin HW28
 - 1 1,200 ohms, 20 watts Bulgin PR6A
 - 1 4,000 ohms, 20 watts Bulgin PR9A
 - 1 5,000 ohms, 20 watts Bulgin PR9
- 1 Dual potentiometer, 0.5 meg./10,000 ohms, wire wound Reliance SG/VM
- 1 5-way cable with twin 70/36 leads and 5-pin plug Goltone
- 1 Switch 13-way, and knob Magnum WW13
- 1 4-way connector Bryce Light Pattern
- 1 Plug-top valve connector Belling-Lee 1175
- 6 Ebonite shrouded terminals, A, E, PU (2), output (2) Belling-Lee "B"
- 2 Knobs ¼ in. bore Bulgin K14
- 2 Lengths screened sleeving Goltone
- Chassis 12 in. x 9 in. x 2 ½ in. B.T.S.
- Miscellaneous:—
 - Peto-Scott or Scientific Supply Stores
 - 4 lengths systoflex, 10z. No. 18 tinned copper wire, aluminium and paxolin platforms for tuning condensers, studding, etc.
- Screws: 36 6BA ¼ in. R/hd., with nuts; 2 6BA 1 in. R/hd., with nuts; 4 6BA ½ in. R/hd., with nuts; 2 4BA ¾ in. R/hd., with nuts and washers; 4 4BA nuts.
- Valves
 - 1 VMP4G metallised, 1 MH4 plain Osram or Marconi

AMPLIFIER

- 1 Mains transformer: Primary, 200 to 250 volts, 50 c/s; secondaries, 425-0-425 volts, 120 mA; 4 volts 2.0 amps. centre-tapped; 4 volts 2.5 amps. centre-tapped; 4 volts 10.0 amps. centre-tapped Kingsway Electricals
- 1 Smoothing choke, 10 henrys, 100 mA, 100 ohms Bryce 5CH528
- Condensers:—
 - 4 0.1 mfd. tubular Dubilier 4513
 - 1 4 mfd. 650 volts Dubilier 9204/LEG
 - 2 8 mfd. 500 volts, electrolytic Dubilier 0281
- Resistances:—
 - 2 100 ohms, ½ watt Bulgin HW37
 - 1 500 ohms, ½ watt Bulgin HW2
 - 2 25,000 ohms, ½ watt Bulgin HW20
 - 2 250,000 ohms, ½ watt Bulgin HW28
 - 2 500,000 ohms, ½ watt Bulgin HW31
 - 1 500 ohms, 20 watts Bulgin PR2
- 7 Valve holders, 5-pin (without terminals) Clix Chassis Mounting Standard Type V1
- 1 5-pin plug for speaker connection Bulgin P3
- 1 4-way connector Bryce Light Pattern
- 1 Fused mains input connector with 1 ½ amp. fuses Belling-Lee 1114
- 2 Ebonite shrouded terminals, input Belling-Lee "B"
- Chassis 10 ½ in. x 9 ½ in. x 2 in. B.T.S.
- Miscellaneous:—
 - Peto-Scott or Scientific Supply Stores
 - 3 lengths systoflex, small quantity Nos. 16 and 18 tinned copper wire, etc.
- Screws: 48 6BA ¼ in. R/hd., with nuts; 10 4BA ½ in. R/hd., with nuts and washers; 4 4BA ¾ in. R/hd., with nuts and washers.
- Valves:—
 - 2 MHL4 metallised or plain, 2 PX4, 1 MU14 Osram or Marconi
- Loud speaker with push-pull output transformer, 1,250 ohms field Magnavox Duode 33

Current Topics

EVENTS OF THE WEEK IN BRIEF REVIEW

New R.A.F. Station

WORK is now proceeding on the erection of a new Air Ministry experimental wireless station at Bawdsey, near Felixstowe. The station is not far distant from the other experimental establishments at Landguard and Martlesham Heath.

Enlivening Train Journeys

THE latest idea on French railways is to fix headphones to each seat in certain trains, not for the purpose of receiving broadcast programmes, but in order to enable a commentator to point out the objects of interest which the train passes. The commentator sits in a special compartment in the front portion of the train.

Radio City Improvements

SPECIAL observation galleries have been built round the studios and control room of the Radio City headquarters of the National Broadcasting Co. in New York. These galleries are enclosed by sound-proof glass partitions, visitors hearing the programmes through loud speakers. Special observation galleries have also been erected in the buildings housing the transmitting apparatus.

Manchester Show

THE Manchester Radio Exhibition this year is organised, not by the Radio Manufacturers' Association, but under the auspices of the *Evening Chronicle* and organised by Provincial Exhibitions, Ltd.

The show will again be held in the City Hall and will be open from September 22nd to October 3rd.

As at Olympia, a variety show will be organised in a specially built theatre.

Scandinavian Progress

ACCORDING to reports issued by the Swedish P.M.G., all broadcasting stations in Sweden are now linked up by cable except those of the Far North, where beam transmitters are used for relaying. Work has now begun on a new 100-kilowatt station near Malmo in the South of Sweden, and a 10-kilowatt installation at Ulea in the North. Norway and Denmark are both planning new broadcasting headquarters.

Service Men's Association

THE recent formation of a wireless factory workers' union in the U.S.A. has been followed by a movement towards a comprehensive association to include all types of radio service men.

Denmark Goes One Better

THE old story of the farmer who used loud speakers dispersed about his field and connected to a powerful set in order to scare the crows has been told to us *ad nauseam*. The story has just arrived again, this time from Denmark, but in this case it is rats instead of crows.

New Swiss Broadcasting Chief

ON October 1st there will be a change in the management of the body controlling Swiss broadcasting owing to the retirement of M. Maurice Rambert, who has reached the age limit of seventy. He is succeeded by M. Alfred Walter Glogg.

cycles per second, the pictures will be so coarse in definition that they will not be worth looking at.

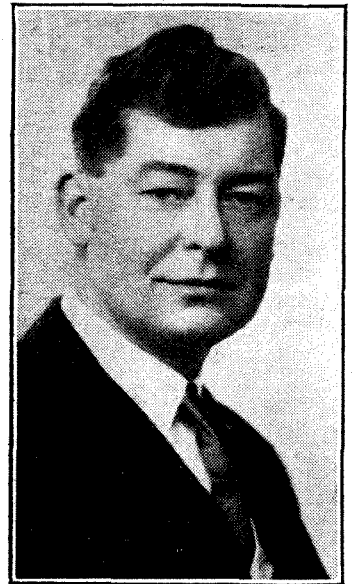
Women Listeners Predominate

SURPRISING figures have just been published by the Columbia Broadcasting Co. of America as a result of a recent survey of its radio audience. It appears that, contrary to the state of affairs existing in ordinary life, women do far more listening than men. Actual figures show that in the afternoon 64 per cent. of the radio audience are women, this declining to 53 per cent. in the evening.

Educational Opportunities

DURING the last few weeks we have drawn attention to several courses of instruction in different branches of wireless technique. Prospectuses from two more institutions have now been received.

The first is from the Electrical



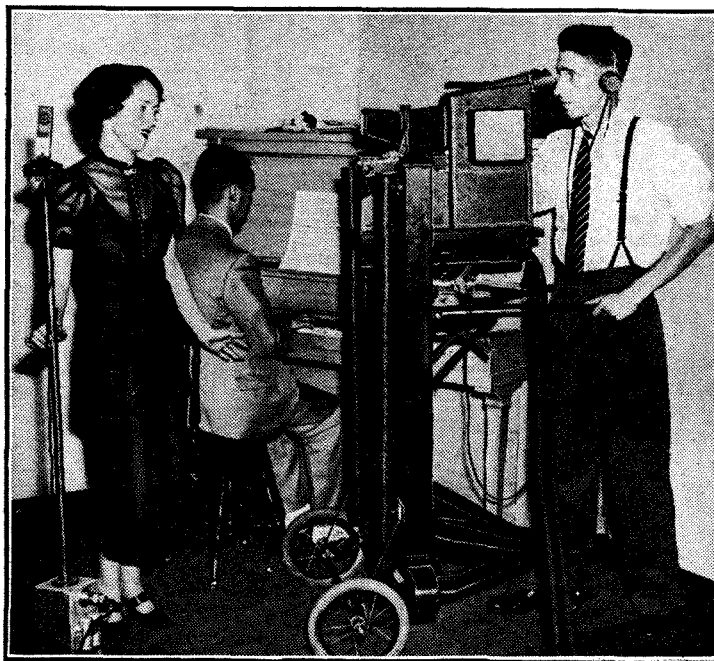
MOUTHPIECE OF THE G.P.O. Mr. J. H. Brebner, M.B.E., formerly Press Officer, has been appointed to the newly-created post of Controller of Press, Information and Publications to the General Post Office.

tion with the Board of Education. Enrolment takes place from September 21st to 25th. Other courses of a less comprehensive nature are also outlined in the prospectus.

The Norwood Technical Institute, Knight's Hill, W. Norwood, London, S.E.27, has also issued a prospectus. Again, enrolment is fixed for September 21st-25th, and there are courses in Radio Engineering, Electrical Sound Equipment, and Radio Servicing.

Radio Engineers' Training Scheme

THE question has often been raised as to the best mode of procedure for a young man who wishes to become a competent radio engineer. Hitherto there has been no properly organised avenue of approach, but the Radio Manufacturers' Association has now come to the rescue by arranging for the training of young men at the works of various manufacturers who are members of the Association. Candidates for this training scheme will, in the first place, be required to attend a course of instruction in a technical institute with a view to taking a National Certificate in Electrical Engineering awarded by the Institution of Electrical Engineers and the Board of Education. Candidates who gain this certificate will be eligible for the R.M.A. scheme of training, and will be sent for six months to the works of a radio manufacturer. During this period they will be paid wages at a special rate to cover the cost of living. Those requiring further particulars should enquire at their local technical school.



AS DONE IN THE U.S.A. A television camera at work in the Philco Studio, Philadelphia.

This Progress

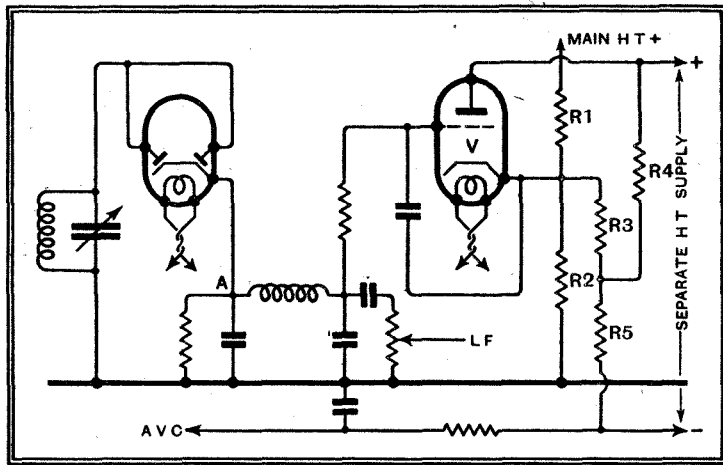
LOW-DEFINITION television is dead but it won't lie down, as a New York firm has just been licensed to establish a transmitter working on 150 metres. By this means it is claimed that a very long range will be secured. Nobody doubts this, of course, but since the frequency band transmitted is to be limited to only 100,000

Engineering Department of the Polytechnic, Regent Street, London, W.1. In it are set forth details of Wireless and High-frequency Engineering Courses (including Television) for the session 1936-37. The first three years of the course are now approved for the award of the "Ordinary" National Certificate granted by the Institution of Electrical Engineers in conjunc-

Letters to the Editor

New AVC Circuit

YOUR readers may not realise that it is possible to devise an amplified AVC circuit to work with a straight set with the tuned circuits earthed. The circuit to which I refer is a modification of that used in the "Q.A. Super." I have never seen it described before, though it will be remarkable indeed if I am the first to have thought of it. It appears perfectly satisfactory in operation.



AVC circuit described by Mr. W. J. Cluff.

With the detector circuit shown in the diagram, the point A is at a positive potential with respect to earth when HF voltages are applied. This positive potential is applied through a filter to the grid of the valve V, fed from a separate HT supply. By means of resistances R1 R2 its cathode is given such a potential that no anode current flows until A is at the potential corresponding to the input at which the AVC is required to start acting. When anode current flows the voltage developed across R3 in the cathode lead is used for bias purposes. In order that the AVC line shall not be initially positive, two resistances R4 R5 are introduced, when the voltage drop across R5 becomes equal to that across R2. These are most simply adjusted to the values exactly required by noting the anode current of a controlled valve in the absence of a signal and altering R4 or R5 until it reaches the value known to be correct.

Maidenhead. W. J. CLUFF.

U.S.W. Reception Experiences

DURING the tests and experiments carried out on the receiver units of the new Scott Sessions Ultra Short-wave Trans-receiver apparatus, the following effect was apparent.

The Alexandra Palace sound transmissions were being received on the 2nd harmonic (presumably) at unbearable strength on the 'phones. The writer and other engineers of the development department noticed that the signal strength varied according to the position of the listener if the set was not being carried by him.

The strength went to a maximum at a certain distance and direction from the receiver, and was very weak or blocked out when the listener and the receiver were in a line parallel to the Palace.

The effect was more prominent if the

listener was of average height. Knowing that the average person is a $\frac{1}{2}$ -wave resonator at about 3.66 metres (sound broadcast is on 7.24 m., the 2nd harmonic of which is 3.62 m.), it would be interesting to know if any of your readers have had the same experience and to what conclusion this brought them.

It may not be out of place to mention that, though it is a dangerous experiment to play with, the average person standing near an aerial working on 3.66 m. may (with medium power on the aerial) light wave-meter lamps in his abdominal region, where there would be a current maximum. If he feels like taking more risks (and there are risks) when using higher power, he can even expect a neon tube to light on applying it to his ear or nose, due to the potential maxima being developed at the extremities of the human aerial.

P. K. CHATTERJIA.

Russell Effect

WE are more than interested in the radio phenomena quoted by your correspondent, Mr. G. J. Russell.

We have been aware of this and similar effects for the past two years, and have been endeavouring to take advantage of them with a view to getting noise suppression and high speed AVC on those wavebands where noises are such an impediment to communication.

We have reached a point where we would have taken out patents, but now the matter has come to light our experiences will be recorded for what they are worth.

In general, our first effects were much the same as your correspondent quotes. In addition, 5-metre transmissions by North London amateurs which were previously inaudible on a super-regenerative receiver came in very strongly when a simple detector and LF set, tuned to 40-metre band and in an oscillating condition, was switched on. Loud speech was available on both receivers simultaneously. The quench noise was heard in the loud speaker employed with the det-LF set, whilst strong speech was coming in, and on neither set did there appear to be any silent point, i.e., "hole in the mush." The signals were of such strength as normally produced speech on the super-regenerative receiver with a quiet background.

Shortly after these effects had been noted a second effect was observed under different conditions, which we believe fits

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

in with the effects quoted above. Experiments were being carried out with a simple super-regenerative receiver (which we see has been dubbed the "Minute Man" in America). This receiver had a LF amplifier attached giving some 40 db. gain and capable of $2\frac{1}{2}$ watts of undistorted output. Whilst adjusting this for super-regeneration we were agreeably surprised to hear Radio Normandie 269.5 kc/s at almost the full output of the set.

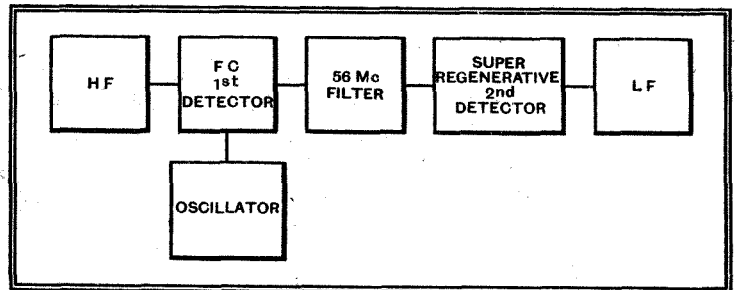
The point to note here is that *no* aerial was attached to the set, and no aerial of any kind was within thirty yards.

The amplifier and power supply were very well screened, HF chokes and condensers were also incorporated as this equipment performs various other duties when required.

When it is pointed out that the transmission was noise-free and moderately free from distortion at a site where Radio Normandie on all normal types of reception is almost obliterated with noise, this represented an advance if the mode of operation could be ascertained and "pinned down."

During the days that followed many stations were received at intervals from all parts of the world, and widely differing fundamentals. For instance, GJG turned up within a division or so of Radio Normandie setting.

A sudden inspiration on our part traced the effect to be simultaneous with the use (in another building close by) of an automatic tuning circuit using a biased oscillator similar to the one used by Murphy in their self-tuning set. No doubt the fundamental of this oscillator and its harmonics (we know what bias does to oscillators) were beating with the various transmissions to give a "Russell Intermediate Frequency" which



Arrangement of the receiver used by Messrs. Search and Edwards.

travelled through space to be demodulated in our antenna-less super-regenerative set. Since the radiating receiver was also in the same high noise field, the noise suppression must be attributed, we thought, to the super-regenerative. Acting on these lines we made up a receiver on conventional lines, employing tuned HF frequency changer and super-regenerative second demodulator. This implies IF of 20 megacycles or more, in order to get the benefit of the second super-regenerative demodulator. No IF amplifier is used, thereby a filter twice a frequency changer (1st det.) and

Letters to the Editor—

super-regenerative stage. It works, and we believe, time and patience permitting, we shall get the "bugs" out of it.

C. J. SEARCH.
P. A. EDWARDS.

"The Beedle Effect on Ultra Short Waves"

THIS is, of course, the same as the Russell effect, *vide* July 31 issue, only about eight years older, for I first gave demonstrations of these and other interesting effects during the autumn of 1928. By using a pentode detector and screen grid quench it is possible to dispense with the external oscillator, and thus extend the capabilities of reception. On several occasions during the past three years, whilst lecturing at the University of London Goldsmiths' College, I have shown the possibility of the reinversion of transatlantic telephony (not new by about five years) and the reception of Continental broadcast programmes. It is amusing to note that on March 29, at 2335, G5HF and I (G6OW) attempted duplex working. He reported me as being in the middle of the Radio Normandie programme, whilst he was in the middle of high-speed Morse stations. However, on the serious side, I have a number of things to say and questions to ask.

Recently I have been working on a series of detailed 5-metre experiments with G5HF, being on the air from 1000 to 0100 nearly every day for a fortnight, and have noted some very curious effects.

1. Periods when both our receivers would "go quiet" for no apparent reason. Adjustment failed to rectify.

2. Mysterious signals that increased the quench with, in some cases, pure CW in the middle of EW and sometimes BR. Sharply tuned (unusual when using super-regen). Sometimes rhythmic (a) 1 burst per 4 sec., (b) 8 per second, (c) 24 per second, and on Sunday, July 4, built another super-regen. receiver without quench coils—same result. Built another, using mains valves—same result. Twice I have noted high-speed fading!

By careful adjustment it is possible to cover the 20- and 40-metre amateur band with good CW and fone signals, but how is one to determine when reception is due to supposed harmonics or Mr. Russell's superhet principle?

Extracts from my log:—

March 8: 2140 G5JW clg Test, R5-6. 2235 G6Gi, saying he was only using 1.5 watts, R8.

May 24: 0945 G5JA, of Cambridge clg on fone and stg bi for a call on 40 metres, R9, QSA5. 1005 G5QO ses QRM to G5PT, R7-8. 1007 G2QY giving congrats on new hamship to another station, ?G2XN.

And so on. I have heard clear, loud signals of amateurs from Scotland to Southampton and from Bristol to Essex on 5 metres, and having in some cases removed the quench valve and turned off the oscillator. I cannot think it would be harmonics, and I know it cannot be superhet. But the signals come in.

In conclusion, may I ask where all the 5-metre people have gone, and for the benefit of those interested in reception on this band that xmitters when on the air would state their location and the fact that it is a 58 mc. transmission.

There is much interesting work here.

ALBERT L. BEEDLE,

Morden, Surrey.

G6OW.

On the Short Waves

NOTES FROM A LISTENER'S LOG

WITH the advent in six weeks' time of a regular public television service, the first in the world, there will be plenty of opportunities for the amateur to indulge in ultra-short-wave propagation studies, especially for those of us who live within one hundred miles or so of London.

An interesting article¹ on this subject has already appeared in this journal, but I do not think that it would be out of place also to recount my experiences whilst receiving the Alexandra Palace vision and sound signals at Epsom.

A single-valve triode-hexode (X31) converter was used in front of a commercial six-valve all-wave receiver working from the DC mains, which, incidentally, are of the mercury-arc type. These are adequately smoothed before reaching the receiver by means of the primary of a "mains-transformer" plus a 4-mfd. condenser. It is amusing to note that quite high AC voltages—mainly at 150 c/s—can be obtained on the idle secondary windings of this transformer. If desired, a metal rectifier may be used in conjunction with these secondaries to obtain *really free* grid bias.

To return to the U/SW converter. Experiments were first made to discover the most suitable IF frequency by switching the all-wave superhet. receiver from one band to another.

It soon became apparent that a good compromise performance was obtained when the

receiver was tuned to, roughly, 3.75 Mc/s (80 m.), but complete freedom from pulling between the oscillator and hexode sections of the X31 was not obtained until frequencies of 7 Mc/s (40 m.) or higher were used.

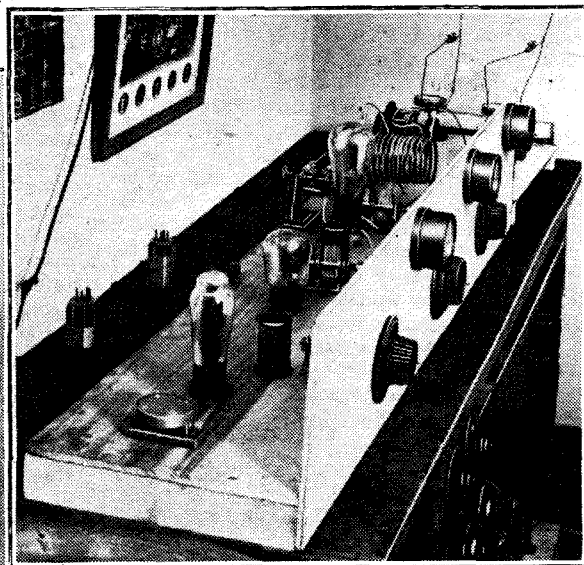
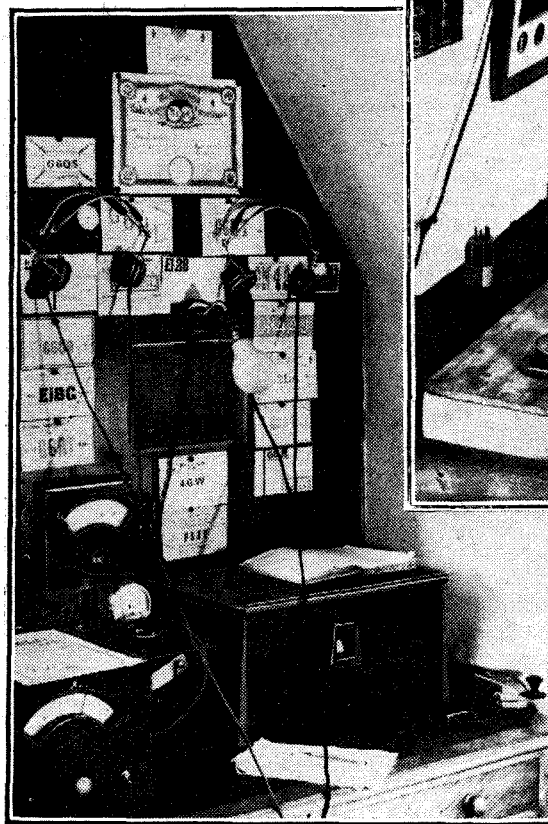
An initial oscillator drift of 150 kc/s was also noticed during the first minute or so after switching on, but after this the oscillator frequency became quite stable, and good signals were received from Alexandra Palace on 7.2 metres throughout the complete transmissions without retuning after the initial period of warming up.

Aerial Experiments

At first the ordinary outside inverted L aerial was used, with fair results, but distinct fading was noticed every time a "Southern" electric train passed on a nearby line, the down trains from London appearing to give the greater effect!

It was obvious, of course, that these vertically polarised transmissions would be better received on a vertical aerial, so, after considering the merits and demerits of various arrays, it was decided to put up a vertical "Kirke" aerial, comprising a $\frac{3}{4}\lambda$ uppermost section 8ft. 6in. long coupled to a lower $\frac{1}{4}\lambda$ section 1ft. 6in. long by means of a "postage stamp" 0.0005 mfd. condenser. A lead-in an odd quarter-wave long was taken away at right angles from the bottom of the $\frac{1}{4}\lambda$ portion to the receiver. All the other arrays considered required either too much space or too many insulators.

G 6 P W



AN ACTIVE SCHOOL STATION.—

For many years Warwick School has shown a keen interest in wireless; its radio society has now been granted full facilities for transmission on the amateur bands. On the left are seen the short-wave and broadcast receivers and key, while the other photograph shows the transmitter, which is at present working on 7,150 kc/s; reports of reception are welcomed.

Notes on Contrast Expansion

METAL AND CARBON LAMPS IN COMBINATION

By GERALD SAYERS

The results on the new aerial were considerably better, and, furthermore, the advent of Southern trains no longer produced fading. Car-ignition interference was not serious, but was audible at intervals; the situation is, however, remote from a main road.

Apart from this slight blemish, reception on the "Kirke" aerial was on a par with daylight reception of Brookmans Park.

Reverting now to our fortnightly study of short-wave conditions, one notes in general a slight but definite trend to autumn conditions on the lower frequencies, though the higher frequencies are still, so far, putting up a summer-time performance.

For example, at 10.30 p.m. on Saturday, August 29th, W1XK on 9.57 Mc/s was a fair, deeply modulated signal, giving a pianoforte recital. Unfortunately, no comparison with W2XAF was possible, as this station was blocked out by a very strong signal from LKJ1.

A little earlier in the evening W3XAL on 17.78 Mc/s had been quite good, so also was W8XK on 15.21 Mc/s at 10.30 p.m.

An audible signal from W2XE was intercepted on 21.52 Mc/s at 3 p.m. on Sunday, August 30th, but only poor signals were obtained on this occasion from VK2ME later in the afternoon.

Later on the Sunday, W8XK was fairly good on 15.21 Mc/s, and after midnight COCH, Havana, was fair, and better than W2XAF on a near-by channel. Very good results, indeed, were obtained from W2XAD late on the following Tuesday and Wednesday evenings during the special transmissions for the Walker Cup broadcasts, and fairly good results were also obtained from W3XAL and W8XK, but neither of these stations was as strong or stable as W2XAD on his European beam.

Some very good programme value receptions, better than that obtainable from Berlin on either the medium or long waves at the time, was obtained from all the four Zeesen transmitters—DJE and DJB for the East, DJL for Africa, and DJQ for South America, during the midday and afternoon period on Sunday, September 6th.

Fair results were also obtained from PHI on 17.75 Mc/s during the afternoon, and VUB, Bombay, on 9.565 Mc/s, also gave moderately good signals at 5.55 p.m.

Strong Japanese Signals

A feature of Sunday, however, was the outstanding performance of several stations using very high frequencies. JNN Tokyo on 19.5 Mc/s (approx.) was a terrific signal nearly all day, and signals were heard on frequencies up to 23 Mc/s.

Conditions were similar on Monday, September 7th, and coincided with the meridian passage of two large groups of sunspots; at 8 p.m. on this day LSE Buenos Aires on 20.5 Mc/s was as strong as I have heard him since 1927/29.

Good results from W3XAL and both W2XE and W8XK on the 15 megacycle band were obtained on Tuesday evening, September 8th, and at 11 p.m. strong signals were the order of the day from W1XAL Boston on 11.79 Mc/s.

New stations heard well during the week were HIN, Trujillo City, giving announcements in English on 11.28 Mc/s at about 10.40 p.m., and further tests by OLR Podobradny on 15.23 Mc/s last week, and 11.76 Mc/s this week at 9 a.m., 5 and 8 p.m. daily.

ETHACOMBER.

THE problems associated with contrast expansion are in practice those of other attenuators, while if the usual conditions of constant input resistance are aimed at there is a ready means of estimating the probable degree of expansion.

We have to remember first that in using the decibel unit we refer here to a ratio of loudness between the highest and lowest degree of expansion and that this has to be added to the normal maximum programme variation. If we take any ordinary set and operate the volume control manually the range of "Expansion," so to speak, of a low-level signal such as "Bow Bells" is some 60 decibels from the threshold of hearing to full undistorted output.

What we are trying to do is to make a similar movement over a narrower range, the movement being controlled by the programme level itself, and such action is to be very roughly the reverse of that done at present manually by the control engineer at the transmitting end of the chain. Bearing in mind the upper limit of undistorted output set by the last valve, and the lower one of inaudibility, then some 10 db. is the greatest extra range that can normally be applied.

Another reference to our manual control demonstrates that the "wick" of any ordinary set will not bear much turning up on loud passages, also that a propor-

tion of the available power must be sacrificed to operate the contrast device (the latter may be visualised as a permanent volume control across the loud speaker which one is unable to open fully out).

We can now call maximum desired attenuation A1 and minimum A2, and A2-

AI is to be 10 db. The bridge arrangement (Fig. 1) which has been recently described can be re-drawn as a lattice-type attenuator (Fig. 2) terminated in a characteristic resistance Rs. To meet possible criticism it must be admitted that the speaker impedance (Rs) is not a constant quantity for all frequencies, but that point is beyond the scope of the present investigation. Call Rs 10 ohms.

Taking A1 (minimum volume) the problem now is: "What are the values of the resistance elements of a lattice-type attenuator to give 10 db attenuation and to have a characteristic of 10 ohms?"¹

CI and C2 are constants for this type of network for a given attenuation in db.

CI is 0.5194
C2 is 1.925

each of which have only to be multiplied by the characteristic resistance (Rs)

then R1 is $10 \times 0.5194 = 5.2$ ohms
R2 is $10 \times 1.925 = 19.2$ ohms

Taking A2 (maximum volume, minimum attenuation) in a similar way but for 20 db ($20 - 10 = 10$) and our constants for 20 db

CI is 0.8183
C2 is 1.222

then R1 is $10 \times 0.8183 = 8.2$ ohms
R2 is $10 \times 1.222 = 12.2$ ohms

It will be observed that the resistance of one pair of arms should be rising while the other pair is falling, from which it might

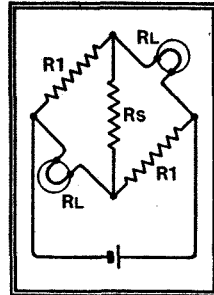


Fig. 1. The bridge type of volume-expansion circuit.

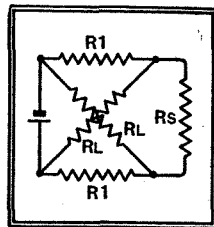


Fig. 2. The equivalent circuit of Fig. 1.

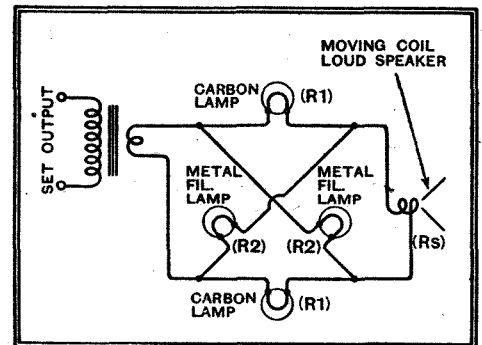


Fig. 3. Use of lamps with both positive and negative temperature coefficients in a volume expansion bridge.

	Resistance in ohms.		
	Cold.	Hot.	
L1 carbon filament	8.2	5.2	10 ohms
L2 " "	8.2	5.2	
L3 metal " "	12.2	19.2	
L4 " "	12.2	19.2	
Rs speaker	—	—	

seem that a rather more elegant attenuation network might be constructed having lamps (or lamps shunted by resistances or filters) possessing either rising or falling temp. characteristics—a combination of metal and carbon filament lamps—in all arms of the bridge as re-written in Fig. 3 and shown in the table. Such an arrangement will present an approximately constant impedance to the applied set output and give an expansion of 10 db beyond the usual maximum modulation (say, 35 + 10 = 45 db).

¹ "Design of Constant Resistance Networks." T. S. Rangachari. *Wireless Engineer*, Nov., 1934.



H.M. Irish Guards
will broadcast
to-morrow.

Listeners

Outstanding

THE first of a series of representative programmes to be broadcast from different continents will be heard by Regional listeners at 9 o'clock on Sunday and has a duration of half an hour. "Inter-continental Programme No. 1" comes from the U.S.A., and will be presented by the National Broadcasting Company of America and the Columbia Broadcasting system. At the opening of the programme will be heard the majestic roaring of the famous Falls of Niagara, and this will form a prelude to the first section, which is devoted to Indian music. Two Iroquois War Songs are to be chanted by Chief Jesse Cornplanter, of the Seneca Indians, direct descendant of the great Chief Cornplanter, who was a great power among the Iroquois; accompaniment is provided by a flute, shell rattles, tom-toms and Seneca singers. Part II deals with old traditional Cowboy songs of the range—"The Streets of Laredo" and "Roll Out, Cowboys" being contrasted with a modern descendant.

The third section deals with Negro music, past and present, and finally comes a selection of Anglo-American music which includes an old song, "Sourwood Mountain," sung to the accompaniment of a dulcimer. The programme ends to Lamar Stringfield's "Cripple Creek" from his orchestral suite, "From the Southern Mountains."

DIRLETON

ERECED in the thirteenth century by the Norman family of De Vaux, and partly destroyed in the War of Independence, owned successively by Haliburtons and Ruthvens, alternately besieged and banqueted in, the Castle of Dirleton provides the subject for a Regional broadcast at 9 o'clock on Wednesday. Relayed from the Castle itself,

this broadcast is the third of a series of "Castles in Scotland," and takes the form of a story in narration and reconstructed scenes from the past. It is compiled by Dr. W. Mackay MacKenzie and the music has been written by John Gough, who will also produce the programme.

SCRAPBOOK

"SCRAPBOOK for 1901," which will be presented and produced by Leslie Baily and Charles Brewer, the joint authors, was originally down for broadcasting in January last, but was postponed on account of King George's death. This is the last of the present series of "Scrapbooks," but the B.B.C. has arranged with Leslie Baily for a new series to be produced between October, 1936, and September, 1937.

In this edition one of the outstanding glimpses into the past will be that of the Marchese Marconi and the late Mr. G. S. Kemp, who, thirty-five years ago, carried out the first transmission of wireless signals across the Atlantic.

The programme is timed for 8.10 on Thursday, when it will be radiated Regionally.

ROMANCE OF THE SUEZ CANAL

FELIX FELTON, the brilliant young B.B.C. producer who was entrusted for the first time with the Round-the-World programme of Christmas Day, 1935, is to do another high-spot broadcasting this (Friday) evening, when a programme designed by himself and dealing with the story of the Suez Canal will be broadcast in the Regional programme at 8.10 under the simple title of "Ferdinand de Lesseps."

The story, revolving about the central figure, de Lesseps, tells how for four years the plans of the great project were constantly modified until in 1858 a company with a capital of two hundred million francs

was formed. Eleven strenuous years passed, the apparently impossible was achieved; the Suez Canal became one of the main arteries of world trade.

PROMS

RELAYS from the Promenade Concerts continue each night this week, and the item selected for this evening at 8.55 is Beethoven's "Eroica." On Saturday at 8.30 (Reg.) Lisa Minghetti will be heard in the Max Bruch Violin Concerto and the Symphony will be Beethoven's No. 5 in C Minor. On Monday the Wagner concert is devoted to "Parsifal," and will include the Prelude, Grail Scene and Finale.

Tchaikovsky's Sixth Symphony (the "Pathétique") will be broadcast at 8.45 (Reg.) on the following day and then on Wednesday (Nat.) there will be

IRISH GUARDS BAND

ALTHOUGH it is more than a year since Colonel A. G. C. Dawnay relinquished the post of Controller of Programmes at the B.B.C., he still takes an active interest in wireless entertainment, and as officer commanding H.M. Irish Guards the permission granted by him for a broadcast by the Band of the Battalion to-morrow (Saturday) is something more than a mere courtesy act. Colonel Dawnay is still to be seen now and then in the corridors of Broadcasting House. The Band's performance on Saturday between 6 and 7 o'clock (Reg.) will be conducted by Lieutenant J. L. T. Hurd, who is Director of Music to the Irish Guards. As an offset to the instrumental part of the programme solos will be sung by that old favourite of broadcasting, Norman Williams (bass).



FISHING FOR SOUND with a microphone. This picture was taken on the occasion of a previous relay of the voice of Niagara, which will again be heard in the Intercontinental Programme on Sunday.

a Brahms concert, when Szigeti will be the soloist in the Violin Concerto in D. A feature of the concert of Russian music on Thursday will be the second appearance at the Proms of Nicholas Medtner, the Russian composer-pianist, who will play his Second Piano Concerto in C Minor. The programme is to be radiated on National at 8 o'clock.

A NOVELTY IN SPORT

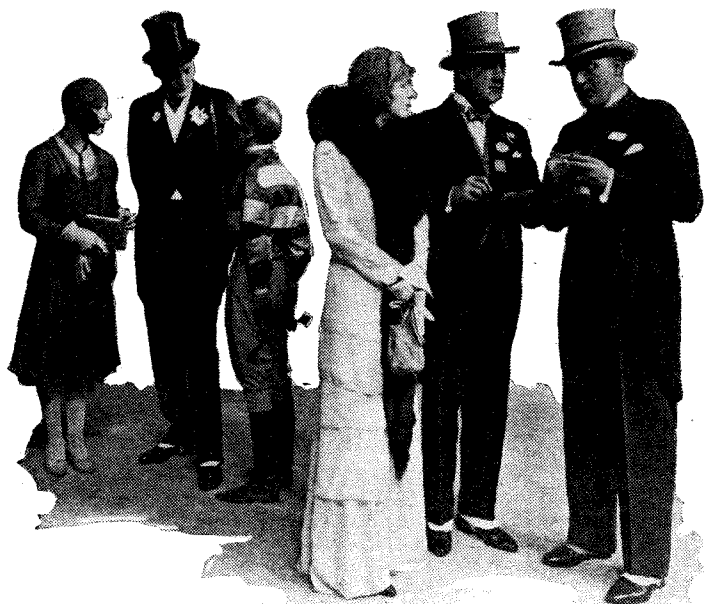
THE Six-Day Cycle Race, which has for some years past enjoyed great popularity on the Continent, is to be introduced to England at the Wembley Pool Stadium this month. The teams, entered by various countries, are not representative of those countries, as, for instance, an Englishman is riding for Hol-

Guide for the Week

Broadcasts at Home and Abroad

land and a Dutchman for England. Mr. J. E. Holdsworth, who described the Herne Hill Cycle Race, will

Orde and the Eight Step Sisters. This show attracted the attention of a B.B.C. talent scout. The result was that



A SCENE from the stage version of Edgar Wallace's play "The Calendar." Adapted for broadcasting by Barbara Burnham and produced by Val Gielgud, it will be heard on Monday and Tuesday.

give a commentary on the opening of the race at 10.30 on Monday evening (Nat.). This should be a new sensation for English listeners and should be welcome as a novelty.

OUTSTANDING PIANOFORTE RECITALS

THE first of two outstanding pianoforte recitals, both on National, is to be given this evening at 7.30 by Irene Scharrer, who will include in her programme the Beethoven "Waldstein" Sonata.

The second recital (timed for 9 o'clock on Sunday) will be given by Moiseiwitsch, who was given such a thunderous reception at the Promenade Concert last Tuesday. He will play two Preludes and the Sonata in B flat Minor by Chopin.

A STAR "FIND"

In the early months of this year Sidney Chasid and his Band were appearing in the cast of a variety show at a cinema in Kingston-on-Thames which included Florence Oldham, Harold Ramsay, Beryl

Sidney Chasid was offered an engagement at Broadcasting House, where he made his debut before the microphone on June 23rd. He has now been given a second engagement and will be heard in the National programme on Thursday at 5.15.

OPERA ABROAD

To the student of contemporary opera "La Leggenda di Sakuntala," by Alfano, should provide more than a little interest. Alfano is one of the finest of present-day composers

HIGHLIGHTS OF THE WEEK

FRIDAY SEPTEMBER 18th.
Nat., 8.10, B.B.C. Dance Orchestra. 8.55, Prom. 10.10, "Down to the Sea in Ships": Talk by Arthur Cargill.
Reg., 7.30, Northern Music Hall from Sheffield. 8.55, Celebrity Trio. 9.20, Comic Opera.
Abroad.
Vienna, 8.20-10, "Alcira"—Two-Act Opera by Verdi.

SATURDAY, SEPTEMBER 19th.
Nat., 6.50, Theatre Orchestra. 8, John Watt tells "The Full Story." ¶Music Hall. 10.30, B.B.C. Orchestra (C).
Reg., 7.30, Albert Whelan in "That Reminds Me." 8, Reah Sadowska (pianoforte). ¶Prom. 9.35, The Continentals.

Abroad.
Sottens, 8.35, Debussy Festival Concert.

SUNDAY, SEPTEMBER 20th.
Nat., 7.45, Federation of Festivals: talk by C. Armstrong Gibbs. 9.30, Theatre Orchestra.
Reg., 5.0, "Voices of the People." 7.55, Presbyterian Service. ¶Owen Nares Appeals. 9.30, London Mozart Orchestra.

Abroad.
Munich and most German Stations. 8, Classical Concert (Mozart, Liszt, Debussy, etc.).

MONDAY, SEPTEMBER 21st.
Nat., 7, B.B.C. Dance Orchestra. ¶Federation of Festivals. 8, Prom. ¶Variety compered by Brian Michie.
Reg., 7.30, Alfredo Campoli Trio. ¶The Calendar. 9.15, Anona Winn and her Winners. ¶Recital.

Monday, Sept. 21st (continued).

Abroad.
Berlin, 8.10, "Money Songs" and Melodies about Money.

TUESDAY, SEPTEMBER 22nd.
Nat., 6.25, Leslie Bridgewater Quintet. 8, Fictional Fame on Parade: A Satirical Revue of Best-Sellers. ¶The Callendar. 10.10, B.B.C. Orchestra (C).

Reg., 7.30, George Scott-Wood and his Six Swingers. 8, Talk: Tameless in Birds by Tom Harrison. ¶Karl Caylus Players.

Abroad.
Radio-Paris, 8.30, From the Opera.

WEDNESDAY, SEPTEMBER 23rd.

Nat., 6.30, "Talks in French" by M. E. M. Stephan. ¶B.B.C. Military Band. Gerald Kasses (bass baritone). 8.55, Al Collins and his Dance Orchestra. ¶Theatre Orchestra.

Reg., 7.30, The Tudor Singers, conducted by Cuthbert Bates. 8, "Patricia Brent, Spinster": A Comedy.

Abroad.
Frankfurt, 8.45, A Beethoven Concert with piano, choir and orchestra.

THURSDAY SEPTEMBER 24th.

Nat., 6.20, Talk by John Hilton. ¶Prom. ¶9.5, The Roosters. 9.20, Forthcoming Changes in Programme: Timing. By the Controller of Programmes.

Reg., 7.30, Problems of Non-Aryan Refugees: Talk by the Bishop of Chester. ¶B.B.C. Orchestra.

Abroad.
Warsaw, 7.40, Unfamiliar Ballet Music.

from the technical point of view and he is a teacher of his craft. This opera, which is presented in three acts, is founded on an Indian legend, and will be radiated at 8.45 on Sunday from Rome, and then again from Milan on Tuesday at the same time.

TELL THE WORLD

SOMETHING new in the line of talks has been evolved in

Swedish broadcasting. A series under the somewhat pugilistic title of "Straight from the Shoulder" is to be launched on Sunday at 9.30. Great hopes are entertained by the broadcasting authorities for the success of these talks, as they will offer prominent personalities an excellent opportunity to speak their opinions very frankly on the topics of the day. THE AUDITOR.



SCRAPBOOK.—A picture taken on Signal Hill, Newfoundland, 35 years ago, which shows Mr. Marconi, on the extreme left, approaching his assistants as they wrestle with the aerial-carrying kite which made their epoch-making experiment possible.

RANDOM RADIATIONS

By "DIALLIST"

A Television Maniac

AN old friend of mine who is a still older hand at wireless has recently become what I can only describe as a television addict. No viewing booth can be opened, no demonstration staged without his arriving at the earliest possible moment and leaving at the latest. He babbles o' time-bases and o' cathode-ray tubes as Sir John Falstaff once babbled o' green fields. But he also grouses, as it is the prerogative of every native of these Isles to do. He doesn't grouse about television itself; far from it; television is to him a kind of delectable ointment in which there can be no fly.

What then, the reader may ask, is biting this old friend of yours, O Diallist? Just this. He objects and objects strongly to the fact that the Press, despite the warm welcome (and the wonderful publicity) that it gave to television, has ventured to remark mildly, here that perfection in technique has still not been attained; there that to own a television receiver one must have a respectable bank balance—or be of the kind to whom overdrafts are lightly granted.

Are We Playing Fair?

"Why," says he, "should they harp on—or even mention—the shortcomings of television in these, its infant days? They didn't point out in 1922 that wireless receivers (and transmitters, too, for that matter) distorted pretty badly. When three-valve sets cost about £40, they didn't try to make out that wireless was a rich man's hobby. Why, then, say that for some time television must be a hobby for the few and that it is still not so good as it might be, and eventually will be?"

There are lots of good reasons. First of all the mechanical and electrical reproduction of sound was in a pretty elementary state when broadcasting began. The obvious standards of comparison were the gramophone and the telephone. In the days before electrical recording, the gramophone could reproduce only a very limited range of radio-frequencies. The same was true of the kind of telephone that was in use 14 or 15 years ago. Since we had never heard anything better than squeaky, scratchy reproduction of music with no real bass whatever by the gramophone, and speech so muffled on the telephone that nearly every proper name had to be spelt out, we did not realise that there was very much lacking in the early wireless sets.

Sweet Reason

With television matters are rather different, for before it came we had already reached a rather high standard in the perfection of moving pictures by the cinematograph, not only of the professional, but also of the amateur variety. Not just those who push pens to earn their living, but every man, woman or child that sees a television demonstration will naturally compare its images with those of the ciné screen. Everyone, then, must realise that, wonderful as is the television of to-day, there is room for improvement. This is no "crabbing" of an infant science.

Then the matter of expense. When the three-valve receiver cost a great deal in "ready-made" form, it was possible for the man in the street to obtain reception

of the broadcast programmes—if he was not too far from the transmitter—with a crystal set. Or he could build his own valve set quite cheaply, even in those days if he made, as many of us did, his own variable and fixed condensers or wound both high- and low-frequency transformers. It has always been possible to receive broadcast wireless on the cheap. Any such thing is quite out of the question with television.

In Thundery Weather

WHEN the "Lady Peace," the 'plane flown across the Atlantic by Mr. Merrill and Mr. Richman, landed in Carmarthenshire, some of the papers reported that the absence of wireless signals during the latter part of the flight was due to the aerial's having been struck by lightning. The damage was certainly due to the thunderstorms through which the flyers passed; but there can't have been a direct hit by lightning, otherwise there wouldn't have been much left of the 'plane. The trouble was probably caused, as it nearly always is when "broadcast" receiving sets are put out of action by thunderstorms, by very high voltages induced in the aerial. Some time ago experiments were carried out to see what kind of voltages could appear in an ordinary receiving aerial system in thundery weather. It was found that when a storm was passing directly overhead they could reach 5,000 volts or more. Hence the wisdom of fitting a good earthing switch—and using it!

A.P. and Interference

MANY complaints have been received from listeners living near the Alexandra Palace that they suffer from severe interference with their reception of the broadcast programmes on the medium wavelengths whenever television transmissions are toward. This had not been expected, but there is no doubt that the trouble is real. The B.B.C. is busily seeing what can be done about it, and talks of

evolving some simple and inexpensive device on wavetrap lines. Listeners in the neighbourhood protest that they should not be put to the cost of fitting gadgets to stop the interference, but really they haven't much to complain about for the necessary outlay will be small.

The Demand for Big Sets

I WAS very interested to see that R. G. D. and other firms who showed large and pretty highly priced sets at Olympia had been agreeably surprised by the volume of orders received for them. I'm pleased too, but not a bit surprised. You may remember that I have long held it to be folly on the part of so many of our manufacturers to neglect the market for really high-class sets and to concentrate on moderately priced gear. There is very definitely a useful demand for the "quality" receiver. And there's a market, far wider than many people think, for the set of many valves which is sensitive, though working well within itself, and containing a dozen or so refinements that cannot possibly be put into apparatus in the £10-£15 class. It is good to see that makers are at last waking up to these facts and beginning to realise that a large section of the listening public wants the very best that can be obtained in the way of wireless sets—and doesn't mind how much they cost, within reason.

THE RADIO INDUSTRY

DURING the Manchester Show period, Voigt speakers will be demonstrated at the premises of Forsyth Bros., Ltd., 126, Deansgate, Manchester. Times: September 23rd, from 3 p.m. to 6 p.m.; September 24th, 25th and 26th, from 3 p.m. to 10.30 p.m.

A very readable booklet issued by Bakelite, Ltd., of 68, Victoria Street, London, S.W.1, describes the properties and uses of Bakelite insulating varnishes, which have many applications in the construction of wireless apparatus, particularly for coil impregnation.

The price of the W.B. 1937 Stentorian Junior chassis model appeared in a recent advertisement as 37s. 6d., instead of the correct price, which is 32s. 6d.

B.B.C. EMPIRE TRANSMISSIONS

The revised times and wavelengths of the short-wave transmissions from Daventry are given below. Readers should listen carefully to announcements since wavelengths and times are liable to be changed.

Call Sign.	Frequency Mc/s.	Optimum Direction.	Times (G.M.T.).
GSD	11.75	East and West	26th July-29th Aug. 05.15-07.15
GSB	9.51	East and West	30th Aug.-3rd Oct. 06.15-08.15
			4th Oct.-7th Nov. 07.15-09.15
GSH	21.47	North and South; East and West	11.00-13.45
GSG	17.79	East	(Sundays 12.00-13.45)
GSH	21.47	East and West	14.00-16.30
GSG	17.79	East	14.00-17.00
GSF	15.14	East	14.00-17.00
GSO	15.18	North and South	17.15-20.40
GSD	11.75	North and South	17.15-20.25
GSB	9.51	North-West and South-East	17.15-20.40
GSG	17.79	West	20.40-22.45
GSF	15.14	West	20.40-22.45
GSB	9.51	North and South	20.40-22.45
GSP	15.31	East and West	
GSD	11.75	North-West and South-East	23.00-01.00
GSC	9.58	East and West	
GSF	15.14	North-West and South-East	02.00-04.00
GSC	9.58	North-West and South-East	

Visual Direction Finders

FOR U.S. COASTGUARD PLANES

New Cathode-Ray Application

WE are daily hearing of new applications of the cathode-ray tube, which seem to be getting as numerous as those of the ordinary thermionic valve. Some time ago details appeared in *The Wireless World* of the use of a cathode-ray device on board ship in order to prevent collisions during foggy weather in congested waters such as the English Channel.* This virtually consisted of an ultra-short wave DF arrangement of very limited

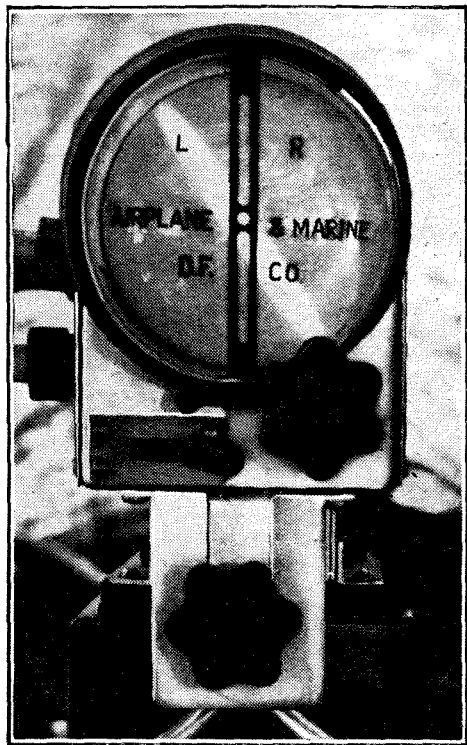


Fig. 1.—The direction of the wireless transmitting station relative to the aeroplane is indicated by the luminous beam.

range whereby the bearing of any neighbouring ship was indicated visually on the screen of a cathode-ray tube suitably mounted on the bridge. This principle of visual indication of bearing has now been applied in the U.S.A. to direction-finding apparatus on aircraft of various types.

In place of ordinary aural indication the bearing of the aeroplane in relation to any given transmitting station is shown by a luminous beam on a cathode-ray screen (Fig. 1). The apparatus is worked

in conjunction with an ordinary fixed aerial and earth system, and a rotating frame, the former being connected to the top and bottom deflecting plates and the latter to the side plates of the cathode-ray tube. The fluctuating voltages on these plates deflect the electron stream in the customary manner, so producing the necessary variations in the position of the luminous beam.

When the operator desires to know the actual bearing of the station indicated on the cathode-ray screen he rotates the frame aerial by means of a wheel (Fig. 2) until the beam of light on the screen coincides with the "fore and aft" line of the plane. The bearing is then read directly from the scale attached to the wheel actuating the frame aerial. In cases where the aeroplane is directly over the transmitting station a circular pattern appears on the screen, while an elliptical pattern (Fig. 3) indicates that a station is being approached. Apart from its use as

Fig. 2 (below).—By rotating the horizontal wheel until the beam of light in Fig. 1 coincides with the aeroplane's longitudinal axis, the bearing of the station can be read directly on the scale shown.

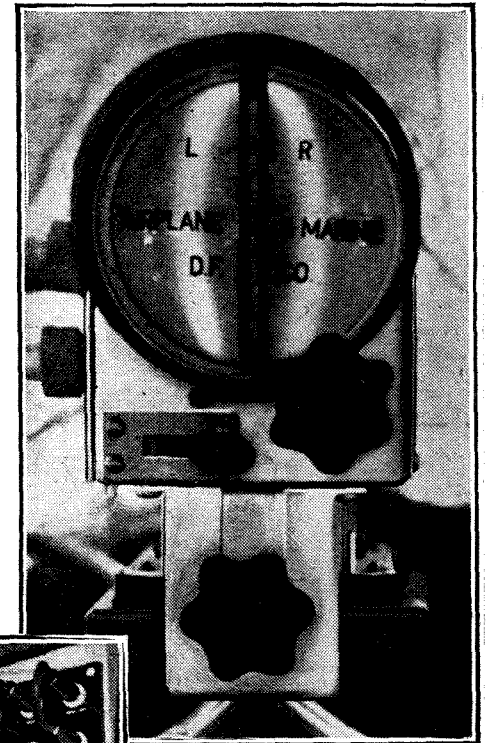
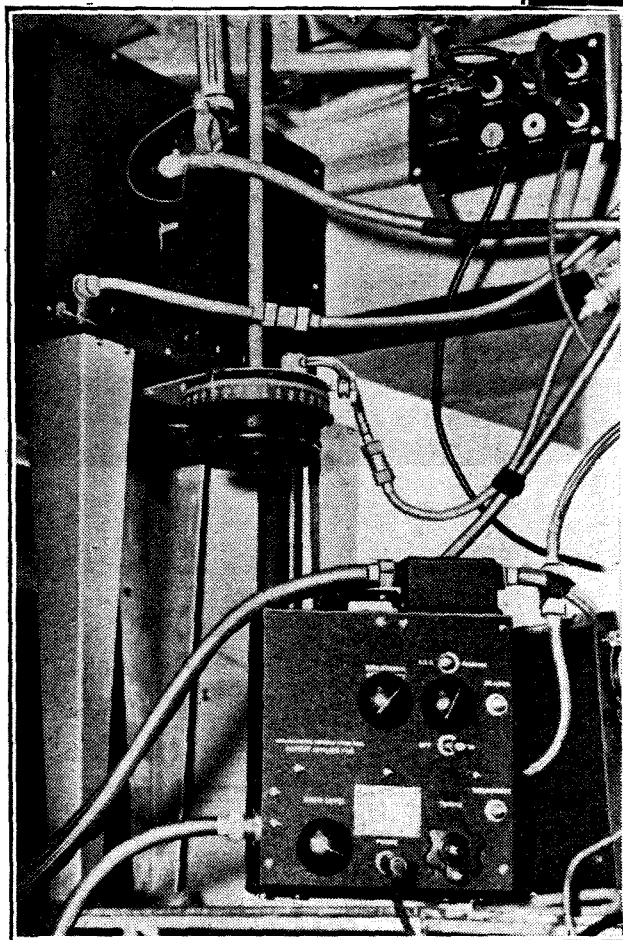


Fig. 3.—When two beams forming an elliptical pattern appear on the cathode-ray screen, it indicates that the transmitting station is directly ahead.

It is claimed that this invention will give accurate bearings through very heavy interference from other stations working on the same wavelength and through severe atmospherics.

Another very great advantage claimed for the apparatus which will be appreciated by all who have had much to do with DF work is that night-effect errors are never sufficiently great to be of any consequence.

This valuable development is due to Edward Hefele, Chief Engineer of the Airplane and Marine Direction Finder Corporation of Lindenhurst, U.S.A., and has been extensively tested by the United States coastguard authorities.

* New Radio Aid to Navigation, *The Wireless World*, August 3rd, 1934, page 76.

Broadcast Brevities

"In Its Infancy"

THE papers are now using the time-worn phrase "in its infancy" in connection with television, with the result that sound broadcasting seems to recede suddenly into middle-age. A talk by Captain H. B. T. Wakelam, truly a veteran among sporting commentators, to be given next week on "Reminiscences of Ten Years' Broadcasting" will also remind us of the antiquity of broadcasting.

In point of fact, broadcasting was a lusty adolescent when Captain Wakelam's microphone adventures began way back in 1926.

Veterans

It is quite a solemn thought that the men who started the great game of broadcasting are now, with barely an exception, verging on middle-age; some of them, indeed, are well stricken in years.

One of the exceptions, surely, must be Cecil Lewis—the "Uncle Caractacus" of Savoy Hill days—who made history once again during Radiolympia by giving the first "running commentaries" by television. Visitors to the television booths caught a brief glimpse of his tall, and still youthful, figure as he began his description of the view from Alexandra Palace as seen by the "electric eye."

First Television Commentary

It was not generally realised, perhaps, that Mr. Lewis's comments were based on what he saw *via* the television screen. After being "seen" on the terrace, he ran indoors, hopped over the trailing cables on the studio floor and took his seat at a check receiver in a darkened corner.

If, as the days went by, he began to lose his first fine frenzy at the beauties of Hornsey and Harringay, he never betrayed the fact.

Popularity of Daventry

THE Empire station at Daventry appears to be gaining in popularity, largely on account of its increasing dependability as a universal provider of good signal strength. (Stations not consistently heard are never favourites, no matter how good their fare.)

New Zealand listeners are asking their local broadcasting authorities to record Daventry during the day for rediffusion in the evening.

NEWS FROM PORTLAND PLACE

In the Antipodes

Australia, too, is becoming more Daventry-conscious.

"Daventry can be heard almost throughout the day at varying strengths," writes a Brisbane enthusiast, who tempers his praise, however, with the remark that Moscow has the strongest signal and is consistently good. All the European short-wave stations, apparently, are heard at their best in the Antipodes at about 7.0 a.m.

Television in Sound

IS sound broadcasting jealous of television? At present there is no evidence of such a thing; in fact, Broadcasting House intends to pay a very pretty compliment to Alexandra Palace towards the end of October, when a Television Feature Programme is to be given on the National wavelengths.

The details have yet to be worked out, but the indications are that this forty-minute transmission will give the "junior service" an excellent send-off.

on the entertainment side, its scope having been confined mainly to the "potted O.B." type of programme.

Things are changing, however, for it is expected to contribute a good deal to the success of "Entertainment Parade," Eric Maschwitz' new feature, which comes on the air for the first time early in October.

Visits to Theatres

"Entertainment Parade" will exploit the "trailer" idea to give listeners a panorama of London amusements, and for this purpose the recording unit may visit the foyers of theatres and cinemas on "first nights" and "premières"—the distinction is a subtle one—picking up the buzz of conversation and perhaps luring "personalities" to express themselves to the world at large.

"What's On" the World Over

The new feature will also contain excerpts from shows both at home and abroad, and will offer a news commentary apropos "what's on" in the world of entertainment generally. Music will also be dealt with, probably

encountered, for the B.B.C. has nothing to learn regarding the dignified presentation of great national events in the Empire's Shrine; the real problems present themselves outside Westminster Abbey.

Appropriate sites must be chosen for microphone points—sites which will afford commentators ample opportunity to entertain listeners while awaiting the procession. Technically, the event should provide the B.B.C. with one of its biggest opportunities, for all the world will be listening.

100 O.B. Points?

The Royal Progress throughout London on the day following the Coronation will again test the O.B. Department to the uttermost. The route, several miles in length, will entail the services of large numbers of commentators, and if the atmosphere of this great day is to be worthily communicated, attention will have to be given to the building up of a faithful sound picture of all that goes on. Possibly a hundred or more microphone points will be necessary, linked up by a cobweb-like span of cables with the control room at Broadcasting House and the International Telephone Exchange in Carter Lane, E.C.

Delay at Burghead?

THE path of true broadcasting—like love—never did run smooth, and this is proven once more in the case of Burghead, where North Scottish is, to all appearances, a complete broadcasting station.

Sundry little technical hitches may or may not be overcome before the end of this month; at any rate, there is a possibility that the North of Scotland may have to wait a week or two longer than was expected before the long-awaited signals go out regularly from the B.B.C.'s most northerly station.

"Here's Looking at You"

THE latest "revelation" in television is that Elizabeth Cowell, the girl announcer, and D. H. Munro, Productions Manager, were lucky to be "in the running" during the Radiolympia transmissions.

On the Monday morning of the second week Mr. Munro took Miss Cowell to Alexandra Palace in his car, rehearsing her *en route* for her duties in the spotlight studio.

For one brief moment the Productions Manager took his eye off the road to note whether his fair pupil was registering the correct facial expression, and it might have been their last brief moment, for the car nearly collided with a lamp-standard. "Here's Looking at You" has its dangers.



PAY WHILE YOU LISTEN. An automatic 5-valve superhet receiver of the type being installed in hotels in America. The insertion of a coin enables the set to be operated for either half an hour or an hour. A wide range of home and foreign stations can be tuned in.

One day Alexandra Palace should reciprocate with a Sound Feature Programme, setting forth—in pictures—the nightly drama of life in the studios of Broadcasting House.

Recording Entertainment

THE B.B.C. mobile recording unit is now equipped with two new vans, each containing a miniature studio. The unit has not hitherto played a large part

through the medium of records, and perhaps composers may occasionally be induced to comment on their new works.

The Coronation Broadcasts

ALREADY the "O.B." Department, under the direction of Mr. S. J. de Lotbinière, is preparing for that world event, the Coronation. So far as the Abbey ceremonial is concerned, little difficulty should be

New Apparatus

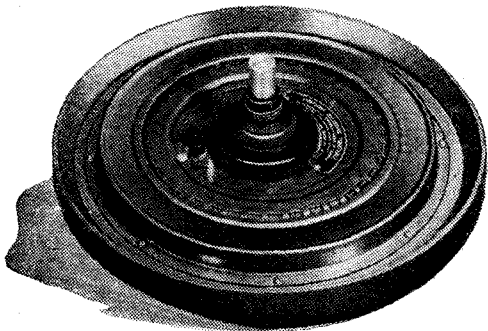
Recent Products of the Manufacturers

SIMPSON RECORDING TURNTABLE

A HEAVY-DUTY electric turntable, which has been designed especially for home recording, is now included in the range of gramophone units obtainable from Kingsway Electricals, Ltd., 3-9, Dane Street, High Holborn, London, W.C.2.

Like the standard-size models, the recording unit employs the turntable plate as the rotor of a synchronous motor, the stator being built in the centre.

The new model weighs slightly less than 18 lb. and is fitted with a massive rotor-cum-turntable plate measuring 12in. in diameter and 1in. thick at the periphery. The underside is recessed to accommodate the stator, and this part measures 7in. across.



New heavy-duty Simpson electric recording turntable.

Fitting the unit is particularly easy, as it is secured to the motor board by one large nut only, which is on the outside of the housing for the bearing of the rotor plate. This requires a hole 1½in. in diameter.

Though it is a slow-running machine, there is ample power in the motor for all normal home-recording requirements. The centre spindle is screw-threaded on the outside, so that a small pulley may be fitted to drive the traversing mechanism.

The motor is not self-starting and has to be rotated by hand at the outset, but thereafter it runs at a constant speed of 78.9 rpm when connected to the 50 c/s AC supply mains. Its consumption is about 30 watts at 200 to 250 volts AC.

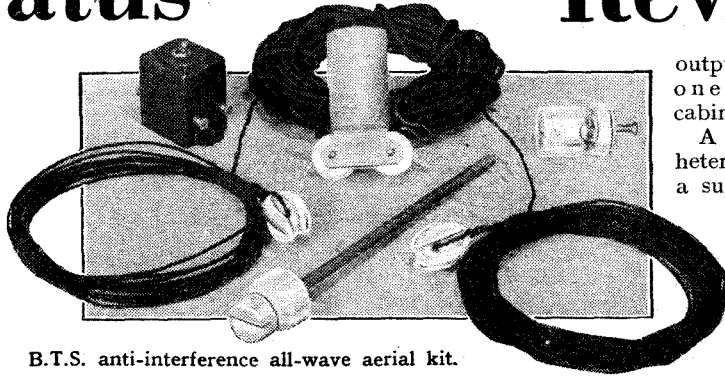
Recording blanks up to 12in. in diameter can be used on this machine, and the price complete is £5 5s.

B.T.S. ANTI-NOISE AERIAL

THIS aerial system has been designed for use with all-wave receivers, its special function being to give a better signal-to-noise ratio in localities where electrical interference is especially bad.

It is claimed to have an effective range of 13 to 2,000 metres, and is arranged in the form of two separate aeriels of dissimilar length joined to a special aerial transformer, from where a pair of twisted feeder wires is taken down to the receiver.

The horizontal, or effective, part of the aerial must be erected well away from buildings and as high as facilities will allow, so as to bring it outside the field of the interference. The feeders merely convey the



B.T.S. anti-interference all-wave aerial kit.

signal voltages from the aerial to the receiver, and when correctly balanced and terminated do not pick up any energy either in the form of signal voltages or interference noises.

The lower ends of the feeders are joined to a special matching transformer located close to the input terminal of the set, and this transformer unit in the B.T.S. system is not aperiodic over the whole waverange but has to be switched from one combination for the normal broadcast wavelengths to another for the short waves.

The aerial is supplied ready assembled and insulators for securing the feeder down-lead are included. On one side of the aerial transformer is a 17ft. length of aerial wire, while on the other is one 43ft. long.

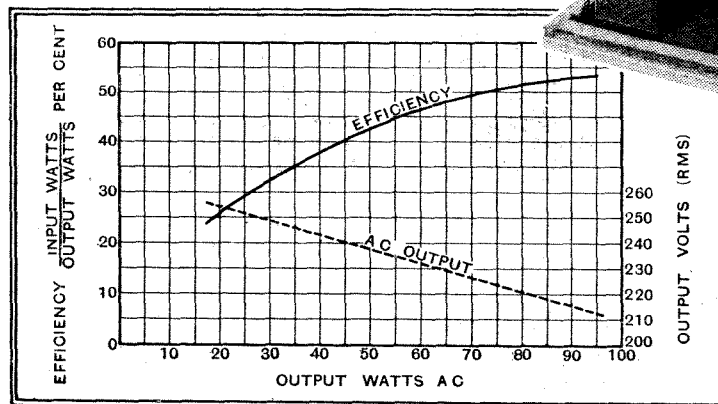
It is essential for the satisfactory operation of the system that the 17ft. portion be kept intact, but the longer length can be shortened if facilities are not available for erecting an aerial 60ft. in length. It should not be reduced, however, to less than 25ft.

The arrangement is such that it shows promise of being quite effective as a noise-reducing system both on normal broadcast as well as on the short waves, and it is obtainable from British Television Supplies, Ltd., Faraday House, 8-10, Charing Cross Road, London, W.C.2.

The price is 25s. complete.

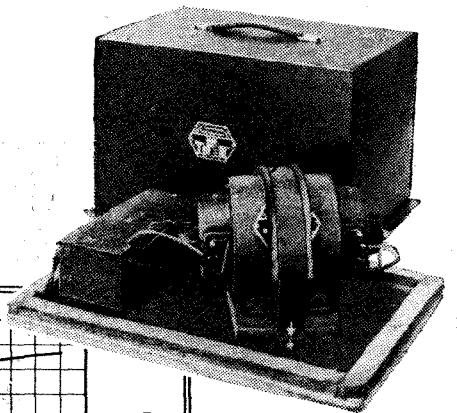
ELECTRO DYNAMIC DC TO AC CONVERTER

SINCE quite a large number of modern receivers now embody a short-wave range, where the need arises to use a rotary converter in order to obtain AC from the



Electro Dynamic rotary converter fitted with new-style filter unit for use with all-wave sets.

Output and efficiency curves of a 90-watt model.



DC supply mains it is, of course, essential that the filtering circuits embodied in the outfit be as efficacious on the short waves as they are on the normal broadcast bands. This has led the Electro Dynamic Construction Co., Ltd., St. Mary Cray, Kent, to evolve a new type of filter unit, and a small rotary converter fitted with one of these has been sent in for test.

This machine is rated at about 90 watts

it will be seen that at about 90 watts, the normal full load, the AC voltage is approximately equal to the DC input voltage, so that on 220 volts DC about 225 volts AC will be available. Also the efficiency is about maximum at this loading.

These new filters are being fitted on all Electro Dynamic rotary converters in future without extra charge. The model illustrated, for example, costs £14 complete.

Reviewed

output and was enclosed in one of their sound-proof cabinets.

A sensitive all-wave superheterodyne receiver requiring a supply of this order happened to be available and tests were accordingly made with it.

The machine was rated for 220 volts DC input, but it was necessary to make

our tests on a 210-volt supply; however, this small difference is of no great consequence, though it may affect very slightly the efficiency of the machine.

The tests were entirely satisfactory and no difference could be determined in the performance with normal mains AC supply or with the AC taken from the converter. There was not the slightest trace of commutator ripple and it was impossible to tell from which source the supply was taken. Only a very faint hum arises from the silence cabinet, and even this is inaudible a few yards away.

No interference was experienced down to the shortest wavelengths of the set, namely 16 metres.

A subsequent test made on the ultra-short waves produced some interference if a very sensitive set is employed, but this was found to become progressively better as the wavelength increased, and at about nine metres, the upper limit of this set, it was not very noticeable.

The curves reproduced show the AC output on loads up to 95 watts, and from these

Recent Inventions

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.

RELAYING WIRELESS SIGNALS

SIGNALS from a main transmitter are picked up at an intermediate point, where they are amplified or boosted-up and then re-radiated to a further station. Either the carrier-wave alone, or one or both sidebands, may be intercepted and strengthened. Or in the case where the main transmitter sends out only a single side-band, the relay station may be arranged to radiate the carrier-wave necessary to receive this type of signal on a "straight" circuit receiver.

The relay station is provided with means for maintaining the re-radiated energy at a constant strength. This ensures stabilised working, irrespective of variations in the strength of the received signals, and prevents undesirable reaction between the receiver and transmitter circuits at the relay station.

J. Robinson. Application date December 19th, 1934. No. 449322.

o o o o

WAVE-BAND SWITCHING

THE setting of the circuits of a wireless receiver to one or other of several wave-band settings is altered simultaneously with the value of a steady magnetising current applied to a coil having an iron core. The degree of saturation of the core determines the effective inductance of the coil, and of other coils associated with it. The value of the control current is varied by means of a rotary potentiometer, which simultaneously operates a pointer to indicate the corresponding wavelength setting on an illuminated dial. The rotary movement of the rheostat also operates an escapement device, which controls the wave-band switch.

L. L. de Kramolin. Convention dates (Germany) October 23rd and November 10th, 1933, and March 5th and 14th, 1934. No. 449240.

o o o o

ELIMINATING DISTURBANCES

FIG. 1 represents the signal voltage V to be received, and the corresponding rectified or "envelope" curve U, together with interfering static impulses S, of greater amplitude than the envelope. In order to suppress the

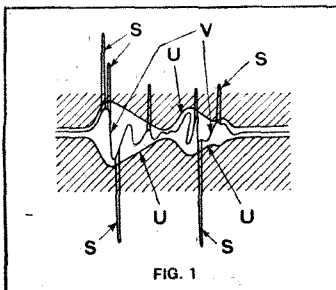


FIG. 1 Schematic representation of received signal voltage, rectified envelope and static interference.

disturbances the circuit shown in Fig. 2 is used. A diode valve D is shunted across the input of the low-frequency amplifier A, and a portion of the output of that valve is diverted through a transformer

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

on each side of the panel, for the medium- and long-wave stations respectively. Station-names, or wavelengths, are set off along the length of each tube. The inside "thread" or marker is moved

T and rectifier D1 to a resistance R. The bias so applied from the resistance R to the diode D causes the latter to act as a limiter. It will pass all signal voltages within the limit of the signal "envelope" U in Fig. 1, but cuts out any disturbances, such as S, of greater amplitude.

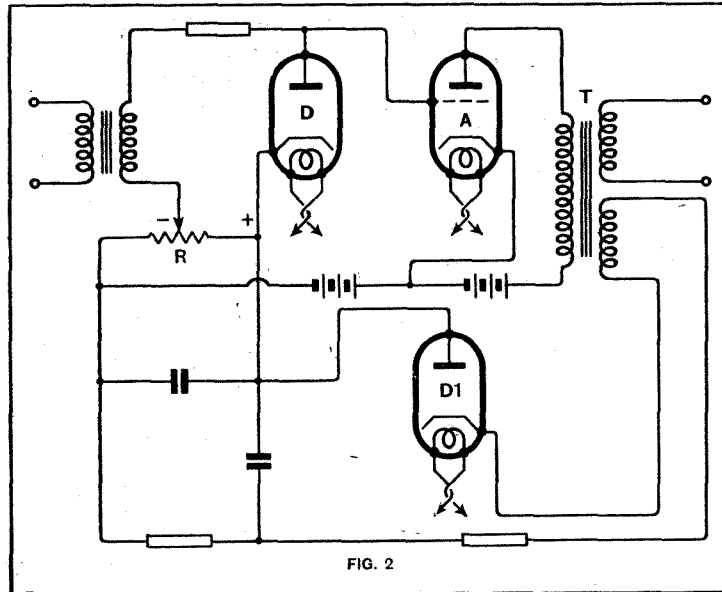


FIG. 2 Circuit arrangement employed to suppress static interference.

K. Pulvari-Pulvermacher. Application date October 4th, 1935. No. 447593.

MOTOR CAR SETS

TO prevent ignition "noise" in a motor car set it is desirable to enclose the receiver completely in an earthed metallic casing, which usually consists of a container proper and a cover or lid to fit over it. In order to ensure a good electrical contact between the two, and to prevent the lid from rattling, the casing is formed with a groove around its upper edge, and the cover is clamped firmly on to it by a number of metal clips provided with detents which spring into the groove once the lid is in position.

J. Y. Johnson (communicated by Philadelphia Storage Battery Co.). Application date December 3rd, 1934. No. 448045.

"THERMOMETER" TUNING

THE tuning-indicator of a wireless set consists of one or more vertical glass tubes in which a flexible opaque metal rod is moved up and down, in the same way as the mercury thread in a thermometer. Preferably there are two such indicators, one mounted

up and down by cord-and-pulley gearing driven from the shaft of the main tuning-condenser.

A. C. Cossor, Ltd., and D. G. Rennett. Application date November 10th, 1934. No. 447125.

o o o o

SHORT-WAVE DETECTORS

FOR rectifying short-wave signals, of the order of 10 metres, a valve is so arranged that the mean potential of the anode is equal to that of the negative cathode-lead, whilst the mean potential of the control grid is approximately equal to that of the positive cathode-lead. This is secured by connecting the grid-lead to a potentiometer in the grid circuit. Curves showing variations of anode current and grid voltage are available to support the theory underlying the invention, which is distinguished from the well-known Barkhausen-Kurz or Gill-Morrell effect.

J. R. H. Forman and Baird Television, Ltd. Application date January 30th, 1935. No. 446778.

o o o o

RESONATORS

A "RESONATOR" or oscillatory circuit, for use with very high frequencies, consists of a hollow metal sphere enclosing two rods which carry plates forming a condenser at the centre of the sphere. The whole of the inductance is distributed over the surface of the sphere, whilst the capacity is more or less

"lumped" inside. The value of the condenser is varied by adjusting the distance between the two end plates. The device can be used for storing or building-up oscillations of the order of 300 megacycles, with very low loss.

Marconi's Wireless Telegraph Co., Ltd. (assignees of B. J. Thompson). Convention date (U.S.A.) September 29th, 1934. No. 446804.

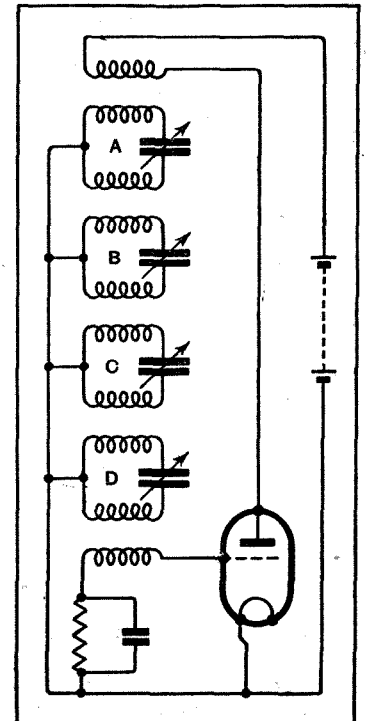
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MASTER-CONTROL OSCILLATORS

IT is well known that an ordinary back-coupled valve will not produce oscillations of constant frequency unless it is controlled by a piezo-electric crystal or other "stabiliser." The inventors have discovered that the generated frequency is, in fact, largely dependent upon the effective phase of the impulses fed back from the plate to the grid circuit. For a given cycle, the earlier such impulses occur, the higher the frequency tends to drift; conversely, the later the impulses, the lower the frequency. In practice the phase relation is determined not only by the electrical constants of the coupling, but also by the characteristic curve of the valve.

According to the invention, the plate is back-coupled to the grid through a cascade arrangement of tuned circuits A . . . D weakly coupled together. This is stated to have the effect of neutralising any phase-variations, and of thus preserving a constant frequency-output in spite of accidental fluctuations in the supply-voltage or elsewhere.

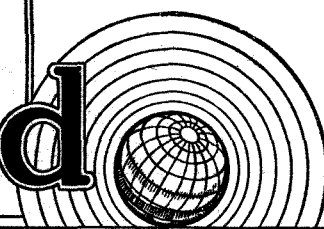
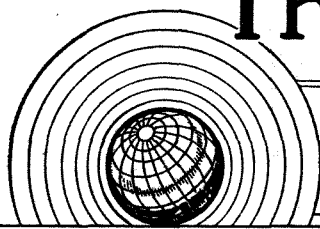
Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright. Application date November 14th, 1934. No. 447280.



Self-excited valve oscillator with frequency stabilising circuits.

The Wireless World

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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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EDITORIAL COMMENT

Informative Receiver Titles

Descriptions in Tabloid Form

EVERYONE who takes the slightest interest in the technical aspects of broadcast receiver design will welcome the present tendency among manufacturers to disclose, much more freely than hitherto, the more essential information about the circuit arrangements of their productions; this data often appears in even the briefest published descriptions, and sometimes forms part of the sub-title of the receiver. To take the simplest case, where two different "straight" sets are produced it has become quite usual to describe the cheaper model as a two-circuit set and its more ambitious companion as three-circuit, triple tuned, or perhaps rather more pretentiously, as "band-pass."

With regard to the superheterodynes, even more useful information is often disclosed by a few such words as "six stages, seven tuned circuits," which give anyone interested a useful, if rough, idea of the comparative sensitivity and selectivity. At least some information on the less tangible (and therefore less easily classified) quality of fidelity of reproduction might at the same time be conveyed by the more general addition of a couple of words with regard to output—say "three watts" or "four watts." We all know that though watts should not vary in quantity they may do so in quality, but the provision of a generous output stage offers at least presumptive evidence that more than usual care has been devoted to the audio-frequency end of the set. Such an assumption is strengthened if we see that at the same time the designer

has not been niggardly in the number of tuned circuits.

It is appreciated that the stage rating is not infallible, but it does, at any rate, convey some useful information and, while multiple valves are used, there seems to be no alternative which would be generally acceptable; rating by number of valves means less nowadays than ever it did, and the thorny problem of inclusion or exclusion of the rectifier from the total remains unsolved.

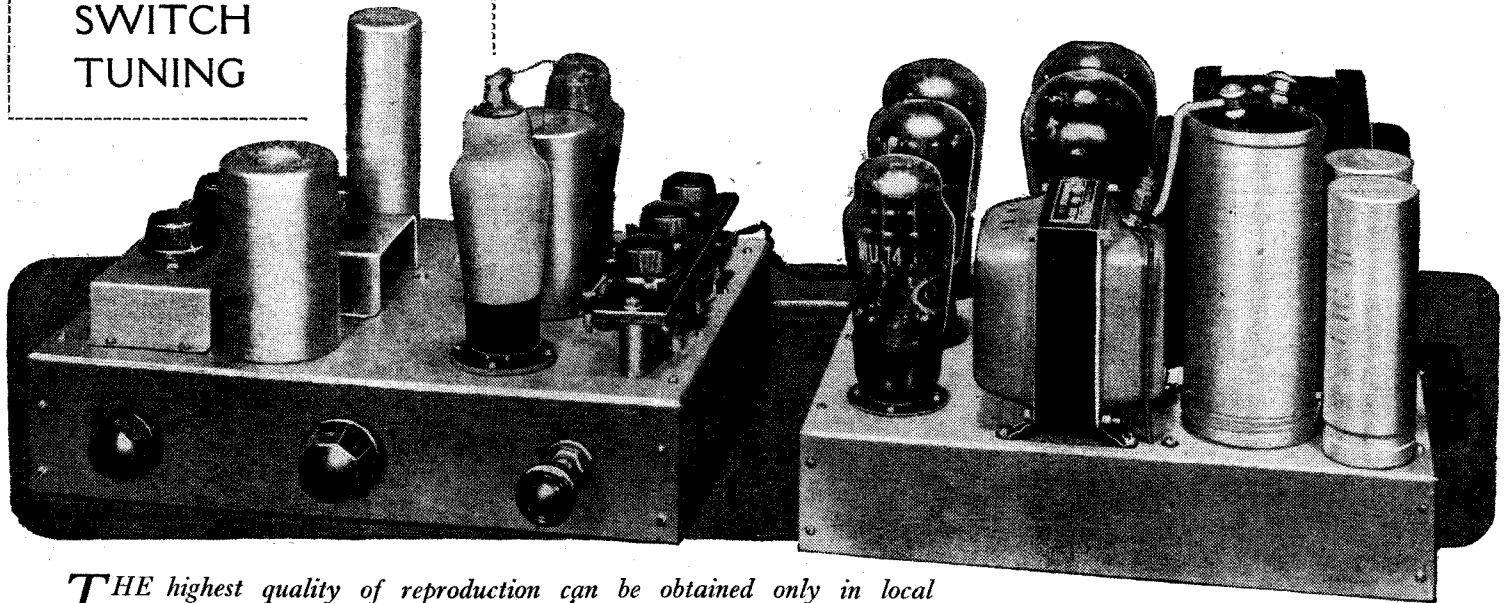
So much for sub-titles and condensed specifications; what of the titles themselves? The imaginations of those whose task it used to be to devise fanciful names for new productions seem to have bogged at the task of finding fitting appellations for the more refined sets of to-day, which are accordingly described by some such cryptic designation as the "Model XYZ1234/5." Perhaps the type number means something to those inside the parent organisation, but to outsiders it often conveys nothing and is not particularly easy to remember; no one ever seems to think of explaining the code.

In a few cases the initial letters, if not the numbers that follow them, have a meaning that is fairly clear to the expert cryptologist, while in others they are understandable even to those of us who are not gifted in such matters. An example of the more informative system of initial letters is the Ekco system, in which the prefixes AC, AD, and B stand for AC mains, universal mains, and battery supplies. Now that names have virtually disappeared an extension of this latter practice, preferably giving an easily remembered significance to both numerals and initials, seems to be wanted, and, where a not-to-obvious code is adopted, its key should be published freely in the manufacturer's literature.

LOCAL STATION SET WITH SWITCH TUNING

The Wireless World

Pre-tuned



THE highest quality of reproduction can be obtained only in local reception on account of interference, and a comparatively simple receiver can then be used. In this article is described the construction of a local-station receiver having pre-set tuning and a multi-contact switch for changing from one station to another.

would be unnecessary to describe an amplifier, but only a receiver, for the well-known Push-Pull Quality Amplifier first described in the issues of *The Wireless World* dated May 11th and 18th, 1934,¹ gives the required standard of performance. The amplifier gives a truly undistorted output of 4-6 watts, and has a

WHEN considering the design of a high-quality receiver, one naturally commences with the output stage; having decided on the type of stage which will give the required performance, the penultimate stage and the detector come under consideration, and lastly the RF circuits. This method of working backwards from

loud speaker to aerial, although ideal, cannot always be followed entirely, and this is particularly so in the case of the detector, for this stage must be considered in relation to both the RF and the AF circuits if satisfactory results are to be secured.

When the design of this equipment was first considered it was thought that it

¹ These issues are now out of print, as is also a reprint in *The Wireless World* for February 22nd, 1935. The articles have been reprinted in pamphlet form, however, and are available at the price of 7d. post free.

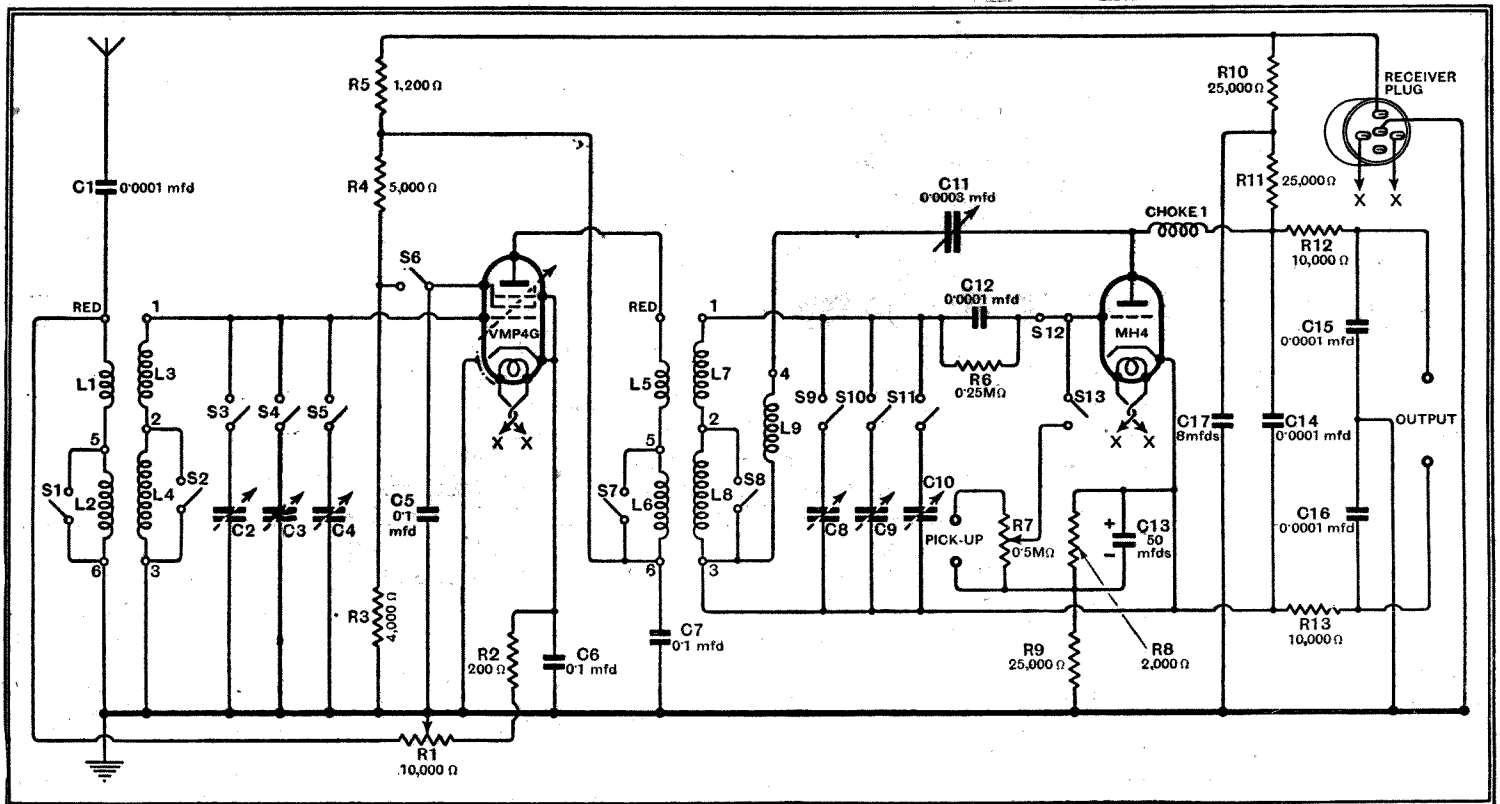


Fig. 1. The complete circuit diagram of the receiver unit shows the switching arrangements. It will be seen that one RF stage is employed with a grid detector.

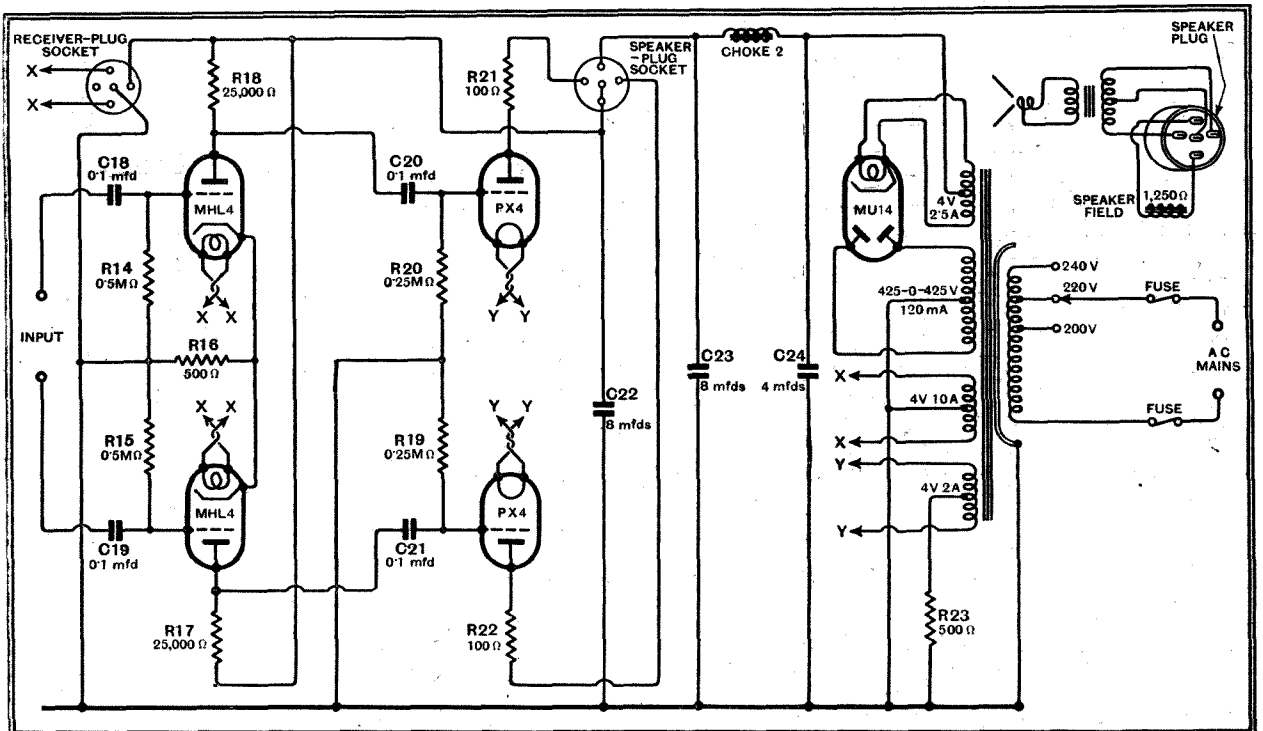
Quality Receiver

By
W. T. COCKING

Fig. 2. The power unit contains, in addition to the mains equipment, a two-stage push-pull resistance-coupled AF amplifier having an output of 4-6 watts.

frequency response characteristic flat within ± 0.5 db. from 20 c/s to 20,000 c/s. Nothing better is needed for sound reproduction, nor is likely to be, and a different amplifier is needed only when a larger undistorted output is required, through using the equipment either with an unusually insensitive loud speaker or in an unusually large room. Even then the PA Amplifier with an output of 12 watts is available.²

It was felt, however, that although the performance of the Push-Pull Quality Amplifier could not be improved upon, it might be possible to obtain the same, or very nearly the same, performance more simply, and

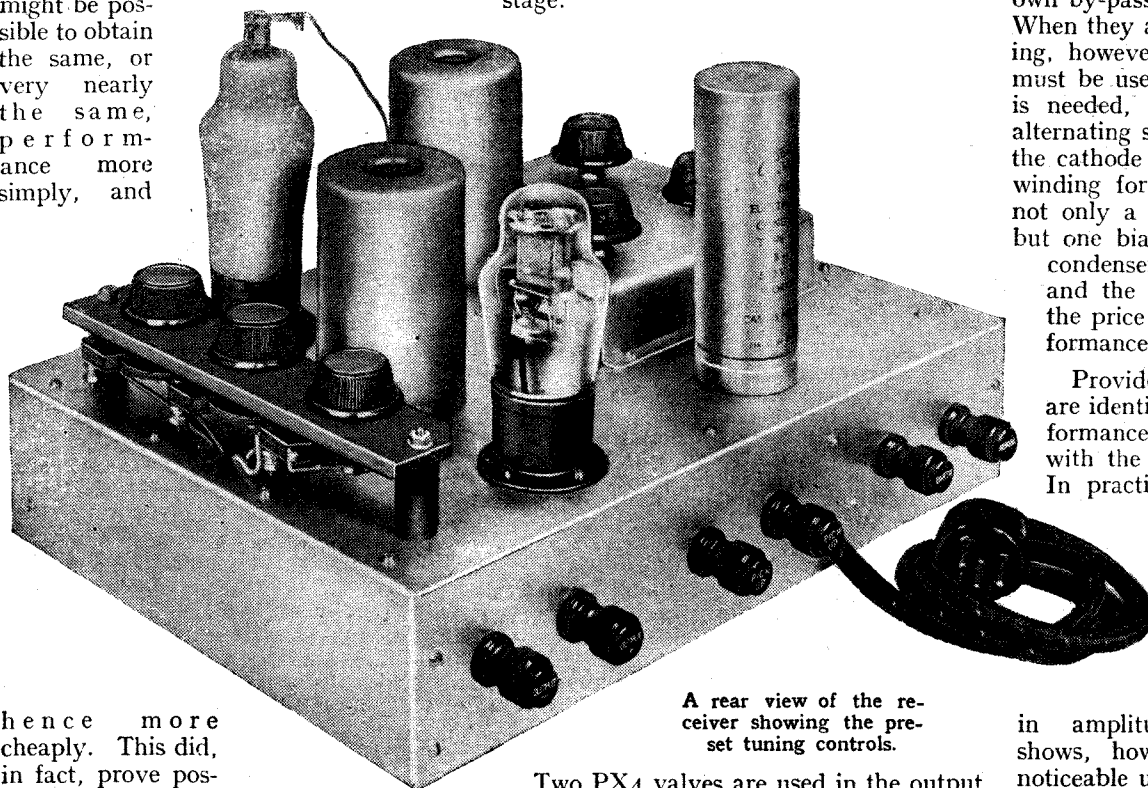


that of the preceding amplifier save for the use of common bias resistances for the valves in each stage, the omission of by-pass condensers for the bias resistances, and the omission of decoupling in the first stage.

10,000 ohms and are capable of an output of 4 to 6 watts. When the valves are operated from separate filament windings on the mains transformer, each must have its own bias resistance and each resistance its own by-pass condenser of some 50 mfd. When they are run from a common winding, however, a common bias resistance must be used, and no by-pass condenser is needed, for if the stage is balanced alternating speech currents do not flow in the cathode circuit. By using a common winding for the filaments we thus save not only a winding on the transformer, but one bias resistance and two by-pass condensers. This seems very attractive, and the question at once arises as to the price which we have to pay in performance for this saving in cost.

Provided that the two output valves are identical, we pay nothing—the performance is in no way inferior to that with the more expensive arrangement. In practice, however, the valves will not be identical, or if they are to start with they will not remain so. Slight mismatching of the valves has a negligible effect, but with serious mismatching we may expect a drop in amplification and some increase in amplitude distortion. Experience shows, however, that even this is not noticeable until one of the valves is nearing the end of its life.

The greatest drawback of the arrangement is that there may be some reduction of valve life. With individual bias, each valve is to some degree self-compensating



A rear view of the receiver showing the pre-set tuning controls.

hence more cheaply. This did, in fact, prove possible, and the circuit diagram of the new amplifier is shown in Fig. 2, and is substantially the same as

Two PX4 valves are used in the output stage and are operated with about 250 volts for HT and 35 volts for grid bias. Under these conditions each valve passes an anode current of some 35 mA., and the two require a load impedance of

² The Wireless World, April 3rd and 10th, 1936.

Pre-tuned Quality Receiver—

for changes; thus, if the emission of one falls slightly so that it passes a lower anode current, the grid bias is at once reduced, and the change in anode current largely offset. With common bias, however, the reduction of current still tends to reduce the grid bias, although not to the same degree, but this time of both valves. The anode current of the other valve thus tends to rise, and it may conceivably be over-run. In this case, there is little chance of this, for the output valves are normally under-run, and there is consequently considerable latitude. Should one output valve fail entirely, however, it is quite possible for the other to be damaged, through being operated with insufficient grid bias, before the fault is located. Valves do not, as a rule, fail suddenly until they have had considerable use, and when one fails the other is usually quite near the end of its useful life.

The reduction in valve life which one might expect on theoretical grounds is probably much less important than it appears at first sight. Extended tests on the amplifier have revealed no sign of premature failure. Constructors are warned,

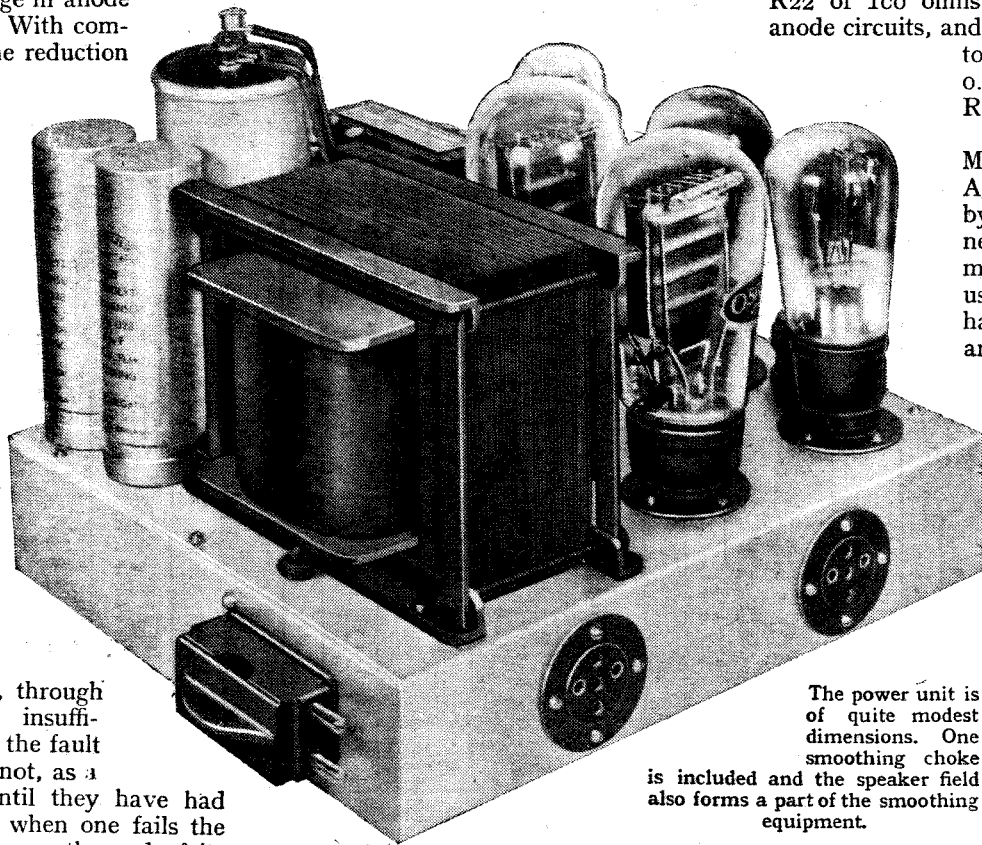
however, against removing one output valve while the other is operating, for this habit, bad with any amplifier, is likely in this case to lead to serious damage to

valves are operated from a winding on the mains transformer rated at 4 volts 2 amp. and are biased by the 500-ohm resistance R23. Anti-parasitic resistances R21 and R22 of 100 ohms each are used in the anode circuits, and the grid bias is applied to the grids through the 0.25-megohm grid leaks R19 and R20.

In the preceding stage MHL4 valves are used. Again a bias resistance by-pass condenser is unnecessary when a common bias resistance is used. This resistance R16 has a value of 500 ohms, and the valves are coupled to the output ones by the 25,000-ohm resistances R17 and R18 and the 0.1-mfd. condensers C20 and C21. Anode circuit decoupling is not used. Each of these valves has a 0.5-megohm grid leak R14 and R15, and the grids are fed through the 0.1-mfd. condensers C18 and C19.

The mains equipment is contained on the same chassis

as the amplifier and the HT supply is taken from a winding rated at 425-0-425 volts at 120 mA. An indirectly heated rectifier, the MU14, is used, and delivers 460 volts unsmoothed DC across the 4-mfd. reservoir condenser C24. Preliminary smoothing is effected by the choke Ch2 in con-



The power unit is of quite modest dimensions. One smoothing choke is included and the speaker field also forms a part of the smoothing equipment.

the valve which remains working.

In addition to these changes, the use of grid circuit stopping resistances has been abandoned, for they are by no means essential with resistance coupling provided that short leads can be obtained. As seen from Fig. 2, therefore, the two output

THE LIST OF PARTS**RECEIVER**

- 1 Aerial coil, L1, L2, L3, L4 **Bulgin C6**
- 1 HF transformer, L5, L6, L7, L8, L9 **Bulgin C7**
- 1 HF choke, Ch1 **Kinva Standard Type**
- 6 Reaction condensers, 0.0005 mfd., C2, C3, C4, C8, C9, C10 **Polar "Compax"**
- 1 Reaction condenser, 0.0003 mfd., C11 **Polar "Compax"**
- 1 Valve holder, 7-pin (without terminals) **Clix Chassis Mounting Standard Type V2**
- 1 Valve holder, 5-pin (without terminals) **Clix Chassis Mounting Standard Type V1**
- Condensers:—**
 - 5 0.0001 mfd. mica, C1, C12, C14, C15, C16 **Dubilier 665**
 - 3 0.1 mfd. tubular, C5, C6, C7 **Dubilier 4513**
 - 1 50 mfd. 12 volts, electrolytic, C13 **Dubilier 3013**
 - 1 8 mfd. 500 volts, electrolytic, C17 **Dubilier 0281**
- Resistances:—**
 - 1 200 ohms, ½ watt, R2 **Bulgin HW39**
 - 1 2,000 ohms, ½ watt, R8 **Bulgin HW5**
 - 2 10,000 ohms, ½ watt, R12, R13 **Bulgin HW15**
 - 3 25,000 ohms, ½ watt, R9, R10, R11 **Bulgin HW20**
 - 1 250,000 ohms, ½ watt, R6 **Bulgin HW28**
 - 1 1,200 ohms, 20 watts, R5 **Bulgin PR6A**
 - 1 4,000 ohms, 20 watts, R3 **Bulgin PR9A**
 - 1 5,000 ohms, 20 watts, R4 **Bulgin PR9**
- 1 Dual potentiometer, 0.5 meg./10,000 ohms, wire wound, R1, R7 **Reliance SG/VM**

Certain components of other makes but of similar characteristics may be used as alternatives to those given in the following list.

- 1 5-way cable with twin 70/36 leads and 5-pin plug **Goltone**
- 1 Switch 13-way, and knob **Magnum WW13**
- 1 4-way connector **Bryce Light Pattern**
- 1 Plug-top valve connector **Belling-Lee 1175**
- 6 Ebonite shrouded terminals, A, E, PU (2), output (2) **Belling-Lee "B"**
- 2 Knobs ¼ in. bore **Bulgin K14**
- 2 Lengths screened sleeving **Goltone**
- Chassis 12 in. x 9 in. x 2 ½ in. **B.T.S.**

Miscellaneous:—

- Peto-Scott or Scientific Supply Stores**
- 4 lengths systoflex, 10z. No. 18 tinned copper wire, aluminium and paxolin platforms for tuning condensers, studding, etc.
- Screws: 36 6BA ¼ in. R/hd., with nuts; 2 6BA rin. R/hd., with nuts; 4 6BA ¼ in. R/hd., with nuts; 2 4BA ¼ in. R/hd., with nuts and washers; 4 4BA nuts.**

Valves

- 1 VMP4G metallised, 1 MH4 plain **Osram or Marconi**

AMPLIFIER

- 1 Mains transformer: Primary, 200 to 250 volts, 50 c/s; secondaries, 425-0-425 volts, 120 mA; 4 volts 2.0 amps. centre-tapped; 4 volts 2.5 amps. centre-tapped; 4 volts 10.0 amps. centre-tapped **Kingsway Electricals**
- 1 Smoothing choke, 10 henrys, 100 mA, 100 ohms, Ch2 **Bryce 5CH528**
- Condensers:—**
 - 4 0.1 mfd. tubular, C18, C19, C20, C21 **Dubilier 4513**
 - 1 4mfd. 650 volts, C24 **Dubilier LEG**
 - 2 8 mfd. 500 volts, electrolytic, C22, C23 **Dubilier 0281**

Resistances:—

- 2 100 ohms, ½ watt, R21, R22 **Bulgin HW37**
- 1 500 ohms, ½ watt, R16 **Bulgin HW2**
- 2 25,000 ohms, ½ watt, R17, R18 **Bulgin HW20**
- 2 250,000 ohms, ½ watt, R19, R20 **Bulgin HW28**
- 2 500,000 ohms, ½ watt, R14, R15 **Bulgin HW31**
- 1 500 ohms, 20 watts, R23 **Bulgin PR2**
- 7 Valve holders, 5-pin (without terminals) **Clix Chassis Mounting Standard Type V1**
- 1 5-pin plug for speaker connection **Bulgin P3**
- 1 4-way connector **Bryce Light Pattern**
- 1 Fused mains input connector with 1 ½ amp. fuses **Belling-Lee 1114**
- 2 Ebonite shrouded terminals, input **Belling-Lee "B"**
- Chassis 10 ½ in. x 9 ½ in. x 2 in. **B.T.S.**

Miscellaneous:—

- Peto-Scott or Scientific Supply Stores**
- 3 lengths systoflex, small quantity Nos. 16 and 18 tinned copper wire, etc.
- Screws: 48 6BA ¼ in. R/hd., with nuts; 10 4BA ¼ in. R/hd., with nuts and washers; 4 4BA ¼ in. R/hd., with nuts and washers.**
- Valves:—**
 - 2 MHL4 metallised or plain, 2 PX4, 1 MU14 **Osram or Marconi**
- Loud speaker with push-pull output transformer, 1,250 ohms field **Magnavox Duode 33**

Pre-tuned Quality Receiver—

junction with an 8-mfd. electrolytic condenser C23, and is completed by the field winding of the loud speaker and the 8-mfd. condenser C22. This field winding has a resistance of 1,250 ohms and is energised at the same time that it provides smoothing. Some 280 volts is available across C22 for operating the amplifier and receiver. On the LT side a winding of 4 volts at 10 amperes is provided, although only 4 amperes is drawn from it in this equipment. This is done in order that adequate current may be available should it at any time be desired to use the amplifier with a larger receiver.

Turning now to the receiver, the circuit of which appears in Fig. 1, two valves are employed. The RF stage employs an RF pentode type valve preceded by a single tuned circuit and coupled to the detector also by a single tuned circuit. The condensers C2, C3, C4, C8, C9, and C10 are for tuning, and only two are in use at any time. A multi-contact switch is employed, and in the first position S1, S2, S3, S6, S7, S8, S9, and S12 are closed. The medium-wave coils L1, L3, L5, and L7 are then in use and tuned by C2 and C8 to any desired medium-wave station. In the second position S1, S2, S4, S6, S7, S8, S10, and S12 are closed, and the same coils are in use, but are now tuned by C3 and C9 to any other medium-wave station. In the third position, however, only S5, S6, S11, and S12 are closed, so that all coils are in circuit and tuned by C4 and C10 to any long-wave station. In the fourth and last position only S13 is closed; this is for gramophone.

An MH4 valve is used as a grid detector, and it also acts as a phase-reverser for feeding the amplifier, and provides reaction. On radio, S12 is closed and S13 open, so that the grid circuit is completed through the 0.0001-mfd. grid condenser C12, and the 0.25-megohm grid leak R6 via the tuned circuit to cathode. An RF choke Ch1 is included in the anode circuit to enable proper reaction effects to be secured, reaction being controlled by the 0.0003-mfd. condenser C11.

Two coupling resistances R9 and R11 are used, one in the cathode and the other in the anode circuit in order that the proper voltages of opposing phase for operating the amplifier may be secured. An RF filter, comprising the 0.0001-mfd. condensers C14, C15, and C16, and the 10,000-ohm resistances R12 and R13, is connected in the output. Anode circuit decoupling is provided by the 25,000-ohm resistance R10 and the 8-mfd. condenser C17.

On gramophone, this valve acts as an amplifier, S13 being closed and S12 open. The grid of the valve is then connected to the slider of the volume control potentiometer R7 of 0.5 megohm, which is connected across the pick-up terminals. Grid

bias is derived by means of the 2,000-ohm resistance R8 shunted by the 50-mfd. condenser C13.

A separate volume control is used on radio, but is ganged to the gramophone control, so that it is operated by the same control knob. It is actually a potentiometer

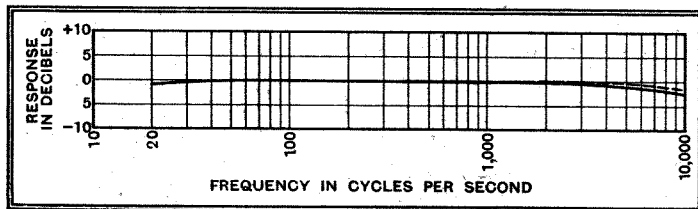


Fig. 3. The overall frequency response characteristic of the apparatus is shown on gramophone by the dotted curve and on radio by the solid line curve.

meter of 10,000 ohms, which is connected to perform two functions; first, it acts as a variable resistance in the cathode circuit of the RF valve, and so permits its grid bias to be varied; secondly, it acts as a

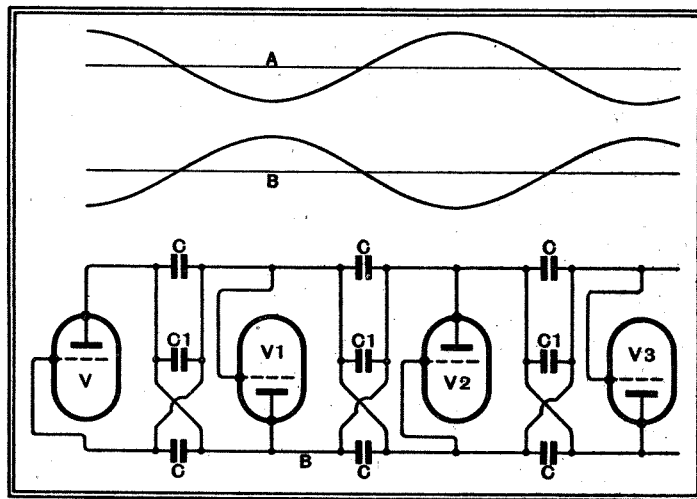
variable resistance shunted across the aerial coupling coil, and so reduces the efficiency of the tuned circuit increasingly as the volume is lowered. A very wide range of control is thus secured, but at the expense of some reduction in selectivity; in cases where local conditions permit, therefore, it is advantageous to omit the lead between C1 and R1. These conditions will usually arise when the set is used at some distance from a local station or when the aerial is poor.

It may be remarked in connection with the list of parts that certain fixed condensers specified have been modified in design by the makers, and are accordingly now listed under different type numbers, and are of somewhat different appearance. They are equally suitable for use in this receiver, however. The components referred to are the Dubilier 665 and 4513 condensers; the equivalent components now bear the type numbers of 690W and 4423/S respectively.

(To be concluded.)

Short-wave Transmitters

IT is difficult in ultra-short wave transmission to get adequate power into the aerial. One cannot, for instance, increase the output merely by connecting several valves in parallel, because the internal valve capacities, and that of the leads, soon put a limit to the working frequency. An ingenious solution to the problem which has recently been advanced by the Marconi Co. is shown in the figure. A number of short-wave oscillators V1, V2, V3, are bridged across a pair of line radiators, A, B, at intervals of half the working wavelength. Each valve is "reversed" with respect to its neighbour, so that they work in push-pull pairs on the common line, though owing to the half-wave separation the currents in the upper and lower conductors are "in phase" for radiation, as shown by the curves in the upper part of the diagram.



An adaptation of the push-pull principle; wave-spaced valves connected to a radiation line.

For convenience the valve generators are only drawn in skeleton form, neither the cathodes nor DC energising leads being shown. Preferably the valves are of the Barkhausen-kurz type, with anode and grid connected alternately to the upper and lower lines of the Lecher wire radiator. Inserted at quarter-wave intervals from each valve are series condensers C, which determine the voltage nodes, the necessary DC connection between the high-potential grids of successive valves being maintained by a cross-over connection at those points. An intermediate condenser coupling C1 between the DC leads maintains the required HF conditions.

The value of the coupling condensers C is somewhat critical, and is best determined by trial and error. If the coupling is too

weak, proper phasing is difficult, whilst if made too strong it is liable to cause detuning, and may throw the whole system out of oscillation.

The arrangement allows any number of valves to be brought into action as required. Incidentally, the failure of one valve does not necessarily throw the sys-

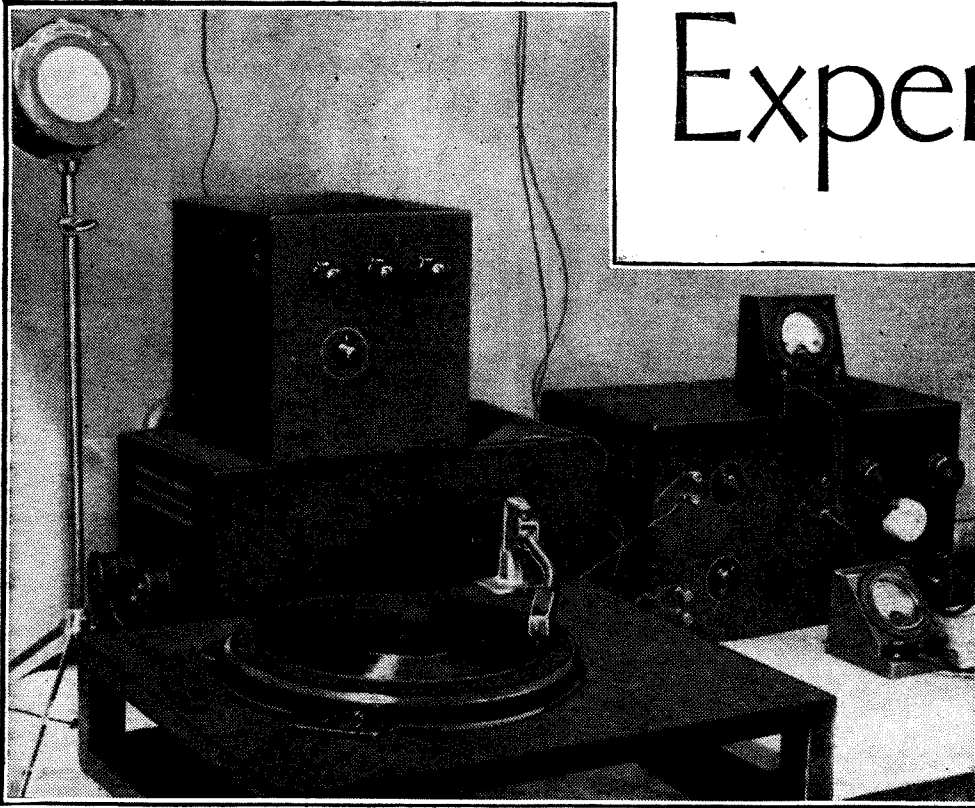
tem out of gear, nor even cause any appreciable alteration of the radiated frequency.

Straight Black Lines. By Frank Boyce. George Newnes, Ltd. London

THOSE who are interested in a faithful record of the experiences of a young man who makes his living out of wireless and the broadcasting boom will find this novel a fascinating story. Mr. Boyce knows intimately the industry which he has made the setting for his hero's career, so that every page is wireless history. It is not surprising, perhaps, to find several references to *The Wireless World*.

The book is one which will, if anything, gain in interest as the horizon of the events it chronicles fades in perspective.

Experiments in



Complete recording apparatus. The pre-amplifier, main amplifier and power supply are mounted as separate units.

WHEN the writer decided to do serious experimenting in Home Recording, he determined, before attempting to build any gear, to make himself acquainted with the work of others. There would appear to be two schools of thought interested in the subject; first, the one who liked to experiment "with a view to doing something," just as one would build up a radio receiver from a blue print, with no serious thought for finding out the really interesting theory of the matter. Secondly, we have the keen worker who must get to the bottom of the work in hand and is prepared to go to extremes to do so.

It was the second class that the writer decided to enter, and much midnight oil was burnt before the gear described in this article came into being. But, as time went on it was found that the oil was not wasted, and it was possible to obtain recording approaching professional standards, in fact, in some cases, far better.

High Mechanical Standards

On seeing other amateur recording gear it struck the writer that the greatest difficulty experienced by experimenters in obtaining a really high standard was due to the fact that many people imagine that the ideal tracking device could be constructed from Meccano parts and an odd length of screwed brass rod!

Despite the usefulness of Meccano in some fields, it is a sheer waste of time to attempt to build up tracking devices on these lines. Many experimenters appear to have overlooked the fact that the average cutting depth is about 0.002in. and the lateral cut about 0.002/0.004in.; working to such fine limits calls for a really first-class traversing gear, built with

a high degree of accuracy, and it is only by adopting a very high standard of tracker that really first-class reckonings can be made. It was for this reason that the writer obtained a commercial tracking device, made to fine engineering limits, and hand finished. Although such an instrument is very expensive, one must not forget that it is the keystone of the whole equipment.

The tracking device used is capable of cutting up to 16in. records, and as one of the writer's interests happen to be in the amateur Ciné world, where large records capable of lasting 10/12 minutes are called for, this was found an added advantage.

Having settled the tracker, the driving motor became the next worry. This, indeed, was a trial. Numerous letters were dispatched to various makers, and although many promises were made regarding the torque output and suitability, it was found that standard motors were not powerful enough to allow a 12in. record to be cut with safety—to cut a 16in. record was out of the question, and it was finally decided to try a German motor. This was a success, and the writer obtained a fine machine with a 16in. turntable running at 78 r.p.m. or 33½ r.p.m. with an output of 12,000 C.M.G.—some four to five times more powerful than the ordinary gramophone motor. This particular motor has many interesting points, and

the large cast-iron turntable of 16in. diameter is driven *via* a rubber pad which prevents any vibration being transmitted to the turntable. The motor is synchronous and massive, the weight, including turntable, being about 50/60 lb.

The motor box was constructed of teak 1½in. thick, this solidity being required to make sure that no vibration be felt. The motor, being synchronous, is bound to revolve at the correct speed, and a two-way switch is fitted to obtain either 33½ or 78 r.p.m.

A three-speed cone which drives the traversing gear and also acts as a clamp for the record while being cut is secured to the turntable spindle by means of a left-hand thread; the gear ratios are 80, 100, 130 T.P.I. For general works the middle gear is used, and is close to the average standard record for playing time.

Having thus fixed up the cutting end of the gear, the cutting head was next on the plan, and to this end it was decided to approach the makers of the cellulose glass record to get suggestions for a suitable cutter; a magnetic head was sent for test, and apart from the special damping arranged by the makers it had the appearance of a standard pick-up; the frequency response was found to be excellent—the high-frequency end being very good indeed. In passing the writer would add that it is possible to record

a broadcast item *via* a high-fidelity receiver and transmit to the record a really nice 9,000-cycle note!

Mention has been made of the coated-glass records. These have been found so excellent that they are now used exclusively.

The possibility of immediate playback is a great asset, and the low-surface noise allows one to cut as deep as commercial records, thus overcoming the trouble of "groove jumping"—very common with some of the other types of discs. If one uses a piezo-electric pick-up, ordinary steel needles may be used without fear of damage.

The amplifier was designed primarily for recording and consists of two units, the pre-amplifier for tone control and the main amplifier, consisting of a paraphase resistance coupled unit driving two PX25 valves in push-pull. The amplifier is quite conventional apart from the input stage, where it will be seen that a simple mixing stage is added so that radio or any other

Points for the Amateur
Who Treats
the Matter Seriously

Home Recording

By **ROBERT W. BRADFORD**

source of signal can be mixed with the output from the pre-amplifier.

Separate rectifiers are used for high-tension supply for obvious reasons, and extra care and thought has been given to the smoothing side of the rectifiers to ensure that the hum level is very low. Turning to the output stage, it was essential to obtain a really efficient output transformer to match the cutter and speaker, it being obvious that no matter how good an amplifier response may be in the penultimate stages the final link is the output transformer. It must be designed to have a very flat characteristic, the one used being capable of responding to a range between 30 c/s to 10,000 c/s, level within 2 db. limits.

Controlling Tonal Balance

The pre-amplifier is essentially the same as described in the April 3rd issue of *The Wireless World*, although some of the condenser values were altered to suit, the frequency tilting being operated by separate switches, the bass control giving two fixed attenuations (1) -4 db. and (2) -10 db., the latter cut-off being useful when copying heavily recorded items, such as organ or symphony. For normal purposes the -4 db. drop is used and appears to suit the cutter very well, the general balance being on a similar level to commercial recordings, the above attenuation being calculated at 50 c/s.

Regarding the top end of the frequency range, this can be reduced 10 db. at 10,000 c/s upwards, also in two steps of (1) 4 db. and (2) 6 db.

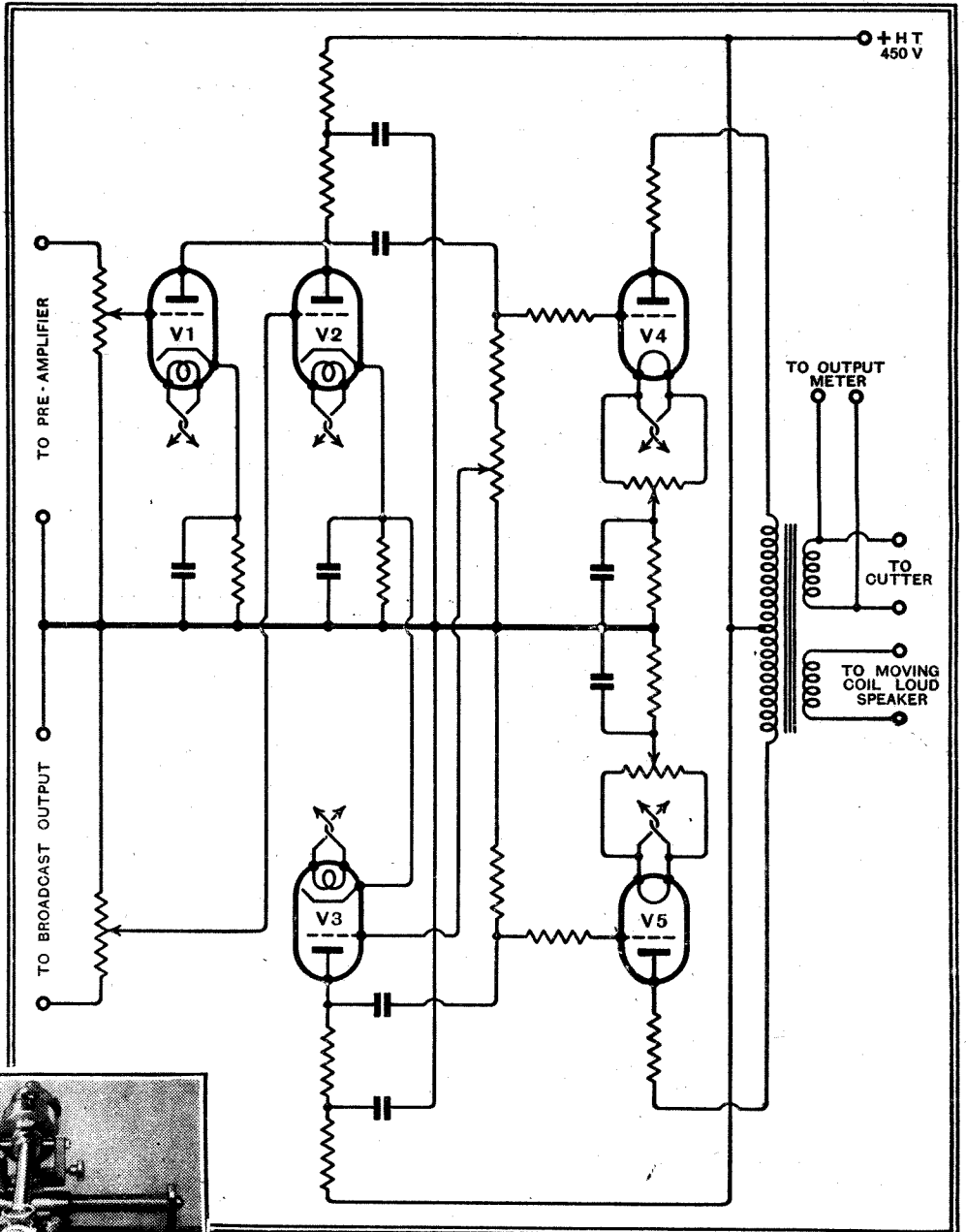
For speech recording a standard

are very satisfactory, and the silent background is an added advantage.

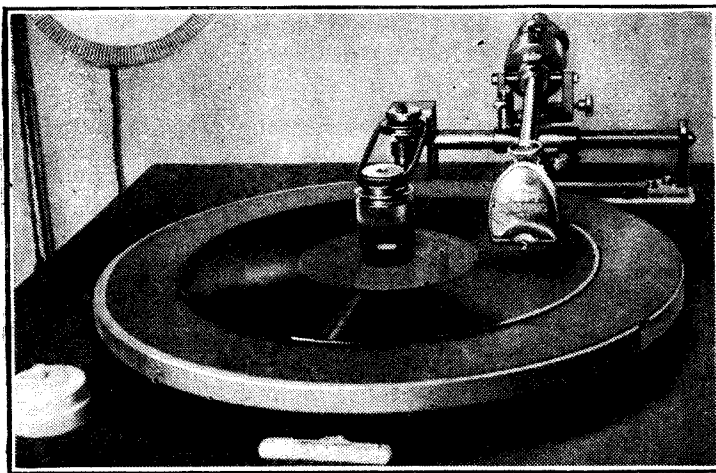
Having thus completed the equipment

Experiment has shown that the most suitable level is about two watts, and this level is easily maintained by the aid of the meter.

In checking the completed equipment, a set of frequency records were used. This method is far better than using the radio or records, for, if a frequency of, say, 500 cycles be cut, it is then viewed *via* a 60x magnifier and compared with the original record. If it is thought good,



Recording amplifier and mixer stage, Valves V1, V2, V3, Type 354 V ; V4, V5, Type PX 25.



The cutting head and turntable.

moving-coil type microphone is used, and although the response of this instrument is not as good as the amplifier, the results

tried, and at the time of writing the author uses a standard high-resistance output meter in shunt with the cutter head.

it was soon found that some type of "level indicator" was desirable, to avoid overloading the cutter and to check the output so that one could tell exactly what level was being fed to it. Many devices were

a higher or lower frequency record is then cut, and by this means any sudden peaks may be found and reduced either by the tone control unit or other means. The balancing of the cutter head to ensure that the correct weight is used is a very critical operation, and a letter balance proves very useful. One cannot expect to obtain good records without wasting a number of discs in obtaining the correct depth of cut and making sure that the cutter is clear of any swarf during cutting.

For playback purposes a piezo-electric pick-up is used, this being a standard

Experiments in Home Recording—

piezo head, mounted to a long counter-balanced arm so as to be suitable for reproducing the larger records up to 16in. It is for the attempts at recording at 33½ r.p.m. that extra care and the choice of the most suitable equipment shows its worth. Slow-speed recording brings more problems than 78-r.p.m. recording. A 12in. 78-r.p.m. record plays about 4 minutes, while a 12in. 33½ disc plays about 9 minutes, and the 16in. record will play up to 15 minutes, depending upon what gear ratio is used for the tracker. The long-playing time is a decided advantage, especially when used in conjunction with a home cinema. It is very nice to be able to play a record that will outlast the standard super reel which most home cinemas use. In this way one can be sure of choosing suitable music for one reel, without the trouble of having to keep changing the standard 78-r.p.m. discs.

It will be obvious that the needle speed is much lower on the slow-speed records, and because of this the recording and reproducing problems are increased. It is very difficult to make good recordings on the inside of the slow-speed record, because of the decrease in velocity. This is especially true for the higher frequencies, which have very little amplitude, and the needle has great difficulty in following the tiny grooves, especially at the start of the record, it being standard practice to cut inner to outer at 33½ r.p.m. Moreover, the scratch frequency is more noticeable, and would appear to be about 3,500 c/s.

Despite these difficulties, the writer has found that by means of a really good motor for both recording and reproduction, good results can be obtained, and if a little care and patience are exercised no trouble will be experienced. The writer has about a dozen 33½ records consisting of copies of commercial records and radio items, that are far better than the "talkie" discs as used in the cinema. For obtaining the correct speed for the reproducing motor, it is essential that a stroboscope be used. With the 78-r.p.m. record, a small variation in pitch does not make itself known, whereas any variation at 33½ r.p.m. is fatal.

Problems of Home Recording can be summed up as under:—

The Tracking Gear.—This is the keystone of all the equipment, and one should obtain the best possible type. The length of traverse will depend upon the nature of the recordings to be attempted. Cost may be a ruling factor, but several are on the market to cut up to 10in. records at about £5. If it is desirable to cut large records for long-playing purposes, then one must be prepared to pay for it.

The Motor.—It is debatable whether this should be placed second on the list, as one cannot overlook the fact that unless the motor has sufficient power, it is useless. It must have good speed regulation to ensure constancy of pitch throughout the whole record. It must run true in its bearings and rotate the turntable in a single plane. The filtering must be very complete, so that no vibration is transmitted to the turntable.

The Cutting Head.—For amateur work the magnetic type is quite satisfactory, providing

a good make is obtained. Matching is very important, and one must not forget that the cutter must deal with powers of 2 watts upwards, therefore the damping *must* be different from that used for reproducing. It is important to bear in mind that the cutter has to stand the stresses of the input from the amplifier and the fact that the cutter is acting as a turning tool. These stresses are very heavy, and one must realise that the ordinary pick-up was never intended to be put to such work. Like the tracking gear, a good cutter is expensive, and up to £10 can be paid.

Main Amplifiers.—It is advisable to use a high-gain amplifier, the average output required being about 2 watts and upwards. The standard cellulose record needs a level of about plus 12 db./18 db. A first-class amplifier is useless without a good output transformer.

Pre-amplifiers.—Some type of frequency tilting is desirable, a straight line output not being very successful for recording, when one takes into consideration the heavy damping of the cutter.

Level Indicators.—To use a recorder without some means of feeding the cutter with a definite signal level is akin to using a boiler without a steam-pressure gauge. The ideal type would be on the lines of a VT voltmeter with some L/C device to damp the needle, but still to allow registration of peaks. A high-resistance output meter is useful, providing the damping does not upset the coupling between the output transformer and cutter head.

Recording Materials.—Originally aluminium discs were used, but present-day research has proved that for successful results the coated type of disc is the best. The "Simplat" disc used by the writer will carry an unusually large frequency response, and the present range is said to be between 50/8,000 c/s. These are simple to use, and for hardening simply require sponging over with two special solutions.

Recording Stylus.—With care 40/50 sides can be cut with a sapphire needle. The needle must be set correctly in the cutter head, and must be parallel to the line of traverse; a cutting angle of about 75° appears to be correct.

When a new sapphire is used a few plain test cuts are made and carefully examined under a magnifier of 60x. The walls of the groove should be perfectly clean and no ragged edge is permissible. Should the cuts be found ragged or not clean, it is certain that the needle is not in the head correctly or that the cutting angle is wrong. If good recordings are to be expected, extreme care must be taken to ensure that the needle is cutting correctly, and not until this is proved should any attempt be made to record.

Once set, no further attention is required, but care must be taken to lower the cutter *gently* on the disc.

After making a recording the disc is brushed lightly and again examined under the magnifier. If correct, the record can then be hardened and polished.

Translation of a German Television Book

Television Reception, by Manfred von Ardenne. Translated by O. S. Puckle, A.M.I.E.E. 121 pages + xv, 96 illustrations. Published by Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2. Price 10s. 6d.

IN the original German edition this book dealt with apparatus developed by the author for the reception of the Berlin television transmissions. The present English edition, however, has been extended by the inclusion of much information relative to the Baird and Marconi-E.M.I. systems as well as to British cathode ray tubes and associated equipment. This extra material has undoubtedly greatly enhanced the value of the book to English readers, valuable though it already was in its original German.

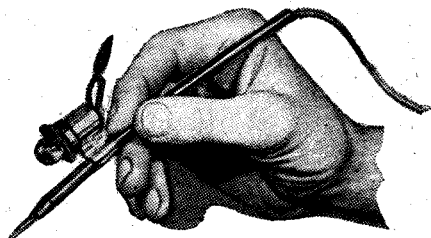
The book opens with a description of the technical problem of television and gives details of the Berlin and the British transmissions. The second chapter is devoted to an explanation of the cathode ray tube, and particular attention is paid to the screen material, useful data on no fewer than seventeen different types being given. There is a useful chapter on the high voltage mains unit for operating the cathode ray tube, and this is followed by a particularly clear and thorough treatment of time bases and the problem of synchronising. This section is one of the most important in the whole book

for it is not only clear and free from mathematics, but it is both accurate and practical. It should be of the greatest assistance to the beginner in this field of electronics.

The remainder of the book covers the receiver employed for television reception, and the detector, which is all too often overlooked, receives a chapter to itself. The IF amplifier is considered, as is, in fact, every part of the receiver. This portion of the apparatus, however, is less fully treated than the purely television problems, and this is as it should be, for there is no inherent difficulty in the design of the receiver proper. The problems involved are naturally more difficult of solution than those found in the case of apparatus designed for sound reproduction, but they are of the same kind and can be solved by conventional methods. The author has thus very wisely devoted the major portion of the book to the purely television problems of operating the cathode ray tube, feeding it with the requisite voltages to produce correct scanning, and synchronising those voltages with the transmitter impulses.

One of the most valuable features of the book is its practical viewpoint, and as an illustration of this it is sufficient to say that not only are complete circuit diagrams of most sections of the apparatus given, but values of components are also included. In addition, there are numerous photographs of television images showing various faults brought about by the maladjustment of the controls. The book is consequently one which will be of the greatest assistance to experimenters, and it can confidently be recommended to all interested in the technical side of television.

The book is well printed and bound, and the numerous illustrations are particularly good, all half-tones being printed on art paper. A word of praise is also due to the translator, whose work has reached an equally high standard; it is sufficient to say that the book does not read like a translation, but like an original. W. T. C.



AN ILLUMINATED TEST-PROD.—Exploration of the dark corners of a receiver chassis is facilitated by the use of this device, which comes from the U.S.A.

Broadcast Brevities

NEWS FROM PORTLAND PLACE

That South Region

BECAUSE the B.B.C.'s mobile transmitting and receiving van has mysteriously disappeared from its happy hunting ground in Hampshire, one must not assume that its work there is finished.

Field strength measurements covering a very large area on the South Coast have been taken, and now the engineers, armed with much useful data, will shortly be holding a round-table conference at Broadcasting House, and possibly choose a site for the much-talked-of South Regional station.

Northward Ho!

On the other hand, they may consider that still more data is required, in which case both the B.B.C. mobile vans (there are two of them) may be co-opted for further tests down south.

Incidentally, both vans are now hard at work in the Bournemouth district, which, owing to its mountainous nature, seems to be offering the engineers a bigger problem than any other "Regional" area.

More About

"Entertainment Parade"

ALL the technical resources of the B.B.C. will be put to the test in "Entertainment Parade"—the new fortnightly series of broadcasts which the Variety Department is inaugurating on October 5th. Not only will the Mobile Recording Unit contribute, but an elaborate international network by wire and wireless will be required to bring to fruition the ambitious ideas of Eric Maschwitz, Variety Director, and Bertram Henson, who is organising the feature.

Back-stage Dialogue

Each programme will be divided into three parts: radio, screen and stage. In the first transmission, radio will be represented by a rapid exchange of greetings between Broadcasting House and Radio City, New York.

The stage part of the show will, it is hoped, take the form of an actual back-stage chat between Leslie Henson, the comedian, and Eric Maschwitz, on the subject of "Swing Along," their conversation fading into the actual show itself.

Transatlantic Film Chats

The film section will not only include sound shots from the greatest London successes during the fortnight, but also some

transatlantic conversations between screen stars in this country and America; it is even likely that the great ones may be heard in dramatic "thumbnail" sketches, which would be far more effective than stereotyped interviews, which always seem forced and unnatural.

Supporting each edition of "Entertainment Parade" will be the B.B.C. Theatre Orchestra, conducted by Mark Lubbock.

Workhouse as B.B.C.

Studio

THE Cork station was originally housed in a disused gaol, but the B.B.C. is going one better, or worse, by constructing studios in what was formerly Swansea's Public Assistance building.

The work of reconstruction has been rather formidable, but is now nearing completion.

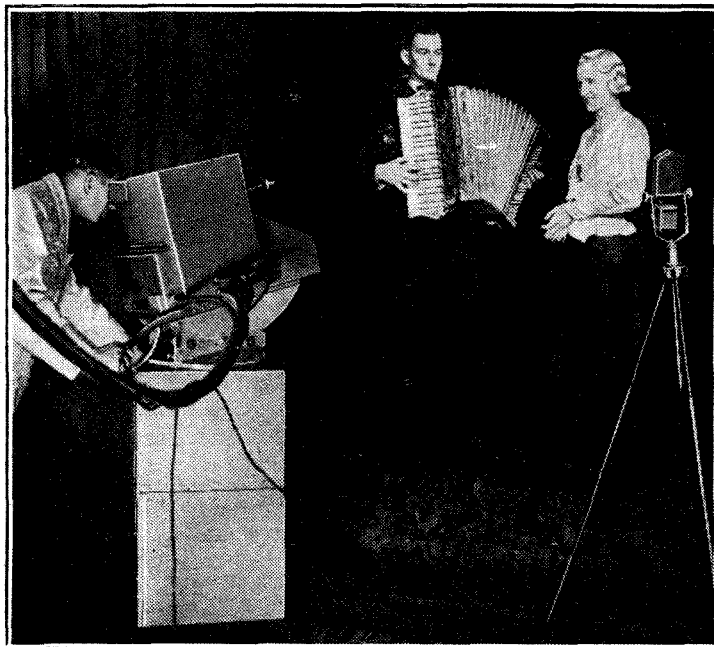
Mr. Lloyd George

THE Rt. Hon. Lloyd George, O.M., M.P., comes to the microphone on Sunday, October 11th, to give a talk on the centenary of the birth of the great Nonconformist divine, Dr. John Clifford.

Few public orators can drop the platform manner when they face the studio microphone, but Mr. Lloyd George is one of the few. Without sacrificing the persuasive, and sometimes compelling, style of his public speeches, he seems to be able to take each individual listener into his confidence. In this he differs from the late Mr. Gladstone, who, it was said, retained his platform delivery in private conversation.

The Spell of the Control Room

CASUAL and non-technical visitors to Broadcasting House would, one imagines, be



AND NOW HOLLAND.—We have quite recently included in these pages photos depicting the development of television in Germany, France and America as well as in our own country. The above scene is from the Philips Television Studios at Eindhoven in Holland.

Studio on Sea Front?

Another Welsh enterprise of the B.B.C. is concerned with the University at Aberystwyth. It is hoped to secure a room in the University buildings which could be acoustically adapted for occasional use as a broadcasting studio for choral and orchestral concerts.

The University is beautifully situated along the sea front, and, with the "studio" windows open, listeners should be able to hear what the wild waves are saying.

more attracted by the glimmers of the studios than by the intricacies of the Control Room. In actual fact, however, it is the Control Room which usually makes the greatest impression on the lay mind.

A typical instance occurred some days ago when sixteen members of the Afghan Olympic hockey team paid a visit to the "Big House." The rows of grey and chromium-plated control desks seemed to fascinate the visitors far more than anything else. Perhaps they felt

that here they were in closer touch with the mysterious ether linking them with the homeland.

"Mr. London Calling"

M. Yaqub, the team's secretary, told the engineers that there were more than 2,000 wireless sets in Kabul capable of picking up the B.B.C. Empire programmes which are very popular.

The team had a real thrill when they met the Empire announcer in his "den." Apparently he is known affectionately in Kabul as "Mr. London Calling."

"Swing" Music

WHETHER we like it or not, this is to be a winter of "swing" music, and, to judge from advance programme plans, the B.B.C. has no intention of hindering the movement.

Readers who seek a definition of this superheated form of jazz may be able to supply one of their own after tuning-in a late night cabaret feature, entitled "Stepping Out," which Bryan Michie and Ernest Longstaffe are presenting at 10.5 on the National wavelengths on October 14th. They are introducing a new and ultra-modern "swing" band, Phil Green and his Ballyhooligans, who are leading exponents of the art.

A Minor Problem

WHILE continually coping with major problems of one kind or another, the B.B.C. is also vexed with minor ones which operate rather like the buzzing of a bluebottle. For a time the Corporation endures them subconsciously, as it were, and then, suddenly realising their existence, swats them.

The latest example is in connection with O.B.s from churches.

And Its Solution

It recently became apparent that broadcasts of this kind were showing a strange tendency to end before their scheduled time, sometimes by as much as five minutes. And the reason, be it noted, was not lack of loquacity on the part of preachers when delivering their sermons.

The real reason, it appears, is this. Ministers have been misled by the published times for the start of transmission. In the case of services scheduled to begin at 8 p.m., the starting time is usually printed as 7.55, so as to include the announcement and the introductory bells or organ music. Ministers, not appreciating this fact, and fearing to keep their invisible congregations waiting, have been beginning their services early.

Future printed announcements will avoid ambiguity.

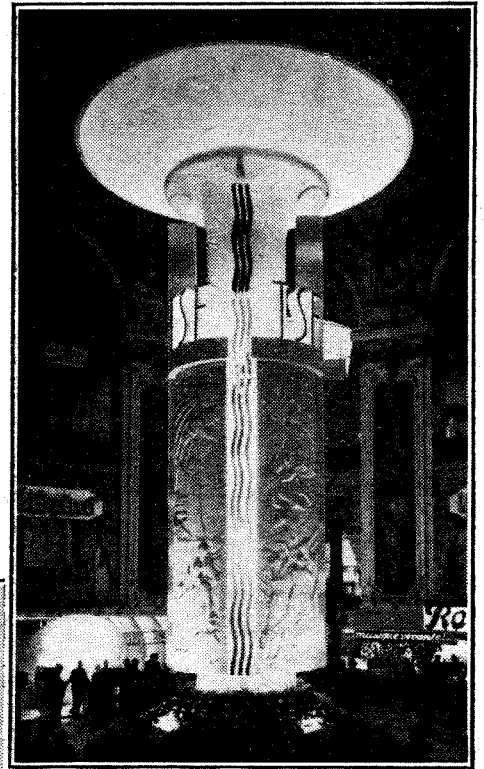
Paris Show

THE FRENCH RADIO AND TELEVISION EXHIBITION

By E. AISBERG
(Editor, *Toute la Radio*)

PARIS this year has been afflicted with three radio-electrical exhibitions, which seem to have established themselves as annual events. In February new accessories were shown at an exhibition of component parts; in May new models of receivers were exhibited, principally for the benefit of the trade; then from September 3rd to 14th the XIIIth Salon de la T.S.F. was held at the Grand Palais. This annual exhibition heralds the radio season, and this year more than ever before it took the form of propaganda for radio on the grand scale. It is quite time that such propaganda should take place, because in France, with a population approximately equal to that of England, there are at present only three million listeners.

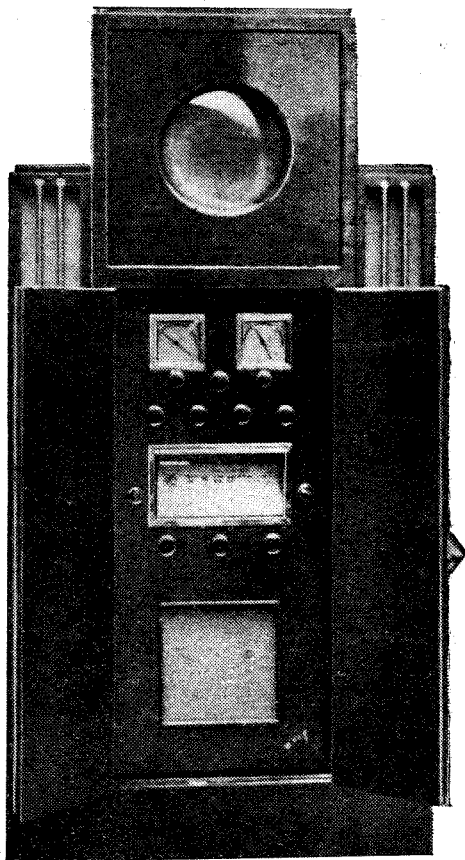
Everything possible was done to attract visitors, and the attendance was far in excess of any previous exhibition. At the



Modernist French decoration: An illuminated column symbolising the various aspects of broadcasting.



View of the direct television studio at the Paris Exhibition (Barthélémy system).

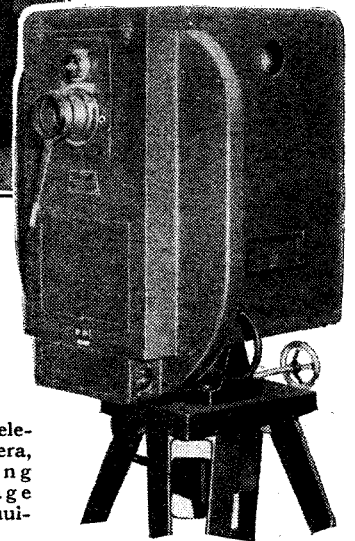


"Stir" 25-valve television and sound receiver.

entrance to the Salon an enormous illuminated column, which cost a large sum to put up, symbolised in bold relief the various aspects of radio—music, theatre, education, news, etc. On two large stages favourite radio artists appeared in constant succession, and mural decorations were on an elaborate scale.

Television Demonstrations

The principal attraction for the public was undoubtedly the demonstrations of television and the telecinema, which were given in a large hall specially reserved for the purpose. Three actual brick houses had to be put up in this hall, each one accommodating a telecinema transmitter. In the first the Société Grammont conducted telecinema transmissions by the German Loewe system, with 240 lines interlaced and 50 frames per second. The De France system, shown by Radio Industrie, employs a cathode-ray scanner for the film, and is, therefore, far more flexible



Barthélémy television camera, incorporating a 10-stage electron multiplier.

than systems with mechanical scanning. This system also makes it possible to vary the scanning progressively from 180 to 400 lines, and results are very good. The third house contained the Barthélémy telecinema transmitter of the Compagnie Générale de Television, with 180 line scanning and 25 pictures a second, with good detail and brilliant illumination. Barthélémy also put up in this hall a direct television studio, where for the first time he made use of his new camera with a ten-stage electron multiplier. Artists

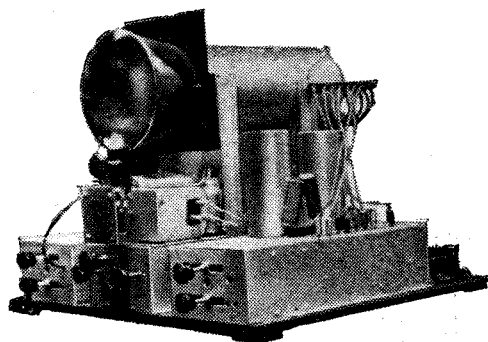
Paris Show—

appearing on the stage were illuminated by two sources of light of a total strength of 5 kW. The Barthélémy camera enables direct television of outside scenes as well as indoor illuminated scenes.

In addition to these exhibits, Poste Parisien had a telecinema transmitter on the Barthélémy system on their stand. Four telecinema transmitters demonstrated to the public reception of the ultra-short-wave television transmissions from the Eiffel Tower, and these were staged as under average home-reception conditions.

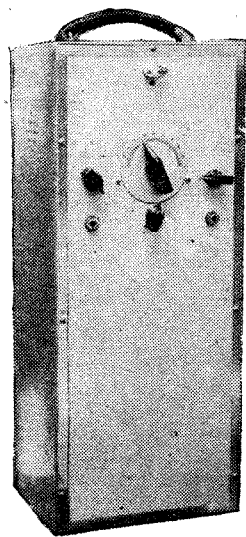
From £65 to £150

Television receivers can now be bought at prices varying from 5,000 to 12,000 francs, and, to take one example, the Stir receiver comprises (1) ultra-short-wave receiver for television (an octode, three intermediate frequency pentodes working at



Small television receiver by Barthélémy available to constructors as a kit.

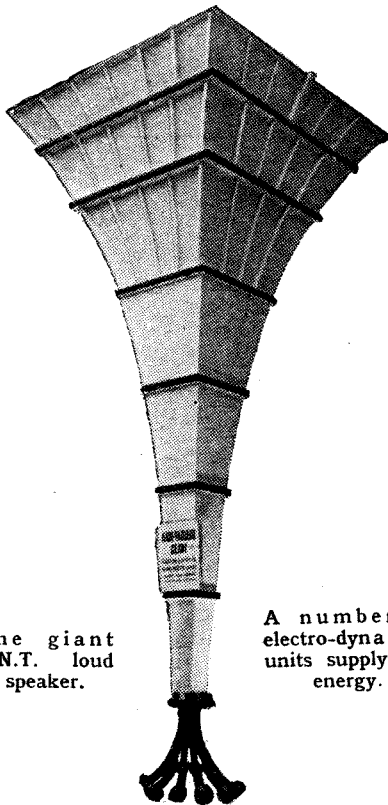
6,000 kc/s, a detector for separating the synchronising signals, and two audio-frequency valves); (2) time-bases employing thyratrons; (3) HT supply unit for the cathode-ray tube, which has a frame of 16 cm. diameter placed behind a lens magnifying it to 25 cm.; (4) a nine-valve sound receiver operating on four wavebands.



"Téléradiophone" transmitter receiver for ultra-short waves, operated by batteries. Weighs 13.5 kilograms and is suitable for operation up to distances of 28 kilometres with a dipole aerial. The transmitter employs two valves with a modulated aerial input of 3 watts. A third valve provides for telephone modulation to 100 per cent. The receiver works on the superheterodyne principle, and wavelengths are variable from 4.5 to 6 metres.

The whole equipment, both for sound and vision, uses a total of 25 valves, and is mounted in an attractive cabinet; it is sold at 7,500 francs.

Technicians would fail to find very much of novelty in the radio receivers, but, on the other hand, substantial progress in



The giant L.N.T. loud speaker.

A number of electro-dynamic units supply the energy.

refinement is to be noted—that is to say, improvements which a year ago were only to be found in the high-priced receivers are now universally adopted, even in the cheaper sets; so that to-day nearly all French receivers incorporate, in addition



Radiophone portable radiogramophone.

to the two normal bands for broadcasting, one, two, or three short-wave bands, and the design of valves and other components have naturally played their part in making a high degree of efficiency on the short-wave bands a possibility.

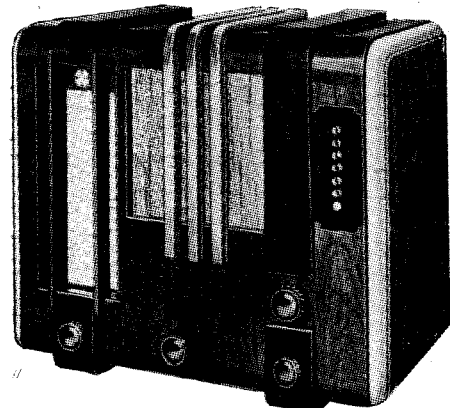
Variable Selectivity Popular

In addition, variable selectivity, which in 1935 was a rarity, is now a feature in quite a large number of sets, and is generally achieved by varying the magnetic coupling of the intermediate-frequency

transformers, and occasionally by a variation of capacity.

Most receivers have a visual tuning indicator, the commonest arrangement being a small cathode-ray tube, the beam of which indicates the precise tuning position.

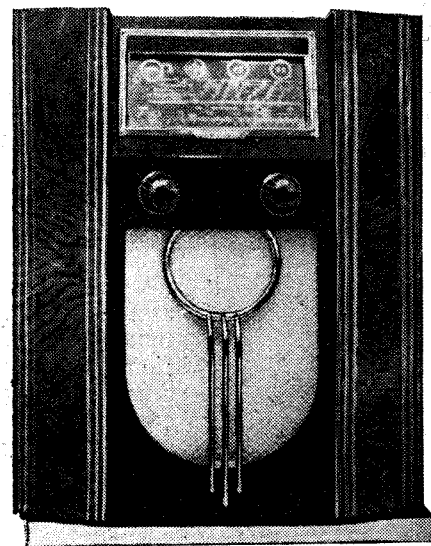
The typical receiver in France is still the four-valve superheterodyne, comprising a heptode or octode frequency changer, a pentode as intermediate frequency stage,



Semi-automatic receiver by "Sprel," enabling any one of six stations to be received by pressing the appropriate button. On the left is a scale for normal tuning of the receiver.

and a double diode detector, with AF pre-amplification and a pentode output stage (unfortunately, very few receivers use a triode output stage). There are a large number of sets with more than four valves, and these include a radio-frequency pre-amplifier and more elaborate audio-frequency stage, push-pull becoming more and more popular, and sometimes with a separate AVC valve or two stages of AF amplification.

The external appearance of French sets has always been the subject of special attention, and considerable originality in design is to be seen. France is copying



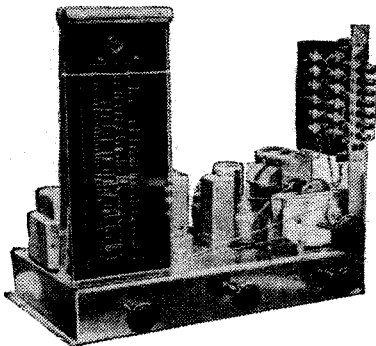
The "Ariane" receiver, a typical high-quality French product.

the English and German idea of mounting the loud speaker in a horizontal cabinet at the side of the controls. Tuning controls

Paris Show—

in the case of the short-wave receivers are generally arranged for coarse and fine adjustment, and a great deal of ingenuity has been displayed to make tuning scales attractive and at the same time easily readable.

Portable sets in France are now very rare; only one was seen and noted at the Show, and that was of German manufacture. Even battery sets were represented

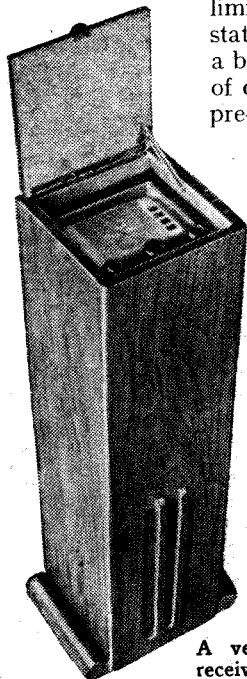


Chassis of the "Sprel" semi-automatic receiver. The press button unit is shown on the right.

on only two stands, and one of these was of English origin. Automatic tuning receivers, of which there is invariably some new model each year, have never had much success in France. The listener is not satisfied to be limited to a prearranged number of stations corresponding to the number of contacts or press-buttons. Probably a new automatic receiver shown by Sprel, on the other hand, may have the success which it seems to merit. With this receiver there are six press-buttons corresponding to six stations most frequently listened to. But the listener is not

limited to these six stations; by pressing a button he can put out of circuit the automatic pre-tuned arrangements and operate the receiver by a normal tuning control.

Another receiver has its radio-frequency tuning unit so arranged that it can be removed from the cabinet up to a distance of 15ft., and the set can be tuned entirely from this unit, thus providing a convenient form of remote control.



A very original form of receiver designed as an upright column.

The firm of Philips had an important stand, but, as they were exhibiting at Olympia, readers will already be familiar with their new receivers.

In contrast to Olympia, where prices

showed little change, the Paris Exhibition gave evidence of a substantial reduction in prices as compared with 1935. A good superheterodyne all-wave receiver with five valves costs between 800 and 1,200 francs (10 guineas to £16). When one takes into consideration that quality is

better and the general design is improved, it becomes obvious that French designers and manufacturers have made a considerable effort to give effect to the spirit of the XIIIth Salon de la T.S.F., which was summed up in the slogan "Le monde à tout le monde."

Letters to the Editor

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

Up Highbrows!

WHAT happened to our programme selectors between August 12th (the "inglorious" twelfth, when Brahms' No. 2 was not put on the air) and September 9th? It is a pleasure to note that on the latter date Brahms' No. 3, in which Elgar considered that music touched its high-water mark, was duly broadcast.

One can only surmise that those who not only hear music, but actually listen to it, must have realised that they must make their wishes known—silent approval may quite obviously pass for lack of interest! Never again must those who reverence the names of Bach, Beethoven and Brahms allow the admirers of jazz and crooning to monopolise the fan mail and suggestion box.

It is not long since a notable journal suggested a day of national humiliation and repentance when it became known that a crooning damsel of tender years had elbowed the mighty Beethoven off the ethereal stage! September 9th can be set off against that lamentable occurrence, and those who have not already done so should congratulate the selectors on a stupendous step forward.

While the framers of our programmes are in this chastened mood, it might be an opportune moment to enquire when we are to be allowed to hear the "Art of Fugue." This work, in an orchestrated form, appears likely to be a permanent addition to the repertoire of the London concert season.

This virile music has remained too long unknown to the great majority of music lovers, and it must no longer be regarded as belonging exclusively to the professors and students of music.

While listening to the austere glories of this noble work we may recall the recent tribute of a leading novelist and poet to the immortal Bach: "The regularity of his mental processes marks the greatest achievement of the human race so far."

London, W.C.1. K. SPROXTON.

The Manchester Show

At the Manchester Radio Exhibition, City Hall, which opened on Tuesday and continues until October 3rd, there are, in addition to the trade stands, displays by the Army, Air Force, and Police. There is also an anti-interference exhibit conducted by the G.P.O. and the B.B.C.

The Show, organised by the *Manchester Evening Chronicle*, has been planned to appeal both to the keen amateur and to the ordinary listener. Arrangements have been made for the issue of return railway tickets at single fare from stations within an 80-mile radius; applications for vouchers, accompanied by a stamped addressed envelope, should be sent to Provincial Exhibitions, Ltd., City Hall, Deansgate, Manchester.

Spectacles for Television

THERE is one thing that is going to hold up popular experimental reception—expense of the C.R. tube.

Has anybody yet suggested that two miniature tubes might be fitted in a frame something after the style of certain race glasses? Such a device could bear the same economic relation to the large apparatus as earphones did to the original loud speakers, and there might even be unexpected advantages in the idea. GERALD SAYERS.

Ware.

Bass Compensation

IN reply to Mr. Irvine, a rising bass characteristic is presumably not required if: (1) the volume of the reproduced version is identical with that of the original, and (2) the loud speaker exhibits a straight-line frequency response below 100 cycles. In this connection it is with great pleasure that I record my appreciation of the effect produced by *The Wireless World* Quality Amplifier feeding a Voigt Domestic Speaker at correct volume level demonstrated to me by Mr. C. Scott Sessions at Muswell Hill. Since, however, the majority of receivers are used in small living rooms, and moreover the average speaker falls off quite noticeably in the lower register (as proved by the response curves published in your journal), the suggestion that some degree of bass compensation is desirable can scarcely be regarded as fantastic. Under average conditions it is safe to say that reproduction of the original at reduced volume levels deviates lamentably from fidelity if the amplifier maintains a flat response. I would refer Mr. Irvine to the excellent series of articles that have been appearing each month in *The Gramophone* from the able pen of Mr. P. Wilson, in which this particular subject has been given very careful consideration. In my opinion it is not the straight line but the kink-less and peak-less response curve that is of such paramount importance in determining the characteristic of an amplifier. In my own home receiver I have not incorporated the biasing choke mentioned in my letter in the issue of July 31st, since I am using two stages of direct coupling followed by one stage of "stereophonic" coupling (patented in 1928), with bass compensation of a different kind for reducing volume level as required. This amplifier feeds a Voigt Domestic Speaker. The biasing choke was merely put forward as a suggestion which I hoped might prove of interest to experimenters, as I believe in passing on ideas which have been found to work successfully in practice.

NOEL BONAVIA-HUNT.

London, N.W.6.

Ultra - Short - Wave Frequency-Changer

A METHOD OF IMPROVING ITS PERFORMANCE IN BATTERY-OPERATED RECEIVERS

By H. B. DENT

THE design of a frequency-changer in a superheterodyne for reception on the ultra-short waves is a matter of some importance now, though, so far as it relates to the reception of television, a ready solution is to be found in the triode-hexode valve, as the equipment must of necessity be mains operated.

The sound accompaniment can, of

oscillator with the oscillator volts injected into the suppressor grid, or even into the control grid circuit through a minute capacity.

Whilst these arrangements are quite practical, it has not been found possible so far to entirely eliminate pulling between the oscillator and signal circuits. The use of a 5 Mc/s IF amplifier helps materially in this

recently, using a heptode mixing valve and a triode oscillator, the usual method of injecting the oscillator volts and the

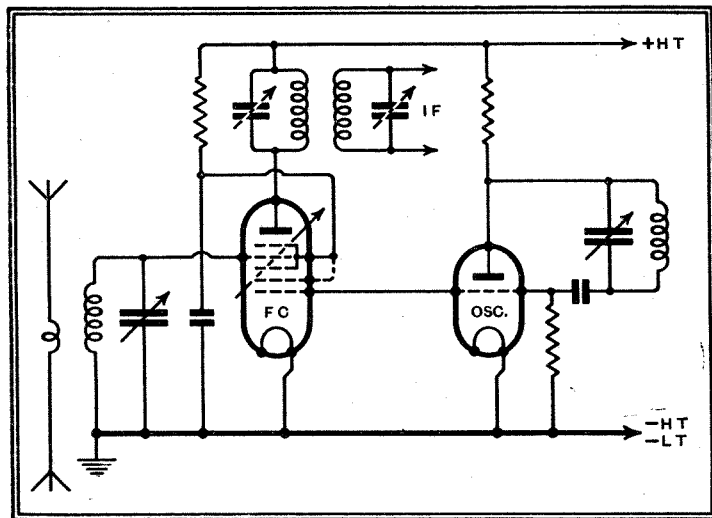


Fig. 1. A heptode valve with a separate triode oscillator connected as above has sometimes been used for frequency changing in an ultra-short-wave superheterodyne receiver.

course, be received on a battery set which, if of the broadcast variety, needs only the addition of a suitable converter.

Separate Oscillator

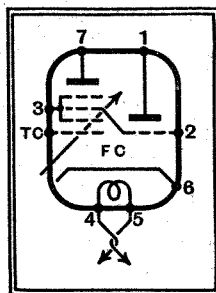
Unfortunately, there is no exact counterpart of the triode-hexode in the battery series of valves, so that those who have been experimenting in the past on the ultra-short waves have usually had to employ a two-valve arrangement. The heptode valve with a separate triode oscillator, such as is shown in Fig. 1, has proved to be a workable arrangement, and, though perhaps not very efficient, has served its purpose quite well.

Among the alternative schemes tried has been an HF pentode and a triode

including a resistance of some hundred ohms or so in the grid lead, with a consequent reduction in signal strength, or by very tightly coupling the aerial and so damping the circuit.

Though the latter arrangement is far preferable and not

Fig. 2. Arrangement of the electrodes in an indirectly-heated triode-hexode frequency changer.



actually a disadvantage, there are occasions when it may be particularly desired to work with a loose coupling.

When trying out various combinations

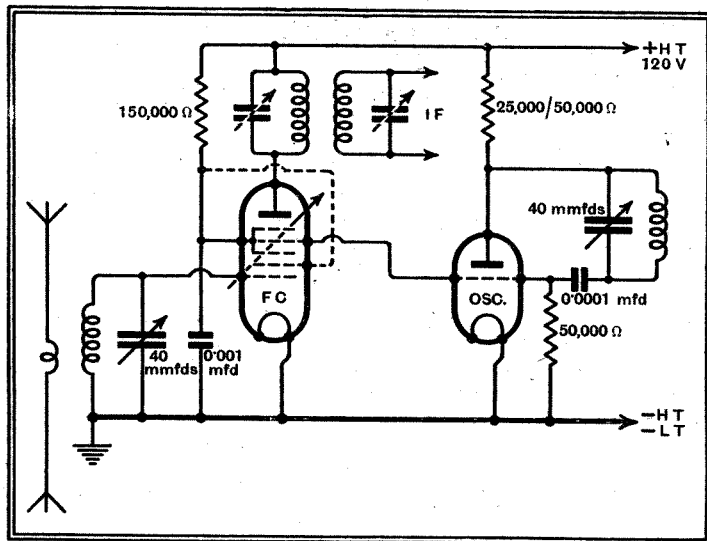


Fig. 3. Connecting a heptode in this manner and injecting the oscillator voltage into the usual signal grid gave comparative freedom from pulling on the ultra-short waves.

respect, but, even so, the trouble still persists and does at times give rise to rather peculiar effects.

One such effect noticed recently was the generation of parasitic oscillations in the signal circuit, which could only be suppressed either by

signal was reversed, the signal being applied to the normal oscillator grid, and the oscillator volts to the signal grid.

It was felt that this reversal in the order of things would bring the battery-operated frequency-changer more in line with the mains triode-hexode (Fig. 2), which was known to be comparatively free from pulling.

The New Circuit

The circuit was arranged as shown in Fig. 3, and proved to be quite a revelation, since all traces of pulling had disappeared, and, so far as could be judged by aural results, was every bit as good as the more orthodox arrangement.

The heptode oscillator anode can be connected to earth, joined to the screen, or joined to what had now become the control grid without having any material effect on the performance of the stage. Since it is an electrode that in most valves of this kind has very little influence on its characteristics, its ultimate fate is apparently of little consequence. As in some makes it might favour one in preference to the others, all the alternatives, however, should be tried.

Marconi

Type RG34A

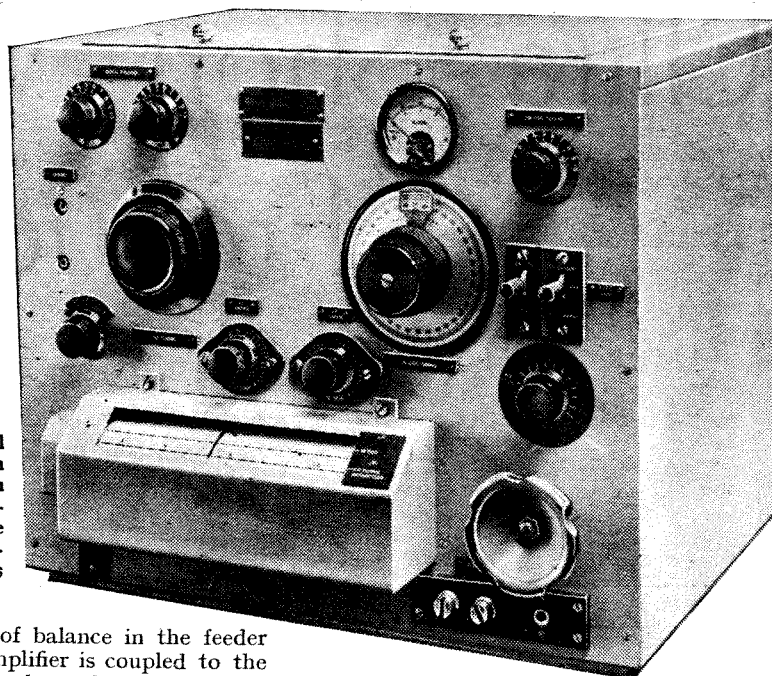
A SHORT-WAVE BATTERY SUPERHETERODYNE FOR SERVICE USE

A RECEIVER which is designed for broadcast reception will presumably be operated by the non-technical, and its makers consequently take care to reduce the number of controls to a minimum. In this respect they probably underestimate the capabilities of the average listener. Provided that they are independent of one another in their settings, extra controls do not increase the difficulty of tuning to any great extent, and they undoubtedly add to the flexibility of the receiver and so make it possible to secure the best results under very varying conditions of reception.

The Marconi RG34A forms a good example of the advantage to be derived from an adequate number of controls. It is designed to meet the exacting requirements of Naval, Military, Mercantile Marine and Aerodrome Services and also for secondary re-broadcast circuits. The tuning range of 14-200 metres is covered in five bands.

A signal-frequency amplifier, for which an RF pentode is employed, is used on all ranges and there is a single tuned aerial circuit. The primary winding is centre-tapped so that a balanced feeder can be

The horizontal tuning scale can clearly be seen in this photograph with the waverange control knob on its right.



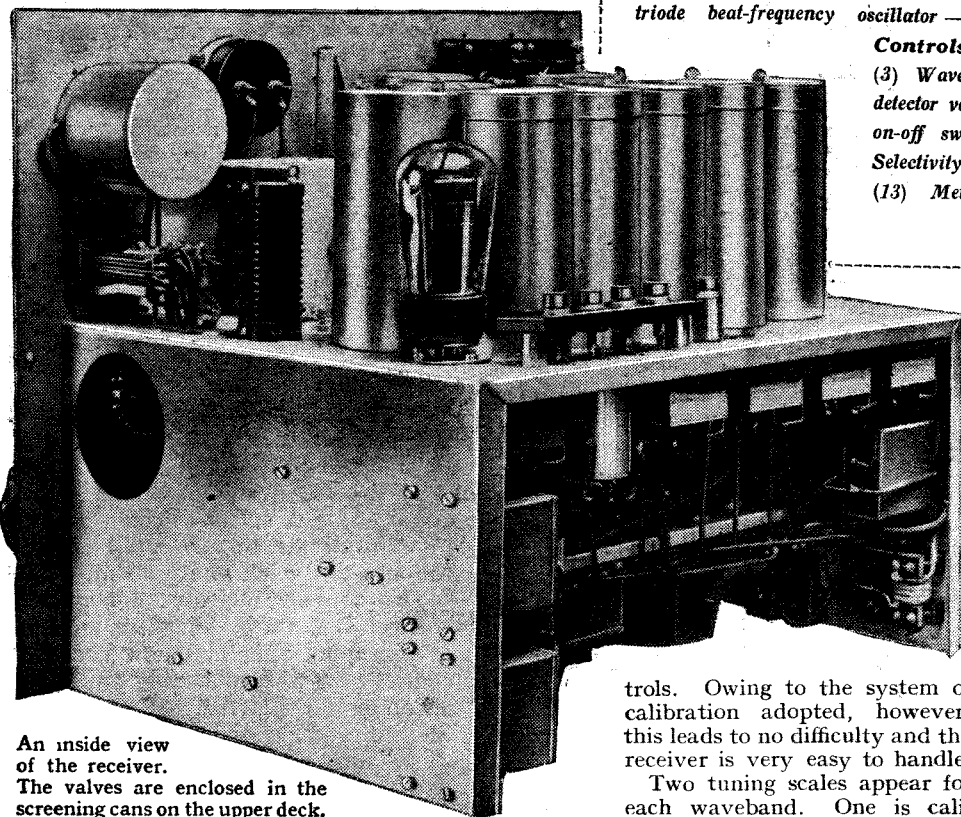
in spite of a lack of balance in the feeder itself. This RF amplifier is coupled to the frequency-changer by the tuned-grid circuit.

A heptode frequency-changer is used and is not controlled for AVC purposes on any range, nor does it generate oscillations. A separate triode valve is employed as oscillator and the Colpitts circuit is employed, its output being coupled to the oscillator grid of the heptode. Two two-gang condensers are used, one for the oscillator and the other for the two signal-frequency tuned circuits, so that there are two tuning con-

degrees and indicates the correct setting of the oscillator scale. In order to receive any given station, therefore, it is only necessary to rotate the signal-frequency tuning control until the scale indicates its frequency, and then to set the oscillator dial to the setting indicated.

The waveband switching is unconventional in the extreme. The five coils for each circuit are mounted inside the circumference of a metal drum with projecting contact

FEATURES.—Type.—Short-wave superheterodyne. Waveranges.—14-200 metres in five bands. Circuit.—Var.-mu pentode RF amplifier—heptode frequency-changer with separate triode oscillator—two var.-mu pentode IF stages—triode grid detector—triode beat-frequency oscillator—pentode AVC amplifier—pentode output valve. Controls.—(1) Signal frequency tuning. (2) Oscillator tuning. (3) Waverange. (4) Pre-detector volume control. (5) Post-detector volume control. (6) AVC switch. (7) Beat oscillator on-off switch. (8) Beat oscillator frequency control. (9) Selectivity. (10) and (11) Aerial balance. (12) On-off switch. (13) Meter switch. Makers—Marconi's Wireless Telegraph Co., Ltd.



An inside view of the receiver. The valves are enclosed in the screening cans on the upper deck.

used for the aerial connection, and variable condensers are inserted in each lead to permit an exact balance being obtained

controls. Owing to the system of calibration adopted, however, this leads to no difficulty and the receiver is very easy to handle.

Two tuning scales appear for each waveband. One is calibrated directly in megacycles and refers to the tuning of the signal-frequency circuits. The indicating pointer, however, passes over the second scale of

studs. The three drums for the three circuits are mounted on a common spindle which can be rotated through bevel gearing by a panel control. The contact studs of the coils in use engage with contact strips mounted on the chassis. It can be seen that only the coils in use are connected in circuit, the unused coils being entirely disconnected and earthed by short-circuiting clips on the periphery of the drum. This scheme of rotating the whole coil assembly has the great advantage of doing away with lengthy connecting wires, for the coil in use is always brought into such a position that short leads are obtained.

There are two stages of IF amplification for which variable-mu RF pentodes are employed, and controlled in common with the RF valve from the AVC system. Iron-cored coils are used in these circuits and coupled pairs are used between the frequency-changer and the first IF valve and between the two IF valves themselves, the coupling being adjustable in two steps by means of a panel control. A single-tuned circuit is used between the last IF valve

Marconi Type RG34A—

and the grid detector, however, and to this circuit is coupled the beat-frequency oscillator for CW reception. A triode valve is used for this oscillator, and a panel control enables its frequency to be adjusted to the required figure, while a switch is provided so that it can be cut out of circuit for telephony or ICW reception. The grid detector is resistance-transformer coupled to the output pentode, which is provided with a choke-filter output circuit.

Two separate AVC systems are provided—one for telephony and the other for telegraphy. The former is more or less conventional in that it is governed by the carrier of the signal. The IF potentials appearing at the detector anode are fed to an RF pentode amplifier which in turn feeds two metal rectifiers connected as a voltage-doubler. The DC output from this circuit is fed through suitable filters of low time-constant to the grids of the controlled valves.

This arrangement, however, is of little use for telegraphy, for in CW reception the local oscillator must be used and this would provide sufficient input to the AVC system to reduce the sensitivity to a low figure. For Morse signals, therefore, a different AVC system is used. A voltage-doubler system of metal rectifiers is fed through a transformer, the primary of which is connected in parallel with the output terminals. The output of the rectifier is naturally in the form of pulses of DC, corresponding to the dots and dashes of the signal, but these are smoothed out by giving the circuit a fairly high time constant. A key switch permits the change over from one AVC system to the other to be made and also permits AVC to be dispensed with entirely.

The Battery Consumption

Two volume controls are fitted. One is a purely LF control and is actually a potentiometer across the LF transformer secondary, while the other is a pre-detector control which operates by varying the screen voltage of the RF and two IF valves. A meter is provided on the panel in order that a watch may be kept on the operating conditions, and by means of a multi-way switch it can be connected to check the operation of any valve as well as reading the battery voltages. The receiver is designed for battery operation and requires an HT supply of 130 volts at 35 mA. with a 10 volts grid battery. The LT consumption is 1.1 ampere at 2 volts. The set is intended for headphone operation and is sensitive enough to permit the reception of any signal stronger than the noise level. Under average conditions it will work a loud speaker and is, in fact, sufficiently sensitive for this, but has hardly sufficient undistorted output for adequate volume. Strictly speaking, therefore, a power amplifier is needed when a loud speaker is to be used. Nevertheless, the results without such an amplifier are good and are comparable in the matter of quality with any other receiver employing a similar small output pentode.

Perhaps the feature which most strikes one on testing the receiver is the absence of second channel interference. The makers claim an image rejection of 25-80 db., according to wavelength, and this high degree of attenuation speaks well for the efficiency of the signal-frequency circuits. It is undoubtedly helped by the independent signal and oscillator frequency tuning

controls, but is nevertheless good when it is remembered that the intermediate frequency is no higher than 400 kc/s.

The adjacent channel selectivity is also high. The makers' figures show that at high selectivity all frequencies outside a band of 22 kc/s are attenuated by more than 40 db., and all frequencies inside a band of 6.5 kc/s are attenuated by less than 6 db. At low selectivity, the bandwidths become 40 kc/s and 19 kc/s respectively.

Performance

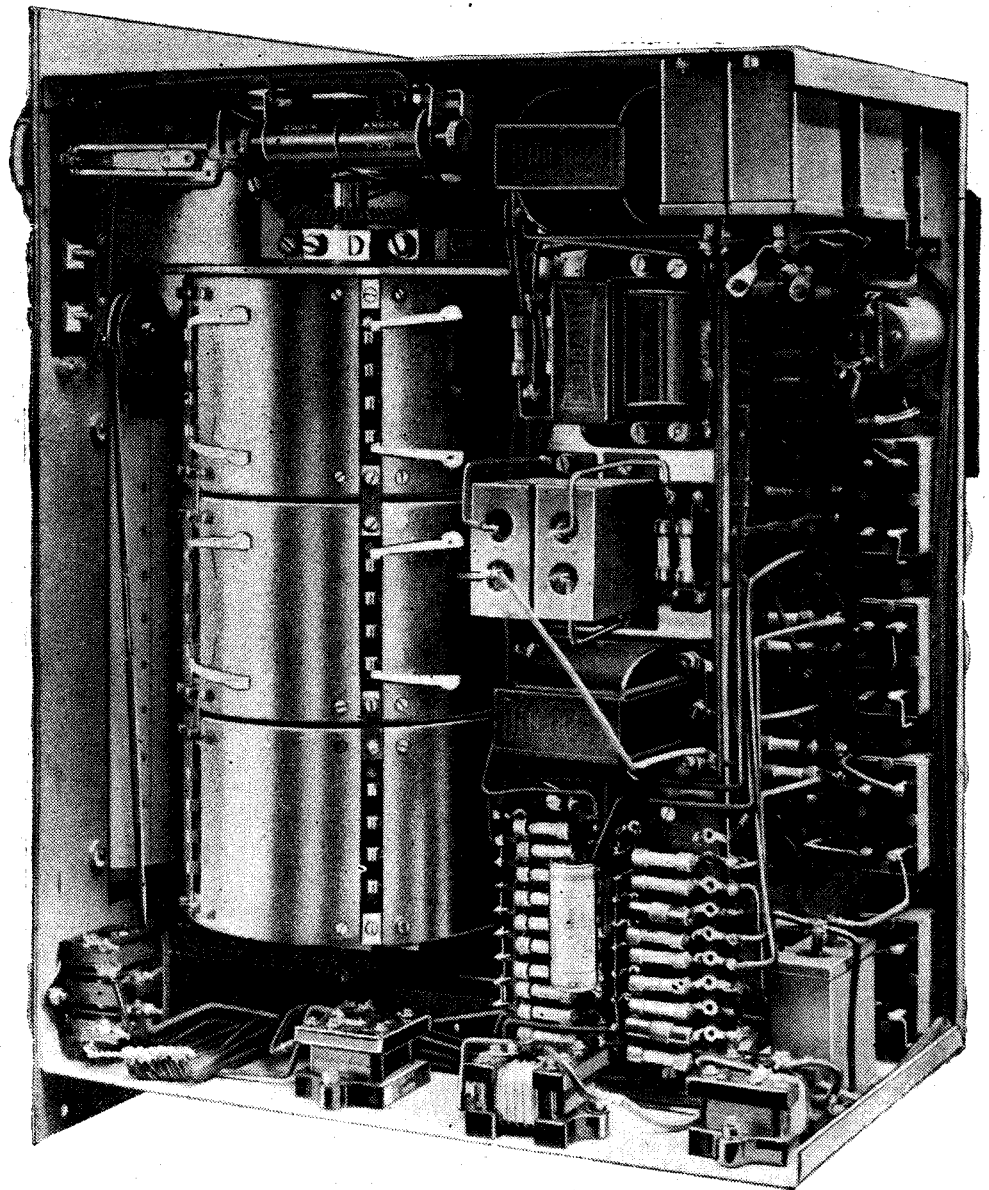
Mechanically, the receiver is well made and exceptionally robust, the coil drum and its associated mechanism being particularly rigid. In spite of the many components, everything is readily accessible and it is quite a simple matter to dismantle the coil drum should the contacts require cleaning at any time. Incidentally, this should not often be necessary since the contacts are wiping and consequently largely self-cleaning.

The multiplicity of controls proved a help, rather than a hindrance, in searching, and

so that the local noise level was just comfortably audible. The tuning controls could then readily be kept in step and even a weak carrier could be detected immediately and tuned to zero beat and the oscillator switched off, when minor touches on the controls would bring in the signal well. It is in points such as these that the difference between this receiver and broadcast sets is most noticeable, and it makes one wonder whether the simplicity of the latter is not more apparent than real.

On test many distant signals were well received, the selectivity being high and the signal-to-noise ratio good. On one occasion W8XK was well received on 15.21 Mc/s at as early as 4 p.m., and somewhat later in the day W3XAL and W2XAD were received. Such comparatively near stations as Zeesen and Rome were, of course, very strong. AVC functioned well and removed the worst effects of fading. The ability to switch AVC out of circuit when searching, however, proved very useful, as also did the independent post- and pre-detector volume controls.

These extra controls do not really add to the difficulty of tuning once one has learned



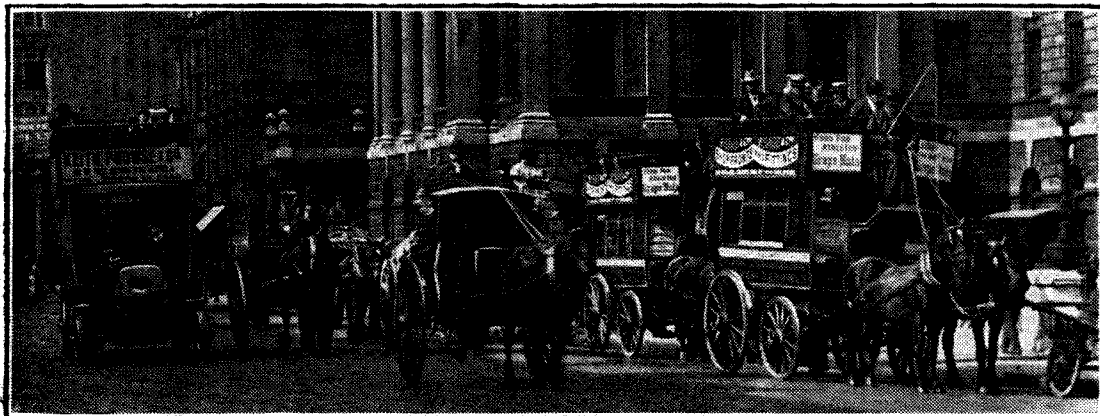
An underview of the chassis showing the rotating coil drum.

it was found that the best course was to cut out AVC, switch on the beat oscillator and to set the volume controls

their proper function, and this is a matter of a few minutes' trial, and they greatly increase the flexibility of the apparatus. Some of them could with advantage be incorporated in broadcast receivers.

Listeners' Guide

THAT the mode of travel has undergone severe changes since 1800 will not be denied by anyone, yet it is difficult for the younger generation to visualise what London was like when the only means of transport was that provided by horse-drawn vehicles. It is the object of a National feature programme, timed for 9 on Monday, to deal retrospectively with the conveyances which have appeared on the streets



Outstanding Broadcasts at Home and Abroad

AN INTRUDER ON THE ROAD. The gradual change in London's traffic is depicted in this photograph taken when the motor-omnibus was indeed counted as an intruder. The programme "London Traffic" on Monday will take the form of a recollection of the cars, omnibuses, cabs, coaches, broughams, phaetons, etc., which have appeared on the roads of London.

of the Metropolis during the last 135 years.

Among the artistes billed for this feature are Carleton Hobbs, Norman Shelley, Gladys Young, and V. C. Clinton-Baddeley. Drivers of now out-moded vehicles will give listeners their opinions of the good old days.

FROM THE QUEEN'S HALL

THE promenade concerts provide a part of each evening's programmes again this week. To-night (Friday) the only portion to be broadcast, at 9.5 (Reg.), is the Symphony, which is Beethoven's Fourth. During the excerpt at 8 (Reg.) from Saturday's miscellaneous programme will be heard Clifford Curzon playing Rachmaninov's Pianoforte Concerto No. 2, and Miriam Licette singing the well-known Charpentier Aria "Louise."

Monday's Wagner concert relay at 8.35 (Reg.) is composed

of three excerpts from "Götterdämmerung," which include the Prelude and Scene I of Act III, Funeral March and Closing Scene, among the soloists being Stiles-Allen and Walter Widdop.

On Tuesday Myra Hess will play Mozart's Pianoforte Concerto No. 20 during the National broadcast at 8. From Wednesday's Bach concert at 8.25 (Reg.) comes the Concerto in A Minor for four pianofortes and strings, with Nancy Weir, Sara Stein, Bruno Raikin and Ross Pratt at the pianos. Jelly D'Aranyi and Adila Fachiri will play the Concerto in D Minor for two violins and strings, and the vocalist will be Margaret Balfour, singing the Aria "Strike at Last, thou Hour Desired."

The only contribution from Thursday's concert is Mendelssohn's Third Symphony, which will be broadcast Regionally at 9.

NORTH OF 70 DEGREES

AN unusual feature programme is to be given from 10.10 to 10.50 to-night (Friday) from the National transmitter. It is unusual in that it is treated from the personal

SOLOMON, who will be giving a half-hour's pianoforte recital in the Regional programme at 7.30 on Wednesday.

angle, being given by an individual seeing the happenings for the first time.

It is the outcome of a visit to the St. Andrew's Fishing Dock, Hull, and will illustrate the fishing industry, listeners being given a picture of the various phases of the work of a typical trawler's crew before and after a voyage to the Arctic fishing grounds.

"SAILORS OF CATTARO"

MUTINY is again brought into the programmes by the play by Friedrich Wolf of this title, which is written around the story of the mutiny in 1918 of some of the Austrian fleet at Cattaro, now known as Kotor. It was produced in New York in 1934 and is now to be heard by listeners to the National transmitter on Wednesday at 8 and by Regional listeners on October 2nd.

CYCLING MARATHON

LAST Monday a broadcast was given by J. H. Holdsworth on the commencement of the Six-day Cycle Race from the Empire Pool and Sports Arena, Wembley. On Saturday the race ends, and at 7.50 a commentary will be given for National listeners describing the progress of the race, which will then be in its final stages.

"CORNELIUS"

J. B. PRIESTLEY's play of this title is to be broadcast by the Liverpool Repertory Company on Sunday at 9 in the National programme. It is set

in an office and takes its title from the name of the main character, Mr. Cornelius. The small firm of importers, in the office of which the action takes place, is on the verge of bankruptcy, and the excitement which ensues is ideal for broadcasting and should be well worth listening to.

FROM WILTSHIRE

"TOWERS and Sheep Bells" is the title given to a programme of memories from Fonthill in Wiltshire to be given Nationally at 8.15 on Thursday. Against the unchanging background of the Downs, it sets some historic memories of this lovely Wiltshire village, and its climax is the strange story of the building of Fonthill Abbey in the eighteenth century by William Beckford.

"THE RED SARAFAN"

LISTENERS will be pleased to know that programmes similar to the very popular broadcasts of the above title last winter are to be given again this autumn, approximately once a month. The first of these comes into this week's programmes from the National transmitter at 7.15 on Wednesday.

It will be remembered that "The Red Sarafan" is the name of an imaginary Russian café in Paris, which name, by the way, is taken from the title of a Russian folk-tune which will be heard during the broadcast.



for the Week

A new Russian orchestra directed by Serge Krish, of the famous Krish Septet, The Serbian Cossack Choir, with new singers and artistes, will come into these programmes, and Captain V. Vivien, Marquis de Chateaubrun, will again be Master of Ceremonies.

ELECTING THE LORD MAYOR

It is with age-old ceremony that the election of the Lord Mayor of London is carried out year by year. Regional listeners will be given an opportunity of hearing what actually happens, for at 9.15 on Tuesday recorded impressions of the ceremony which took place at noon in the Guildhall will be broadcast.

TALKS

AN extraordinary number of interesting talks come into the current week. To-night at

contain a very representative selection. Corsican folk lore is presented by Radio-Paris to-night at 8. On Sunday Königsberg gives a programme of unfamiliar folk songs and dances of East Prussia.

Old German folk songs, including May, Summer and Hunting Songs of the 16th and 17th centuries sung by the Leipzig University Students' Madrigal Society, will be given on Sunday from Leipzig at 2.55.

A Youth Programme, taken by all German stations at 8.15 on Wednesday, is entitled "Harvest Festival in the Village."

CONTINENTAL CONCERTS

THE works of Siegfried Wagner, the only son of Richard Wagner, are to be performed by the Bayreuth Festival Society in a Siegfried Wagner Anniversary Concert



THE RUSSIAN CHOIR which took part in the last series of "The Red Sarafan" broadcasts. The lilt of Russian music will again pervade our homes from "The Red Sarafan" café.

7.45 (Reg.) is included a travel talk by William Teeling on Kwang-si. On Monday J. C. Trevor will speak about the Negroes of the Virgin Islands in the Regional programme at 7.45.

The Rt. Hon. Lord Macmillan comes to the National microphone on Tuesday at 7.45 with the topic "This Freedom of Ours."

Finally, on Thursday at 9.20 (Nat.) we shall again hear the Controller of Programmes.

FOLK MUSIC

THIS traditional music has an appeal of its own, as it gives listeners an insight into the customs and lore of the people. The week's programmes from the Continent

from Deutschlandsender at 11 on Tuesday. From the same station at 8 on Sunday comes a programme of melodies from contemporary German musical comedies under the title "Künnecke-Götz-Mackben," which are the names of the best-known German light music composers.

OPERA FROM ABROAD

THIS week's opera programmes offer music by both the German romantic composers and those belonging to the Italian school. At 7.35 this evening Bucharest and the powerful Radio-Romania transmit a recording of "Tristan and Isolde" by the Bayreuth Festival Cast, conducted by Elmendorff. Stockholm, at 10, pays us a graceful com-

CONTROLLER OF PROGRAMMES. Mr. Cecil Graves will give another talk on the autumn programme arrangements on Thursday at 9.30 (Nat.).



HIGHLIGHTS OF THE WEEK

FRIDAY, SEPTEMBER 25th.

Nat., 7.30, Elizabethan Ballads and Madrigals by the B.B.C. Singers. ¶Scrapbook for 1901. 10.10, North of 70 degrees.

Reg., 6, Music of Eric Coates—Reginald King and his Orchestra. 7.45, Travel Talk, "Kwang-si," by William Teeling. 9.5, Prom. ¶Mantovani and his Tipica Orchestra.

Abroad. Brussels No. II, 8, "Fanny Elssler," Operetta (Johann Strauss).

SATURDAY, SEPTEMBER 26th.

Nat., 6.50, Theatre Orchestra with Tessa Deane and John Rorke. 7.50, Commentary on Six-Day Cycle Race. 8, The Last Part of "The Full Story." 8.30, Variety. Reg., 6, Band of His Majesty's Welsh Guards. 8, Prom. 9.5, Debate: "That Women and Children Should not be Saved First."

Abroad. Deutschlandsender, 8.10, Relay from Municipal Theatre, Stettin.

SUNDAY, SEPTEMBER 27th.

Nat., 6.45, B.B.C. Orchestra (C) and Leoni Zifado (soprano). 9, "Cornelius," by the Liverpool Repertory Company.

Reg., 4.30, Concert by the Winning Band of the Crystal Palace National Championship. ¶Recital: Arthur Catterall and the Kedroff Quartet. 10, Melodies of Christendom—28.

Abroad. Munich, 8, Siegfried Wagner Concert.

MONDAY, SEPTEMBER 28th.

Nat., 7.45, "Meet the Prince," with Patrick Waddington, Davy Burnaby and June Clyde. 9, "London Traffic."

Monday, Sept. 28th (continued)

Reg., 7.45, Talk: "The Negroes of the Virgin Islands," by J. C. Trevor. ¶Irish Folk Songs from West Kerry. 8.35 Prom.

Abroad. Königsberg, 9, Austrian Light Music.

TUESDAY, SEPTEMBER 29th.

Nat., 7, Jack Harris and his Band. 7.45, Talk: "This Freedom of Ours"—the Rt. Hon. Lord Macmillan. 8, Prom. ¶"Intermission"—the Variety Orchestra and Clarence Wright (tenor).

Reg., 7.30, Recital: Tatiana Makushina. ¶"Meet the Prince." 9.15, Election of the Lord Mayor. ¶B.B.C. Orchestra (C) and Lionel Tertis.

Abroad. Paris PTT, 8.30, Choral Concert from the Salle Gaveau.

WEDNESDAY, SEPTEMBER 30th.

Nat., 7.15, "The Red Sarafan." 8, "The Sailors of Cattaro." ¶"I've Got to Have Music"—Eric Siday and his Orchestra.

Reg., 6.40, From the London Theatre—3. 7.30, Pianoforte Recital, Solomon. 8.25, Prom.

Abroad. Frankfurt, 8.45, "Our Army is Playing." Band of the Infantry Regiment, No. 15.

THURSDAY, OCTOBER 1st.

Nat., 6.40, Mrs. Murgatroyd and Mrs. Winterbottom. 7.45, The B.B.C. Singers. ¶"The White Coons." 9.20, Talk by the Controller of Programmes.

Reg., 6, The Middlesbrough Boro' Brass Band. 8.15, "Towers and Sheep Bells," feature programme from Wiltshire. 9, Prom.

Abroad. Kalundborg, 8.10, Second Thursday Concert from the State Broadcasting Building. Guest conductor, Malko.

pliment by giving recorded excerpts from "Cosi fan tutte," as played by the Glyn-debourne Festival Cast.

On Saturday Athlone gives a programme entitled "Stories of the Great Operas," in which the story of Leoncavallo's "I Pagliacci" will be retold at 7.15. Later in the evening (at 9) Paris PTT gives that impressive opera, in oratorio

form, "The Damnation of Faust" by Berlioz.

Verdi's "Aida" comes from Leipzig on Sunday at 7, when it will be relayed from the State Opera, Dresden, where Margarete Teschemacher takes the title rôle. On Tuesday Frankfurt relays Mozart's "Don Giovanni" at 8.10 from the Landestheater, Darmstadt.

THE AUDITOR.

RANDOM RADIATIONS

The New Bulletins

LATELY I've been travelling about a bit in the remoter parts of the West Country where evening papers are quite unobtainable and the news bulletins are looked upon as amongst the best features of the programmes. Most people that I have come across are delighted at the new arrangement which gives three complete bulletins as well as two summaries. Perhaps the most popular change is the separation of combined National and Regional first news at 6 o'clock into first news from the Nationals at 6 and the second from the Regionals at 7. Lots of people don't get home until some time after 6 and used to miss the first news. The second is now just at the right time for them.

To my mind the best point about the arrangement is that it makes it much more easy to devise completely contrasting programmes for the two sets of wavelengths, since zero hour for the evening show of both is no longer 6 o'clock. You get a clear run of three hours and twenty minutes for the Nationals in the evening—6.20 to 9.40—and of three hours for the Regionals—7.20 to 10.20. This makes the whole arrangement much more elastic, which is all to the good.



Autumn Features

WE are promised that the programmes are going to be brightened up in all sorts of ways this autumn, and I think that there will undoubtedly be a big improvement. I can't help feeling, though, that the programmes will never give such wide and complete satisfaction as they should so long as the present quaint practice continues of trying to make each contain items to suit all tastes. You know what I mean? As you sit in your arm-chair listening some glorious piece of classical music comes to an end. There is a brief pause and then the loud speaker proceeds to deliver the back-chat of a pair of mother-in-law-and-kippers comedians. From them you may pass to a religious service, an oratorio, or a song recital, which fades out to make way for the hot jazz that leaves many listeners cold. The result is almost as incongruous as would be the wearing of a perfectly ironed topper, a club blazer, evening trousers, white spats and brown shoes as an everyday costume!



We Have Alternative Wavelengths

The suggestion made in these notes some time ago that the attempt to make the programmes on both sets of wavelengths a *farago* of items that don't fit in with each other should be abandoned was warmly welcomed by readers. Many of them feel as I do that you should be able to listen right through a programme, whatever your mood. As it is, if you want an evening of light entertainment you must turn now to National, now to Regional. Should your inclinations be towards something less trivial you must go through a similar process of retuning as each item comes to an end. That, I am sure, is all wrong. It means that many good things in the programmes are missed since not a few people, when something that doesn't appeal turns up, are more prone to use the switch than the tuning knob. We have two sets of wavelengths

By "DIALLIST"

and it would be far better to make the entire evening programme on each something harmoniously arranged and complete in itself.

One-station Listeners

The only objection that I can see to the allocation of one set of wavelengths to one kind of programmes is that in some parts of the country there are listeners who are more or less confined to a single home station—usually Droitwich. Many of them live in places which are notoriously bad for reception, but I don't think that the transmitter or the locality is always to be blamed for poor results. I have investigated not a few reports of "blind spots" by actually going to the places in question and seeing for myself how matters panned out. Quite often one finds that the grouser is using a three-valve set of very ancient vintage and that his real trouble about the medium waves is not that he can't hear stations, but that he hears several simultaneously through the lack of selectivity of his apparatus. It isn't unusual, either, to find that the valves are as old as the set—and "old bottles" don't go with the "new wine" of modern conditions. The B.B.C.'s job is, naturally, to provide the best service for the greatest number. Years ago they were accused of being crystal-minded and now have an idea that their standard listener is still to some extent the man whose set ought to have been scrapped long ago. At any rate, when an up-to-date set is tried in an alleged bad spot one generally finds that not only can the National and Regional programmes be received well, but that several Regionals besides the local come in strongly. My own view is that the B.B.C. should increase the power of its medium-wave stations to the limit allowed at the earliest possible moment and should then take the attitude that at least two home stations can be heard if you use a respectable receiving set of reasonably up-to-date design—not necessarily an expensive "super" set.



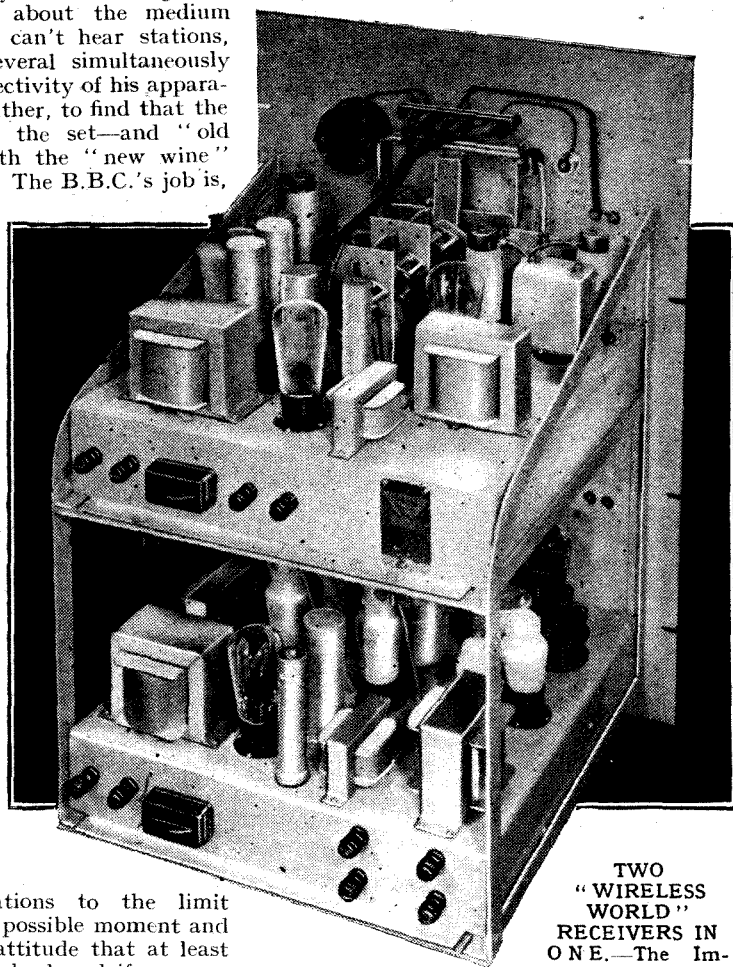
An Earlier Re-start for Television

THE criticism poured upon the B.B.C.'s intention of going to sleep, so to speak, over television for a month or two after the close of the Exhibition has had its effect. The quiescent period has been cut down to four weeks or less and it is now proposed to start a regular service at the beginning of November. This is good news for all concerned. There have been far too many delays over television in the past and we've

already seen that it is perfectly capable of giving a good service in the London area. The gear is ready, the technical staff, the announcers, the orchestra and the artists are all to hand and one doesn't see any reason why it should ever have been proposed that they should eat their heads off. I hope that soon after it comes into being the television service will be able to provide longer and more frequent programmes than those originally suggested. Though orders for television receivers were pretty good at Olympia it is not to be expected that thousands of people will put down something over a hundred pounds apiece for apparatus unless they can expect a reasonably good programme service during the day and in the evenings.

BOOK RECEIVED

Television with Cathode Rays: By Arthur H. Halloran. 172 pages. Published by Pacific Radio Publishing Co., Pacific Building, San Francisco, U.S.A. Copies may be obtained from L. F. Postlethwaite, 41, Kinfauns Rd., Goodmayes, Ilford, Essex. Price 12s.



TWO
"WIRELESS
WORLD"
RECEIVERS IN
ONE.—The Imperial Short-wave

Six and the QA Super, suitably modified to suit the P.O. lines output, constructed as an all-wave unit by G. Scott-Sessions and Co. for the Exeter Radio Exchange. We are indebted to the Chief Engineer of the Exchange for this photograph.

SCIENCE MUSEUM CATALOGUE

A NEW edition of the classified catalogue dealing with works on pure and applied science has been added to the library of the Science Museum at South Kensington. The book is based on the universal decimal classification of the International Institute of Documentation and constitutes an English abridgment of that work.

Some Optical Problems in Television

THE QUESTION OF FRAME-FREQUENCY AND FLICKER

NOW that the British public has had the opportunity of judging for itself the progress already made in television, a quite understandable curiosity has arisen regarding the optical problems involved. For example, many viewers have been puzzled to find that although one system has 240 lines and the other 405, and one 25 frames per second against the other's 50, so far as definition is concerned there seems nothing to choose between the two systems. Indeed, many have expressed the opinion that the smaller number of lines seems to give the better definition. Whether this is so or not, the mere existence of this divergence of opinion shows that any difference can only be slight.

Another question asked by those who are home cinema enthusiasts, is why there should be any flicker on the system using 25 frames per second when the modern home cinema, showing only 16 frames per second, is virtually flickerless. The 50-frame system certainly has the advantage over the 25 in the matter of flicker, but why should there be flicker with either?

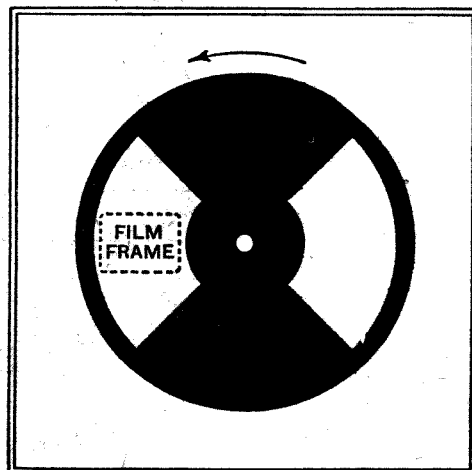
It may be of some assistance to the student of television if we consider a few of the optical problems surrounding the projection of a television picture, and remove certain misconceptions which exist regarding persistence of vision and flicker.

First of all, persistence of vision and flicker must be separately considered, for they are *not* the same problem. The "time-lag" of the cells in the eye is such that if we project a cinema or television picture at any speed above twelve frames per second, persistence of vision will be secured, and (always providing that the picture was taken at the same speed as that at which it is being projected) movement will seem to be natural and not jerky. If now with the same apparatus we project instead of the picture a series of blank "frames" at this rate of twelve frames per second or lower, we shall perceive upon the screen a most irritating

flicker. If we vary the intensity of the light while maintaining the same frame speed, we shall soon find that the brighter the light the more irritating and pronounced is the flicker.

I should say, at this juncture, that the experiment cannot be performed with ordinary home cinema apparatus because this is designed to remove flicker. I am supposing the experiments to be performed with an apparatus which will project each single frame on to a screen, will simply move the film downwards so as to bring the next frame into position and will cover the aperture during the time the film is being so moved.

Now still projecting blank frames (with clear film) let us speed up the apparatus to find at what point flicker ceases. Many people will be surprised to find that the flicker—at least with a reasonably bright light—will persist until we reach well over 40 frames per second! It will thus



Two-bladed shutter as used in modern cinematograph theatre projection. 24 frames per second are shown, and the shutter causes the light to be cut off 48 times per second. In this way flicker has been abolished, in spite of the fact that the frame-frequency is actually lower than that used in television.

be realised that flickerless projection is not obtained as soon as we reach a sufficient speed to give persistence of vision for film images, and that the eye is acutely susceptible to changes of light intensity.

The flicker problem was a great worry to the pioneers of cinematography, as it was confused with persistence of vision. For this reason early cinematograph apparatus was run faster and faster with the idea of eliminating the flicker until a speed of some 50 frames per second was

By PERCY W. HARRIS

reached. Flicker then ceased, but this speed was impracticable in commercial apparatus for several reasons, such as the excessive cost of film, and the difficulty of making apparatus to work at so high a speed and still give a steady picture.

Cutting off the Light

Then it was discovered that by using a three-bladed shutter in place of the single blade variety, one blade could be used to cover the aperture while the film was being moved downward and the other two blades to cut off the light momentarily twice during the projection of each frame. Thus, sixteen frames per second could be projected on the screen while the light beam from the projector could be cut off 48 times per second. This was found to abolish the flicker while maintaining a reasonable speed of projection.

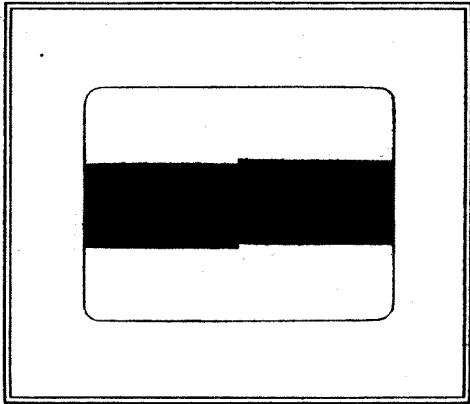
Sixteen frames per second became the standard speed in commercial cinematography until the advent of the talkies, when the speed was increased to 24 frames a second—not because there was any flicker trouble, but for the reason that the necessary frequency range could not be satisfactorily recorded on a sound track travelling at less than 90 feet a minute (the speed of travel for 24 frames per second). Home cinema apparatus for silent pictures has, however, retained the standard speed of 16 frames per second, although 24 frames is used for sound-on-film home talkie apparatus.

With the increase of frame speed from 16 to 24 it was no longer necessary to use a three-bladed shutter, for a two-bladed shutter would afford the necessary 48 maskings per second and greater light efficiency is thereby obtained. Some home cinema apparatus is provided with both two- and three-bladed shutters, the two-bladed shutter being available either for 24 frames a second projection or else for those occasions where a very big picture is being projected and the maximum light is required. As with a big picture the light intensity is proportionally reduced, the flicker is less noticeable than it would be with a normal size of picture, and the additional gain in light is worth having.

We now see why it is that in the two television systems now being projected the 25-frame system still shows flicker

Some Optical Problems in Television—

while the 50-frame system is practically free from it. The reader might think that the simple way would be to introduce a rotating shutter to break up the picture twice per frame in the 25-frame system, or alternatively the cathode ray itself might be cut off twice per frame, but a moment's consideration of the method of producing television pictures shows that any cutting off by either method would produce black bands in the picture.



If an attempt is made to apply cinema technique to reduce flicker by cutting off the light momentarily during projection, a black band will appear in the televised picture, the width depending on the duration of cut-off.

We are not projecting a whole frame at a time but building up the picture point by point, and those parts projected during the cut-off period would appear as black lines or bands. In my opinion there are several possible solutions of the flicker problem with the 25-frame picture, and increasing from 25 to 50 frames per second merely to reduce flicker is, I think, a wasteful use of the etheric spectrum.

When we come to the question of definition itself many other interesting problems present themselves. At the present time with both systems, and in fact with any practical television system so far suggested, definition depends not merely upon the number of lines per frame or picture, but on the sharpness or definition of the moving spot itself (whether the scanning is mechanical or electrical) on certain physiological attributes to the human eye, on the "time-lag" of the fluorescent material on the end of the cathode-ray tube when this is used, and of course on the perfection of the transmitting apparatus. There has been a tendency in some quarters to suggest that the greater the number of lines used the better will necessarily be the definition, but it is easy to see that line frequency is only one of many factors, and the experimental transmissions at present proceeding do not show any marked difference in definition between the two systems. It is, indeed, highly probable that neither system is getting the definition possible even with the smaller number of lines used.

I have mentioned in a previous paragraph certain physiological characteristics of the human eye. In this connection it

is interesting to note that the definition of a moving object in television nearly always seems better than the number of lines would suggest. Those of us who worked with 30-line television must have been very surprised at times at the detail visible, which certainly seemed in excess of that theoretically predicted. Some light on this problem can be obtained by examining a home cinematograph film of an object in motion in the foreground of the picture, such as a person walking across the field of view some 10 or 15 feet away from the camera. The picture will appear on the screen to be perfectly sharp, but if the projector is stopped on a single frame or, better still, the strip of film itself examined under a magnifying glass, it will be seen that each individual

frame is considerably blurred, so much so, in fact, that the inexperienced might imagine the film would be useless for projection purposes.

A final point—for space does not permit us to discuss all the many interesting problems of definition—is the degree of detail perceptible by the average human eye, and the great difference in apparent detail between the examination of a single picture and receiving in the eye the additive result of a number of pictures projected one after the other. When the existing elements of a television picture have been further refined it will quite probably be found that all the sharpness required for the finest detailed picture will be obtained with a number of lines not greater than 500.

DISTANT RECEPTION NOTES

Winter-time Prospects

THIS coming winter is going to be a very interesting time for long-distance men, since it will determine whether the present Lucerne Plan is going to be adequate to cope with conditions of the immediate future. As I mentioned in my last notes, it was proving extraordinarily successful as summer drew to its close; but will it be found wanting when tried under autumn and winter conditions this year?

Few new stations have appeared and few old ones have raised their power since the spring. Mutual interference of the heterodyne and sideband-splash types is always at a minimum in summer time when the field strength of small, distant stations is so low that they are completely drowned by their more powerful neighbours in wavelength. But with the coming of the darker months their voices become louder from quite an early hour onwards.

This season conditions will be made still more difficult by the advent of a considerable number of high-powered stations on the medium-wave band. In fact, within about

six months from now there will be very few channels between 280 and 550 metres—except those given over to common-wave working—that won't be occupied by stations with a minimum rating of 50 kilowatts and a maximum of 120.

Some long-distance enthusiasts with whom I have chatted about radio things to come take rather a gloomy view, holding that we are likely to return to the pre-Lucerne chaos or even to find things worse than they were during the last days of the Geneva Plan. I am rather more optimistic. The I.B.U. has a much stronger hold in these days than it had even two or three years ago. Thanks largely to its excellent work the nations of Europe have come to realise the benefits of central control and to see something of the folly of "muscling-in," and shouting-down.

There are sure to be difficulties as brand-new stations, or old ones rebuilt for a much higher output, come into action; but I haven't the smallest doubt that things will be straightened out satisfactorily—though it may take a little time to do so.

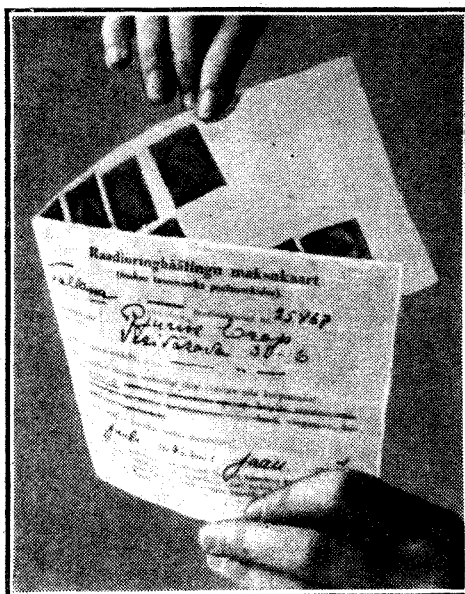
On the long waves, the new Deutschland-sender may cause Droitwich some trouble for a time, and matters won't be made any easier when Radio-Paris becomes Radio-National with nearly double the present kilowatts. But these little troubles will no doubt be straightened out in time.

I mentioned recently that both Wilno and Lwow were shortly to blossom out into 50-kilowatt stations. They won't do so all of a sudden. The new transmitters are now ready to take the field, and the power will be worked up by degrees from 16 kilowatts to 50. In both cases the process should be completed before the end of December.

The Model 7 Avometer

In our issue of September 4th it was stated that the coil of the Model 7 Avometer is safeguarded against overload by an automatic cut-out. This description hardly does justice to the ingenious protective device included in the new instrument; in actual fact, the automatic cut-out works on the main meter circuit, thereby protecting not only the coil but all shunts and series resistances, etc., in the meter.

Incidentally, the range of capacity measurements, made with the help of 50-cycle mains, is from 0.01 mfd. to 20 mfd., and not as stated.



LICENCE BY INSTALMENTS.

For those not in a position to pay in full when the half-year licence is due, the Estonian Post Office has arranged for the use of stamps of low value to be periodically stuck on the form.

Oscillating Crystals

AND THE POSSIBILITY OF AN AMPLIFYING METAL-OXIDE RECTIFIER

IT may seem difficult in these days of double-diode-triodes and pentagrid converters to conjure up any interest in crystals, oscillating or otherwise. But things were very different a dozen years ago, when four out of five listeners depended upon a pair of headphones for their broadcast programmes, and waxed eloquent over the respective merits of Perikon, Zincite, or Hertzite and the fickleness of the cat whisker.

Early in 1924 O. V. Lossev, a young Russian employed in the Soviet Government laboratories, announced the discovery of a crystal "oscillator" which could also be used as a high-frequency amplifier. This news created something of a stir amongst the large circle of headphone users, who naturally foresaw the time when a comparatively simple and inexpensive crystal outfit would be able to compete on more or less equal terms with the valve. At least they looked forward to working a loud speaker from the nearby station and to getting a wider "reach" on the headphones.

Lossev's circuit is shown in Fig. 1. The "super" crystal K, which may be of pyrites and carbon, or of galena or zincite in contact with steel, is in series with a dry-cell battery B, which supplies the external energy required for amplifying the received signals. The contact adjustment at which the crystal begins to develop the "negative resistance," upon which its amplifying action depends, is found by careful exploration of its surface, and at the same time the value of the biasing voltage is adjusted by means of the potentiometer P.

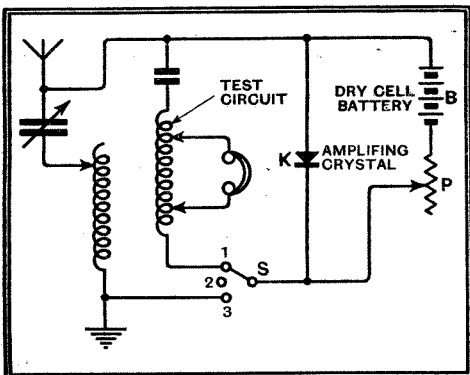


Fig. 1.—The first oscillating crystal circuit, as devised by the Russian engineer Lossev.

To facilitate the initial setting a test circuit with a high ratio of inductance to capacity can be shunted across the crystal by moving the switch S to the point 1. When the crystal becomes active an audible note having the frequency of the

testing circuit will be heard in a pair of headphones tapped across the coil as shown. The switch S is now moved over to the point 2, and the headphones are inserted between 2 and 3 for reception, the test circuit then being out of action. The crystal K may be used both for amplifying and rectifying, or a second ordinary crystal may be added as a detector.

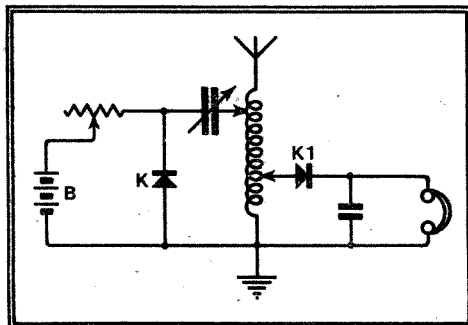


Fig. 2.—The Round-Rust crystal amplifier.

About the same time Captain H. J. Round and Mr. N. M. Rust, who were working on similar lines in this country, produced the circuit shown in Fig. 2. Here, too, the amplifying crystal K reinforces the signal input with energy drawn from the battery B, but a second or ordinary crystal K1 serves as detector.

The fact that certain crystals possessed a negative-resistance characteristic—and could therefore be used either for amplifying or generating oscillations—had been pointed out some years before by Professor W. H. Eccles, but it seems to have been overlooked until broadcasting and the needs of the headphone "listener" gave it a new significance.

Arzenite and zincite will both give definite results, particularly after an initial treatment. The crystal is mounted in a small cup of molten zinc and subjected, when cool and firmly set, to the discharge from an arc gap. This forms a dark fused layer on the crystal which is found to be particularly "active." A film of oxide on copper will also give a regenerative effect when used either with a cat whisker contact or a plate of metal.

The theory of the crystal amplifier is closely bound up with the electronic "mechanism" of ordinary rectification. It is thought that under the action of the applied high-frequency voltages a one-way discharge of electrons takes place across the very thin film which separates the crystal and the metal. The discharge may be compared, in miniature, with that which occurs across the electrodes of an arc lamp, or inside a thermionic valve.

Like both of these, the path of discharge across a crystal rectifier is not purely ohmic in character, but has a curved characteristic, which under certain conditions can be made to fall as the voltage is increased, and so, like the Poulsen arc and the back-coupled valve, to produce a regenerative effect.

It is interesting to note that attempts have recently been made to develop the amplifying possibilities of dry-contact rectifiers of the metal-oxide type. Assuming that a flow of electrons takes place across the rectifying-electrodes, it is not unreasonable to assume that the flow might be controlled in much the same way as the electron discharge through a thermionic valve is regulated, namely, by an interposed grid.

Fig. 3 shows a circuit in which the two metal electrodes A, B of a dry-contact rectifier are separated by a layer of oxide, in which a wire-gauze electrode G is embedded. Alternating current applied across the input terminals N is then both rectified and amplified in its passage across the oxide layer, in accordance with the biasing voltage applied to the grid. The output from this "cold" valve may be applied to any suitable load L, such as a loud speaker, storage battery, or the like.

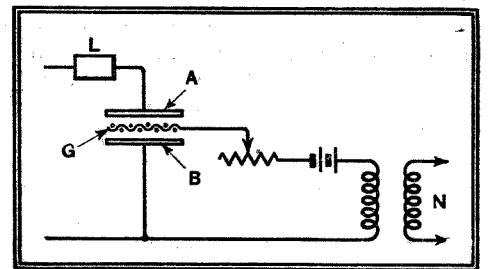


Fig. 3.—The metal-oxide rectifier as an amplifier, showing the addition of a controlling grid.

Now that the era of the multi-grid valve and the mains-fed receiver seems to be firmly established, it is difficult to say what the future of the amplifying crystal might have been had events kept the headphone listener a power in the land. On its merits it still remains a most fascinating corner for research, even though the practical or financial reward of success may, for the moment, seem remote.

But it is not safe to dogmatise on what the future may bring forth, particularly in radio science. The superhet circuit, for instance, had its short day, suffered a more or less severe eclipse, and then came back into the full light of popular favour. And much the same thing may be said, if not now, perhaps in the near future, of the super-regenerator. So, too, it may be premature to say that the crystal amplifier, in one form or other, is gone past all recall.

Current Topics

EVENTS OF THE WEEK IN BRIEF REVIEW

Australian Short-wave Broadcasts

THE October schedule of Sydney VK2ME (31.28 metres) provides for transmissions on Sundays from 5.30 to 7.30 a.m., and from 9.30 a.m. to 1.30 p.m. On Mondays the times are 2.30 p.m. to 4.30 p.m.

Melbourne VK3ME, on 31.5 metres, transmits on Mondays to Saturdays inclusive, from 9 a.m. to 12 noon. All times given are G.M.T.

B.B.C. Helps Electrical Industries

MR. A. H. BROWN, of the Programme Division, has been lent by the B.B.C. to arrange a cabaret at the annual Electrical Industries Ball, at which Henry Hall and his band will provide the music.

The Ball, which is in aid of the Electrical Industries Benevolent Fund, takes place at Grosvenor House on Tuesday, November 24th.

Attendance at the Berlin Show

JUST under 250,000 persons visited the German Radio Exhibition this year. This is considerably greater than the

attendances in 1933 and 1934, but only about half that of 1935 when, owing to the publicity incidental on an outbreak of fire, all records were broken.

Televising the Nazi Rally

FILMS of the Nuremberg Rally were taken by the German Broadcasting Company's Television Unit and sent by special aeroplane to Berlin, whence they were transmitted the same night from the Witzleben station.

The transmissions were received in many public viewing halls in Berlin and also in Leipzig, where they were relayed by cable.

Austrian War on Static

IT is gratifying to see that more and more attention is being paid in the various countries of the world to the question of interference caused by various forms of electrical apparatus. In Austria makers of anti-static devices have opened a consultation bureau at which listeners can obtain free advice and help concerning their interference troubles. The bureau is, of course, paid for indirectly by the sale of the various devices which those consulting it are recommended to buy. It is stated to be doing a great deal towards the elimination of the disappointing experiences of people buying apparatus unsuitable for dealing with their particular interference troubles.

I.W.T. Lectures

A SYLLABUS of lectures for the 1936-37 session of the Institute of Wireless Technology has just been issued. The following subjects are to be dealt with:

Wednesday, September 30th.—"Transmission Lines, Radio and Television feeders, matching and relaying." By Dr. L. E. C. Hughes.

Thursday, October 22nd.—"Ultra-Short Waves, their advantages, applications and limitations." By M. G. Scroggie.

Wednesday, November 11th.—"Practical Design of Receivers for High Musical Quality." By P. K. Turner.

Thursday, December 10th.—Debate: Straight Circuit v. Superheterodyne.

Wednesday, January 6th.—"High-Definition Television." By H. J. Barton-Chapple.

Thursday, January 28th.—"The Detection and Suppression of Radio Interference." By F. W. Newson.

Wednesday, February 17th.—"The Electronic Organ." By L. E. A. Bourne.

Thursday, March 11th.—"The Reproduction of Transients and Higher Harmonics in Loud Speakers." By Dr. N. W. McLachlan.

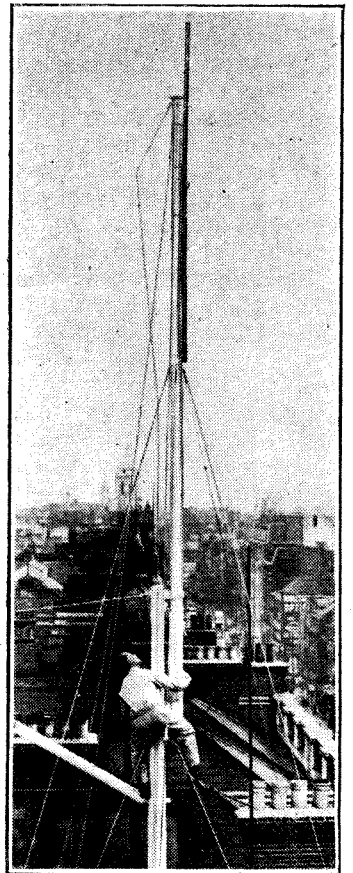
Thursday, April 8th.—"Horn-Loaded Loud Speakers." By P. G. A. H. Voigt.

Ordinarily these lectures are open to members and student members of the London Section of the Institute and their guests, but the lectures on October 22nd and February 17th are open to non-members by invitation.

Estonian High-powered Station

THE popularity of broadcasting in Estonia, which for a long time has lagged considerably behind other Baltic republics, has gone ahead by leaps and bounds during the past twelve months. A year ago there were only 18,000 licensed listeners in this country, but since then this figure has increased to 30,000, and there are

no signs of any lessening in the stream of new applicants for licences. As a result of this great increase in the number of listeners, the broadcasting authorities have decided to build a 120-kilowatt station at Turi in the geographical centre of the country. It is calculated that this will serve 98 per cent. of the population. A so-called anti-fading aerial of the steel tower type will, it is said, be employed.

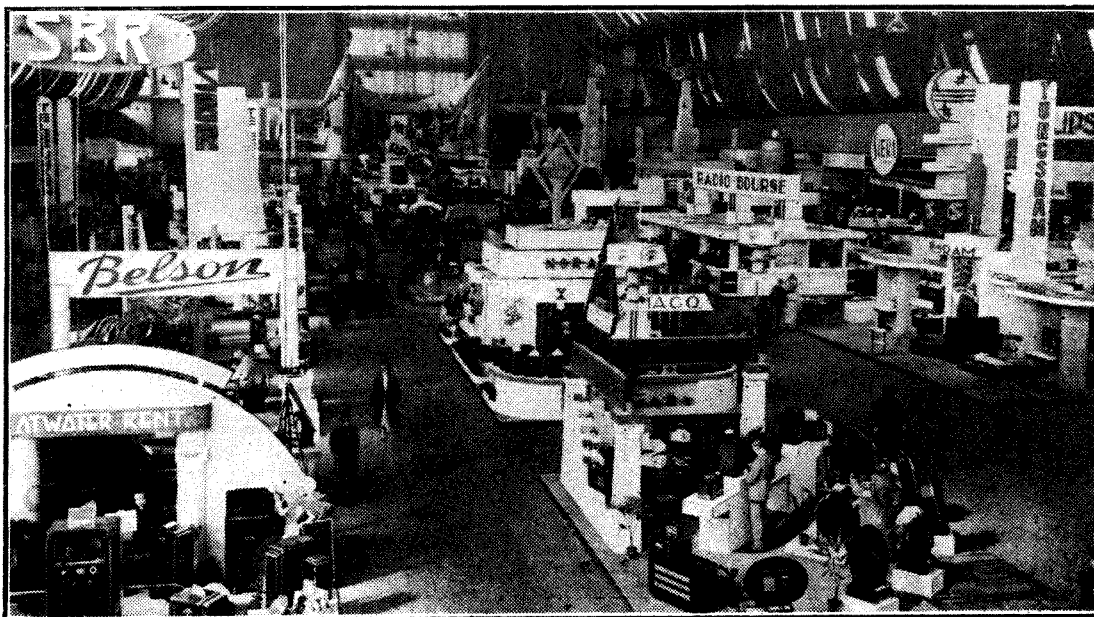


AN HISTORIC MAST.

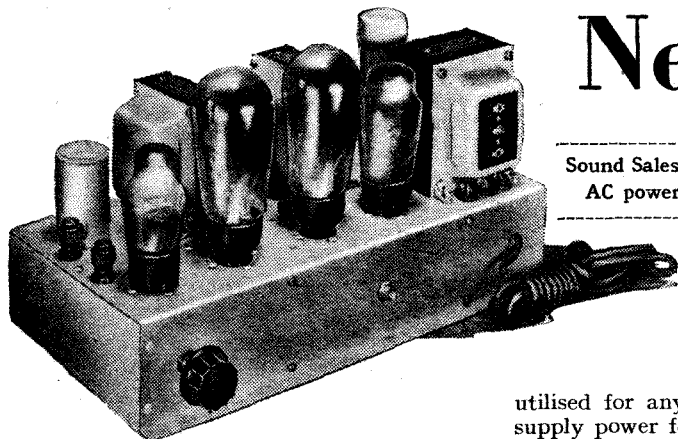
After many years' use as a flag pole this mast, which Marchese Marconi employed in his early experimental work in the Isle of Wight, has now been recovered by the Marconiphone Co. and serves to support a television aerial at their Tottenham Court Road headquarters.

An Interesting Proposal

FROM time to time the question of broadcasting the debates of the French Chamber of Deputies has arisen, just as it has in the case of our own Houses of Parliament. French Deputies have, however, with very few exceptions, always been greatly opposed to it, but now a new suggestion has been made which is likely to be accorded much more favourable consideration. It is proposed that all important debates in the French Chamber should be recorded in full and stored in the National archives. Thus they will be available for broadcasting on future occasions, and would prove of historical interest to future generations.



ANOTHER RADIO SHOW. Belgium follows the lead of other European countries by holding a National Radio Exhibition. The above is a general view of the stands in the Centenary Palace in Brussels.



SOUND SALES MODEL S.S.346 AMPLIFIER

THIS amplifier is a new model designed for general-purpose use and has a rated power output of 4 to 6 watts. It is AC-operated and embodies two amplifying stages. The first is an Osram MH4 valve, which is coupled by a parallel-feed transformer unit, described as the S.S. Audio Coupler, to a pair of PX4 valves working in push-pull.

The layout of the amplifier has been very well arranged and everything is accessible, yet there is no waste space as the chassis measures but $15\frac{1}{8}$ in. \times 8 $\frac{3}{8}$ in., and it includes, of course, the mains equipment.

An interesting feature of the output stage is that facilities are provided for varying the grid bias, so that the anode current of each valve may be accurately balanced.

Adjacent to each output valve is a pair of sockets normally joined by a short-circuiting plug. When these plugs are withdrawn each anode circuit is interrupted and a milliammeter can then be interposed and the currents set to the same value in each case by adjusting a variable grid-bias resistance, the spindle of which projects through the front of the chassis and has a slot for a screw-driver.

As the amplifier may be required for broadcast reproduction as well as other purposes, provision is made for using it in conjunction with one of the Sound Sales wireless receiving units. A five-pin socket is fitted on the back to supply the unit with HT and LT. Up to 3 amps. of LT and about 285 volts HT at 10 mA. are the rated outputs from this point, but the supply could be

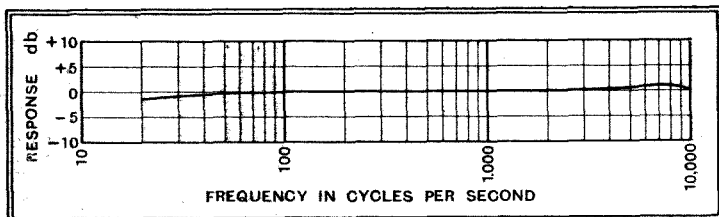
Sound Sales 4 to 6 watt
AC power amplifier.

utilised for any other purpose, such as to supply power for an extra amplifying stage should it be required. This may occasionally be needed, for we find that an input of about 1 volt is required to fully load the output valves. This point gave 290 volts at 12 mA. by measurement and exactly 4 volts at 2 amps. LT.

The amplifier's rating of 4 to 6 watts is not exaggerated as we were able to obtain just 5 watts before indication of distortion appeared, so that 6 watts could be taken from it without noticeable distortion in the reproduction.

Its response curve is also very satisfactory, for, as will be seen from the graph, it is sensibly flat from about 30 c/s to over 10,000 c/s.

In the form illustrated the amplifier costs £10 complete, and a companion model is available at the same price giving an extra 100 volts at 110 mA. for the field of an energised loud speaker. This is known as



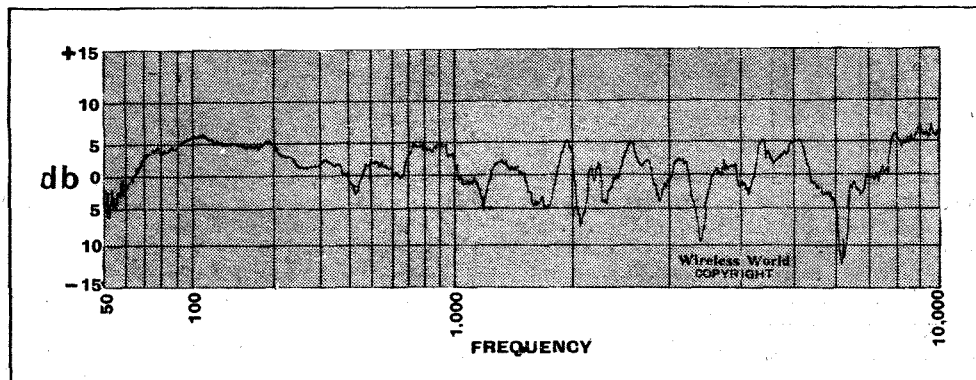
Response curve of Sound Sales Amplifier. Model S.S. 346.

the Model S.S.346F, the final letter signifying that a field supply is available.

The makers are Sound Sales, Ltd., Marlborough Road, Upper Holloway, London, N.19.

GOODMANS JUNIOR AUDITORIUM LOUD SPEAKER

DESIGNED to give the same type of frequency response as the original "Auditorium" model, reviewed in our issue of February 7th, 1936, but at a lower price, this unit has, if anything, an even better charac-



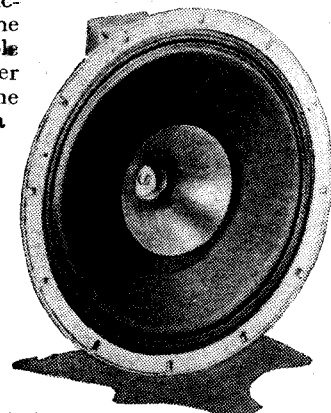
Axial response curve of Goodmans Junior Auditorium loud speaker on irregular baffle (area approx. 22 sq. ft.). Microphone distance 4ft., power input 1 watt.

New Apparatus Reviewed

Recent Products of the Manufacturers

teristic. There are fewer irregularities and the bass response is relatively higher, though the maximum acoustic output is naturally not so great as in the larger model. Nevertheless, it is an instrument which will handle the output from the W.W. Quality Amplifier without distress, and with full justice to the frequency response of that instrument.

The construction follows the same principle as the larger model and the main dia-



Goodmans
Junior
Auditorium
PM loud
speaker.

phragm is 10 inches in diameter. The magnet is powerful and the electro-acoustic efficiency is high. Frequency doubling is absent as far as the ear can judge, and the transient reproduction is exceptionally good. Undoubtedly an instrument in the front rank of quality reproducers. The price is £3 10s. and the makers are Goodmans Industries, Ltd., Lancelot Road, Wembley, Middlesex.

THE RADIO INDUSTRY

IN the current issue of *Short Wave*, issued by Lissen, Ltd., Angel Road, Edmonton, London, N.18, are given descriptions of the new Lissen Hi-Q short-wave components. A number of articles of considerable interest to all short-wave listeners are also printed in this useful publication, which costs 2d.

In our Olympia Show Report the use of a hyphen between the words Decca and Brunswick may have conveyed a misleading impression. Although the two makes of sets were shown on the same stand, the companies are entirely separate and the receiver chassis they produce are mechanically and technically different in every respect.

The new season's edition of the Osram Valve Guide and Book of Circuits is now out. The booklet is bound in a handy pocket size and the information is well arranged. Copies are available from the General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2.

The new Philco Car Radio set has been designed to operate without sparking plug suppressors; it includes such features as continuously variable tone control, improved AVC and a speaker of wider acoustic range. Consumption is given as 2.2 amps. and 4.3 amps. for 12-volt and 6-volt supplies respectively.

Scientific Supply Stores have opened a new branch, accessibly situated at 33, St. Martin's Court, Charing Cross Road, London, W.C.2, for the purpose of showing and demonstrating sets of component parts for all *Wireless World* receivers.

Recent Inventions

Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section

AUTOMATIC VOLUME CONTROL

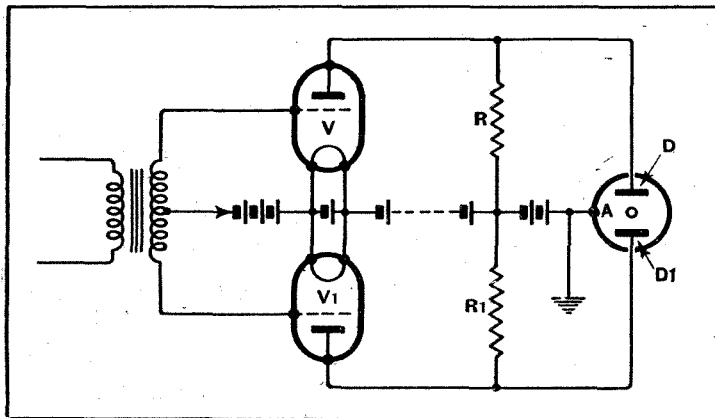
RELATES to regulating systems, suitable either for monitoring the output from a broadcast transmitter, or for expanding the volume range when an orchestral performance is being reproduced on a gramophone, or for volume-control generally. According to the invention, the control is effected by means of a Wheatstone-bridge arrangement, which renders it unnecessary to use any smoothing circuits, and ensures a quick-acting response, free from extraneous noise.

Telefunken Ges Fur Drahtlose Telegraphie m.b.h. Convention date (Germany) November 5th, 1934. No. 449386.

SCANNING IN CATHODE-RAY TUBES

IN the ordinary way the scanning voltage applied to one or other of the deflecting electrodes of a cathode-ray tube varies from positive to negative during each cycle. For instance, one of the electrodes may be anchored to earth, and the full range of scanning potential applied to the other. When the electrode is positive it diverts or attracts some of the electrons from the cathode-ray stream, and this so-called "cross-current" gives rise to an undesirable shift of the image point produced on the fluorescent screen.

The arrangement shown in the figure is designed to overcome this source of trouble. Both the deflecting plates D, D1 of the cathode-ray tube are connected over resistances R, R1 to earth and to the anode A of the tube. The two driving valves V, V1 act



Push-pull circuit for applying scanning potentials to cathode-ray tubes.

in push-pull, with their grids so biased that in a state of rest no anode current flows. The consequence is that whilst, say, the scanning electrode D1 is connected dynamically to earth, the other plate D oscillates only into negative, and vice versa. The electron stream is therefore de-

flected by repulsion alone, and since there is no positive voltage in action, there can be no cross-current from the stream to either of the scanning electrodes.

Radio Akt. D. S. Loewe. Convention date (Germany) November 10th, 1934. (Patent of addition to No. 423427.) No. 447070.

TELEVISION SYSTEMS

THE amplifiers used in television should be capable of handling the entire frequency-band, from high lights to dead black, without discrimination. At the same time, it is necessary to be able to regulate the amplification factor, or to apply gain control. If one attempts to do this by varying the grid bias of an ordinary variable-mu valve, the correct "balance" as between black and white is upset, and the half-tone character of the image is adversely affected.

The problem is solved, according to the invention, by applying the gain-control voltage to the suppressor grid of a pentode valve. This electrode, though actually outside the chain of amplification, secures the desired result by controlling the path of the secondary electrons emitted from the anode of the valve.

Radio Akt. D. S. Loewe. Convention date (Germany) September 21st, 1934. No. 447312.

TELEVISION "INTERFERENCE"

WHEN a cathode-ray tube is energised from AC mains, the supply frequency, and its harmonics, do not, of course, appear as a "hum" since the tube (unlike an amplifying valve) will not

convert electrical variations into sound. They do, however, create various forms of distortion, such as "curving" the sides of the frame or raster.

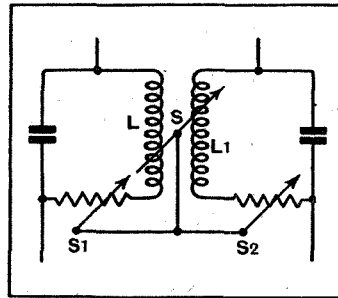
As a corrective, compensating voltages are derived through a coupling from the supply transformer and are applied, in phase-

opposition to the original disturbances, through a pair of plates arranged outside the glass walls of the tube, but as close as possible to the deflecting electrodes.

The General Electric Co., Ltd., and D. C. Espley. Application date March 18th, 1935. No. 449822.

SELECTIVE COUPLINGS

THE usual double-hump in the resonance curve of a magnetic coupling is eliminated by automatically inserting resistances in series with each circuit as the coupling is increased. The resistances are first brought into circuit



Method of control for variably-coupled circuits.

at a predetermined point by the ganged control S, S1, S2, and are then gradually increased with the degree of coupling between the coils L and L1.

E. K. Cole, Ltd. Convention date (Italy) April 11th, 1935. No. 446809.

LOW-FREQUENCY AMPLIFICATION

CARBON microphones tend to become "noisy" when amplification is increased beyond certain limits, whilst it is usually necessary to suspend or "spring" the initial valve-stages in order to prevent microphonic "noise." Moreover, the ultimate level of amplification is largely restricted by valve "hiss."

These various limits to amplification are offset, according to the invention, by first applying the microphone signals to a carrier wave, amplifying the resulting modulated wave, and then rectifying the latter to restore the original signal. The microphone may be connected in one arm of a Wheatstone bridge, a high-frequency source being shunted across one of the diagonals. The resulting modulated wave is taken off from the opposite diagonal of the bridge, and fed to the amplifying stages.

L. H. Paddle. Application date January 3rd, 1935. No. 449874.

MECHANICAL SCANNING

IN the ordinary method of mirror scanning, a beam of light is projected on to one drum, known as the "line" drum, and is reflected from each of its facets on to a second slower-moving drum, known as the "frame" drum, from which it is thrown on to the viewing screen. To secure high-definition pictures of, say, 120

lines, it would be necessary to rotate a 30-facet "line" drum at 6,000 revolutions per minute.

According to the invention, the "line" scanning drum is associated with a number of stationary reflecting surfaces, which, in combination with the rotating facets on the drum, effectively multiply the number of scanning lines produced. For instance, a drum carrying nine mirrors, and cooperating with five stationary reflectors, produces the equivalent of 45 scanning lines for each single rotation. High-definition pictures can be reproduced in this way at comparatively low mechanical speeds.

E. Traub. Application date December 3rd, 1934. No. 448238.

"STATIC" SUPPRESSORS

SOMETIMES the field-winding of the motor of domestic labour-saving devices, such as a vacuum cleaner, is tapped off in order to give speed control, which means that there are three terminals to be silenced instead of the usual two. The arrangement shown in Fig. 1 is designed for such cases. It will be seen that the three terminals T1, T2, T3 are shunted by the three condensers C1, C2, C3 connected in delta, and these, in turn, are bridged by two further condensers C4, C5, connected in series and with a mid-point tapping to earth or to the frame.

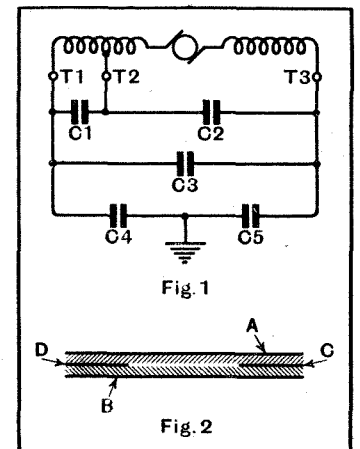


Fig. 1.—Noise suppressor circuit for a motor having a tapped winding. Fig. 2.—Condenser assembly for the circuit shown in Fig. 1.

Fig. 2 shows a simple and compact capacity unit which provides the necessary combination. It consists of two outer electrodes A, B, with two interposed plates C, D, which extend only partly through the separating-layer of dielectric. The capacities C1 and C2 of Fig. 1 are provided between A and C, and B and C, respectively; the capacity C3 between A and B; and the capacities C4 and C5 between A and D and B and D respectively, the plate D being connected to earth.

P. A. Sporing and the Telegraph Condenser Co., Ltd. Application date December 23rd, 1935. No. 449742.

The British abstracts published here are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each. A selection of patents issued in U.S.A. is also included.