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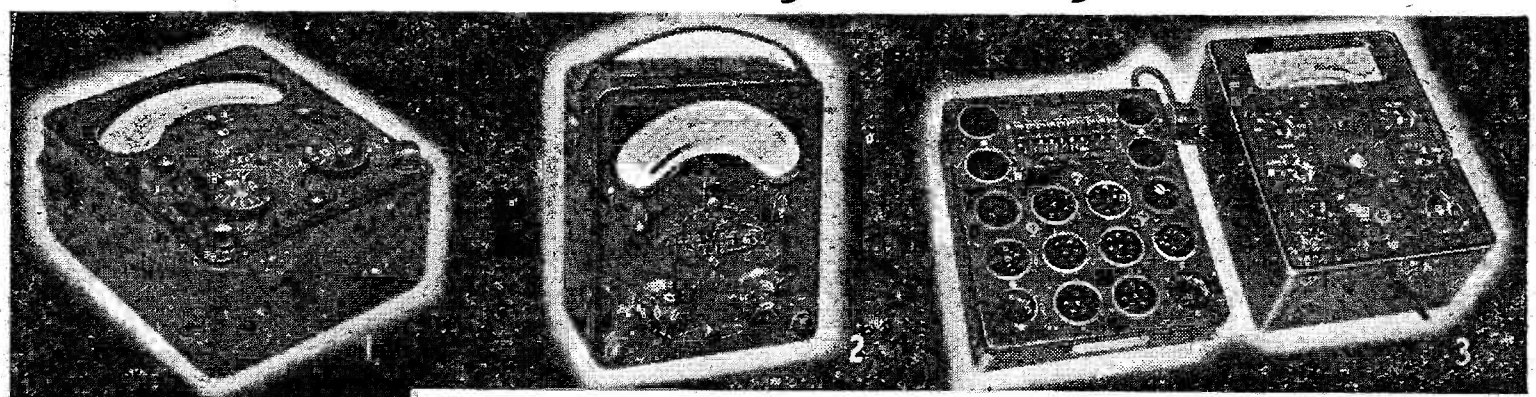

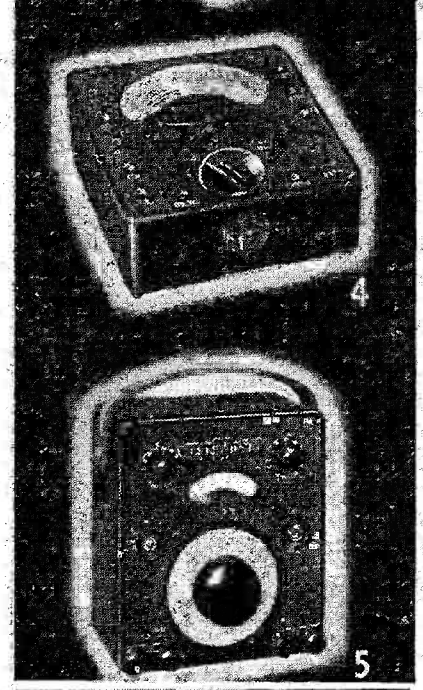

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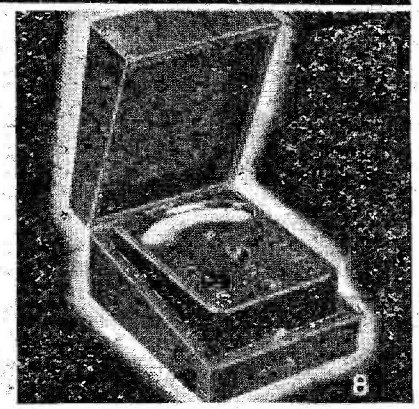

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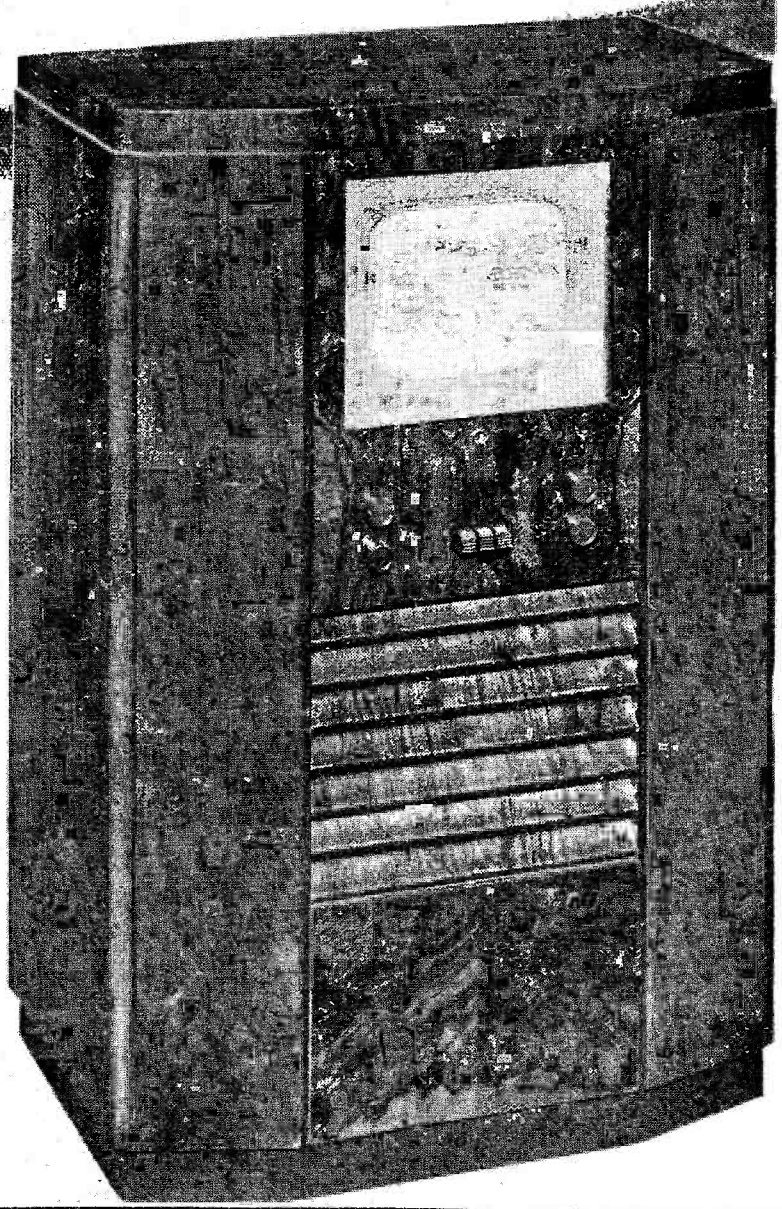

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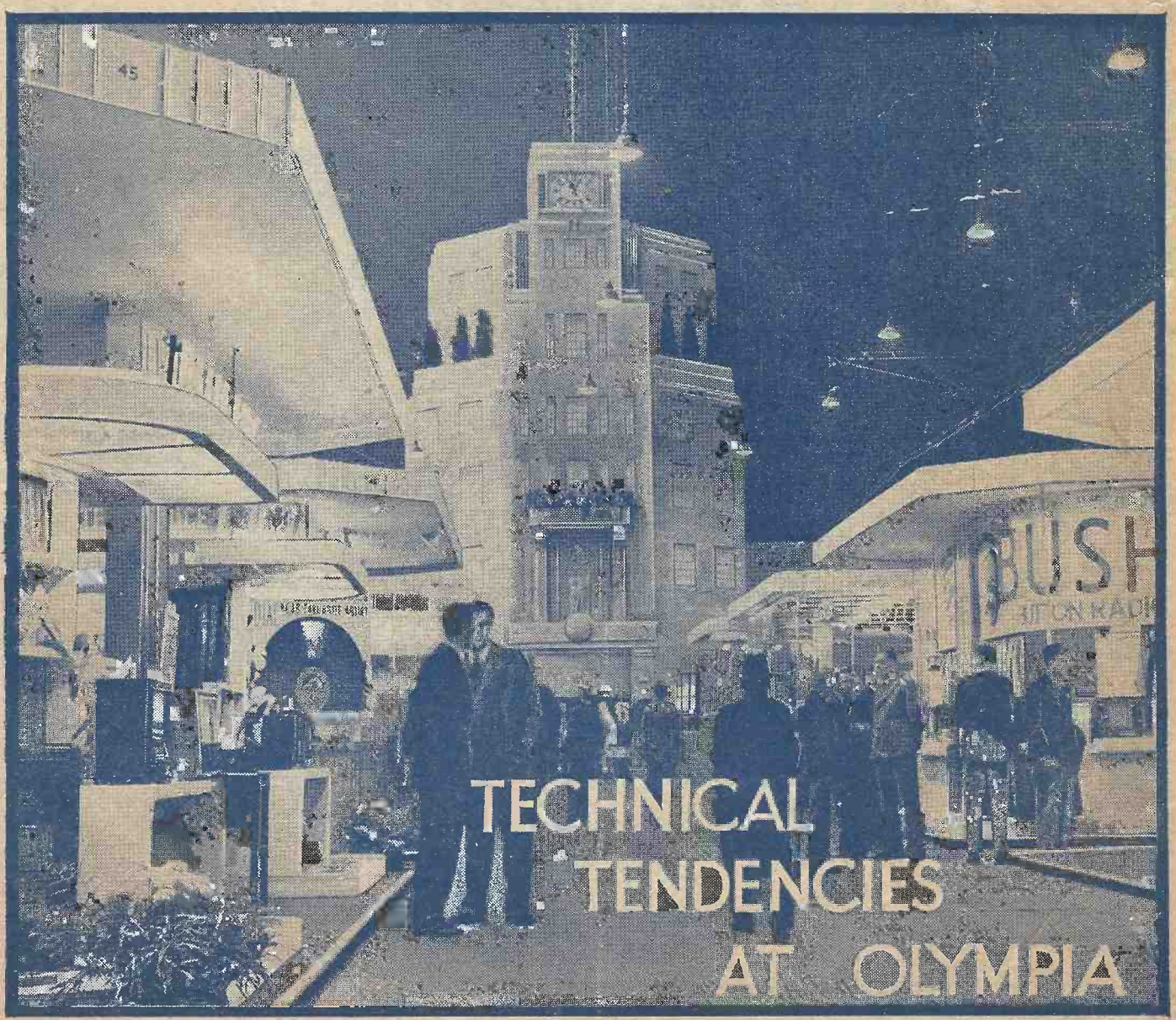
SHOW REVIEW

The Wireless World

6D.

THE PRACTICAL RADIO & TELEVISION JOURNAL

Thursday, August 31st, 1939.



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Editorial Comment

Broadcast Receivers : 1939-40

Trend of Design

THOUGH held under the shadow of grave international events, the Olympia Show is at least fulfilling one of its most important functions as the focal point of the wireless calendar. It has served to prevent stagnation, and to keep those responsible for the design of apparatus on the alert for new ideas.

Quite a minor detail of the less expensive type of broadcast receiver will illustrate the danger of accepting standardised practice as final. When "all-wave" sets with a single short waveband were first introduced the coverage was usually roughly from 16 to some 50 or 60 metres ; the 13-metre band was omitted. Long after the difficulties associated with operation at the lower wavelengths had been overcome, designers still clung to the same waverange. Now confidence in the correctness of that choice is shaken by the introduction of at least one set with a single short-wave band of 12.5–35 metres. It may be argued that the 13-metre band which is thus included is of much greater value than the 49-metre band that is omitted.

Improvement of quality of reproduction, largely brought about by increased output power, is a tendency that will be generally welcomed, especially as it is now to be found in sets that are by no means costly. Ingenious methods of overcoming or at least minimising the natural limitations that restrict the performance of the smaller cabinet model have been devised.

Tone control has lately been in the limelight, and those who have followed the correspondence on "Reproduction Levels" in our columns will have gathered that there is a school of thought holding that its use is wrong, at any rate for local-station "quality reception." Without entering into that controversy, it will be agreed by everybody that the crude form of control included until this season in the majority of cheap or medium-priced sets was hopelessly inadequate. The more refined systems to be found in some of the new sets do at least provide some scope for the listener who takes the trouble to learn how to use his receiver controls intelligently.

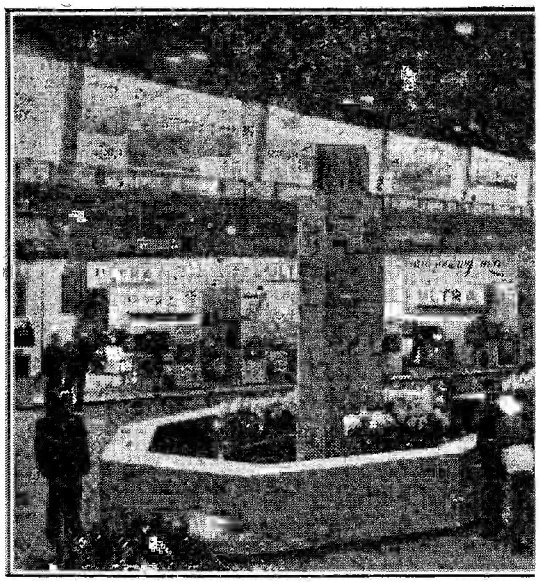
The new highly sensitive sets, in the design of which special attention has been paid to the short-wave bands, should serve as a useful link between the ordinary all-wave broadcast set and the "communication" receiver which, fascinating as it is, may perhaps be a little too complex for the majority of wireless users. These high-performance sets, and also the need for extreme stability in press-button tuning systems, account for the increasing use of low-loss ceramic insulating materials in the manufacture of various components.

The attractions of dry-cell LT batteries for portables and similar sets designed for intermittent use was urged in these pages even before recent valve developments made this an entirely practical proposition for the man in the street. The new "all-dry" portable should do much to establish the auxiliary set in its proper place.

Perhaps the most important tendency in the design of television receivers is towards the use of bigger tubes. The public still has the lingering idea that television pictures are "too small," and the change should help to forestall criticism on those grounds.

SHOW

Technical Tendencies



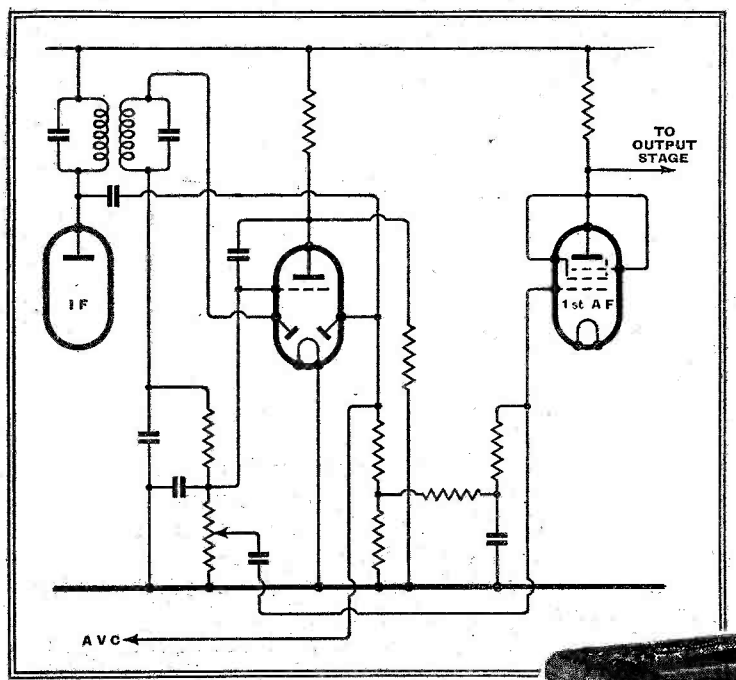
Special Report Compiled by the

New Broadcast Receivers

"Solid Work Has Been Done"

THOSE who last year foretold a period of stagnation in receiver design as the result of a shifting of the focus of publicity from broadcast sets to television have been proved indifferent prophets by the course of events. Relieved of the necessity of appealing to the eye, designers have been able to concentrate on performance, and some really solid work has been done on the clearing up of background noise and the improvement of tone.

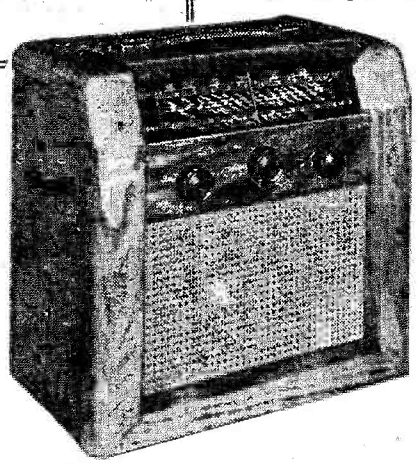
In place of the struggle to outdo competitors in the number of valves, gadgets and exclusive selling points, one finds general acceptance of the four- or five-valve superheterodynes, with or without a stage of RF amplification, as the circuit giving all the range and selectivity required by the average listener, and a concerted effort to make it as pleasant to the ear as it has always been to the eye.



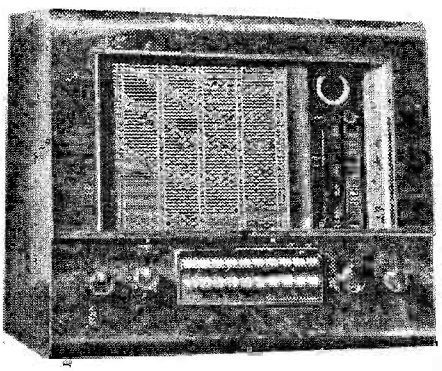
Every effort is being made to rid the set of extraneous noises of all kinds, and the widespread use of valves designed to give the maximum signal-to-noise ratio is significant. Automatic noise suppression circuits are coming to the fore again, and a simple but effective method is to be found in the Cameo Model AWB designed by Gordon Elf, Ltd. In this superheterodyne receiver the triode portion of the second detector stage is allotted to noise suppression instead of AF amplification, a separate AF valve being included to take its place. The input circuit of the triode section is connected in parallel with the volume control and due to the Miller effect in the valve it represents a capacity the value of which will depend upon the amplification factor. On a strong signal the DC component of the rectified signal will bias back the valve and reduce the amplification factor, and hence the capacity across the volume control. With a weak signal, on the other hand, the valve will reflect a high capacity and so reduce the high frequencies developed across the volume control. Another interesting feature of this set is that the AF amplifier is also controlled by the AVC bias.

Successive economies during past years in the proportion of cost allocated to the output stage and loud speaker have been proved bad business and the pendulum has swung in the opposite direction. There is now keen competition to provide the finest possible quality of reproduction, and many of the current table models give results every bit as good as last year's consoles or radio-gramophones.

A battery receiver with an unusual circuit, the Cameo Model AWB, in which the triode section of the second detector is used for noise suppression and AVC is applied to the AF amplifier.



The improvement is due primarily to the general increase in the power-handling capacity of output stages; the 3 watts, which was thought adequate two years ago, is found only in the cheapest models. No receiver with any pretensions to quality claims much less than 5 watts undistorted, and the tendency is for powers to rise considerably above this figure. The H.M.V. Model 1200, with 10½ watts, and the G.E.C. Model 4010, with 12 watts, are good examples of the trend towards increased power output in the better class of table models. Even higher ratings are to be found in the Alba Model 855 (16 watts) and Burndept Model 290 (18 watts).



A 9 kc/s whistle filter is included in the Bush PB65.

There is evidence also that manufacturers are giving more attention to the reduction of harmonic distortion and that this drive is resulting in a return to the triode as an output valve. Cossor, who have consistently held to this type in many of their receivers, are using it in the Models 70 and 71, and in the Bush Model PB63 triode valves are used throughout the AF portion of the circuit. To compensate for the lower amplification available an additional triode stage has been inserted as a "driver" before the output stage.

Next in importance to the improvements in output circuits is the work that has been done on tone control. In place of the crude resistance-capacity circuit giving a wholesale cut in the treble which extends well down into the middle register, scientifically designed tone controls, usually with four positions, give exactly the right frequency response for the recep-

Staff of "The Wireless World"

REVIEW
Revealed at Olympia

tion conditions which fall under the headings of "High-Fidelity," "Normal," "Foreign" and "Long Distance."

In the McMichael sets a switch effects suitable combinations of two degrees of selectivity in the IF stages with bass "boost" by selective negative feed-back in the output stage. Ekco favour a continuously variable tone control which simultaneously adjusts bass and top lift networks included in the negative feed-back circuit, while in the G.E.C. sets adjustment is made for both bass and top in the AF coupling circuits after a general increase of overall amplification. The new Philips tone control is designed to give a sharp cut-off of high frequencies without affecting the middle register. Instead of returning to earth, the by-pass circuit across the anode of the output valve diverts the high-frequencies into the negative feed-back circuit, thus giving a much steeper cut-off. The normal feed-back is variable and is coupled to the volume control in the latest Philips set. Back coupling is greatest when the volume control is turned down on a strong local signal; with the volume control at maximum on weak stations, feed-back is reduced and full amplification restored to the circuit.

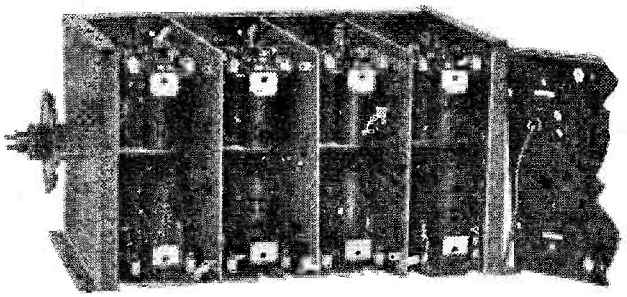
The introduction of 9 kc/s whistle filters in standard production models is indicative of the extension of the usable frequency range, and the Ekco PB515 and Bush PB65 may be quoted as examples. Ten-inch loud speaker diaphragms are the order of the day in table models, and with the judicious lifting of bass in the circuits, really good low-frequency response free from the defects of resonance is obtained from receivers such as the R.G.D. 166.

So much for the table model sets which form the backbone of the industry. What of the developments in other directions? The table model radio-gramophone can hardly be hailed as new, but the McMichael Model 903 and the Decca 39TGM point to a revival of interest in what is undoubtedly a very attractive type.

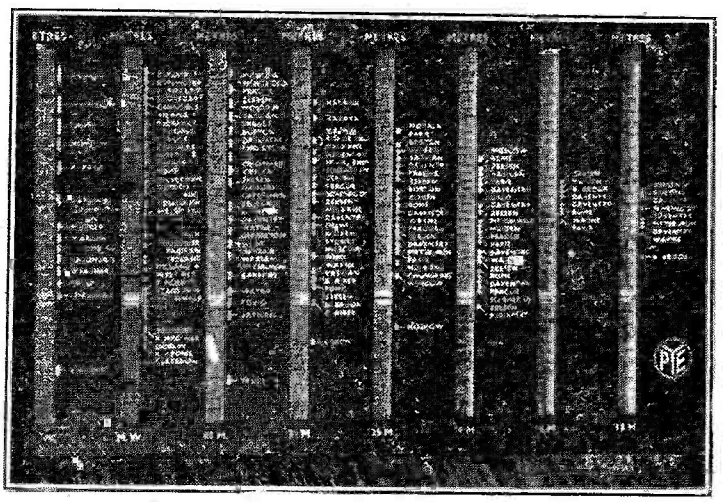
There is also a tendency to separate mutually conflicting interests in broadcast listening and to provide, within a given price limit, specialised receivers for good quality reception of signals of outstanding programme value or, on the other hand, highly sensitive sets for long-distance short-wave transmissions. The Murphy 74 and 76 are good examples of this policy. In the latter, separate tuned circuits are allotted to each of the principal short-wave broadcast bands and the tuning of each band is expanded to the full depth of the tuning scale.

The Pye "International" is another receiver in which band spread tuning has been applied in the short-wave range. Each band is calibrated not only in wavelengths but with the settings and names of the principal stations in their correct order. As far as we are aware, this is the first instance of accurate station calibration on short waves. The oscillator circuit for each band is tuned by a stable fixed capacity in conjunction with a separate short-wave variable section of the main tuning condenser. Separately adjusted image rejection circuits are also provided for each waveband.

Highly efficient short-wave circuits are also to be found among the products of the luxury set manufacturers. The export model of the de luxe McMurdo Silver receiver employs coils wound on polystyrene formers. The windings of the aerial transformers are separated by electrostatic shields and on the lowest waveband unity coupling is achieved by passing the primary through the silvered copper tube which forms the secondary. To preserve the high "Q" of the coils the connections to earth and to the tuning condenser are made with multi-strand silvered braid. Another interesting feature of this particular set is a direct-coupled system of AF amplification giving a considerable extension of level frequency response at both ends of the scale.

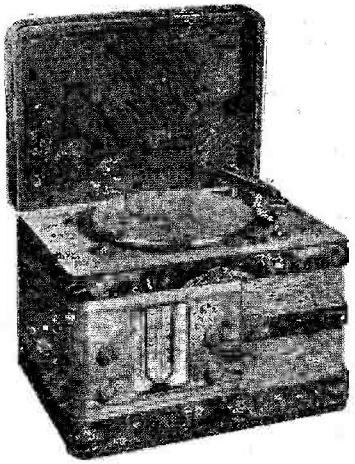


Short-wave coil assembly in the Murphy 76.



Individual calibration of short-wave stations is a feature of the Pye "International" tuning dial.

The Dynatron "Commander" chassis shown on the Keates-Hacker stand is virtually three receivers in one. A straight circuit is provided for local station reception, a "normal" superheterodyne with a redesigned variable selectivity system giving true band pass characteristics even at 4 kc/s band width is employed for general



McMichael table model radio-gram. Model 903.

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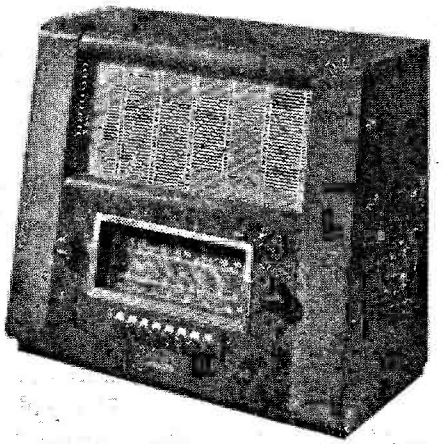
reception, and on short waves a double superhet. circuit with *two* RF stages is brought into operation. There are twenty-

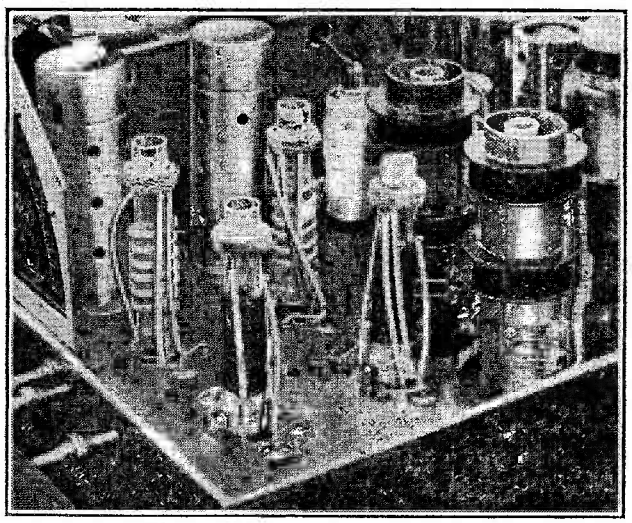


Philco B.2 all-dry battery superhet with push-button tuning.

five valves in the circuit, four of which are triodes working in push-pull to give an undistorted output of 20 watts. Refinements include noise suppression circuits, a manually operated adjustable whistle filter and a cathode ray indicator for grid current in the output valves. The chassis is built on a machined aluminium casting and costs £165.

The humble portable has this year provided one of the most interesting and practical technical developments. New valve types have been introduced which enable the filament current to be derived from dry cells which in some cases are built into a unit with the HT battery. The capacities of both batteries are adjusted so that they run down together and a life of 250 working hours may be taken as an average. Usually the HT battery is arranged to run down just before the LT, as the efficiency of the valves is quickly affected by a fall in the filament volts, which should not drop much below 1.1 volt. With the standard batteries available these conditions will be met by allowing for an LT current of 0.25 amp. and an HT current of 10 mA.

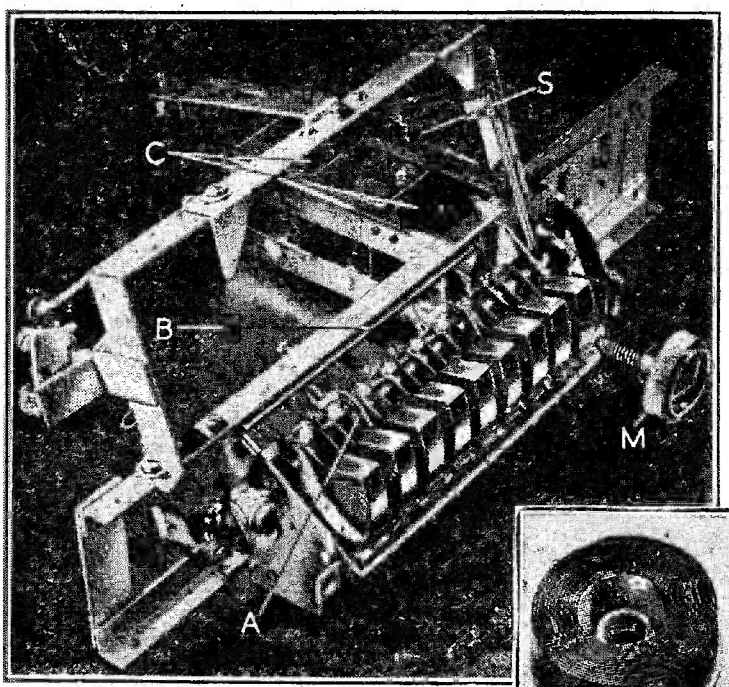
The circuit usually adopted is a 4-valve



In the McMurdo Silver de Luxe export model the short-wave coils are wound on polystyrene formers.

superhet., and the Philco P429 was one of the first portables of this type to be produced in this country. Other notable examples shown at Olympia are the Decca-Brunswick Model 42 and the Vidor Model 320. The advantages of all-battery operations are equally important to the country dweller, and there are signs that we shall see a number of table model receivers working on this principle. In the meantime, for those who wish to acquire a set of this type, there are, among others, the Ferranti Model 539 and the Philco B2, the latter with push-button tuning.

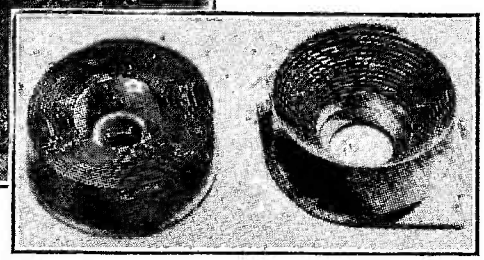
The alternatives of dry battery or accumulator supplies for LT current are available in the Cameo Model ARP. This set uses standard 2-volt valves which may be run direct from an accumulator, or from a 3-volt battery through a barretter lamp. Yet another alternative source of power supply is provided in the



Philco "Twin Miracle" portable. This includes a rectifier and smoothing circuits for operating the set from AC/DC mains in addition to the self-contained all-dry battery supply. A relay is included which automatically changes over the supply circuits and keeps the set operating without any break in the programme if the mains supply fails.

Push-button tuning systems, many of which were rather hurriedly produced for last year's show, have overcome their teething troubles and have been further simplified in operation. Most of the permeability-tuned sets now make use of the improved switching arrangement which automatically switches on the set when any button on the receiver is pressed, and in the Murphy remote control system a motor is used to select the appropriate pre-tuned circuits. The simpler mechanical systems which call for separate operation of the wave range switch are generally supplied with much clearer indications of the waveband in use, and a good example is to be found in G.E.C. sets in which a "fluorescent" bar of colour shows immediately above the row of controls.

In the new Philips direct-action mechanical tuning system, wave changing is effected automatically by an auxiliary link motion associated with three of the operating keys. A rocker bar B connected to the wave-range switch S is pulled forward by the claw A when one of these keys has been set up for a long-wave station. When the key is required for a medium-wave station the claw is dropped and a second bar, not shown in the photograph, is pushed forward by a cam underneath the key which restores the switch to the medium-wave position. A special adjusting tool is provided, and the wave range obtained depends on whether or not the key is depressed when the adjustment of the station is made. The tuning condenser C is of the linear action type used last year, and for manual operation the vanes are engaged by a screw thread operated by the knob M. The spiral vanes in this year's type are shaped to give linear frequency response.



Philips push-button tuning system with automatic wave-range selection, and (inset) the modified condenser vanes giving straight line frequency characteristic.

Important modifications have been made to the Ekco motor-driven automatic tuning system. The contacts of the homing disc are now provided by metal rollers, designed to overcome the inaccuracies which result from sparking and burning of the edges of discs of the normal type. New selector clips with machine-cut key-type contacts have been developed for use with the new roller contacts, and high accuracy of location is claimed.

The driving mechanism has been speeded up, and is provided with a reverse-vernier device of clever design. The gear wheel G driven by the motor pinion carries a bridge B with a peg P engaging in a slot in the link L. When the

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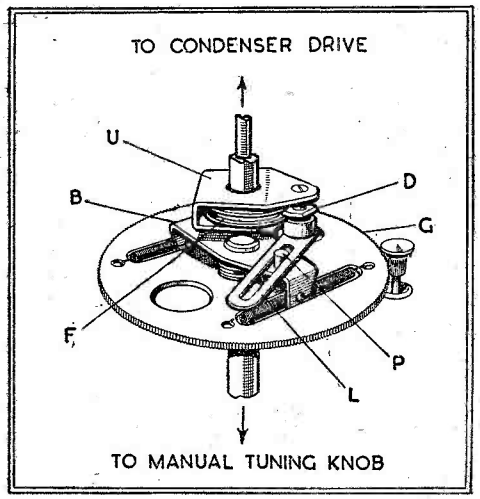
motor is first switched on the peg travels to the bottom of the slot and drives round the bracket U, to which the tuning condenser is coupled, at the same speed as G. When the contacts on the homing disc reach the appropriate selector clip they overshoot slightly and the motor is reversed. The peg now travels along the slot and imparts an angular movement to



Reverse-vernier mechanism in the Ekco high-speed motor tuning system.

the link L, thus engaging the friction wheels D and F. Since F is fixed the rotation imparted to U and the condenser drive is opposite to the direct drive and the gear ratio is enormously increased by the combined action of the link motion and the reduction introduced by D and F. Incidentally, the edge of the friction wheel D is cut away so that it disengages when the peg is in the bottom of the slot during the high-speed drive.

The final centring between the roller contacts of the homing disc is made with such precision that the need for AFC circuits in the receiver is eliminated. Adequate steps have been taken to offset the possibility of increased wear with the higher initial motor speed and suitable shock-absorbing springs have been included in the drive.

In principle the waveband selector mechanism, termed by Ekco the "Radio Brain," remains the same as last year, but a corresponding increase in speed of operation has been met by the introduction of ball contacts.

Special apparatus for life-testing of automatic tuning systems was shown in action by Ekco, Philips, and a number of other firms and the severity of the tests applied should convince sceptics of the reliability of this year's designs.

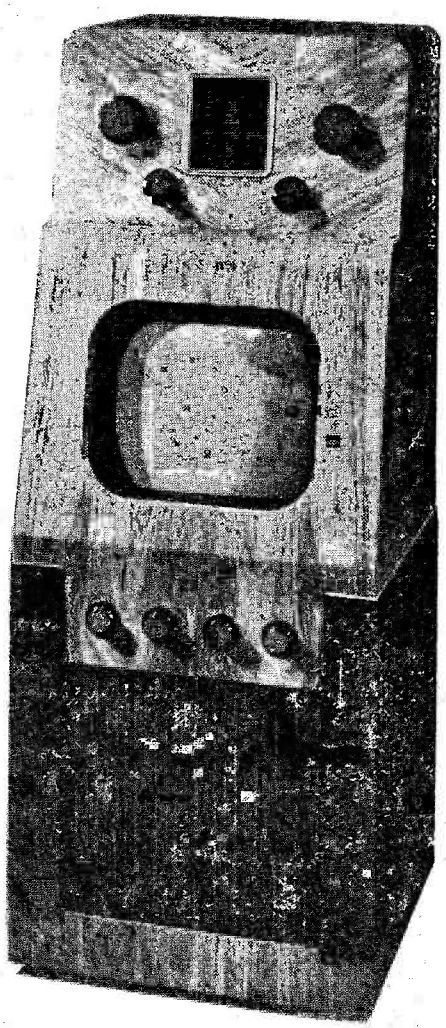
Television Receivers

No Standardisation Yet

A TREND in the development of television receivers which was clear last year has now become normal practice —the use of electromagnetic deflection and focusing instead of electrostatic. Nearly all the receivers are of the magnetic type. This is not necessarily due to any inherent technical superiority of the magnetic system, but usually to the economic element. Most people find it easier and cheaper to obtain a given standard of performance from a magnetic tube than from an electrostatic. Not everyone does, however, and electrostatic tubes are still to be found, especially in the smaller types.

Probably the most obvious trend this year is towards the use of larger tubes; there are now fewer sets with tubes less than 7in. diameter and more with tubes over 12in. Tubes of 14in. and 15in. diameter are, in fact, not uncommon, but the most usual sizes are still 9in. and 12in.

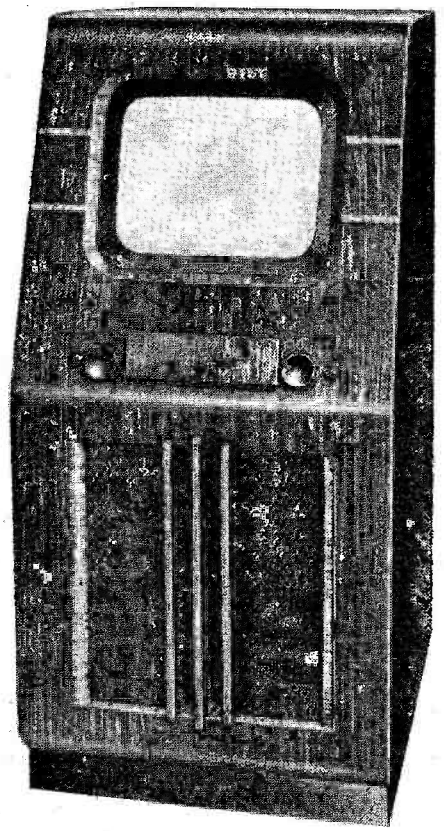
The superheterodyne is still the favourite type of vision receiver, although there are quite a number of straight sets to be found. The usual procedure is to employ one RF stage, frequency-changer, three IF stages, a diode detector, and one VF stage. Insofar as television has achieved any degree of standardisation, and it is still very small, it is in this valve arrangement. But although this may be the basis of many vision receivers there is a much greater lack of uniformity about the arrangements for sound reception. It is usual to make the early stages function for both channels, but the number of stages in common varies in different sets. There is probably a greater tendency than



Murphy V88 receiver with all-wave sound equipment.

before to make the vision and sound receivers entirely separate, since this simplifies the arrangements necessary for operating the sound receiver alone—a facility which most sets now include. It is clearly wasteful if one has to operate the whole vision equipment if television sound only is wanted.

The small degree of standardisation to be found precludes any general discussion and it is much more informative to consider in some detail a few representative examples of modern practice. Murphy Radio, for instance, adopt a superheterodyne. The RF stage is followed by a two-valve frequency-changer and an IF stage which has a sound rejector in its cathode



In the Pye receiver "occasional controls" are behind a small panel.

circuit; these three stages function on both sound and vision channels. The signals are then separated and each has a further IF stage of its own. The vision channel feeds a diode detector which in turn feeds a VF stage. The tube is fed from the anode of this and the sync separator, which consists of a duo-diode, from the cathode. Cas-triode time-base oscillators are used with tetrode amplifiers feeding the line and frame deflecting coils.

In the case of the sound channel, following the common first IF stage the signal passes to a second stage and thence to a diode detector and noise suppressor. The AF output is taken to the last IF valve, which is thus reflexed, and finally to the output pentode.

The noise suppression circuit is an interesting variation of the common peak limiting circuit in which a diode is biased so that it is non-conductive over the range of signal modulation voltages, but conducts and virtually short-circuits the output on higher voltage peaks. In this case a fixed diode bias is not used but the signal itself

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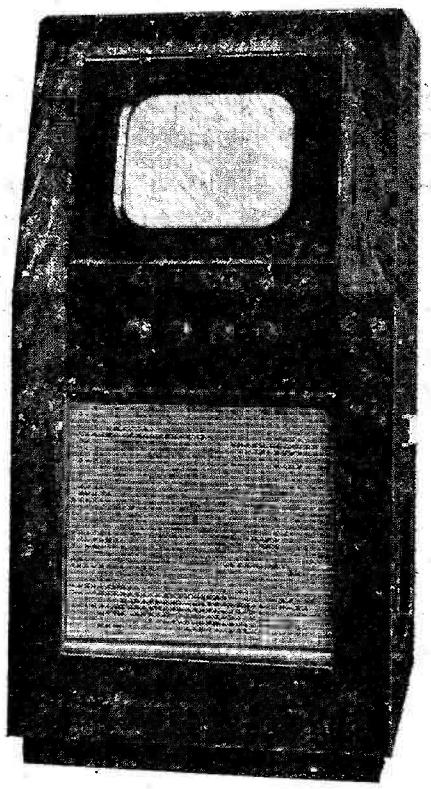
provides the bias. The bias is actually the signal derived from another point in the circuit and fed to the diode through a delay network. It is claimed that much more effective noise suppression is obtainable in this way.

In its smallest form this receiver is the V84 giving a picture 7½in. by 6in., but it is available with substantially the same circuit with a 12in. tube.

A receiver of an entirely different type is the Pye. This is a straight set with five RF stages using band-pass intervalve couplings. An anode-bend detector is used and its output is fed to the cathode of the CR tube. A duo-diode sync separator is used and is followed by an amplifier. A single hard valve forms the frame time-base oscillator, but for the line scan the oscillator, which is again a hard valve, is followed by an amplifier. Magnetic deflection and focusing are employed.

An entirely separate receiver is used for sound and this has two RF stages, detector and output valve. The mains equipment for vision and sound channels is also separate.

One very interesting feature of this apparatus is its mechanical arrangement. All the "occasional controls" are mounted on the front of the chassis and accessible from the front through an opening which is normally covered by a small hinged lid. For servicing, it is only necessary to undo two screws. The chassis then slides backwards and downwards on sloping supports until two large hooks on its rear edge engage with a horizontal bar across the cabinet. The chassis is then



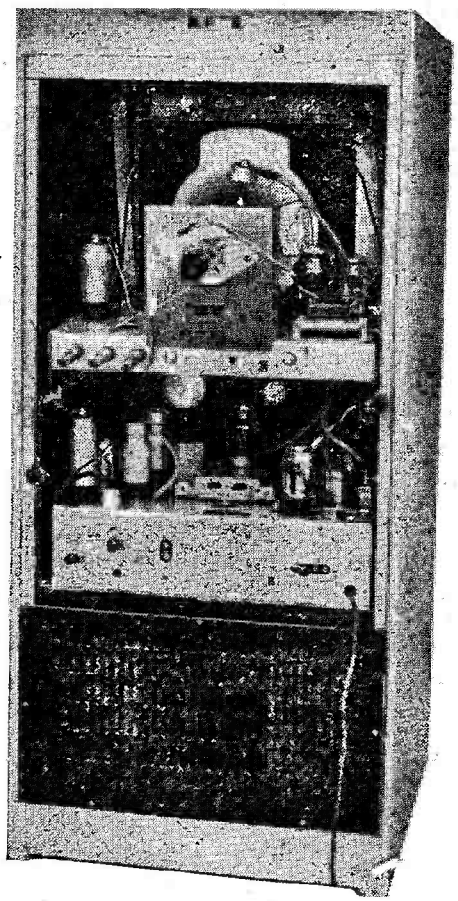
Ekco Model TSC902.

pivoted on this bar and can be swung right out and examined and operated in an inverted condition. Folding struts for holding the chassis in this position are even provided.

The model 12C has a 12in. tube and is also available with an all-wave receiver or with a radio-gramophone. There is also a smaller set, the 9C, with a 9in. tube.

Baird also adopt a straight set for vision and use two RF stages with secondary emission valves, a diode detector, and one VF stage. A triode sync separator is employed and feeds the time-base oscillators through separate diodes. Hard valves are used in the time-bases. There is one valve for the frame scan, and another for the line, but this is provided with a damping diode. The oscillators feed the deflecting coils without the intermediary of an amplifier.

A separate receiver is employed for sound and consists of a superheterodyne with a triode-hexode frequency-changer, one IF stage, duo-diode detector and AVC system, a pentode AF stage and a pentode output valve. This is a three-band broadcast set; for television sound the same receiver is used, but then the AF stage is reflexed and acts as an RF stage also.

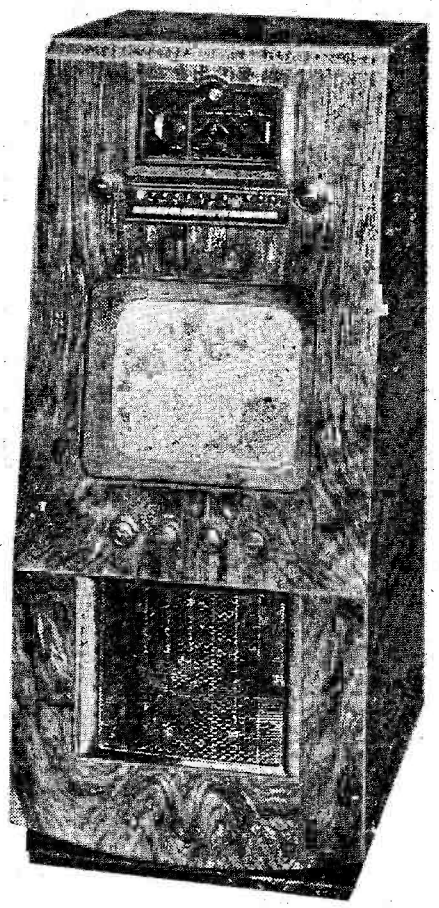


The Baird T27 television receiver.

This is the model T25 with a 12in. tube. Both smaller and larger sets are available, with 9in. and 15in. tubes, and they are also available with provision for television sound only.

Bush receivers are again of the straight type. Three RF stages are used with a diode detector and one VF stage. Gas-triodes with pentode amplifiers are used in the time-base, however, and the 12in. tube has electromagnetic deflection and focusing. Separate power units are employed for the vision and sound receivers, the latter being a superheterodyne with push-button tuning.

Another adherent of the straight set is Ekco. Three RF stages, diode detector, and one VF stage are used. Band-pass coupling is employed and a wavetrap is included in the suppressor grid circuit of the second RF valve in order to avoid in-



H.M.V. 1850 all-wave broadcast and television receiver.

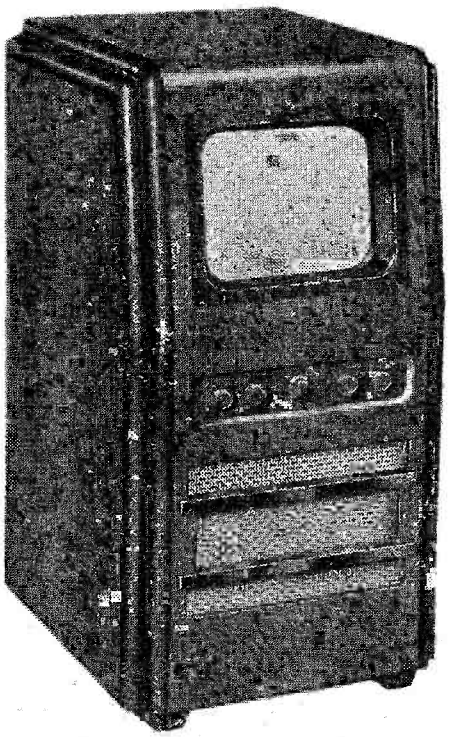
terference from the sound channel. The contrast control varies the bias of both control and suppressor grids of the first stage, this dual control being adopted in order to maintain the input resistance and capacity of the valve at a nearly constant value.

Two diodes and a pentode are used for the separation of the sync pulses and their subsequent amplification and in the time-bases gas-triode saw-tooth oscillators are used. The tube is of the electromagnetic type.

For sound reception a separate receiver is used with two RF stages followed by a duo-diode-triode. In the case of "add-on" units the output of this valve is brought out for connection to the pick-up terminals of any standard broadcast set. In other models it feeds a pentode output valve.

Both H.M.V. and Marconiphone adopt the superheterodyne and have very similar receivers. The details vary somewhat in the different models, but the H.M.V. 1802 and the Marconiphone 712 both start with an RF stage and have a triode-hexode frequency-changer followed by two IF stages. All these stages are common to both vision and sound channels and their

separation is accomplished after the second IF stage. Each channel then has a further independent IF stage.

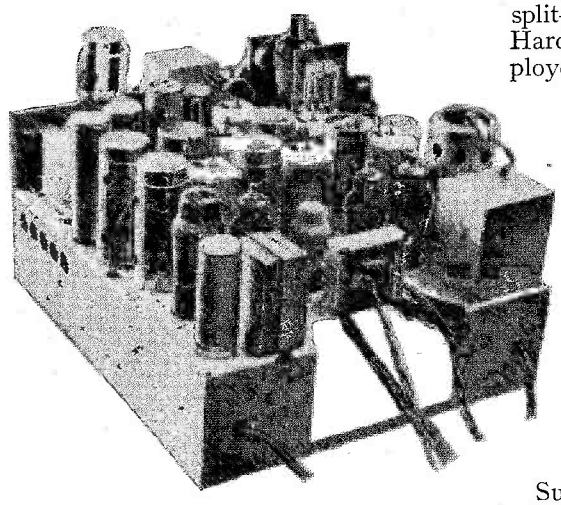


The Cossor 131 with 13½in. tube.

The sound IF is fed to a duo-diode, which acts as a detector and noise suppressor and is followed by a triode AF amplifier and tetrode output valve. On vision a diode detector is used with one VF stage and the output of this is fed to the cathode of the CR tube. A diode followed by a limiter is used for sync separation.

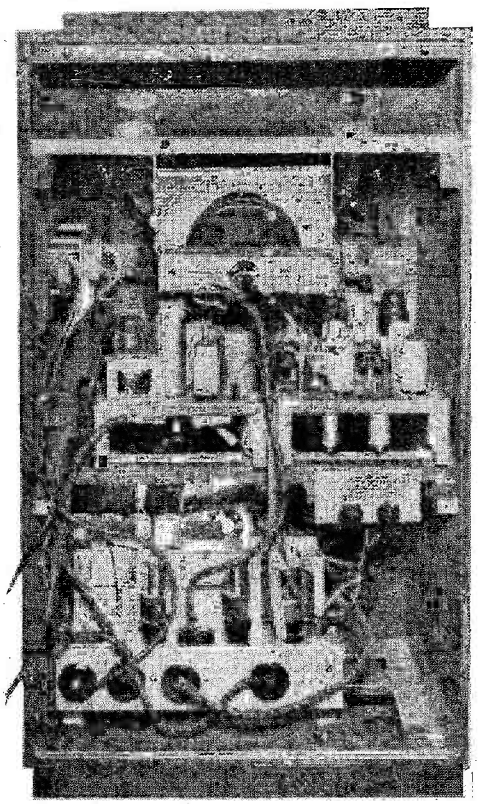
Hard-valve saw-tooth oscillators are used in the time-bases and are provided with tetrode output valves. Focusing and deflection are both electromagnetic. The tube has a diameter of 14in. and so gives a picture 11⅝in. by 9⅜in.

Cossor are also adherents of the superheterodyne. The model 131 is for television only and has a 13½in. tube; the picture obtained is 10in. by 8in., the usual size for a 12in. tube. By designing for a somewhat smaller picture than usual for the tube diameter a much flatter picture is secured. Magnetic focusing and deflection are adopted and a permanent magnet is employed for focusing, an arrangement which is also adopted by Ferranti. Rough adjustment of the field is obtained by a sliding sleeve on the magnet and precise adjustment by a small variation of gun volts.



Chassis of Marconiphone television receiver.

The receiver has one RF stage and a triode-hexode frequency-changer followed by three IF stages for the vision channel and two for the sound. The output of the latter is taken to the detector, with which is incorporated a noise suppression circuit. The output valve is a pentode. On the vision side a full-wave diode detector is used, followed by one VF stage, and a split-anode pentode for sync separation. Hard-valve saw-tooth oscillators are employed with pentode amplifiers.



The interior of the R.G.D. 393 television receiver.

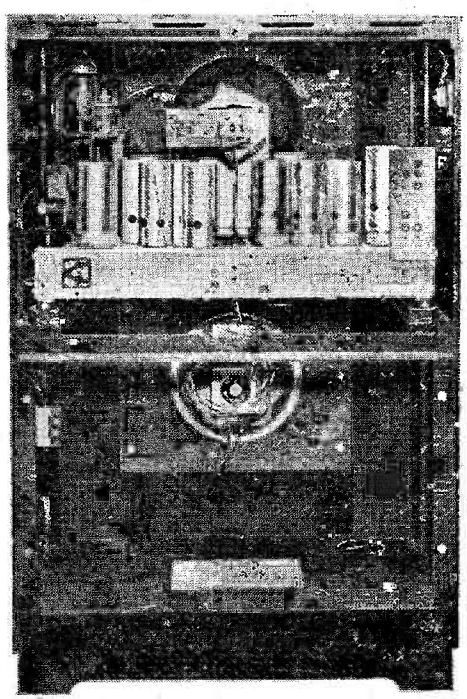
A similar receiver incorporating an all-wave broadcast set is also available. This is the model 151. It has a 15in. tube giving a picture 12in. by 10in. and for broadcast reception the major part of the television sound equipment is used and preceded by a frequency-changer. Push-button tuning is provided with permeability trimmers and allows of four MW and two LW stations being obtained. Provision is made for manual tuning over three wavebands.

Superheterodynes are used by the G.E.C., but the method of deflection varies. In the case of the smaller models electromagnetic deflection is used. These are the BT.0091 and BT.0092 and are similar save that the former provides only television sound while the latter includes a broadcast set. They have a 9in. tube giving a picture 7½in. by 6in. The large receiver, BT.0124, has a 12in. electrostatic tube and gives a picture 10in. by 8in. This model includes an all-wave receiver and gramophone equipment with an automatic record-changer.

In the R.G.D. superheterodyne the frequency-changer, which is preceded by an RF valve, is of the two-valve type and consists of an RF pentode mixer with a separate oscillator. The sound and vision channels separate immediately after the mixer and on sound there are an IF stage, duo-diode-triode, and pentode output. On vision three IF stages are adopted with diode detector and one VF stage. The sync separator comprises two diodes with an amplifier for the frame pulses. The saw-tooth oscillators are gas triodes with pentode amplifiers. Magnetic deflection is used. There are two models—the 393 with a 12in. tube and the 391 with a 9in.

Decca models are superheterodynes and magnetic deflection is used with a 12in. tube. There is an RF stage and sound and vision are separated just after the frequency-changer. Two IF stages are used on vision and there is one VF stage.

The Philips and Mullard receivers are unusual in that only the RF stage is common to vision and sound. Two frequency-changers are used, the vision IF being taken from one and the sound IF from the other. Secondary emission valves are employed. The picture size is 7¼in. by 5¾in. in the case of three models, but there is also one giving a picture 10in. by 8in. and in addition this firm makes a projection model with a picture 18in. by 14½in.



G.E.C. Type BT.0092 with all-wave broadcast set.

The Scophony receivers differ from others in being mechanical. The smallest gives a picture 18in. by 14½in. The vision

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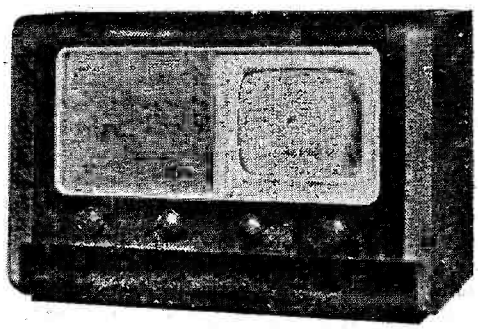
receiver is a straight set with two RF stages and a diode detector followed by a VF stage. Then comes a DC restoration



Philips 2405 table-model television set.

circuit and the modulator for the oscillator which drives the quartz crystal of the light control cell. The sync pulses are separated and amplified, and used to control the motors driving the scanning drums.

Electronic Devices

Valves—CR Tubes—Multipliers

SO far as valves are concerned the trend of development has now taken two distinct branches and although there is a possibility that in the future these branches may reunite, it seems more probable that they will continue to diverge. The two branches are television types and ordinary receiving valves, and the fact that their development is proceeding on different lines does not mean that they have not some improvements in common nor that their uses are rigidly confined to their classification. So-called television valves are sometimes used in apparatus other than television receivers.

The general trend among television RF pentodes is towards higher values of mutual conductance with low values of interelectrode capacity. This, however, is coupled with a marked effort, present in all classes of RF pentode, to obtain a higher input resistance at ultra-high frequencies. At these frequencies the limit to possible stage gain is set by the product of mutual conductance and input resistance and with a given valve construction the one increases as the other decreases. New forms of construction are being adopted, therefore, in order to improve matters, and some of the latest types have perhaps the same mutual conductance as older specimens, but a much higher input resistance.

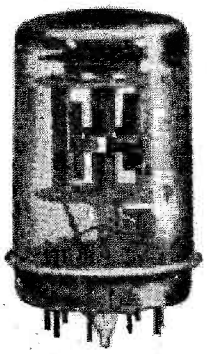
This increase of resistance is obtained by reducing the length of the internal leads of the valve, and this also reduces the capacities. The methods adopted by different makers, however, vary considerably. Some firms use a modified pinch for the electrode supports, others abandon it and use a short glass seal or even a glass ring forming part of the envelope.

The Mazda SP41 and SP42 have been available some time and are, consequently, quite well known; they have mutual conductances of 8.4 mA/v. and 9.0 mA/v. respectively, and the former has an input resistance of some 2,300 ohms at 45 Mc/s. The valves have the Mazda octal base. Marconi and Osram have the Z62 with a mutual conductance of 7.5 mA/v. and an input resistance at 40 Mc/s of 4,000 ohms; it is a pentode with the International octal base.

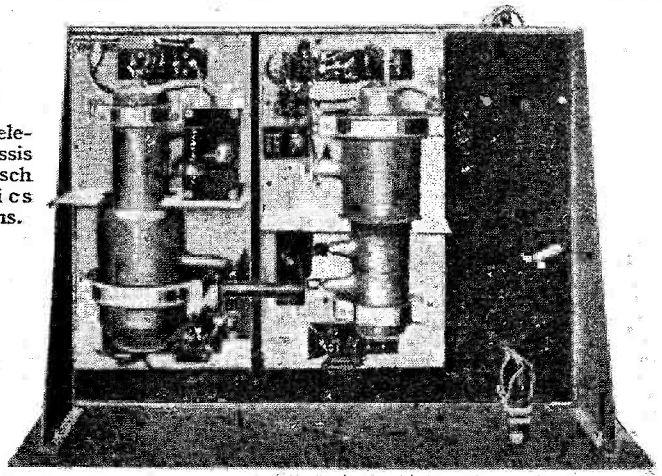
Mullard have two types. One is of more or less conventional type. This is the EF50, with a mutual conductance of 6.5 mA/v. It is a single-ended all-glass valve with a "ring" construction and 9-pin base. The other is the EE50 with a mutual conductance of 14 mA/v. This is of similar construction, but is a secondary emission valve.

Apart from RF pentodes, new television valves are chiefly low-resistance and low-capacity diodes. Mazda have the D1 with a 4-volt 0.2 A. heater, while Mullard have the T4D and EA50 with 4 v. and 6.3 v. heaters respectively, and the Marconi and Osram type is the D43 rated for 4 volts.

Listed for television application, although by no means confined to this, is a new triode-hexode frequency-changer, X62. This is a Marconi and Osram valve and has a conversion conductance of 1.75 mA/v., while the triode section has a high mutual conductance. Of particular interest is the fact that the cathode has two separate connections to separate pins in the base in order that interaction between the various circuits may be kept at a minimum.



Mullard EF50 all-glass valve.



(Right) Television chassis with Bosch Electronics Augetrons.

A duo-triode, the BL62, with separate cathodes, is another valve having interesting possibilities, as is also the U134. This is a most unusual valve since it consists really of two separate full-wave rectifiers, each with a rating of 350 v. 100 mA., in one envelope.

Cossor also have a triode-hexode of high conversion conductance, the 4THA, and a triode-pentode which is not intended to act as a frequency-changer. This is the 4TP and it is essentially a time-base valve. The pentode is designed to act as a discharge valve and the triode as a paraphase amplifier.

Turning now to non-television types, probably the most striking development is the production of valves for dry battery LT supply. These valves have 1.4-volt filaments and most types consume 0.05 A., but output pentodes naturally take rather more. Tungsram have a range with the American octal base which are the counterparts of American types. Mazda valves of this rating, however, are provided with the Mazda octal base. The range includes a heptode frequency-changer, an RF pentode, a single-diode-triode and an output pentode, and the valves are rated for a 90-volt HT supply. The valves, of course, have lower values of mutual conductance than the ordinary 2-volt type.

Mazda SP42 RF pentode.

Marconi and Osram adhere to this latter rating and have a triode-hexode which consumes only 0.2 A. filament current. This is the X24, and in a new output tetrode, the KT24, the current has been kept down to the same figure. The HD24 duo-diode-triode takes only 0.1 ampere.

These firms have also added high-slope valves to their 6.3-volt range. There are the KTW61 RF tetrode and the KT61 output tetrode—the latter having a mutual conductance of 10 mA/v. A complete range of 6.3-volt valves taking only 0.16 A. current has been introduced; this is the Uniwatt range, and in view of the low current it is of particular interest for car radio.

Changes have also been introduced in Cossor battery valves. Probably the most noticeable is the 210 VPA, which is substantially the same as the older 210 VPT, but has lower inter-electrode capacities.

A development of considerable interest is the electron multiplier. Although most obviously useful for television, it has many other applications, and a six-stage model has been developed by Bosch Electronics and is known as the Augetron.

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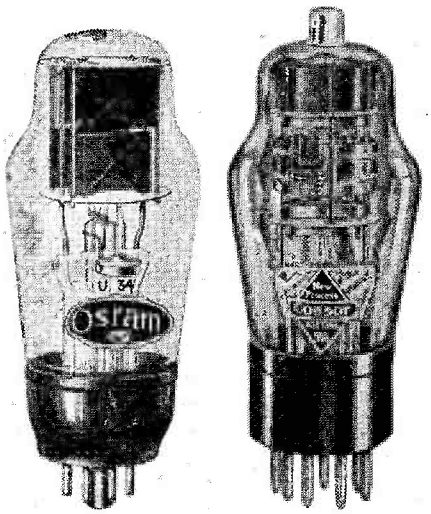
It requires some 300 volts per stage, or nearly 2,000 volts per tube. This high voltage does not seem of great drawback for television, since there appears to be no reason why it should not be obtained



Osram U134 double full-wave rectifier, and the Cossor 302 VPB pentode.

from the CR tube's high voltage supply. The multiplier has an overall mutual conductance of 40 mA/v. and an input resistance of over 20,000 ohms at 45 Mc/s; a gain of the order of 1,000 times is realisable from a single multiplier.

Turning now to cathode-ray tubes, Mullard have both triode and hexode types in both 9in. and 12in. sizes. The triodes are the MW22/3 and MW31/5, while the hexodes are the MW 22/2 and MW 31/6. The hexodes have two anodes to one of which a potential of about 250 volts is applied. Both types are for electromagnetic deflection and focusing.

Mazda tubes are of the short type and again are for magnetic deflection and focussing, while Cossor have both electrostatic and electromagnetic types. Oscillograph tubes, as distinct from television types, are listed by most firms and have screens ranging from about 1½in. to 4in. in diameter. Cossor have a split-beam tube.

Marconiphone have a range of television tubes ranging from 5in. to 14in. in diameter. These are of the triode type for electromagnetic deflection and focusing. Hexode tubes for magnetic deflection but electrostatic focusing are also listed.

Components and Accessories

New Products Reviewed

FOR some time past now the components that have been shown each year at Olympia have fallen within one of two distinct categories. On the one hand there are those parts designed and produced exclusively for set makers, while on the other are the components available to home constructors. The former are very largely sample productions showing the main features only, since modifications may have to be made to meet particular requirements.

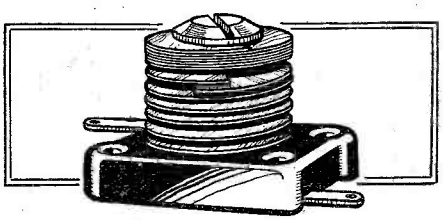
So far as the broadcast listener is concerned their main interest lies in the ability to examine and appraise the technical skill and workmanship devoted to the many individual items that go to make up a modern broadcast set.

Press-button tuning systems can be divided into two main categories, those that operate on the principle of mechanically rotating the gang condenser and those that consist of a series of switches to bring into use circuits previously tuned to the desired stations.

Motor-operated condenser units are shown by Garrard and by Plessey, while examples of the mechanically operated condenser can be found on the Polar stand.

Switch units are being shown by Bulgin, Plessey, Polar and Wearite, the last-mentioned embodying permeability-tuned coils.

With the introduction of this system of tuning a demand arose for fixed and semi-variable condensers of high stability, that

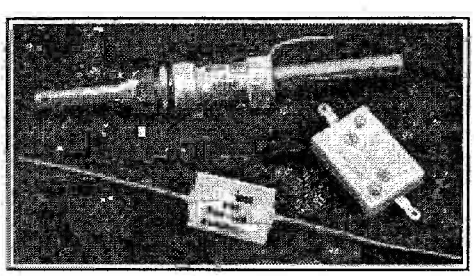


T.C.C. air-dielectric trimmer.

is to say, condensers that maintain their capacity unchanged over a long period and in varying temperatures. Actually this problem has occupied the attention of condenser makers for some time past, but even so improvements are still being made.

One method of construction is to deposit metal on sheets of mica, another is to use a base of ceramic material, while a third takes the form of air-dielectric condensers. Dubilier are showing examples of all three varieties and so are T.C.C. A series of metallised mica condensers, having protecting side plates and wire connections and with tolerances of two per cent. in capacity, have now been made available to the home constructor, while sundry improvements and extensions of range have been effected in other patterns.

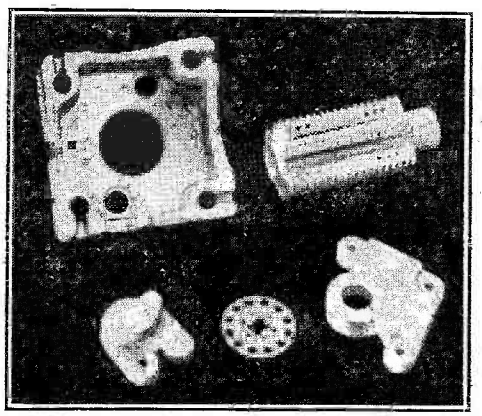
There is a T.C.C. air-dielectric trimmer



Dubilier air-dielectric trimmer and metallised mica condensers.

constructed on quite a new principle, as both moving and fixed vanes are cut in the form of a continuous spiral, the former interleaving with the latter when the adjusting screw is rotated. The idle portion of the moving vane concertinas into a compact space at the top of the unit. A feature of the condenser is its very small size, as the base measures 1in. × ¾in. only.

Bulgin has an improved range of silvered mica condensers, while other

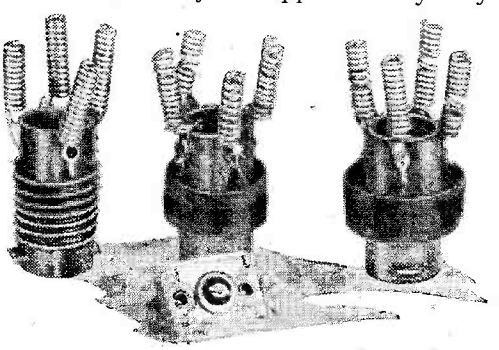


Selection of low-loss Frequentite mouldings shown by Steatite and Porcelain Products.

examples of a similar pattern are among the products of Polar-N.S.F.

The very large number of parts that now has to be accommodated on the chassis of a modern set, quite apart from television sets, has led to a demand for components of extremely small dimensions. One need only examine any of the chassis exhibited to realise this fact. Yet despite this, the quality has to be maintained.

The Drilitic condensers made by Dubilier are largely the outcome of this demand, as they are approximately only



New unit coils with trimmer made by Bulgin.

one-quarter the size of a condenser of equivalent capacity produced a year or so ago. In a metal container measuring 1½in. diameter, T.C.C. has now fitted three separate wet electrolytic condensers, whereas last year this size case held only two. Capacities made are 8-8-8, 8-10-8 and 8-10-4 mfds.

The introduction of the all-wave receiver possibly had a greater effect than any other single factor on the development of high-frequency insulating materials, though the need for low-loss insulators had long been voiced by short-wave amateur experimenters in this country.

As a result rapid strides have been made

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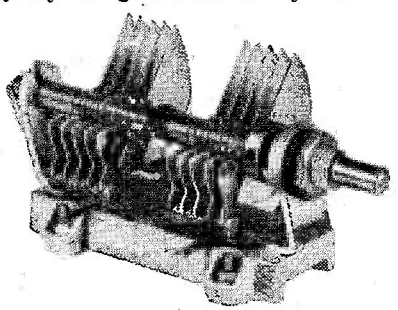
in the production of moulded parts for condensers, valve bases, valveholders, coil supports, switches and formers of every

Varley dry accumulator.

conceivable kind. The display of these parts made from Frequentite and shown by Steatite and Porcelain Products well exemplifies the progress made in this field. Many of the new short- and ultra-short wave components, such as, for example, the range of variable condensers shown by Polar, are assembled on Frequentite bases.

Coils of the skeleton type for use in home-constructed sets have been given due attention by component makers, particularly by Bulgin, who this year show a



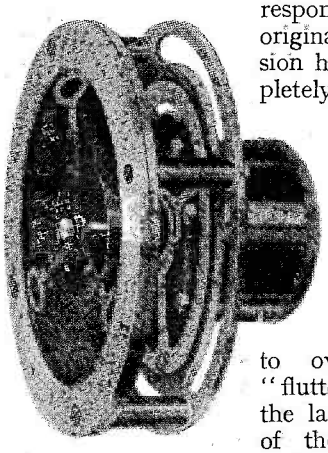
Type E Polar ultra-short wave split-stator condenser mounted on Frequentite.

new range covering all wavelengths from about 7 to 2,600 metres. This firm has introduced numerous new lines, extended some of their existing series, and improved others. For example, a complete new range of HT vibrators for working voltages of from two to thirty-two can now be obtained. Likewise Belling and Lee have devoted much time and thought to the development of new parts, as their series of insulated connectors, particularly for use in television sets and high-voltage circuits, testifies.

Two interesting contributions have been made by makers of batteries for portable sets. One is an extension of the range of dry-cell LT batteries for the latest 1.4-volt valves, and the other is a dry accumulator introduced by Varley.

Basically, the new Varley accumulator is the same as the familiar free-acid lead cell and its potential is two volts, but each cell is solid and contains no liquid electrolyte at all. Possessing the cleanliness of a dry cell, it has the added advantage that the cell can be re-charged in exactly the same way as an ordinary free-acid accumulator. These new cells are made in a wide range of sizes up to 80 Amp. Hours capacity.

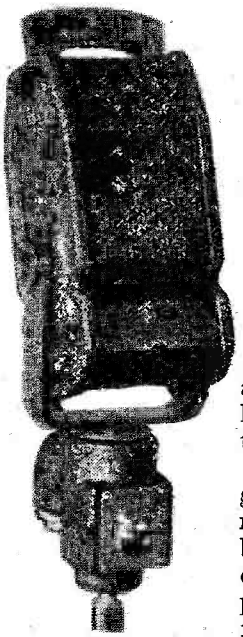
Loud-speaker developments, with one exception, are not apparent to the eye, but if the ear can be relied upon under the rather noisy conditions inseparable from an exhibition, the general quality of the units now being installed in sets is much better than during the last two or three years. The Goodmans "Infinite Baffle" unit is both aurally and visually an improvement on the experimental model shown last August. While retaining the wide frequency response of the original the suspension has been completely redesigned



The Goodmans "Infinite Baffle" loud speaker with redesigned cone suspension.

to overcome the "flutter" due to the large excursion of the diaphragm at low frequencies. A large diameter rear centring spider is used in conjunction with a three-point radial support instead of the tapes which were employed in the earlier model.

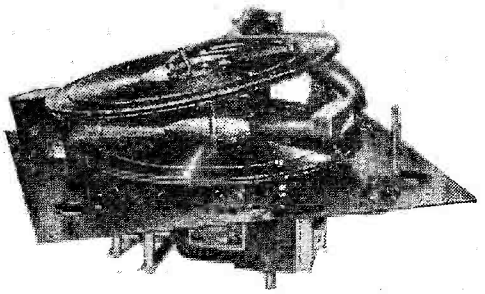
As with the loud speakers, improvements in PA equipment are not readily discernible to the eye, but the ear will be able to differentiate between this and last year's models. Better quality of reproduction, coupled with the use of higher grade microphones, constitute the main line of development. E.M.I. Service has a long range of fixed and portable models containing many improved features, whilst an entirely new range of Truvoice units has been introduced by Henri Selmer. Carbon, moving-coil and a new design of ribbon microphone



New ribbon-microphone embodying input transformer, made by Henri Selmer.

are included in the latest products of this firm.

Developments in gramophone equipment are chiefly bound up with record-changers and pick-ups. The mechanism of record changing has been taken a step further in simplification and reduction of cost in the Garrard RC10 and RC50 units, and the shape of things to come is seen in an experimental model of a new record-turning unit (RC100) which plays both sides of ten discs.

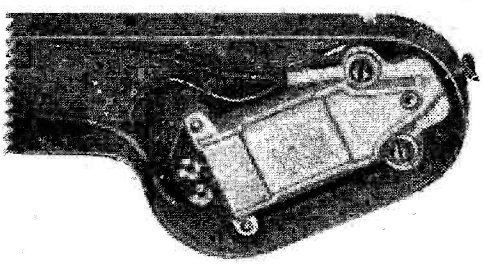


In the Garrard RC50 record changer the selector mechanism has been further simplified.

Most of the progress in pick-up design is epitomised in the exhibit of R. A. Rothermel, Ltd., who are showing piezo electric pick-up cartridges in various stages of manufacture. The torsion type is coming into favour, and a very neat housing has been arranged for it in the new Rothermel "Junior" pick-up.

Apart from the seasonal improvements made in servicing and testing equipment, this year has seen the introduction of several new test sets designed exclusively for adjusting television receivers in the absence of a wireless signal.

The Baird Sync Pulse Generator, which has been produced to enable dealers to install a television set and make all essential adjustments, such as frame and line time-base settings, check for synchronisation and general operation of the set in the purchaser's house without having to wait for



Underside of Rothermel "Junior" pick-up head.

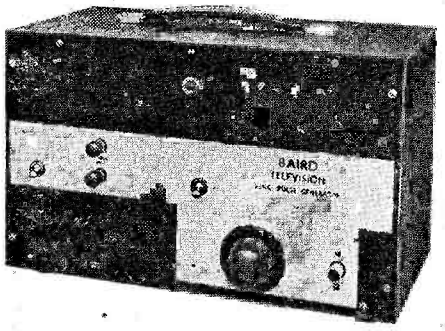
Alexandra Palace to commence transmitting, is quite a small self-contained unit.

An RF output at the correct frequency is provided and this is modulated so that it produces the familiar B.B.C. test cross on the CR tube in the receiver. Alternatively the RF signal can be modulated from an external source so as to give a pattern consisting of vertical bars, these being used to check the overall performance of the receiver.

The user then only has to make a few minor adjustments, such as brilliance and focusing when the transmission starts to ensure obtaining a perfect picture. As the output is adjustable between 200 microvolts and 2 millivolts it allows for satisfactory tests to be made in districts of widely different field strengths. The price complete is £15 15s. 0d.

Show Review—

Another test set of this kind, but built on much more ambitious lines, can be seen on the Marconi-Ekco stand. Here it takes the form of a large rack-built assembly, being intended for installation in factories and production test shops. Known as the Scophony Pulse Generator Type OA.134, a video signal, which appears on the CR tube in the set as a lattice pattern of rather complicated design, is produced in addition to the correctly phased synchronisation pulses. The complexity of the pattern enables adjustments to be made for exact focusing and linearity of the time-base circuits. In addition a sound carrier modulated at 400 c/s is produced for checking the sound portion of the set. This test rack can be used with CR tubes or with mechanical scanners.

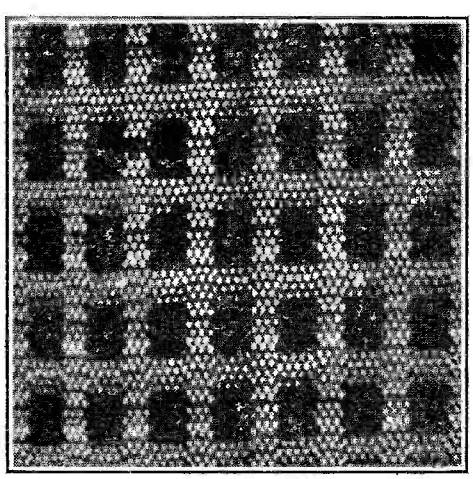


Baird Sync Pulse Generator.

Full monitoring facilities are included, there being three small CR tubes for checking the waveform at different parts of the equipment and a standard receiver with a large tube for checking the overall performance and comparison with sets under test. It is, in fact, a complete television transmitter, but modulated with a lattice pattern of fixed design for video testing. Both RF frequencies are exact, being generated by crystal controlled oscillators.

The output is applied to a number of buffer amplifiers with an output impedance of 80 ohms and these can be fed to different testing booths by low-impedance transmission lines.

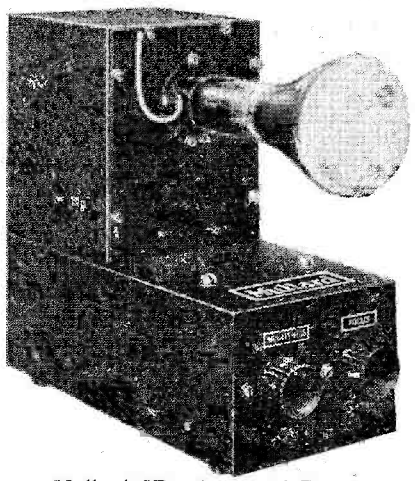
The extent to which cathode ray tubes are now used in general test and servicing work is exemplified by the large number of self-contained units and oscilloscopes shown this year. E.M.I. Service have several models, one of which is a CR tube voltmeter of laboratory pattern, while Cossor has developed a Radio Service Equipment Rack in which is included one of their double-beam CR Oscillographs, Ganging Oscillator, a new Square-Wave Generator and an AC Impedance Bridge. This comprehensive assembly of apparatus enables every kind of test likely to be required by the service engineer, or in a factory test room, to be carried out. Each unit is self-contained and can be supplied separately so that the equipment may be built up in easy stages.



Test pattern produced by Scophony Pulse Generator made by Marconi-Ekco.

A rack for the two basic units, CR Oscillograph and Ganging Oscillator with switches and input points costs £3, while an extension for the two other units is available at £2 10s. The price of the new Square Wave Generator is £30.

Mullard continue to improve, extend and devise new applications for their CR equipment, the use of oscilloscopes in checking the waveform at different stages in a television set being demonstrated and explained.



Mullard CR tube Model B100.

An inexpensive self-contained unit comprising a 3-inch hard tube with HT and grid bias supplies and having all high voltage circuits adequately protected, has been introduced this year. The unit, which costs £8 8s., would form the nucleus of a complete oscilloscope, as circuits for time bases and amplifiers are available if required.

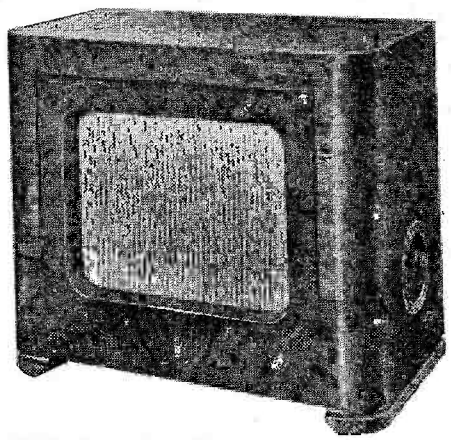
The expansion of television reception is exemplified by the large number of firms making a special display of dipoles and other forms of television aerial. Belling and Lee have a comprehensive range, including plain dipoles and reflector types, so also has Antiference, who include twelve different models in the range.

The Belling-Lee Skyrod vertical aerial (for anti-interference broadcast reception) has been improved by making the aerial transformer as an easily replaceable plug-in unit, while the method of installation has been simplified.

E.M.I. Service has developed a new compressed dipole which can be used with or without a reflector, while the new Tilted-wire aerial provides an example of the latest developments made in this field to ensure a good signal in localities where interference is particularly bad, or where one with good direction discriminating properties can be employed to the best advantage.

W. B. STENTORIAN SPEAKERS

New Cabinet Designs for Extension Units



W. B. Stentorian "Senior" cabinet extension loud speaker, Type 40SC.

FOR the coming season the Senior, Junior, Baby and Midget Stentorian loud speakers are being continued without major alteration. A new range of cabinets has, however, been designed and the "Baby" cabinet model is now housed in a horizontal-type cabinet and costs 29s. 6d. complete with volume control.

In the new "Cadet" the constant impedance volume control includes a push-button for use in conjunction with the "Long Arm" remote control device. The cabinet has a plain opening with a thickness of nearly an inch and the corners are rounded. Contrasting veneers are separated by an inlaid dark line.

The "Junior" and "Senior" cabinet models are of similar design and progressively increasing size. The prices are 49s. 6d. and 63s. respectively. Other cabinet models include the "Pendant" model at 59s. 6d., the "Regent" at 5 guineas, and the "Emperor" at 7 guineas.

All the chassis types are available with the Stentorian universal matching device or with direct speech coil connections at slightly lower prices.

Replacement universal output transformers are supplied at a retail price of 5s.

The Wireless Industry

THE 1940 catalogue of the Premier Radio Co., 167, Lower Clapton Road, London, E.5, contains information of many new lines including vibratory power units, mobile amplifiers and an inexpensive cathode-ray oscillograph. It is well illustrated and contains much useful information, including a 20-page valve section. The price, as usual, is 6d. per copy.

◇ ◇ ◇ ◇

The Dubilier Condenser Co. (1925), Ltd., Victoria Road, North Acton, London, W.3, have prepared a new catalogue of condensers and resistances of interest to home constructors and radio and television service engineers. A useful abac for calculating resistance ratings is included.

◇ ◇ ◇ ◇

A trade list of components and accessories has been received from Norman Rose (Electrical), Ltd., 43, Lambs Conduit Street, London, W.C.1. In addition to standard replacement parts the list includes many tools and materials useful to the serviceman.

Garrard Record Changers

The Garrard Engineering and Manufacturing Co. asks us to point out that, in the advertisement in last week's issue, the illustration showed Model RC10, and not Model RC50, as stated.

New Television Aerial

THE TILTED-WIRE SYSTEM, AND HOW IT WORKS

DESCRIPTION of a recently introduced type of aerial for ultra-short-wave reception that is easier to install and less conspicuous than the conventional type of television dipole. The new tilted-wire aerial is claimed to have marked anti-interference properties.

ONE of the most interesting and important developments connected with television aerials has been disclosed by the publication of two recent patents, Nos. 490,414 and 493,758, issued to Messrs. E. C. Cork, J. L. Pawsey, and M. B. Manifold, members of the Research Staff of Electric and Musical Industries.

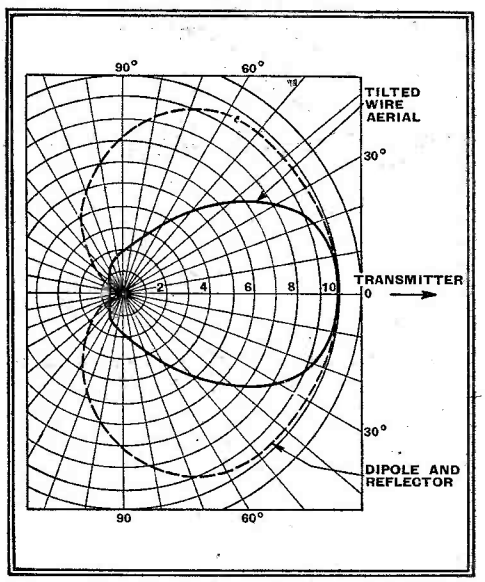


Fig. 1.—The dotted line represents the polar diagram of a dipole with reflector, and shows that at 90 deg. from the direction of the transmitter the pick-up is still 70 per cent. of maximum. The improved directional properties of the tilted-wire aerial are shown by the full line.

As will be realised from the description which follows, the new type of aerial is almost fundamentally different from the conventional dipole. Since its characteristics, however, are in general considerably superior to a dipole and reflector, and, since it is in any case easier to install, there can be little doubt that its use will soon become widespread.

Anti-Interference Properties

As is well known, a plain vertical dipole aerial is equally sensitive to signals (and interference!) from every direction in the horizontal plane. The use of a single reflecting element behind the aerial is a useful device when the field strength from the transmitter is low or when the receiving aerial is situated in a locality where interference is serious, as it results in a gain of about 3 db. over the single dipole. But, so far as the elimination of interference is concerned, the use of a single element reflector is not of very great value unless the source of the interference is confined to a small angle more or less directly behind the aerial. The reason for this is clearly seen in Fig. 1 (dotted-line curve), from which it will be seen that the pick-up of the aerial varies almost imperceptibly up to 60-70 deg., and even at 90 deg. from the direction of the transmitter the pick-up is still about 70 per cent. of the maximum.

The polar diagram of the new tilted-wire aerial is shown by a full line in Fig. 1, from which it will be seen that, while its sensitivity to signals from the desired transmitter is of the same order as a dipole and reflector, it is much less sensitive in other directions. This more pronounced directional characteristic is of very considerable assistance in reducing interference from motor car ignition systems, provided always, of course, that the source of interference is not directly between the aerial and the transmitter.

The tilted-wire aerial is a form of wave-antenna of which the well-known Beveridge aerial was an early example. Instead, however, of employing an exceedingly long horizontal wire along which the induced waves travelled with substantially the same velocity as the incoming wave from the transmitter, the tilted-wire aerial employs a length of capacity-loaded conductor which forms the effective part of the aerial and along which the phase-velocity of an electric wave is very considerably greater than the velocity of light.

Electrically, the tilted-wire aerial consists of a series of small condensers, as shown in Fig. 2. In practice, such an aerial might consist of, say, No. 14 SWG copper wire cut into short lengths of about 15in., each length being separated from the next by a small insulator across which a condenser of about 50 micro-micro-farads is connected. The phase-velocity of an electric wave along such a path is about 1.4 times the velocity of light.

Process of Phase Addition

Suppose that such an aerial is erected at an angle of about 45 deg. to the horizontal and *in the same vertical plane* as the waves from the transmitter. As each wave from the transmitter advances past the aerial, it induces corresponding wavelets at each point of the aerial as it passes. These little wavelets travel in both directions, up and down the aerial with, as we have said, a phase velocity of about 1.4 times the velocity of the waves coming from the transmitter. Considering for the moment only the wavelets which travel along the aerial towards the receiver, it will be evident that if the aerial is set

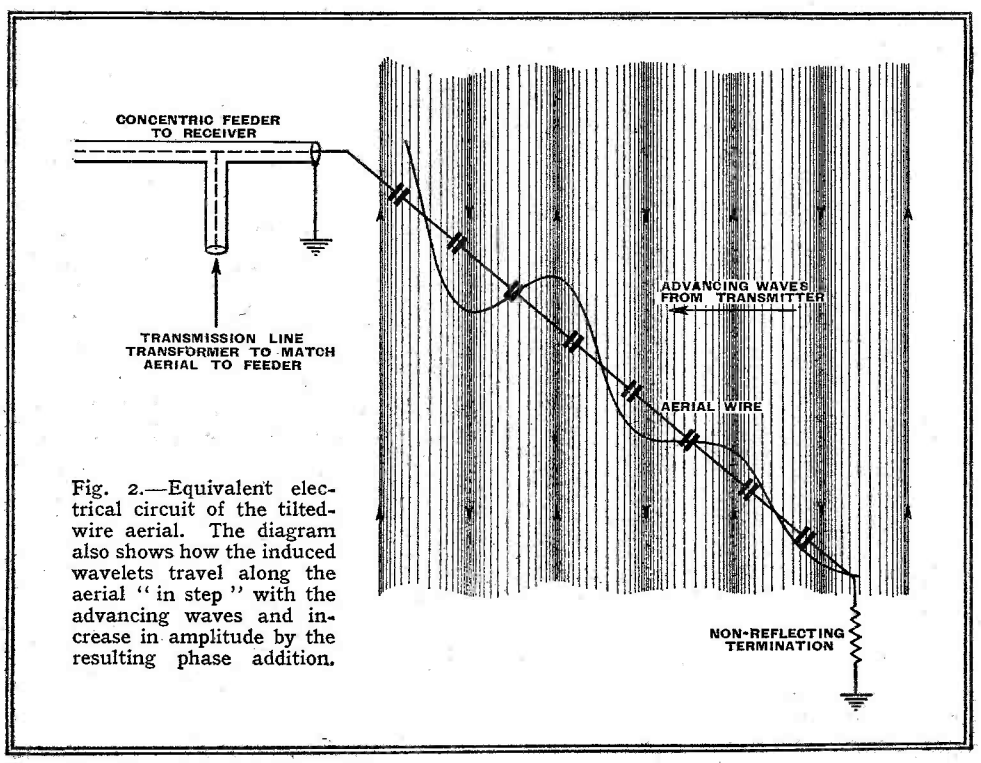


Fig. 2.—Equivalent electrical circuit of the tilted-wire aerial. The diagram also shows how the induced wavelets travel along the aerial "in step" with the advancing waves and increase in amplitude by the resulting phase addition.

up at an angle of about 45 deg., these wavelets will have a component velocity in the horizontal direction which is equal to the velocity of the waves from the transmitter. In other words, a wavelet initiated at any given point travels forward in phase with the wave from the transmitter and, therefore, in phase also with the other little wavelets as they are initiated at each point along the aerial. The wavelets thus augment each other by a process of phase addition, provided, of course, that the vertical plane of the aerial corresponds with the direction of travel of the waves from the transmitter.

If the aerial is not in line with the transmitter, then the wavelets travelling down the aerial will not keep in exact phase with the transmitted waves, and the resulting amplitude will thus be smaller when it reaches the feeder end of the aerial. The aerial thus has maximum sensitivity in one direction only in the horizontal plane provided that it is set up at the correct angle.

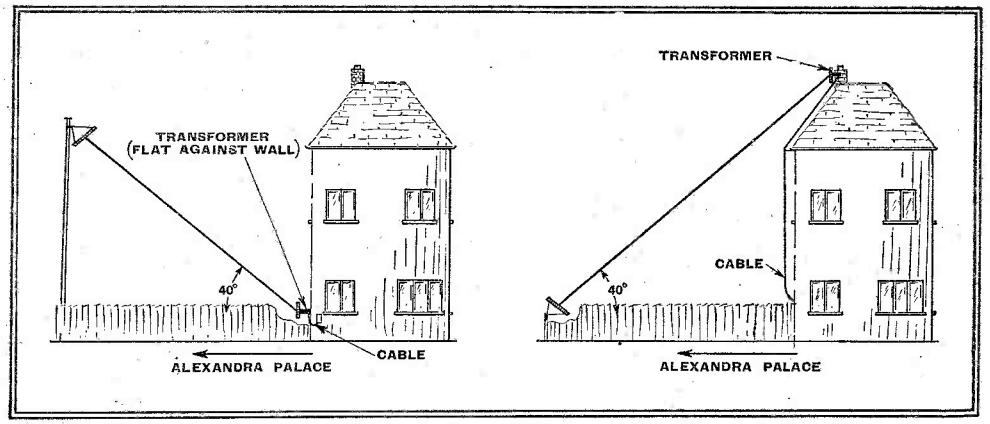
It was mentioned above that the wavelets initiated at each point of the aerial by the advancing waves from the transmitter travel in both directions along the aerial from their point of origin. Since we are only interested in those which travel towards the receiver, it is necessary to arrange for the suppression of those which travel backwards in order to avoid the effects of their reflection which would otherwise occur at the remote end of the aerial. Absorption of the wavelets which travel backwards is achieved by terminating the end of the aerial with a resistance approximately equal in value to the characteristic impedance of the aerial, i.e., about 250 ohms. The other end of this resistance must, of course, be effectively earthed, and this is arranged by connecting the resistance to the mid-point of an ordinary half-wave dipole. Since a dipole possesses a very low impedance to space, it forms the equivalent of an effective earth, but, in order to reduce the general clumsiness and inconvenience of a full-length dipole at the end of the aerial, a "compressed dipole" is employed, this consisting of a coiled winding of appropriate dimensions on a small spreader only about 3ft. in length.

It has been said that the new aerial might be made up of a series of small condensers, and, although this is the correct electrical equivalent, such an arrangement would have obvious disadvantages in practice.

Instead, the E.M.I. aerial conductor is composed of a twisted pair of wires, alternate wires being cut at intervals of 14½in., a small gap being left at the point of each cut. The capacity between the overlapping section of the wires provides the requisite amount of capacity loading from which the aerial derives its properties.

The Feeder System

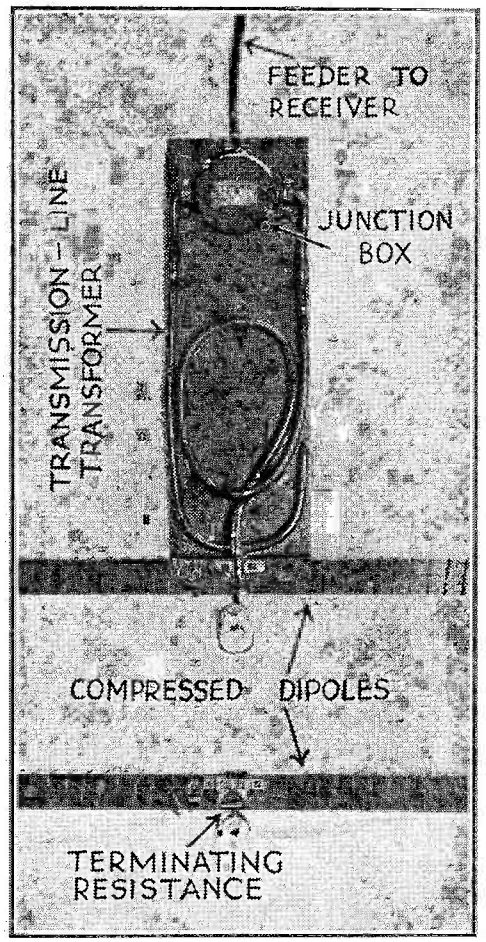
The characteristic impedance of the aerial is of the order of 250 ohms, and, to avoid the losses which would result if this were connected direct to a 70-ohm feeder, a transforming device is required at the junction. It is fairly well known that, in order to match two dissimilar impedances, they may be coupled by a quarter-wavelength line, but if the match is to be an accurate one, it is necessary that the coupling line shall itself have precisely the correct characteristic impedance. It should, in fact, have an impedance equal to the geometric mean of the two impedances which it is to connect.



Sketches showing two of the methods in which the new aerial may be installed.

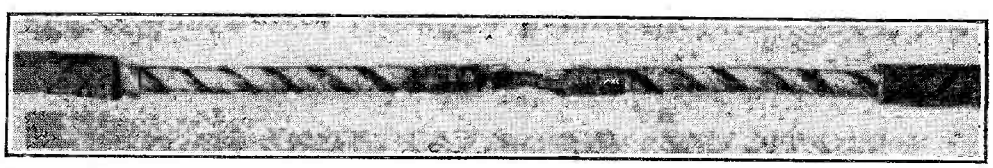
As lines of only certain impedances are readily available, a correct match might be difficult to obtain, but the desired result is obtained by artificially loading the last quarter-wavelength of the feeder. An impedance, which actually consists of a short-circuited length of feeder, is shunted across the line about an eighth wavelength from its end, and it is possible by correctly choosing the dimensions of the arrangement to obtain an accurate match between the aerial and the feeder. (Patent No. 489,704.)

As may be seen from the accompanying photograph, this "transformer," or impedance-matching device, is mounted on a small wood panel. This panel also carries a second compressed dipole which acts as a virtual earth at the end of the outer conductor of the concentric feeder.



Part of the terminating dipoles; the top photograph shows the connection and transmission-line transformer between the aerial conductor and the feeder.

Practical tests with the new type of aerial have shown it to possess almost ideal characteristics for television reception, and the results which one would expect from a review of its theoretical workings are amply borne out in practice. In one particular locality, about twenty miles from Alexandra Palace, where motor car interference had rendered reception, if not impossible, at least very unpleasant at times, and where the addition of a reflector to the aerial had only effected a partial cure, the installation of a tilted-wire aerial has eliminated the interference altogether. While such a complete cure cannot be expected in every case, since a great deal must depend on the exact location of the aerial, yet its excellent characteristics and general adaptability should enable a very considerable improvement to be made in every case where interference is serious. These factors, combined with its ease of installation and inconspicuous appearance, seem likely to assure its widespread use.



Part-sectioned length of the aerial wire, showing the twisted and overlapping conductors with one of the "breaks," which occur at 14½in. intervals.

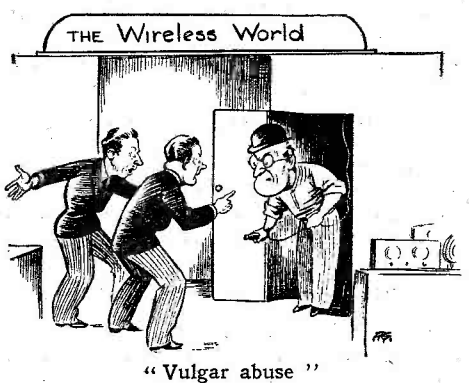
Radiolympiana

By FREE GRID

NO doubt the great majority of you who have visited the Show will have been grievously disappointed at not seeing exhibited a pram equipped with my baby car radio in accordance with my promise of last week; in fact, I am told that on one evening of the Show a hostile demonstration was staged by disappointed readers in front of *The Wireless World* stand, and that the Editor, who happened to be present, only avoided being lynched by escaping in the uniform of one of the commissionaires. The whole trouble is the radio manufacturers. As I told you last week, they were trampling each other under foot in their eagerness to secure the manufacturing rights from me. Unfortunately, however, their idea of fair and equitable terms is not mine, and we were soon compelled to part brass-rags, with the result that not only have I been refused permission to exhibit my Radiopram, but the relations existing between the manufacturers and myself are if possible a little more strained than they were prior to this unfortunate incident.

There was, I am sorry to say, yet another regrettable incident which led to a clash between myself and the authorities. It so happens that I am learning to use one of the new electric razors, and, as the makers of these devices frankly admit, it does take a little time before the schoolgirl complexion stage is reached. At present I am still in the phase where it is necessary to shave twice a day in order to make myself presentable, and in the first few days of the exhibition I was in rather a dilemma, as in the afternoons my face began to look as if it needed weeding rather badly, and as I had several important people to meet every evening something simply *had* to be done about it.

In the end I got in touch with the Editor and secured his permission to have a tea-time shave in the little office at the back of *The Wireless World* stand. One would have thought that no untoward incident could possibly have arisen from such a



"Vulgar abuse"

simple circumstance as that. I was screened from public view, and visitors were warned off by the simple expedient of hanging a "Danger—High Voltage" notice on the door. There was, however, one very important fact that I had overlooked, and that was that closed-circuit television demonstrations were going on in Olympia practically throughout the day. Apparently my tonsorial efforts were getting through and playing havoc with the picture at one or two neighbouring stands, in spite of the fact that, as already mentioned, a closed circuit was being used. I am always willing to be helpful, and volunteered to submit my razor to the expert attentions of any firm of "suppressor" manufacturers in the Show whom they cared to bring along. All I met with, however, was vulgar abuse and a complaint to the exhibition authorities, with the result that I and my son Henry, who was with me, were summarily thrown out into the street, and had we not happened to have had season tickets we should have had to have paid to get in again. As we had been ejected once before we were viewed with the codfish

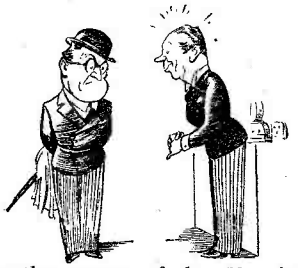
"Codfish eye of suspicion."

eye of suspicion by the Admirals-of-the-Fleet on duty at the door and were only readmitted after a somewhat acrimonious altercation and after being compelled to submit to the indignity of signing our tickets and leaving our fingerprints.

As for the Show itself, I must grudgingly admit that the manufacturers have done us much better this year. I have, in past years, always regretted the presence of the side-shows on the ground that they were non-technical, and I was relieved to see that they were not present last year. This year they have come back with a vengeance, but with the difference that they are of considerable technical interest.

There is not much that I can say about the sets on view, for they are dealt with in other and less widely read parts of the journal, to which I would direct your attention. I did notice, however, that a great number of the receivers incorporated inventions and ideas of my own which I have put forward from time to time in this journal—and this, mark you, without so much as a thankyou, let alone a more tangible acknowledgment in the form of a royalty. Still, such is the fate of all inventors and pioneers, and I well remember in my younger days going to the theatre with a girl who, throughout the performance, kept her eyes glued to her opera glasses. I felt compelled to remind her of the great debt she owed to Galileo, only to receive the somewhat fatuous answer that she "didn't remember him,"

"The dawn of intelligence."



and "what was the name of the film in which he had appeared?"

I should like to pay a tribute to the great improvement made in the matter of having people on the stands capable of giving intelligent answers to a technical question. There is, of course, still a long way to go in this direction, but as I gazed at some of the immaculately clad young men on the stands I was irresistibly reminded of the famous picture by Rembrandt or Beethoven—I forget which—entitled "The Dawn of Intelligence." It is said that the darkest hour usually precedes the dawn, and judging by some of last year's efforts I certainly think that this old saying has once more proved true.

An angry reader has sent me a long telegram—and from Aberdeen, too—rebuking me for flippancy because in my notes last week I said that the side-show in which a demonstration is given of the quality churned out by a modern set and that given by one of a few years back might have been made more interesting if we had also had demonstrated to us the quality of the set of ten years hence. My correspondent suggests that such a demonstration would be a scientific impossibility.

I need scarcely say that it would not be impossible at all. In the first place, I would point out that since a wireless receiver is—or should be—merely a reproducer it would be perfectly easy to demonstrate the perfect reproduction which will presumably be given by a wireless receiver of a century hence. Such a demonstration could be given by putting the actual orchestra into the demonstration theatre; obviously, reproduction would then be 100 per cent. perfect. Now it would be a simple matter to detract from the perfection of this quality, even without calling in the aid of wireless principles, by means of a series of sound-absorbing and sound-reflecting screens.

The only thing lacking now seems to be a means of ascertaining exactly how far short of perfection the set of ten years hence will fall. But the insurance companies' actuaries, knowing the rate of progress since broadcasting began, could surely tell us that?

"Effective Height"

WHAT IT MEANS AS APPLIED TO RECEIVING AERIALS

By F. R. W. STRAFFORD
(Research Dept., Belling and Lee, Ltd.)

THE author suggests that the expression "effective height," as applied to receiving aerials, tends to become meaningless. It is a quality depending not purely upon the aerial itself, but also upon the input impedance of the associated receiver.

THE term "effective height" is about as applicable to modern radio as the extinct coherer detector. In the early days when nothing but inverted "L" or "T" aerials were employed, and the polarisation of the transmitted and received waves was substantially vertical, the term was applicable in an empirical sense and served as a basis for comparison between the effectiveness of an aerial under practical conditions and the same aerial under theoretically ideal conditions. Furthermore, in the early days, the input impedance of receivers was much higher than that used to-day, and this also contributed to the usefulness of the term in a manner to be hereinafter described in more detail.

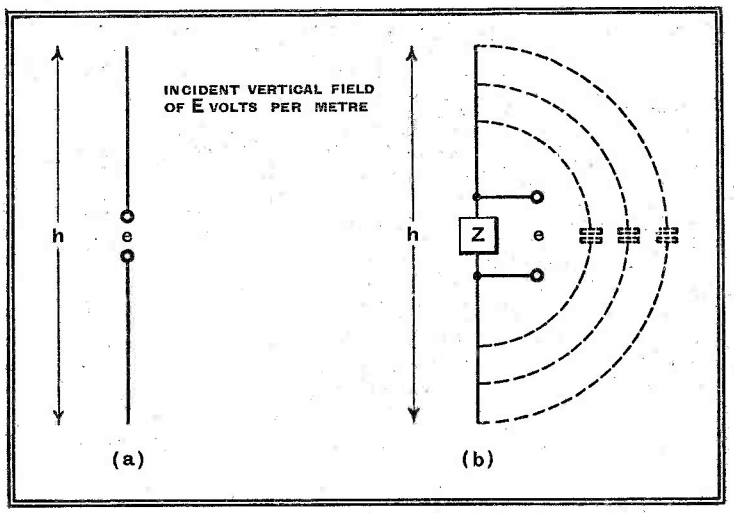


Fig. 1.—A simple dipole (diagram (a)). At (b) is shown the same arrangement with the addition of an impedance load.

Calculating Induced EMF

If a vertical wire is suspended high above the earth's surface (see Fig. 1 (a)) and is acted upon by a vertically polarised electromagnetic wave of field strength E volts per metre an EMF is induced in it whose magnitude is given by the simple process of multiplying the field strength by the height *h* of the aerial in metres. By height is meant the actual length of the wire and not the actual height above the earth's surface—another important point in connection with the term. Hence the EMF is given by the simple equation $e = Eh$. It must be remembered, however, that this simple formula is only applicable when the length of the aerial is quite small compared with one quarter of the wavelength of the electromagnetic field to which the aerial is responding.

It is obvious that one cannot use this voltage so created without some loss occurring, since the aerial is not a closed circuit of zero impedance. It is not the aerial EMF which operates our radio receivers but the PD produced across its input impedance by currents caused to flow round a circuit by the action of an applied EMF. The term EMF and PD are often loosely used, and the reader should remember that EMF may only be measured directly by an instrument which is not actuated by current (e.g., an electrometer).

If, as in Fig. 1 (b), we connect an impedance Z (which might be the input of a broadcast receiver) in the manner shown, the PD across its terminals can never be as great as the EMF induced in the aerial. The PD is produced as a result of the EMF giving rise to currents around an infinite number of capacities as indicated by the dotted line which represents a few representative paths. Hence the amount of current which flows and thereby creates a PD across Z is a function of the geometry of the wire. Figs. 1 (a) and 1 (b) are typical of what is known as the dipole aerial. If the length of the wire on each side of the impedance Z is any integral multiple of a quarter of the working wavelength, the aerial is referred to as a tuned dipole. It will later be considered whether the term "effective height" can be applied usefully to this simple aerial arrangement which is commonly applied on short and ultra-short wavelengths.

In the case of the dipole the earth is not used as one connecting terminal and may be considered as non-existent. In the conventional "Marconi" aerial, whether inverted "L" or "T," the earth plays an important part in providing the other input connection.

Consider a vertical wire of height *h* as depicted in Fig. 2 (a), and further let us assume that we wish to calculate the open circuit voltage *e* across the terminals A and B. From a high-frequency viewpoint A and B are not open-circuited, because the capacity of the aerial to earth acts across them and offers a finite impedance which decreases as the wavelength to be received diminishes.

Aerial as a Generator

Now the equivalent circuit of Fig. 2 (a), as shown in Fig. 2 (b), is clearly that of a generator whose EMF is Eh, which is driving current through two capacities C1 and C2 in series.

This equivalent circuit is only correct if one neglects both the inductance and the resistance of the aerial wire. It may be shown theoretically that this is permissible if the length of wire is not greater than one-tenth of the wavelength to be received. Hence, from 200-2,000 metres, a wire of 20 metres height may be represented fairly accurately by the equivalent circuit of Fig. 2 (b). It may also be shown theoretically that C1 is very nearly equal to C2, so that the voltage *e* across A and B must be half the generated EMF since it is equally divided between the two capacities. Hence *e* is equal to Eh divided by 2.

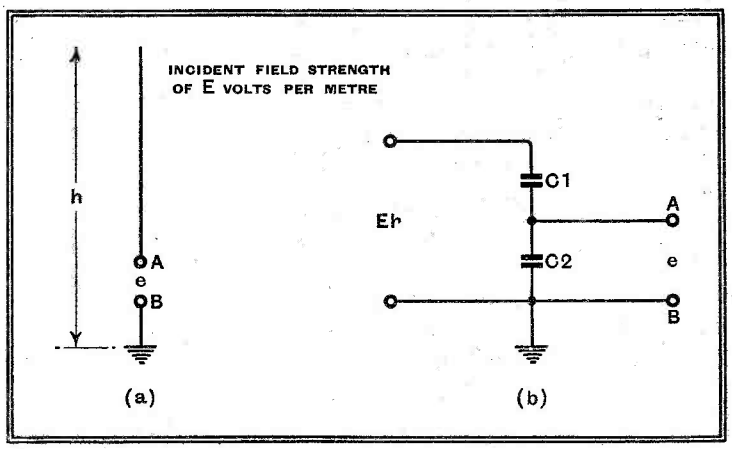


Fig. 2.—Diagram (a) represents a simple "Marconi" aerial, while at (b) is shown the equivalent circuit.

We now approach closely to a correct

"Effective Height"—

appreciation of the term "effective height." The aerial generates an EMF equal to Eh, but we can only use half of this under the ideal open circuit conditions. Hence the PD we obtain is the same as the EMF generated in an aerial of half the height. Hence we say that the effective height of the aerial is half its physical height.

Thus we may define "effective height" as that height *he* which will provide an EMF equal in magnitude to the PD we obtain from an aerial of height *h*. Obviously *he* must always be less than *h*.

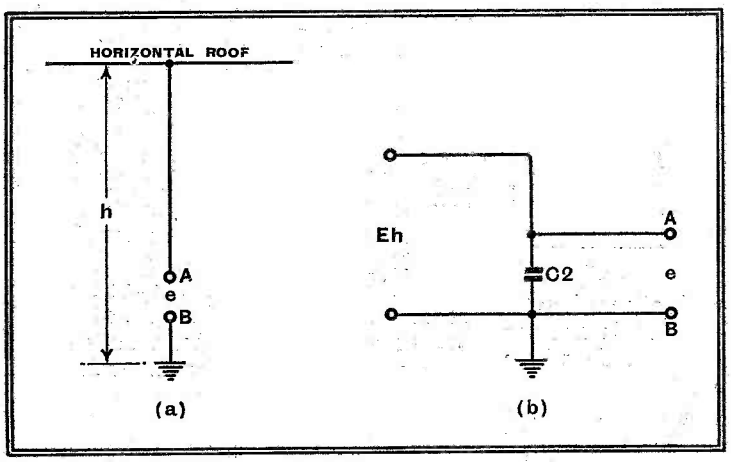


Fig 3.—A "Marconi" aerial with a horizontal roof. Subject to restrictions mentioned in the text, diagram (b) represents the equivalent circuit when the roof is infinitely large.

Now let us increase the capacity of C1 by adding a horizontal roof to the aerial as shown in Fig. 3 (a). If this roof could be increased indefinitely C1 would become so large compared with C2 that the equivalent circuit could be redrawn as in Fig. 3 (b) and in this case $e = Eh$ and the effective *he*, becomes equal to the physical height *h* of the aerial. In practice, however, the roof cannot be increased without restriction since it must be remembered that as soon as the total aerial dimensions approach one quarter of the working wavelength the simple capacity consideration no longer applies and classical transmission line theories must be applied.

The adding of a roof to a vertical aerial always increases the effective height but can never increase it to a height equal to the physical length of the vertical portion of the aerial.

Practical Working Conditions

The foregoing has been discussed purely in terms of what is regarded as the open circuit condition, that is with no impedance between the terminals A and B other than that offered by the aerial capacity itself.

When a broadcast receiver is connected between the terminals A and B it is clear that the PD across these points must be reduced to a lower value than $\frac{Eh}{2}$ and the equivalent circuit now becomes that shown in Fig. 4. Hence the effective height is by definition similarly reduced. *Thus we see that the effective height of an aerial is a quantity which is not purely characteristic of the aerial itself but depends upon the input impedance of the receiver to which it is connected.*

A further influencing factor is that provided by any departure from uniform distribution and vertical polarisation of the actuating electromagnetic field. The proximity of other conducting objects, such as buildings and trees, will modify the distribution of the field along the vertical portion of the aerial.

Hence the generated EMF will not be given by Eh excepting under ideal theoretical conditions—that is a flat, perfectly conducting earth, and an entire absence of nearby vertically disposed conductors.

The effect of this modified field distribution is to provide a further reduction in the PD across the receiver input impedance and can only be referred to in terms of the present definition of the expression "effective height," as a reduction thereof.

Summarising: the derived expression "effective height" is only applicable where the aerial has dimension small compared with one quarter of the working wavelength, and it further depends upon:—

(1) The amount of roof capacity of the aerial.
(2) The input impedance of the receiver.
(3) The configuration of the electromagnetic field.

It is impossible to derive the separate contribution of (1), (2) and (3) without experiments, so that if one is given the effective height of an aerial associated with a receiver it is impossible to say to what extent the figure is dependent upon the various parameters described.

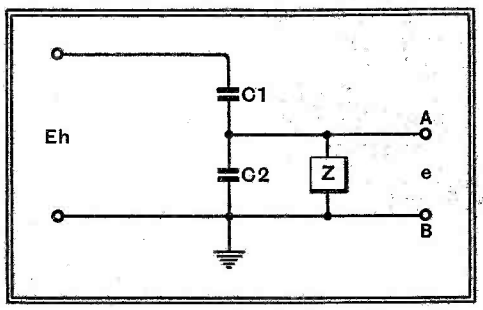


Fig. 4.—Equivalent circuit of a "Marconi" aerial with an input impedance connected between the lead-in wire and earth.

In the case of the dipole of Fig. 1, it can be shown that the same reasoning applies, and that the effective height is given as $\frac{Eh}{2}$ under the open-circuit conditions.

Note here that the term "height" only applies to the length of the wire and is not relative to the position of the earth with respect to the wire—another stumbling block in the lay interpretation of the term "effective height."

The same influencing factors apply with the exception of (1) since there is no horizontal roof. If the dipole is tuned so that the total length of wire is equal to $\frac{\lambda}{2}$ where λ is the working wavelength, it can be shown that the effective open-circuit height is given by the expression $he = \frac{\lambda}{\pi}$. When the dipole is matched to its resistive load (theoretically 72 ohms: practically, something like 90 ohms), the effective height becomes $he = \frac{\lambda}{2\pi}$.

Proof of these formulæ involves the analysis of hyperbolic function and is somewhat beyond the scope of this article. It can be readily appreciated, however, that the term "effective height" is applicable in a purely classical sense to the tuned dipole and is useless for practical design purposes.

Finally, there is the frame or loop aerial. The open-circuit voltage in this case depends upon various dimensional factors of the loop and also the wavelength to be employed. Providing the dimensions of the loop are small compared with one quarter of the working wavelength and the number of turns are small the formula for the open circuit voltage *e* is given as follows:—

$$e = \frac{2\pi Ehbn}{\lambda}$$

When h = height of loop.
b = width of loop.
n = number of turns.

If we equate this in terms of our expression $e = \frac{Eh}{2}$ for the open-circuit voltage from a vertical aerial and solve for the effective height *he* of a loop in terms of an open aerial we find that $he = \frac{2\pi hbn}{\lambda}$ which is equal to the physical height multiplied by $\frac{2\pi bn}{\lambda}$ and has nothing whatever to do with the height of the loop above ground, and is only proportional, with other factors, to the height of the loop. Here again the same factors (2) and (3) as for the vertical aerial influence the ultimate value of *he*.

Apart, therefore, from the particular case of the simple vertical aerial working into a fairly high impedance, the term "effective height" appears to be completely devoid of practical usefulness. This is made all the more obvious when one considers the modern receiver with its comparatively low input impedance and the increasing tendency towards screening of aerials, resulting in non-uniform field distribution. The author therefore proposes that the term should be relegated to the limbo of forgotten things, as something that has outworn its usefulness. He ventures to predict that it will not be used in two or three years' time

Sideshows at Olympia

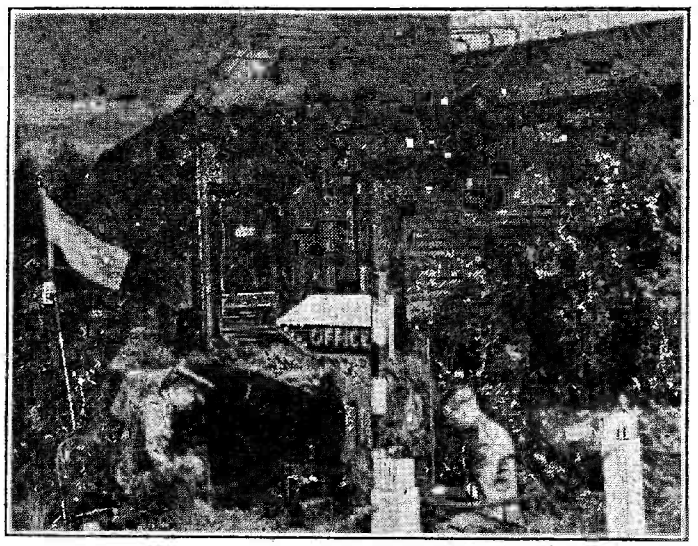
THE NON-COMMERCIAL EXHIBITS

THE annual Radio Exhibition has always been noteworthy for the fact that there are several interesting things to see apart from the sets and the components on the stands of the manufacturers, but there has never before been such a variety of these sideshows as this year. The B.B.C. is, as usual, the principal showman, and the theatre, with its opportunity of seeing broadcasting stars in the flesh, is the principal B.B.C. show for the ordinary listener. Apart from this, however, the B.B.C. is making a special effort this year to claim the attention of those visitors to the show who like to see something of the technical side of broadcasting.

The main technical exhibit of the B.B.C. is in the small National Hall, and the visitor is able to inspect many objects of interest, including the mobile film and sound-recording units and the "fire escape" portable television aerial used for relaying certain television O.B.s to the Alexandra Palace. Another exhibit of considerable technical interest on this stand is the van containing the apparatus for measuring field strength in different localities. This enables B.B.C. engineers to check up on any transmitter in an area where signal strength is reported to be in any way abnormal.

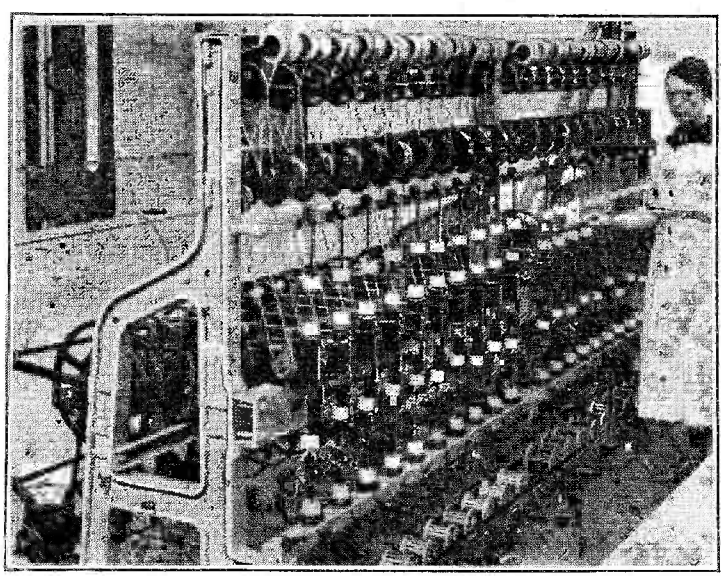
Televiewers will be particularly interested in the repeater station, which is used in conjunction with ordinary G.P.O. telephone circuits for conveying O.B. signals to the nearest point at which specially laid television cables are available. There is also a "sound" O.B. transmitter covering a wave range of 40-120 metres, which is used in cases where a cable is impracticable. Another piece of apparatus of this type is the microwave transmitter, which is carried strapped to the back of the commentator, and is used to enable him to wander freely about among crowds. A collection of various types of microphones which are at present used by the B.B.C. is also shown.

The model wireless factory in the main annexe of the main hall is by a long way the largest single sideshow of the Exhibition. In it are to be seen working machines to be found in receiver and component factories. Most of the leading manufacturers are represented, and the visitor can see the whole process of set making from the manufacture of the wire to the wiring up of the complete receiver. All the intermediate processes, such as coil making and testing and the manufacture of valves, batteries, and transformers, are also exhibited, while in the centre of the factory is a large revolving drum carrying receiver chassis in various stages of manufacture.



One of the camouflaged mobile stations shown by the Royal Corps of Signals.

Of even greater interest than the manufacture of receivers and components are the methods taken to test them, and among other things the visitor is enabled to see how condensers are individually tested and then how, after becoming part of a receiver, they are ganged and aligned. The wobbulator used for testing the response curve of television receivers attracts considerable attention. It consists of an oscillator, the frequency of which is varied between 41 and 49 Mc/s about 300 times per second. It enables both the gain and the frequency response of the television receiver to be quickly ascertained.



In the Model Factory; the process of lapping 40-SWG copper wire and 30/48 SWG Litz with a double silk covering was demonstrated by the Scott Insulated Wire Company.

The G.P.O. has considerably widened the scope of its exhibit this year, and on its stand in the National Hall a good deal of interesting apparatus is to be seen, apart from instruments used for tracking interference, which, as in previous years, are strongly in evidence. One of the most interesting exhibits is a microwave transmitter and receiver in actual operation on a wavelength of 20 *centimetres*. The visitor is able to rotate the whole transmitter, including the aerial system, and observe the very marked directional effect as transmitted by the signal strength given out by the neighbouring receiver. Coming up the wavelength scale from 20 centimetres to 4.4 metres, there is exhibited a transmitter-receiver designed for this latter wavelength and used by the G.P.O. for linking up outlying islands off the Scottish coast. Another exhibit of interest is a model coast station as used for working with ships at sea.

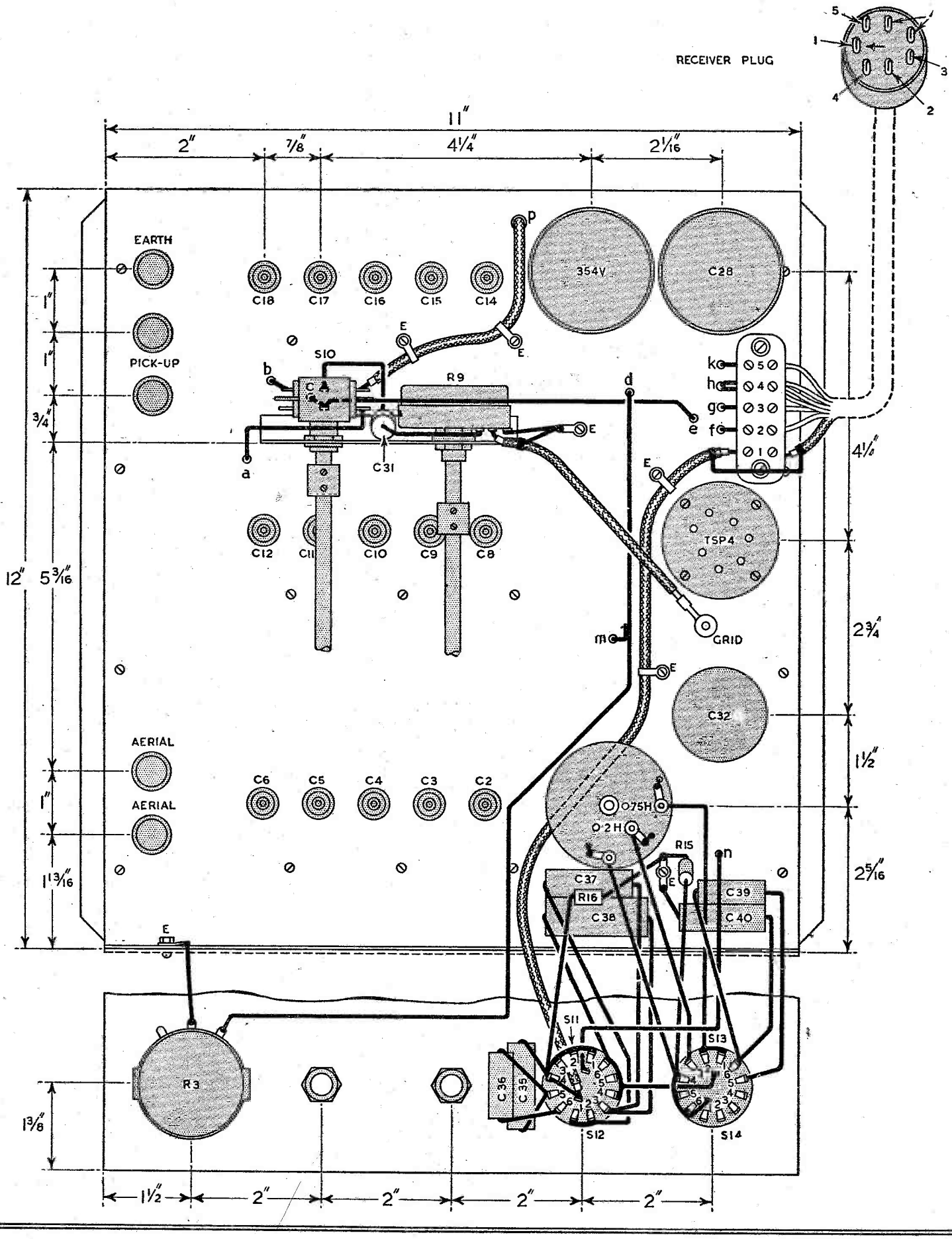
The three fighting services are all represented. The Navy exhibit consists of the wireless cabin of a destroyer. On the stand of the Royal Corps of Signals, representing the Army, are a number of cleverly camouflaged mobile wireless stations. These range from a three-ton lorry carrying the complete gear necessary to provide long-range communication between headquarters of Army formations, to an assembly designed to be carried as a pack by one man, the purpose of this latter being to provide communication by wireless telephony between the units of an infantry battalion. On the R.A.F. stand, as would be expected, emphasis is laid on various methods of DF and homing for aircraft. Several types of aircraft radio installations are shown, demonstrating the principles of remote control of tuning as used in R.A.F. machines.

Visitors from overseas should not omit to pay a visit to the export stand, on which are exhibited many sets and components, designed and manufactured specially for use in tropical climates. Complete receivers are exhibited by H.M.V., Marconiphone, Alba, G.E.C., Cossor, and Ekco, while components are shown by Plessey, T.C.C., Reproducers and Amplifiers, Ltd., Garrard, Belling and Lee, Bulgin, Erie, Westinghouse and Carr Fastener. Many of the sets exhibited in this section are fitted with specially designed tuning systems for receiving Daventry at the various Empire stations. All these sets are built to British Standards Specification No. 415, and will pass any local electrical regulations.

No visitor, be he televiewer or not, should omit to pay a visit to Television Avenue in the gallery. It can be said without hesitation that this is by far the best method of demonstrating television that has yet made its appearance in any exhibition.

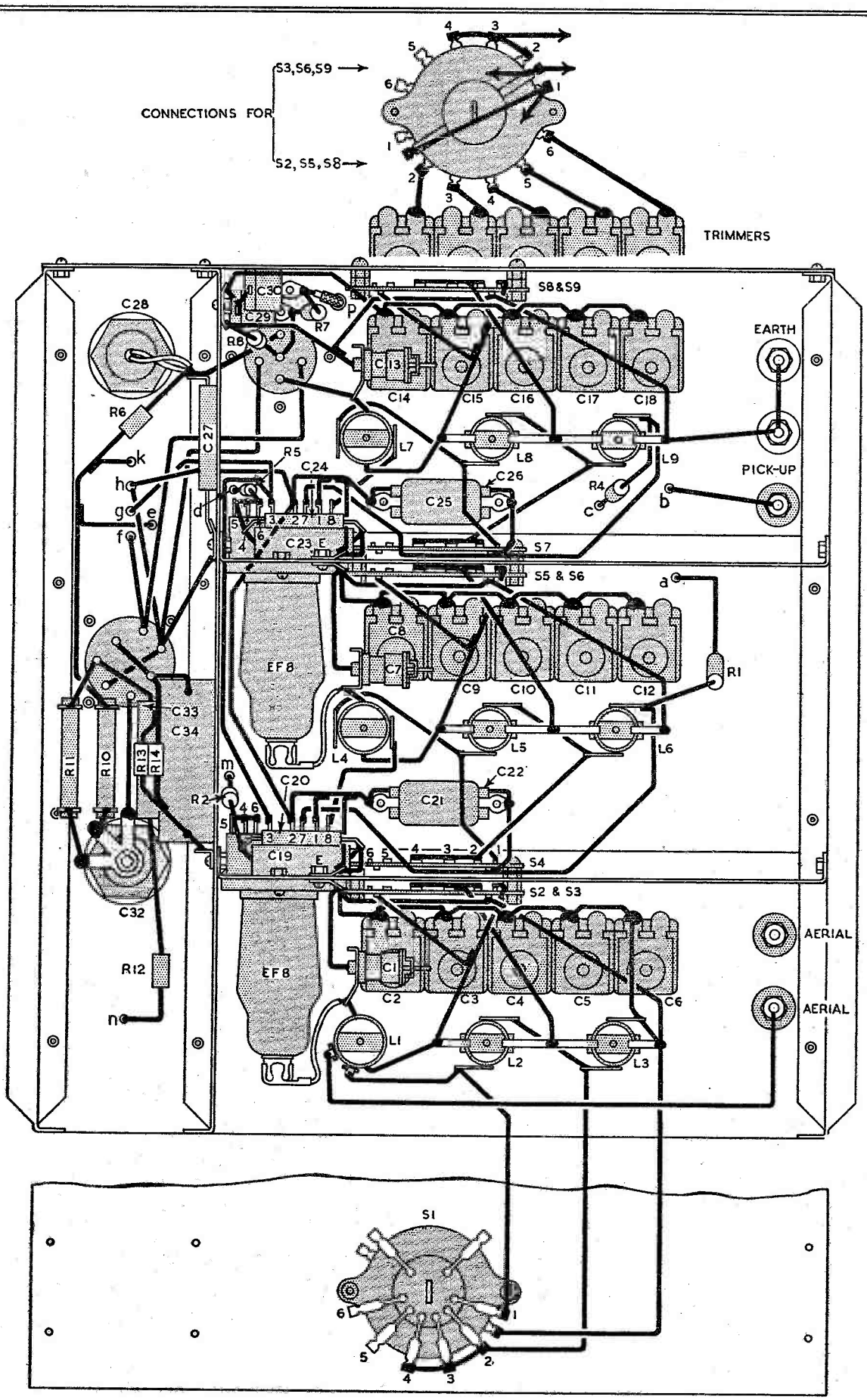
The Wireless World PRE-SET QUALITY RECEIVER

A full description, together with circuit diagrams, photographs, constructional details and notes

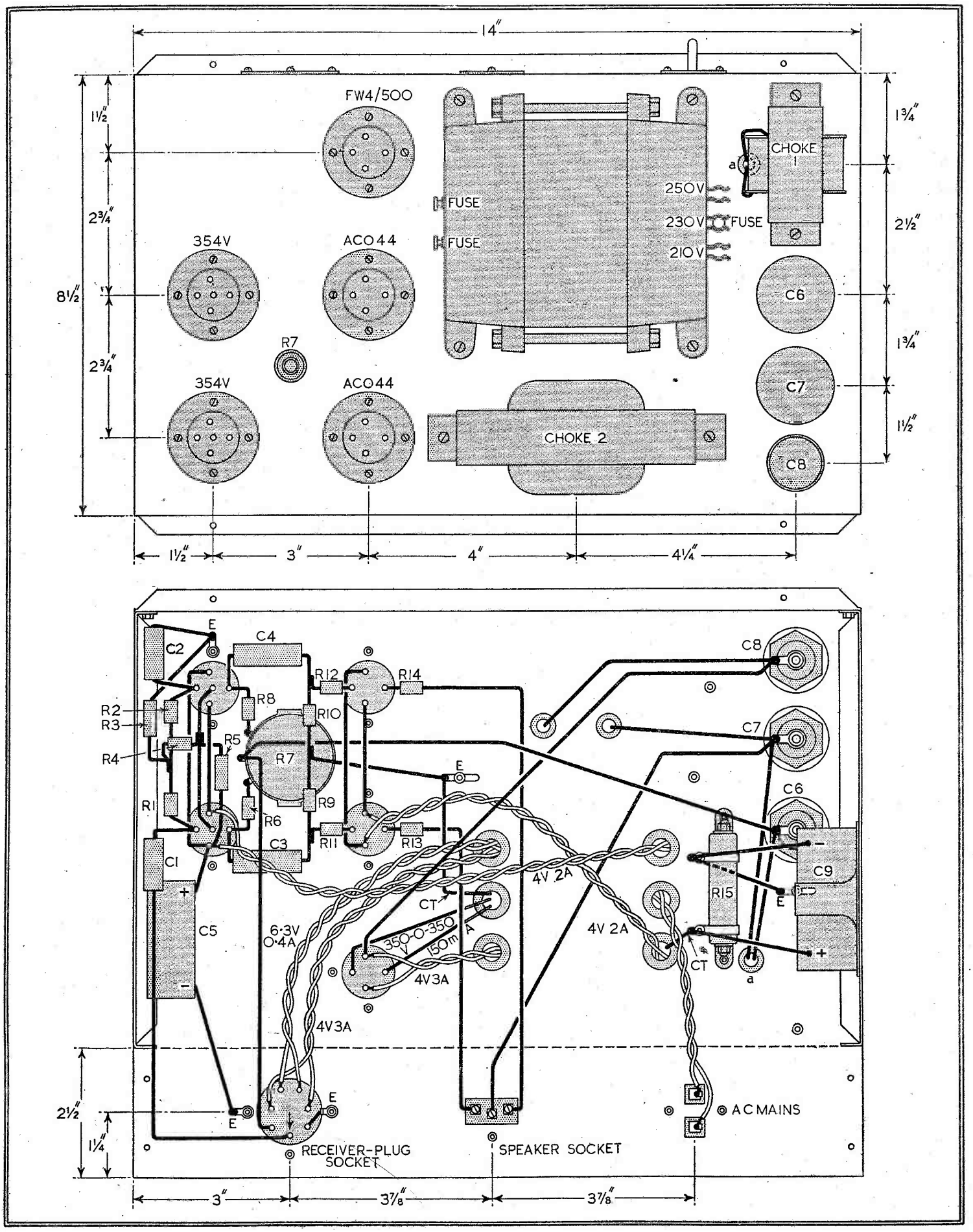


SEMBLY AND WIRING DETAILS OF THE RECEIVER UNIT

djustment of this receiver and its power unit, was published in our issues dated August 17th and 24th



WIRING DIAGRAM OF THE POWER UNIT OF *The Wireless World* PRE-SET QUALITY RECEIVER



Constant Sharpness of Tuning

STEPS TOWARDS THE IDEAL ALL-WAVE RECEIVER

AT short wavelengths the true selectivity of an all-wave set is actually inferior to that at medium and long wavelengths, in spite of the fact that tuning seems to be vastly more critical. This apparent anomaly is explained in the present article, and the possibilities of radically improved tuning systems are discussed.

IT is well known that tuning on short waves is much sharper than on medium, and on medium than on long. This simple fact, observable by anyone possessing an all-wave set, has been responsible for many misconceptions. It is, for instance, often believed that the tuning is sharper at the higher frequencies than at the low because the selectivity is greater. Actually, however, the selectivity is not greater; surprising as it may seem, it is often much lower. Generally, selectivity is at its highest on long waves where the tuning seems the flattest!

This common misconception is brought about by the fact that the sharpness of tuning as it appears to the operator depends not only on the selectivity but on the tuning range. An increase in selectivity is always accompanied by an increase in the sharpness of tuning, but that it is not the only factor is readily demonstrable with a modern all-wave superheterodyne. With such sets selectivity is substantially constant everywhere, and yet the sharpness of tuning increases rapidly on the lower wavelength ranges.

The factor responsible for the apparent sharpness of tuning is the change of frequency for a given movement of the tuning control, or the number of kilocycles covered in 1 deg. rotation of the control.

An ordinary set covers about 550 kc/s to 1,500 kc/s on the medium waveband. This is a frequency ratio of 2.73-1 and a band of 950 kc/s. With the usual 180 deg. rotation of the condenser this represents 5.27 kc/s per degree. This is for a straight-line-frequency condenser; with a condenser having a different law the frequency change is greater over part of the scale and less over another part.

On long waves, the coverage is usually about 150 kc/s to 410 kc/s, giving the same frequency ratio, but a band of only 260 kc/s. As a result, the "sharpness of tuning" is only 1.44 kc/s per degree. On short waves the frequency ratio remains about the same, and a typical band might be 6 Mc/s to 16.4 Mc/s (50-18.3 metres). The band is now 10.4 Mc/s = 10,400 kc/s, giving 58 kc/s per degree for the sharpness factor! The sharpness of tuning is about 11 times as great as on the medium waveband and 40 times as great as on long waves.

As an example of what one might expect, Table I shows the figures for an all-wave set covering 5-2,000 metres in six bands, assuming a constant frequency ratio of 2.73-1 for every band. On the ultra-short waveband the sharpness of tuning reaches 221 kc/s per degree! With the usual 9 kc/s station spacing, there is room for 24 stations in every degree!

Of course, in practice the same frequency ratio is not maintained on all bands, but in the average case it does not change very much. In an all-wave set it is rarely less than 2:1 on any band. It is largely because of this that few sets tune above some 42 Mc/s and the majority do not go above 24 Mc/s. There are other difficulties, but the tuning problem is one of the greatest.

The ideal is obviously constant sharpness, which means a constant frequency band on all ranges. If we make this the same as on the medium waveband, 5.27 kc/s per degree, we shall need 63.5 bands to cover 0.55-61 Mc/s! This is clearly impracticable with present-day tuning systems.

Without a radical departure from normal methods the best that can be done is to adopt a compromise, to decrease the frequency ratio on the higher frequency bands and so reduce the sharpness of tuning as compared with the figures in Table I. This inevitably means an increase in the number of bands.

One example of this course is given in Table II. This is taken from an actual receiver which had a small capacity tuning condenser for ranges 6, 7 and 8, and a normal capacity one for the other bands. The minor variations in frequency ratio are caused by the different values of the stray capacities on the different bands. In spite of the increase in the number of bands to eight the sharpness figure is still high.

So far as actual tuning is concerned it is possible to keep it reasonable by the use of a suitable reduction ratio drive. It is customary to use about 6:1 for the ratio on the medium waveband, and referring to Table I, this makes the sharpness about 0.88 kc/s per degree movement of the control knob. On range 5, the reduction ratio needed for the same sharpness would be 86.5/0.88 = 98.5:1. This is well within the bounds of possibility, and it is common practice to employ a ratio of this order.

While it simplifies the tuning, it does nothing to improve the dial itself. The scale length is still inadequate to make it possible to read the dial sufficiently accurately to record settings for particular stations. Various methods of overcoming this have been tried, and among the most promising are systems of optical magnification of the scale, but these are still uncommon.

The use of band-spread is usually no solution of the problem. The auxiliary tuning control makes tuning quite easy, and its scale can easily be read. The calibration, however, depends entirely upon the accuracy with which the main control can be set, and this is no better than with the ordinary arrangement.

TABLE I

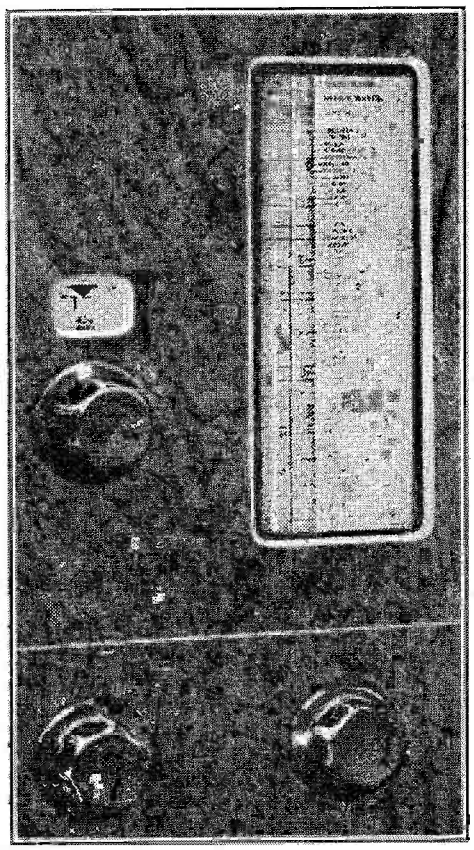
Band	Frequency Ratio	Frequency Range Mc/s.	Wavelength Range metres	Frequency Band kc/s.	Sharpness kc/s per degree
1	2.73	0.15—0.41	2,000—732	260	1.44
2	2.73	0.55—1.5	550—200	950	5.27
3	2.73	1.45—3.96	206—75.7	2,510	13.9
4	2.73	3.5—9.55	85.6—31.5	6,050	33.6
5	2.73	9.0—24.6	33.3—12.2	15,600	86.5
6	2.73	23—62.8	13—4.78	39,800	221

TABLE II

Band	Frequency Rati	Frequency Range Mc/s.	Wavelength Range metres	Frequency Band kc/s.	Sharpness kc/s per degree
1	2.29	0.139—0.318	2,160—945	179	0.995
2	2.73	0.5—1.365	600—220	865	4.8
3	2.83	1.26—3.57	238—84	2,310	12.8
4	2.75	2.75—7.55	109—39.8	4,800	26.6
5	3.0	6.3—18.9	47.6—15.9	12,600	70
6	1.49	18.6—27.8	16.1—10.1	9,200	51
7	1.57	2.38—37.4	12.6—8.05	13,600	75.5
8	1.59	36.6—58.2	8.2—5.15	21,600	120

Constant Sharpness of Tuning—

A modification of this idea, however, has distinct possibilities. This is to abandon continuous control by the main dial



One of the most ingenious methods of overcoming the difficulty of critical tuning on short waves was that introduced in the Murphy A36 receiver. The waveband required is selected by means of the upper left-hand knob (controlling RF stage and 1st frequency changer), final tuning is then effected by varying the 1st intermediate frequency of a double superheterodyne circuit.

and to provide it with a system of mechanical stops which lock it in any one of half a dozen definite positions. All tuning is then carried out on the band-spread dial. In effect, one then has double waveband switching with a single tuning control giving very small coverage. One might, for instance, have four SW ranges on the usual inductance switch control, and six on the stepped condenser control, giving a total of twenty-four effective bands.

This scheme is not yet common, but it is used by at least one firm, who moreover, also obtain constant sharpness of tuning. This is done by using an ordinary medium-wave superheterodyne and preceding it by a SW converter. The converter controls are the usual inductance switching and a variable condenser movable only in definite steps as already described. All tuning is carried out on the medium wave set. This is a clever idea and works well.

Armstrong Chassis

In the Show Report section of our last week's issue the price of the Armstrong Model SS10 was incorrectly given as 10 gns. The price is actually 12 gns. for the all-wave model; the equivalent 2-band broadcast set costs 11 gns.

Five-Metre DX

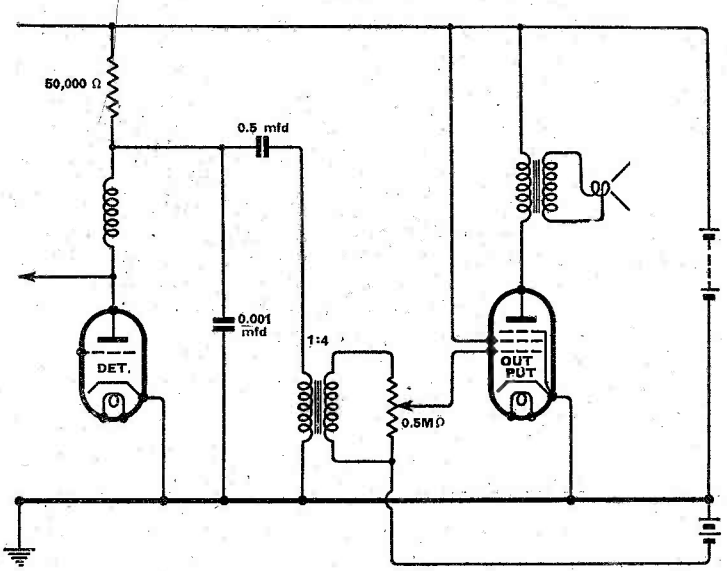
TRANSMITTING WITH INDOOR AERIAL

IT seems advisable to clarify a statement made in these notes recently regarding the weather conditions encountered on Snowdon by GW6AA. As reported it implies that the unprecedented bad weather coincided with the week-end July 29th-30th, whereas it was the July 9th Field Day that was rendered so unpleasant by the weather.

Despite the fact that many of the regularly heard five-metre stations appear to be quiescent, due no doubt to holidays, activity has been moderately high for the week August 11th to 18th. G2MV has been heard on several occasions reporting reception of French stations, though it is not known if any two-way contacts have actually been effected.

On Monday, August 14th, strong signals were being received in London and the southern counties from G6CW, and between 9 and 10 p.m. GMT this station was heard working G2ZV located near Littlehampton. G5RD at Abbots Langley also effected contact with G6CW, whose telephony was peaking to R9 at times, though very deep fading was observed.

The writer's station is about 14 miles N.W. of London, and in almost direct line between G6CW and G2ZV, yet, while the former was of exceptional strength, the latter's CW signals were barely audible.



The Nottingham station was apparently receiving G2ZV very well indeed.

On Wednesday evening, at 9.30 GMT, a "test" call brought forth a reply from G2ZV, whose signals at times peaked to R5, but deep fading precluded receiving more than 50 per cent. of the replies.

The strange part about this affair is that G5RD, who is 12 miles north of the writer's station, invariably receives G2ZV at far better strength.

Good conditions prevailed on Thursday evening, August 17th, when surprisingly strong telephony signals were received from G2OD. It transpired that this station is still using a temporary indoor aerial, yet the telephony was received by G6CW in Nottingham at R5. The distance would be about 150 miles.

G2OD reported having heard F8AA on CW at fair strength on Wednesday evening with only slight fading.

When the writer remarked on the great difference in signal strength between his (G2OD's) and G2ZV's signals, the information was imparted that the former's station is located at High Salvington on the South Downs just behind Worthing, whereas G2ZV is at sea level. The near presence of the Downs appears to have a greater absorbing effect on the transmitted signals than on the received, as G2ZV reports quite good reception of stations situated to the north of him.

G2MC.

Henry Farrad's PROBLEM CORNER

No. 35.—"A Continuous Buzz"

An extract from Henry Farrad's correspondence, published to give readers an opportunity of testing their own powers of deduction :—

67, Muddlecombe Buildings,
Nether Backwash.

Dear Mr. Farrad,

I have a 3-valve set—HF, detector and output pentode. When the HT battery is new it is not too bad, but when it is near the end of its life—as now—the volume is poor. So as I had an old intervalve transformer doing nothing I connected it in place of where the grid leak used to be, as in the diagram herewith, with the idea of getting more amplification. But whenever I turn the volume up there is a continuous buzz that gets very loud if I turn it far. It doesn't make much difference whether a station is tuned in or not.

Can you advise me how I can avoid this buzz and yet get good volume?

Yours truly,

Ernest Tryer.

What was wrong? Henry Farrad's solution is on page 225.

ATMITE

THE Strowger Journal for May, 1939, a publication of the Automatic Telephone and Electric Co., Ltd., of Strowger Works, Liverpool, 7, contains details of a new material with interesting properties. Atmite is a silicon-carbide compound which has a resistance very nearly inversely proportional to the third power of the applied voltage. It is mechanically tough and is capable of withstanding a crushing strain of 26 tons per sq. in.

In the form of a disc of 1 in. diameter with a thickness of 0.125 in., it has a resistance of over 100,000 ohms at 100 volts, falling to only 600 ohms at 400 volts. The permissible continuous dissipation is 2 watts.

The material has valuable applications for spark quenching, for lightning arrestors, for the suppression of induced EMFs in telephone work, and for the protection of copper-oxide rectifiers.

NEWS OF THE WEEK

TELEVISION DEVELOPMENT

Improvements at A.P.: Extension to the Provinces

SOME interesting points were raised during the Dealers' Television Convention which was held last Thursday, August 24th, at Olympia.

The first speaker was Dr. E. V. Appleton, who was recently appointed to serve on the Television Advisory Committee. He said that he was unable to disclose the recommendations of the Committee to the P.M.G., but he enumerated the points considered. Regarding the London area, he said that the service was stable for some years to come, and that he was frankly disappointed in the response of Londoners to the service.

Sir Stephen Tallents, B.B.C. Director of Public Relations, who was the second speaker, referred briefly to the work of the B.B.C. television staff and the Television Development Sub-committee of the R.M.A. Sir Noel Ashbridge, B.B.C. Director of Engineering, in his address, dwelt at some length on the improvements during the year at Alexandra Palace. These include the new studio, a central control room, improved lighting and considerable development in the Emitron, due to Marconi-E.M.I. research. He referred to the addition of a second O.B. unit; the Highgate receiving post and the portable "fire-escape" aerial. It was now possible, he said, to use the ordinary telephone lines up to distances of four miles for the purpose of linking with the balanced cable. Repeater stations are required at approximately every mile of the P.O. line.

Range of A.P.

Sir Noel was emphatic in his denial that the problem of linking London with a provincial station was a difficulty which is likely to hold up the extension of television to the provinces. Regarding the effective range of the transmitter, which was still considered to be 30-35 miles, he said that this could be considerably increased if "we could somehow contrive that all motor cars could be suppressed." The question was asked regarding the possibility of increasing the present power of the transmitter with a view to extending the range as a stop-gap measure until such time as the first provincial station was built. In reply Sir Noel said that the vision transmitter's power of 17 kW would need to be increased some four times in order to double the effective range. He pointed out that even then it would be serving a sparsely populated area.

Mr. C. O. Stanley, chairman of the R.M.A. Television Development Sub-committee, spoke forcefully on the present position of television. He said that the need of extending the service to the provinces was vital in order to convince the public that the service had progressed beyond the experimental stage. "While Members of Parliament still refer to 'experimental television' we cannot," he said, "convince the public that the preliminary stage is passed."

He caused a sensation when he stated that he did not think the lack of finance was the primary cause of the hold-up in extending television to the provinces. "I blame the G.P.O. entirely," said Mr. Stanley, "for the lack of television development."

BROADCASTING IN THE 40-METRE BAND

Comments from Both Sides of the Atlantic

FROM tomorrow, September 1st, the 40-metre band will no longer be the property of amateurs. It was decided at a Cairo Telecommunications Conference, held in February, 1938, to permit a number of broadcasting stations to transmit on frequencies between 7.2 and 7.3 Mc/s from Sept., 1939. Although a number of Governments have registered at Berne frequencies for future use, it is not yet known whether broadcasting stations will commence transmissions within this band immediately.

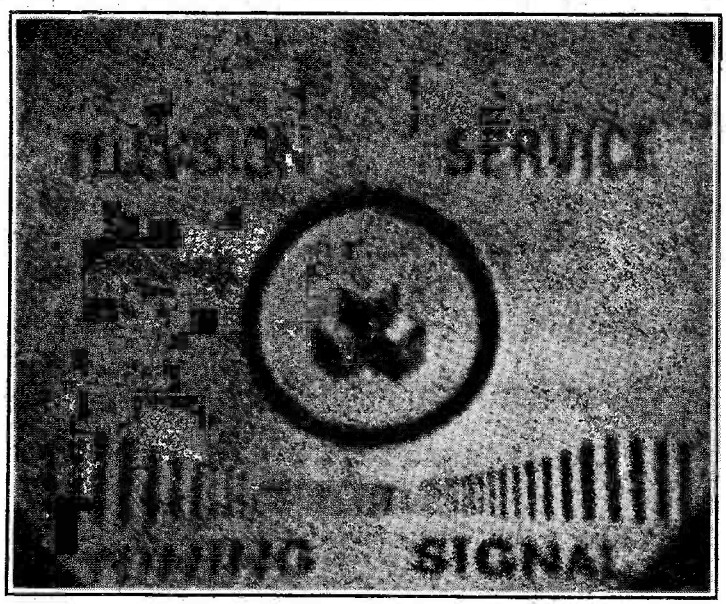
For some time Paris-Mondial has been transmitting on 7.28 Mc/s, despite protests from the A.R.R.L. and the R.S.G.B., and a Portuguese station has also begun transmission within this band. It is reported that the B.B.C. will eventually use two frequencies between 7.2 and 7.3 Mc/s.

In the August issue of *The T. & R. Bulletin* the question of short-wave broadcasting is raised and the query asked "Who listens to these short-wave broadcasts?" The writer continues "We go so far as to say that the audiences who listen regularly to most of the semi-propaganda stations are microscopically small."

Amateurs on both sides of the Atlantic are fearful as to the consequences of this encroachment upon what has so far been their preserve. In the July issue of *QST* was included a voting card on the question of asking the North American governments to permit telephony operation between 7.2 and 7.3 Mc/s. "The fear has been expressed," says *QST*, "that the usual 40-metre CW signal won't be able to compete effectively with strong carriers of foreign broadcasters . . . It is argued that 'phone transmission would be better able to compete with carrier interference from foreign broadcasters . . . And there can be no doubt that 'phones, given the chance, would make thoroughgoing occupancy and prevent the building up of any American audiences for these foreign stations."

The point stressed by the R.S.G.B. is that the short-wave broadcast interests already have a super-abundance of frequencies for the comparatively small listening public they serve.

It therefore remains to be seen what will happen during the next few months.



INTERESTING DATA on the propagation of ultra-short waves is being gathered by Mr. F. T. Bennett, of Guernsey, who regularly receives the B.B.C. television transmissions from Alexandra Palace. This reproduction is of an untouched photograph of the B.B.C. tuning signal as received by him. He uses a Marconiphone 701 television receiver which is preceded by two separate amplifier units in cascade. The output from the second amplifier is split and fed to the television receiver and a separate three-valve amplifier for sound only.

C-R TUBES IN TELEVISORS

TELEVISION receiver manufacturers have been recommended by the Radio Manufacturers' Association to fit protective glass over the cathode-ray tubes in televisors. Until such time as the construction of C-R tubes eliminates the necessity for a protective screen all television receivers must have a sheet of heat-treated safety glass fitted in front of the tube.

For tubes over 16in. in diameter the minimum thickness of the glass is $\frac{3}{8}$in.; for tubes with a diameter over 9in. and up to and including 16in., $\frac{1}{4}$in. thick; and for tubes up to and including 9in. in diameter $\frac{3}{16}$in. thick.

RADIOLYMPIA'S CINEMA

An Interesting Demonstration

SOME delay was caused in the opening of the special cinema at Radiolympia due to technical points raised by the L.C.C. licensing department. The first show was eventually given on Friday evening, two days after the opening of the exhibition.

A feature of the performance, which lasts about an hour and for which a charge of 3d. is made, is the demonstration of gramophone recordings of comparative quality in receivers of to-day and yesteryear. Contrary to expectations, the audience sit looking at a blank screen during this demonstration which is punctuated by the compère's remarks. The recordings, which

News of the Week—

are played on the turntables in the projection box are heard through the ordinary talkie speakers at the back of the screen.

There is a very marked difference in the quality of reproduction from the old and the modern sets demonstrated in the recordings. After a passage of music has been heard as reproduced by each of the two sets, the compére clearly explains what is the difference, i.e., the attenuation of upper musical frequencies, etc.

Of Doubtful Antiquity

The "old" set is referred to as "a receiver of a year or so ago." From its output it would appear to be "a receiver of *ten* years or so ago." The causes of electrical interference are demonstated and the effects of some means of combating them are given.

Following the demonstration, which lasts for a quarter of an hour, the G.P.O. film "North Sea," which illustrates vividly the working of the G.P.O. trawler telephone service, is shown. In this, interesting shots of the Wick Post Office station, the apparatus on the trawler and the skipper actually operating the set are included. The method of sending out a Mayday call from the trawler is shown, together with the method in which it is handled by the coast station.

TYNE RADIO BEACON

THE Tyne Radio Beacon, erected by the Tyne Improvement Commission on the North Pier, Tynemouth, was formally inaugurated by Sir Arthur M. Sutherland, chairman of the Commission, on Monday, August 21st. The station, provided by Marconi, transmits under the call sign MMY on 988 metres with a note frequency of 535 c/s. The normal range is 50 nautical miles.

In the event of a failure in the town's electric supply the beacon would be operated by an emergency generating set.

In his inaugural address Sir Arthur said that the cost of the installation had been more than £1,000. "In 1938," he said, "there were 2,240 British ships and about 5,000 foreign ships fitted with direction finding apparatus. The system of wireless beacons was first introduced in 1924 at Nash Point in the Bristol Channel with the installation of a spark transmitter. In 1925 the first automatic beacon was erected at Round Island in the Scilly Isles, and there are now 34 similar beacons on the coasts of Great Britain and Eire and 450 in the world. 200 of these are in the United States of America."

INTERFERENCE SUPPRESSION

A Comprehensive Guide

IN view of the probability that anti-interference legislation will soon be introduced, it behoves electrical engineers who have neglected the "lighter" branches of their art—including wireless—to learn something of the nature of interference and the methods taken to prevent it at the source.

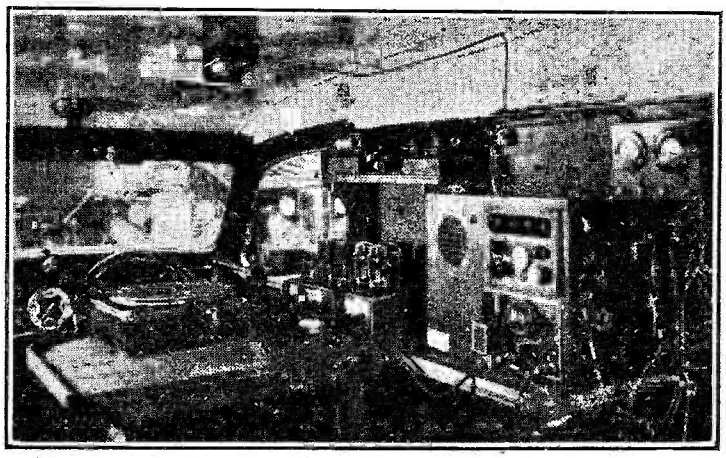
It is largely to satisfy the demand that has arisen for information on this subject that "Radio Information Suppression," briefly reviewed in last week's issue, was written. This book constitutes a comprehensive survey of methods of suppressing electrical machinery, and deals not only with heavy industrial plant but also with light domestic appliances. The book is issued from the offices of *The Electrical Review*, Dorset House, Stamford Street, London, S.E.1, and costs 5s. (by post, 5s. 3d.).

FRENCH NATIONAL TRANSMITTER

Quadruple Aerial System

THE new French National transmitter at Allouis, which is expected to start operations in September, embodies two independent transmitters of 450 kW each, and will work on the Radio-Paris wavelength of 1,648 metres. Each section of the quadruple aerial system is fed with currents having a relative difference of phase in such a way that vertical radiation is reduced and horizontal radiation (which is virtually omni-directional) is reinforced. It is anticipated that this will reduce short-distance fading.

The B.B.C. system of National and Regional programmes will be adopted by France next month when Radio-Paris operates at its new power. The two groups of stations given in our issue of August 10th will on alternate days become National and Regional.



RADIO-PARIS has equipped several reporting cars, the interior of one of which is shown above. On the right is the short-wave transmitter which is used for the broadcasting of news for reception at headquarters.

FROM ALL QUARTERS

Continental Television Reception

A NEW record for Continental television reception is reported from Beeston, Notts, where Mr. F. Weddle, who is a regular B.B.C. viewer, received the transmissions from Rome. The letters E.I.A.R. were clearly distinguishable although the sound was very faint. The distance is over 1,000 miles. The previous record was the reception of Rome in Guernsey, a distance of 900 miles.

"G" Station in Newfoundland

HAVE you heard G8XY or G8XZ? The station transmitting under these call signs on 42.22 and 117.55 metres (7.104 and 2.552 Mc/s) is erected at the base camp of the Public Schools Exploring Society's expedition to Newfoundland. Situated at Grand Lake, it is transmitting from 9 to 11 p.m. G.M.T. daily until September 6th.

Luxembourg in Short Waves

IT was announced some time ago that Radio Luxembourg would commence transmission on short waves. It is learned that the wavelength to be used is 31.49 metres (9.527 Mc/s) and that transmissions, which will be announced in five languages, will be between 4 and 6 p.m. G.M.T.

I.W.T.

MR. HARRIE J. KING, the secretary of the Institute of Wireless Technology, having recovered from his recent illness will be making his customary visit to Radiolympia.

Correspondents Wanted

A READER of *The Wireless World* in British Columbia—Mr. J. J. Bouzek, P.O. Box 56, Stewart, B.C., Canada, wishes to correspond with other service-men in this country with whom he could discuss differences in British and Canadian radio servicing practice.

R.C.A. Profits

IT is revealed by Mr. Sarnoff, president of the Radio Corporation of America, that the net profit of the Corporation and its subsidiary companies for the first half of this year was more than $350,000 less than the corresponding period last year.

Studio in School

RECORDING apparatus, floodlighting, and balance and control rooms are now being fitted into the specially adapted studio at the Guildhall School of Music and Drama, London. Mr. Reginald Denham, a former student, who has had considerable experience as a producer, will supervise the television work. The studio will be completed and put into service in September.

Glasgow Wireless College

PREMISES at 3, Park Gardens, have been opened by the Glasgow Wireless College where there is accommodation for resident students. The college, which is associated with the Dundee and Aberdeen wireless colleges, is now enrolling pupils for the coming term.

Indian Radio Journals

THREE publications devoted to wireless have recently made their appearance in Bombay. They are: *The Indian Radio Review*, which aims at becoming "the vital link between the listeners and the broadcasting organisation"; *The Bombay Radio Times*, which is a technical monthly and includes the short-wave programmes from Germany, Italy and Japan; and *Radio Services*.

Radio Engineering

COURSES for the National Certificate in Radio Engineering have been arranged by the Borough Polytechnic on the lines recommended by the Radio Manufacturers' Association for the training of men who have entered, or wish to enter the radio industry. The courses, which spread over five years, include radio communication, advanced physics (acoustics, light and electricity), advanced theory of radio apparatus, high-frequency measurements, wave propagation and reception and television. A two-year course on radio service work is also given in the syllabus, which is obtainable from the Borough Polytechnic, Borough Road, London, S.E.1. Enrolment for the session which commences on Monday, September 25th, begins on Monday, September 11th.

Radio Society for Bishop Auckland

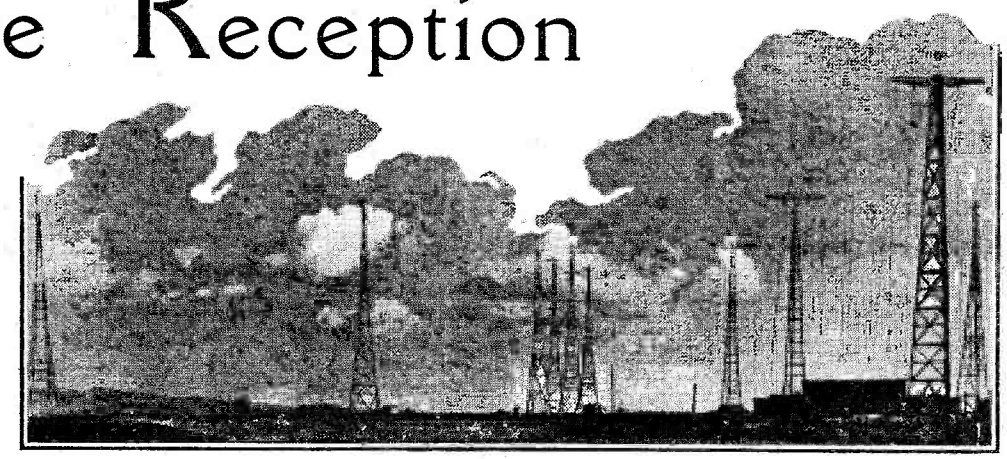
A SHORT Wave Radio Society is being formed in Bishop Auckland. Will any person interested please write to Mr. W. W. Field (G2GC), 5, Albert Hill, Bishop Auckland, Co. Durham, for full particulars of times and dates of the meetings.

Antiference

THE address of Antiference, Ltd., is King's Yard, Bayham Place, London, N.W.1, and not as given in our Show Report last week. Prices of television aerials produced by this firm are from 16s. 6d. upwards.

Short-wave Reception

HOW TO OBTAIN THE BEST RESULTS WITH MODERN SETS



Italy's Imperial Short-Wave Centre at Prato Smeraldo, near Rome, is equipped with fourteen towers, varying in height from 180 to 300ft., which support directional and non-directional aerials. Of the seven transmitters at present in use, two have a power of 100 kW, two 50 kW and three 25 kW.

ALTHOUGH it is only during the past few years that short-wave ranges have been included in domestic broadcast receivers as a matter of course, broadcasting on these wavelengths was in vogue for quite a long time before this. Most readers will remember the special units that could be obtained and which were used in conjunction with their existing sets to tune-in the short-wave stations.

Reception was not always as satisfactory as one might wish, but we were prepared to accept the fare offered and there is no gainsaying that many enjoyable hours were spent listening to events broadcast from a station several thousand miles away. Anyone who has sampled short-wave reception on sets of that period will fully appreciate how much better it is on a modern all-wave set. Improvements have, of course, been made in the design of the short-wave portion of receivers, but contributing in no small measure are the changes effected at the transmitting end. Years of study of short-wave propagation has enabled engineers to predict, with a fair accuracy, the best wavelength for any season and for any time of the day, while the wider use of special aerial systems that concentrate the energy radiated into the desired directions have vastly improved reception on the short waves.

It is quite true to say that there is no part of the world too remote to be reached by short waves, so that we in this country can listen to programmes broadcast from the Antipodes with almost the same facility as to those transmitted over a few hundred miles, though in the case of the former both wavelength and time of day become important factors.

Empire Broadcasting

Being so well provided with broadcast material on our medium and long wavebands we are inclined to look on the short waves as a third string, but in our Dominions and Colonies the short waves assume far greater importance, for they provide a direct link with the Motherland. The B.B.C. have no fewer than 18 frequencies in the short-wave region on which Empire programmes and news are radiated. These extend from 21.47 Mc/s (13.97 metres) to 9.05 Mc/s (49.59 metres) and the most suitable one is used for transmissions to each part of the Empire, according to the time of the day.

Under normal conditions the Daventry transmitters are active for just over 20 hours a day.

Contrary to what one might expect, these short-wave stations are not always well received in the south of England, owing to the directive nature of the aerials employed, to the phenomenon of "skip distance," and sometimes to a peculiar echo. This echo, which gives the effect of the speaker, orchestra or artists being located at one end of a very long bare room, will often help to identify the origin of the programme if the announcement is missed.

Echo is rarely heard on the Continental short-wave stations and the strength and clarity of these transmissions is surprisingly good.

THANKS to the general use of higher power, to directional transmission and also to improvements in receiver design, short-wave broadcasting is now much more dependable than a few years ago. But full advantage cannot be taken of it unless the listener chooses the correct waveband for the time of day and for prevailing conditions

Germany operates an extensive short-wave service, much of which is transmitted in English, and Zeesen, the home of the stations, can be picked up on thirteen different frequencies between 21.45 Mc/s (13.99 metres) and 6.08 Mc/s (49.35 metres).

It is rarely necessary to listen below 6.0 Mc/s, i.e., above 50 metres, for short-wave broadcasting, as the majority of it is confined to six bands between 13 and 50 metres.

These are often referred to as the 13-, 16-, 19-, 25-, 31- and 49-metre bands, and as they are always clearly defined on all modern all-wave sets, the listener need not concern himself with the actual upper and lower frequencies of each.

Usually the short-wave broadcast bands are indicated by thickened bars on boxes on the scales, though there are some sets that give stations' names and indicating lines as a means for identification, while in others the short-wave broadcast bands can be selected by push-buttons or similar mechanical devices.

"Marker" Stations

With a set where only a thickening of the scale line defines the broadcast band a useful tip for finding a station is to tune in one that is easily identified, and as near as possible in frequency to the wanted station, and then search carefully on the appropriate side of the marker station.

If it cannot be found on the first attempt try again a little later, as short-waves are often subject to considerable variation in strength, sometimes fading almost to inaudibility, while at others they are strong enough to necessitate the use of the volume control. AVC cannot compensate for this degree of fading, though it will keep a signal at fairly constant volume if fading is not too severe.

It is also necessary to make sure that the time and wavelength are correct, for if the programme one is after happens to be radiated from one of a chain of stations, this organisation will have several wavelengths at its disposal.

Examples of this are the U.S.A. short-wave stations. The programme may be listed as coming from Bound Brook, but this station has the use of four frequencies, one in each of the 13-, 16-, 31- and 49-metre wavebands, and may use either the call sign W3XAL or WNBI (ex W3XL). Wavelengths are chosen according to the time of day and season, though at this time of the year the 16-metre wavelength is used more than any other under the call sign WNBI and with an aerial beamed on Europe.

In general, this station will be at its best during the afternoon and early evening, but may be affected by bad fading as darkness falls. Late evening reception will as a rule be best on the longer wavelengths, such as 25 and 31 metres, in which case Schenectady WGEO (ex W2XAF) in the 31-metre waveband, or Wayne W2XE in the 25-metre band might provide the best fare. The vagaries

Short-wave Reception—

of the short waves preclude making definite statements concerning the best band to listen-in to at any particular time of the day, since often the shorter ones, i.e., 16 metres, are good signals quite late in the evening, while the 19-metre stations often remain steady and quite reliable up to midnight GMT.

The general tendency, however, is for the shorter wavelengths to predominate during daylight and the longer after night has fallen. One point that should be borne in mind when listening to U.S.A. stations is that some of them use aerials beamed on Europe while others serve the South American continent. The former will always provide the strongest and steadiest signal. The published programmes usually state the times when the transmission is beamed in our direction.

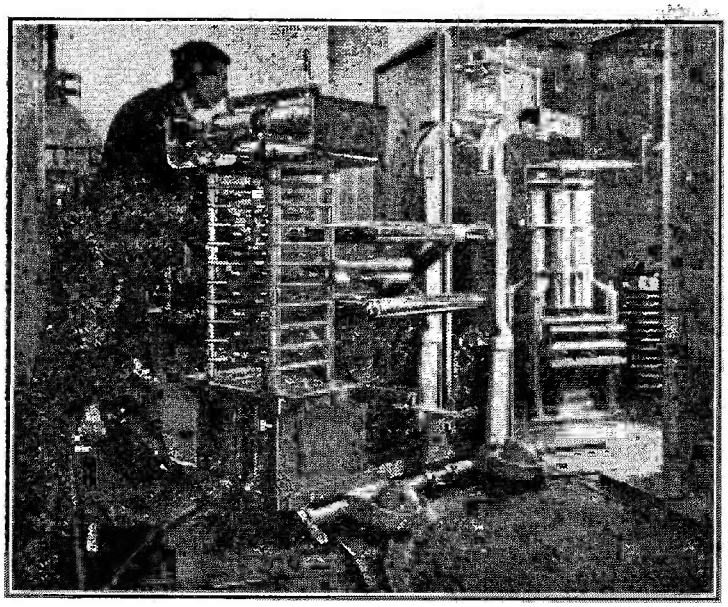
A station that recently has been receivable at good strength in this country is the Chinese station XGOY at Chungking. As it works on 25.21 metres and with a power of 35 kilowatts, the late evening, i.e., between 8 and 11 p.m. GMT., is the best time to listen. It shares this wavelength with the Rome station I2RO13, but as the wavelength generally used by Rome in this band is the 25.4-metre one, Chungking has a clear channel. A news bulletin in English can often be heard about 10.0 p.m. GMT and occasional talks in English are transmitted before the news. This station has been consistently good for some time past.

Australian stations are best looked for in the early mornings between 6 a.m. and 8 a.m. GMT, both Sydney VK2ME on 31.28 metres and Melbourne VLR on 31.32 metres being receivable about this time when conditions are favourable.

Some of the Russian short-wave stations are particularly strong and are to be heard at various times of the day in the 19-, 25-, 31- and 49-metre wavebands. Midday news or talks in English are sent out on 19.35 metres, while in the evening, and on either 31.25, 31.51 or 49.75 metres, talks in English are usually transmitted at 9 p.m. GMT.

Though only a few examples have been given, these will suffice to show that there is plenty of interesting broadcast matter to be found on the short waves. Particular stress has been placed on the use of English by most countries for talks and news bulletins, as some listeners might feel that it is hardly worth while tuning in to foreign stations if they do not understand the language. There are, of course, always the musical items in the programmes, and often these alone justify the little trouble involved in finding a particularly elusive station.

So far nothing has been said about the actual receiver or the best type of aerial to use. For short-wave reception a receiver of good sensitivity is desirable, and for preference it should be a superheterodyne. One with an RF stage before the frequency-changer will always give the best signal-to-noise ratio, other things being equal.



Three methods are employed for the frequent changes in wavelength at the B.B.C. Empire station. One method is the plug-in type of coil, shown here, which is wheeled into position on rails. The overhanging projection on the right carries the grid tuning circuit. In the centre are the two large tubular turns of the main anode inductance between which is the feeder-coupling coil. The other two methods of wave-changing are by the use of continuously variable inductances and a turntable fitted with four sets of pre-tuned circuits.

Two or more short-wave ranges will be better than one, while the set should tune down to at least 16 metres, but preferably to 13 metres. A few years ago we would have advised a very careful examination of the tuning dial and scale, as with a few exceptions the tuning-in of short-wave stations required not only great patience but no little skill.

Whilst tuning will still have to be carried out with care to obtain the best results, so many improvements have been made in the design of scales and slow-motion tuning devices, added to which press-button selection of short-wave bands is now being adopted, that the purchaser of a new set need not really concern himself with these. Attention must, however, be given to the installation of the set in the home.

The object should be to provide the set with the best possible signal, which can only be done by erecting a good aerial. Short waves can be received on quite a short indoor aerial, but the set must then be operated at maximum sensitivity, and the inherent receiver noise will then be audible as a background accompaniment. If this were the only drawback of a short aerial it might be tolerated, but as few distant stations will be strong enough to generate an AVC voltage, slight fading of the signal will be immediately apparent. By using a good outdoor aerial the receiver will have a strong signal to deal with, and normally will be operating at lower sensitivity owing to the generation of a considerable AVC voltage. Now a fading signal can be compensated for by the reserve sensitivity of the set, so that reception will be steadier and for the most part quieter.

The aerial should be as high as possible, and where local electrical interference is troublesome one of the all-wave anti-interference type can be installed. Always use a good earth connection and fit a lightning arrester to the aerial.

Little advantage is to be gained by erecting an aerial solely for the short waves unless reception is required from one particular direction. Most of the special aerials have marked directional properties, and it is this feature that is largely responsible for the improvement effected in the optimum direction.

Local Television Relay

Distribution from a Central Receiver

IN view of the relatively high cost of television receivers, arrangements which will enable the receiving equipment to be cheapened are always of interest. Many schemes have been suggested for blocks of flats, where a central receiver can be provided and the demodulated picture and sound signals distributed to the various subscribers living in the flats so that a simplified and consequently cheaper receiver can be used by the subscribers.

In order to cheapen the subscribers' receivers still further, it has been proposed to generate and synchronise the deflecting currents in the central receiver and to transmit these currents over feeders to each receiving point and thus to avoid the expense of synchronising and scanning circuits in each individual receiver. A practical difficulty arises in carrying out this, however, as on account of imperfect matching between the scanning coils of the receivers and the feeder carrying the scanning currents it is not always possible to avoid reflections.

According to a report from the Siemens and Halske laboratories, this difficulty can be largely overcome by winding the deflection coils of the receivers in several sections and building them by means of suitable condensers into an artificial line properly terminated to have the same surge impedance as the feeder. The deflection currents can then be fed to the scanning coils without setting up any reflections. The individual sections of each deflection coil can be arranged in series along the axis of the cathode-ray tube.

BEETHOVEN 1940 SETS—A CORRECTION

IN the note on page 159 of the August 17th issue, it was stated that the P44 portable was of the all-battery type. Actually the LT is derived from an unspillable 14 AH accumulator and HT from a 90-volt battery with quick-fitting contacts.

The price of the Model B43 mentioned in the same note has been fixed at 8½ guineas. This is a 5-valve superhet with QPP output and an illuminated four-colour tuning scale.

Letters to the Editor

The Editor does not necessarily endorse the opinions of his correspondents

Replaceable Components

IN *The Wireless World* of July 27th, there is an Editorial on the problem of tuning scales for the Montreux plan. There would, in my opinion, be no problem at all were tuning scales readily accessible, but in the majority of receivers replacement of these scales can be effected only through the removal of the chassis, or at least of several components.

I have never yet discovered any adequate reason whatever why tuning scales, and still more such things as pilot lamps, should not be made easily accessible for changing or replacement.

A further point is that tuning scales often become dirty in course of time, especially in the case of mains-driven receivers, which get considerably warmed-up when they have been switched on for an hour or so, with consequent infiltration of dust behind the glass covering of the scale. Were the glass cover so arranged that it could be readily removed, this unsightly dust could be cleared out periodically. As things are now, it is most tantalising to be able to see these tuning scales and pilot lamps "so near, and yet so far!"

T. J. E. WARBURTON.

St. Leonards-on-Sea.

Reproduction Levels

THE correspondence in *The Wireless World* on reproduction level has now reached a very interesting stage, and I would like to express a few ideas which appear to have been overlooked in the discussion so far.

Mr. Hughes, and the others, agree "that for perfect reproduction the correct level is essential."

As this elusive perfect reproduction has not yet been invented, the arguments are all based on an imaginary ideal, and that for real quality reproduction it is not essential to have the correct level. Mr. Hughes appears to have the psychology of listening all wrong. When we listen to the reproduced version of an orchestra we want to be able to hear the correct proportions of the original.

We know that when we hear music reproduced to-day it has first to pass through the control room, and it is altered from the original according to the control engineer's own idea of balance.

When we keep our level of reproduction down—not by any means to a low level—our ears attenuate the high and low notes, so why should we not use tone correction? After all, what is the criterion of good reproduction? When we can sit back and receive the utmost satisfaction from it, and we can say that it was magnificent. Does it really matter if it was not quite like the original? We must not lose sight of the fact that as we cannot hear the original at the same time as the reproduced, we cannot make a comparison.

Many individuals' ears—those of musicians included—attenuate more than others, so why not make it possible for them to recreate the tonal balance as required by them through tone compensation?

If everyone had the same idea of tonal balance, then they would all be cramped into a very small space should they decide to hear an evening's music at the Queen's Hall.

As different orchestra conductors have their own standards of tonal balance, I cannot understand why we should try to fix a standard for this.

There are too many variables from the original to what we hear to fix a standard.

To my mind, the question of reproduction level and quality is bound up with the individual's taste, and what he wants in tonal balance to suit his musical feelings; so long as he has a means of adjusting his wants to his satisfaction, it should not be argued that it is wrong.

He has to listen to reproduction through his own ears and not through the medium of another person's—which may interpret balance quite differently.

Scientists, while giving us plenty of food for thought in their articles on quality and distortion forget that we listen to reproduction through the medium of a loud speaker and not from a cathode-ray oscillograph.

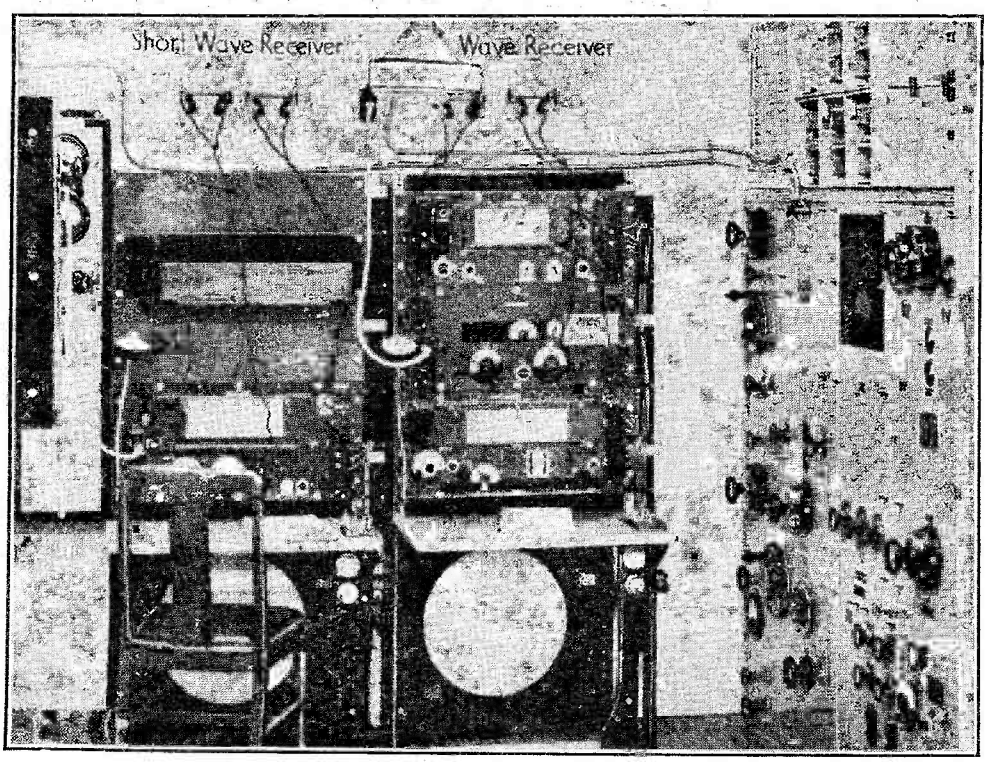
London, N.4. R. C. HARRIS.

ALL those interested in this correspondence will appreciate the clear summary and conclusions given by "Cathode Ray," but there still seems to be one important point which has not been fully considered, namely, this "listening ear at the original performance," which has been taken as an arbitrary standard. Does its position always coincide with that of the microphone, and in any case does the B.B.C. know anything about it?

I have always understood that the B.B.C. bears in mind the artistic quality of the ultimate reproduction of its musical programmes, and to this end frequently deviates from orthodox musical practice with regard to the placing of performers and instruments, even in the concert hall, while studio arrangements are usually made entirely from the point of view of the "mike." Furthermore, when two or more microphones are used the various components of the sound waves may be combined with their relative amplitudes such as could not be heard by an ear in any one position. I believe the usual routine is to balance up a concert performance at rehearsal using a loud speaker for reproduction; surely the loudness level used for this is of some importance? Do the engineers work to some approximate standards and assume, for example, that there is an ideal listening distance for a given type of performance? Some authoritative information about this side of their work would be very welcome, as in the absence of any standards most of our tone control adjustments would appear to be haphazard and meaningless except as a matter of individual taste.

It appears to be agreed unanimously that in circumstances where it is necessary for the reproduction to be appreciably below normal there is some loss of realism or naturalness, but while some listeners find it possible to restore this by tone adjustment, others do not. If we may define naturalness as the degree to which the reproduction resembles the idea in the listener's mind of how a similar performance should sound, surely we have here an explanation of the only actual

WIRELESS IN THE NAVY



Until recently the civilian seldom had an opportunity of seeing inside the wireless "office" of a man-of-war. This privilege is given him at Olympia, where the complete transmitting and receiving equipment of a destroyer forms one of the "sideshows"

difference of opinion which has arisen, for we have introduced a factor which is likely to be different for each listener. I personally find I am much more critical of the quality of reproduction of a concert when I am familiar with the auditorium where it is being given, and often find it noticeable that the microphone is not in the position I would be in myself.

From all these rather indefinite conjectures the fact does emerge that a properly designed tone control will sometimes be found helpful to a critical listener if it is used intelligently, and with some thought as to the conditions at the other end; as a second best some degree of automatic tone compensation can be provided for the non-intelligent, but as the latter will probably not be very critical it seems doubtful if it is worth while.

It is to be hoped that some of the points raised in discussions of this nature may lead to a closer co-operation between musician and technician; I am convinced that in the near future electrical reproduction of music will prove to be of considerable importance in the progress of the whole art.

Stanmore, Middx. C. C. BUCKLE.

Call-sign Duplication ?

I SEE from your issue of August 10th that Mr. Stanley Garnett complains of piracy of his call-sign G4AW. He may be interested to know that I have a station two hundred yards from me who has G4AW as a call-sign, and cards on the wall to that effect. Have the P.O. issued two G4AWs ? I wonder. J. E. THOMSON, G3RY.

Stockport, Ches.

Shaver Interference: Views from Canada

THE letter from Mr. J. A. Yearsley in *The Wireless World* some time ago on the very vexatious matter of interference caused by electric shavers is rather apt to lead others astray.

My experience and experiments in suppressing the fierce radiation of these pests of the ether have shown that the cure (if and when possible) is nothing like so simple as your correspondent would have us believe. In the several different makes of shaver which I have investigated, only one has a condenser across the contact points, and this is of only very small capacity (estimated about 500 micro-microfarads), of the mica type. In this particular machine the shaving head (i.e., cutter) is insulated from the motor by a Bakelite insert.

Long ago I tried out the rather obvious cure, in a shaver which had no capacity whatever installed by the makers, of putting in a 0.01 mfd. 500 V (1,000 V test) midget condenser directly across the contact-breaker. *That* condenser lasted rather less than one minute! Another (same rating) stood up for several minutes—long enough to discover that sparks about $\frac{1}{16}$in. long could be drawn from the cutter to any part of the user's anatomy, accompanied by a decidedly unpleasant prickling sensation. Again the condenser broke down under the enormously high voltage induced in the motor windings. This machine, of course, did not have the cutter-head insulated from the motor. Operating voltage was 110 V, 60 c/s.

A suitable small resistance in series with the by-pass condenser will take the edge off the extremely steep and high wave-fronts of induced voltage, and also destroy most of the RF-suppressing qualities. Also, where, in the average shaver, can one find room for anything but the simplest and tiniest of devices inside the casing?

A suitably designed choke-plus-capacity filter, installed *at the right spot* (not at the wall-plug), is effective with some machines (next to useless with others, particularly the cheaper varieties).

Meanwhile, the manufacturers of the gadgets seem to know nothing, and care rather less, about the interference caused, or means of preventing it.

SYDNEY R. ELLIOTT.

Allenby, B.C., Canada.

Wireless in the Wilds

"DIALLIST" has on a number of occasions sought information on various primary cells for the solution of the battery problems of the exiles in the wide open spaces.

In these days junk motor cars fetch 50s. each. Every one has a 6- or 12-volt dynamo with cut-out and ammeter. You could probably get a dozen at any breaker's yard for 5s. or 10s. each. The rotors are on ball bearings, and they start charging at about 2 amps at some 500 r.p.m.

The only other requirements seem to be a 6- or 12-volt battery, a simple windmill, and an old bicycle. Then, even if the wind drops, there's always leg-power.

FREDK. GRISLEY.

Leigh-on-Sea, Essex.

Start Point: Complaint from the West

A FLY remains in the ointment of quality reception in these parts. Start Point is a great asset, but one is precluded from using broad tuning or a wide band filter by the fact that Rennes-Bretagne occupies the next channel, only 10 kc/s away, and geographically only just across the Channel, about 160 miles away.

I suppose it would be too much to expect the B.B.C. to swop over wavelengths now so that stations adjacent geographically shall not be neighbours in frequency, too. Having waited fifteen years for a decent service, the part of the country showing the highest proportion of licences to population will meekly wait another nine months (until the Montreux Plan comes into force) for a few more crumbs to be thrown to it. So we see that it is not sufficient to lay down that stations sharing a channel shall be set far apart or use directional transmission; the same rule should apply to cases like the present; Start Point has the necessary equipment, but Rennes hasn't, and it would hardly be reasonable to ask an inland station to reduce its radiation over an important part of its service area. L. J. VOSS.

Plympton, Devon.

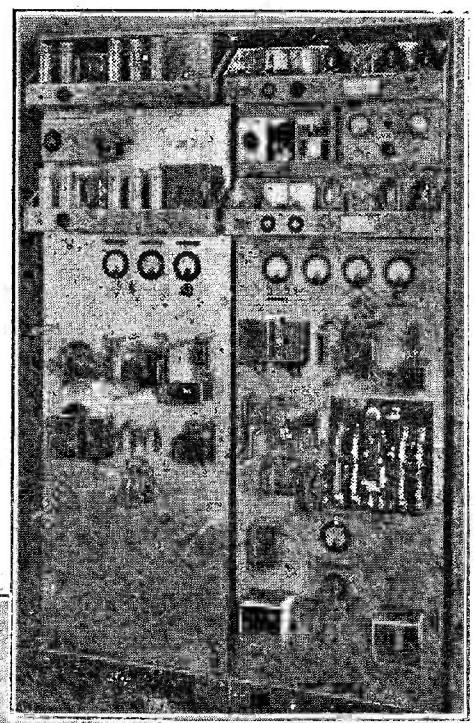
"Free Grid's" Speed Indicator

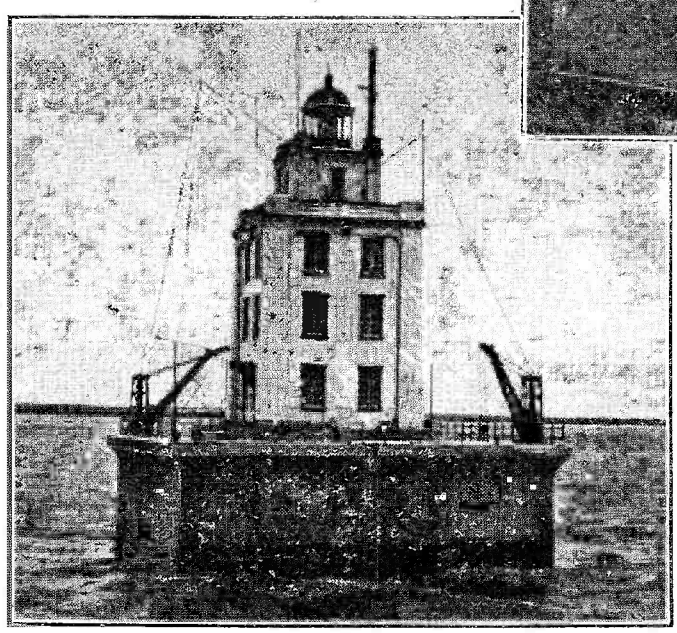
"FREE GRID'S" speed indicator is very interesting. I cannot, however, refrain from questioning the use of the Doppler principle as an explanation of its action, both by the author and "Henry Farrad."

According to the Theory of Relativity the velocity of light with regard to any observer is the same whatever the relative velocity of the source and observer. Radio waves, being also an electromagnetic radiation, will act in the same way, and will pass the airman at the same velocity independent of the speed at which he is flying. So they can scarcely change their frequency unless they are also prepared to change their length.

The velocity of light, three times 10^{10}m. per sec. is also laid down as a limiting velocity, greater than which no velocity can exist. Thus the wave cannot have a velocity greater than this relative to the airman. If it did it would possess peculiar properties such as that of being in two places at once.

"PARASITE."





WIRELESS CONTROL of the lighthouse on Fourteen Foot Shoal, Lake Huron, maintained by the United States Lighthouse Service, is carried out from a point on shore about four miles distant. The extensive equipment comprises lantern, fog signals and a radio-beacon; any of these devices can be put into operation from the remote point. Power is supplied from a 110-volt accumulator battery, the charging equipment for which is automatically started and stopped. The inset photograph shows apparatus in the lighthouse control room.

What *is* "Fluctuation Noise"?

By "CATHODE RAY"

IF you have any experience of very high-amplification receivers you know that unless they are tuned to a station of at least moderate strength, or are provided with a quietening device, they emit a noise that may be anything from a faint hiss to a roar. You may think that this is due to atmospherics, or a defect in one of the valves, or some such cause. Well, perhaps it is. But even when the aerial has been disconnected (to keep out atmospherics), and suppressors have been put in the main leads (to keep out any other sort of interference), and all defective valves or components have been replaced by good ones, the set still utters a rushing sound if it amplifies enough. It may be possible to reduce the noise corresponding to a given amplification, but only to a certain extent. Devices such as "Q.A.V.C." silence it by cutting down the amplification, so don't count.

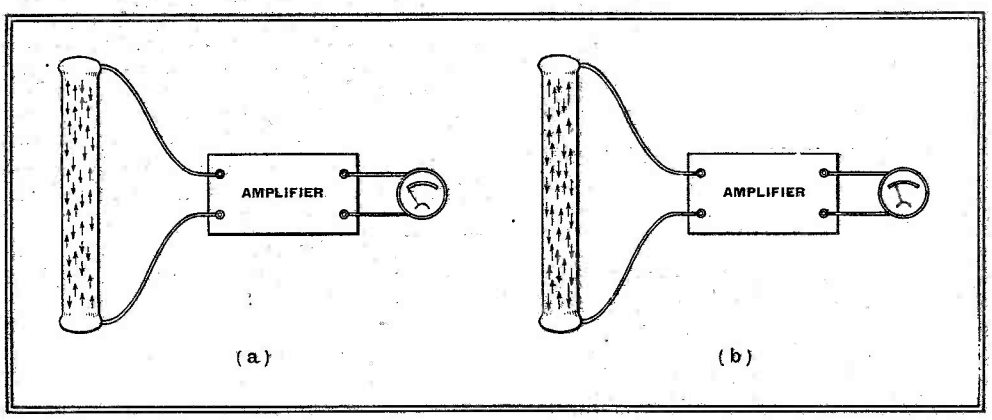
The noise that is left after all avoidable causes have been eliminated is known by so many names—thermal agitation, fluctuation noise, Johnson noise, Schottky effect, "schrotteffekt," shot effect, etc.—that it is not surprising if readers get muddled. Actually there are two closely related phenomena: the first three of the foregoing names apply to one, which occurs in all ordinary electric circuits; and the last three apply to the other, which occurs in the spaces between the electrodes of valves.

Both are due to the ultimate structure of matter. A distant view of a sand beach after the tide has gone down gives the impression that it is one continuous substance; whereas close examination soon shows it to be made of separate small particles. These particles can be crushed into still smaller fragments, of microscopic size. If water is examined, even through a microscope, it is impossible to distinguish between one particle of water and another; in fact, in spite of modern education, probably most people suppose it is quite continuous. Anybody with even a smattering of scientific knowledge knows, however, that water, air, glass, copper and everything else is actually composed of small particles separated by wide open spaces. The wideness of the spaces is, of course, relative: the most powerful microscope is totally inadequate to reveal them, still less the particles themselves.

FACTORS THAT SET A LIMIT TO RANGE

A large proportion of the particles are of the particular type known as electrons, and whenever an electron moves there is an electric current. Moreover, all electrons are always moving very rapidly (unless the temperature happens to be 273 degrees below zero Centigrade, and that eventuality can be neglected for practical purposes, though it is very interesting and important theoretically). Since electric currents consist of the movements of electrons, and all matter is composed largely of electrons, and all the electrons are moving, it seems as if electric currents must be everywhere. This disagrees with experience (fortunately!), for two reasons. One is that many of the electrons, especially those in what we know as insulators, are bound up with particles of the opposite electrical polarity; so the electric currents resulting from movements of these married couples exactly cancel out. The other reason is that unless there is any special influence at work even the free electrons do not move in any one direction more than another and therefore the effect is that their own movements cancel out.

This is one of the so-called statistical laws of nature, which means that it is true if the average is taken of a sufficiently large number. It is a statistical law of nature that when a coin is fairly tossed the chances of its being heads or tails are equal. If you toss a coin 10 times you may get seven heads and three tails. It is just possible that you might get ten tails and no heads. But if you tossed it 1,000,000,000 times the number of heads and tails would each be almost exactly 500,000,000. As electrons exist in vastly greater quantities than this, even in drops of water and grains of sand, the chances of any appreciable surplus happening to move in one direction at the same moment are small. But not nil. In the ordinary way these unbalanced movements are not detectable, but the enormous magnification that is possible with a multi-valve amplifier is sufficient to reveal them. The electrons in a piece of wire may be thought of as a crowd of people or a swarm of gnats rushing about absolutely at random. Over a space of time the chances are in favour of as many electrons moving up the wire as down it; so the electric currents cancel out. But if it were possible to account for every single electron out of the trillions present, it would be found that at one moment a few more were moving up the wire; the next moment the tendency might be reversed; occasionally a fairly large number might happen to be moving together. Therefore, although the average current is nil, there is a very small current continually fluctuating in direction and strength. The nature of this current has been closely studied, and it is rather a paradoxical thing (as it is with the tossed coin) that although the result in any one particular case is entirely unpredictable, yet the average result—which is the only one of any practical importance where electrons are concerned—is known with a large degree of accuracy. So accurately, in fact, that it is used for the calibration of certain instruments such as standard signal generators.



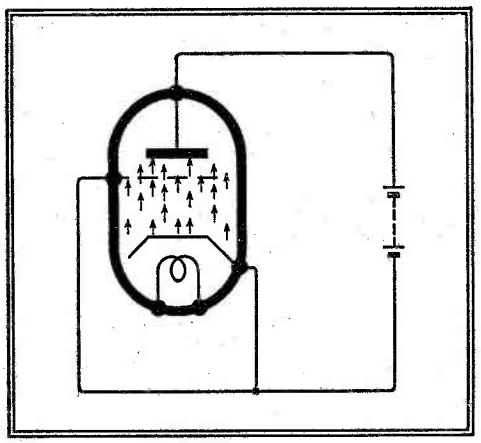
The electrons in, say, a resistor that is not connected to any source of electricity are moving about at random. At the instant represented by (a) equal numbers are moving up and down (those moving sideways, etc., are not shown), and the voltages developed by these minute currents in the resistor all cancel out. At another moment (b) it happens that more are moving up than down, so there is a small resultant voltage that can be detected by the use of sufficient amplification. With a resistance of about 100,000 ohms, the average may be a few microvolts. A tuned circuit is equivalent to a high resistance so far as fluctuations of the resonant frequency are concerned.

Temperature Effect

In the first place, the higher the temperature the faster the electrons move, and therefore the greater current a given number causes. Then the greater the resistance of the circuit or component the greater the voltage set up by these small currents. Finally, the currents include all frequencies equally, from zero up to high radio frequencies at any rate. So you can reduce the amount of noise in the output of a receiver by narrowing the band of frequencies accepted by the amplifier. Even if one wasn't obliged to do this in order to tune out interfering stations, it would be

What *is* "Fluctuation Noise"?—

worth doing it to reduce noise. Reducing the resistance of, say, the first tuned circuit (which is equivalent to a high resistance at the frequency to which it is tuned) is no good, because it reduces the "signal" more rapidly than the noise. So actually it pays to make the tuned-circuit resistance as high as possible, which is done by making the series resistance of the coil and condenser as small as possible. As regards the temperature, you can get a very satisfactory reduction in noise by cooling the first tuned circuit with liquid helium. But you might find it rather a troublesome treatment to apply!



In a vacuum valve the electrons are all going the same way; but the current is not quite free from fluctuations, because the number of electrons in transit varies from moment to moment.

Why have I referred particularly to the *first* tuned circuit? Because it is followed by the largest amount of amplification. If the first stage amplifies 100 times, then it is obvious that the noise due to the second tuned circuit is negligible compared with the hundredfold noise from the first. Even when the amplification is small—around ten times—as it is at television wavelengths, the second circuit is hardly worth considering compared with the first.

How about the shot effect? The current through a valve is rather a different sort of affair from those in wires and other things. It crosses empty space, so there is no permanent swarm of gnats to dart to and fro. No electrons are allowed in the vacuum except on business. When a current is drawn across to the anode by the HT battery or other attraction, it consists of a one-way stream of electrons released by the heating of the cathode. But although it is one-way, and the electrons are very small, there are slight irregularities in the rate of arrival, just as the pressure on a steel plate peppered by a thousand machine guns would be subject to continual slight variations.

At first, a valve was treated as a resistor heated to the temperature of the cathode; but although that gives something like the right answer in certain cases, the matter was found actually to be much more complicated. It has now become the practice to refer to the shot noise generated by a valve under given working conditions in terms of the resistance at the input (grid to cathode) that would be necessary to produce the same amount of noise voltage. A typical equivalent resistance is 10,000 ohms. This means that the shot noise of the valve with its input short-circuited is the same as that produced if shot noise could somehow be abolished and all the noise were due to thermal agitation in a 10,000 ohm resistor, amplified by the valve. At medium broadcast frequencies the tuned circuit resistance is likely to be about 100,000 ohms; perhaps more. So the added effect of 10,000-ohm shot noise is not very significant. But for short waves the tuned circuit resistance, allowing for the input resistance of the valve itself, may be less than 10,000 ohms, and the shot effect of the valve in question would then contribute the majority of the noise.

Shot noise is decided largely by the design of the valve, but one way in which it can be kept to a minimum is by avoiding passing any anode or screen current that is not accompanied by at least a corresponding increase in amplification.

In practice it is impossible to eliminate either type of noise entirely, so they are often referred to as inherent amplifier noise, and form a natural boundary limiting the amount of amplification that it is practicable to employ. The very elaborate receivers used for important services—for example, the Post Office receiver I described a few weeks ago—are ingeniously contrived for getting the maximum signal with the minimum noise; and although the total number of valves used may be enormous the number of actual stages between aerial and output is never very large. The idea of connecting up 50 stages of amplification and receiving a 1-watt transmitter anywhere just doesn't work!

Random Radiations

By "DIALLIST"

For Overseas—and Home

ONE thing that may strike you at Radiolympia is that some of our wireless manufacturers have at last awakened in good earnest to the vast possibilities of the overseas markets. Till lately, they didn't seem to be bothering much about these, though *The Wireless World*, which has readers everywhere and has therefore excellent sources of first-hand information, has repeatedly urged them to be up and doing ere others stepped in and skimmed the cream. What is specially interesting is that *The Wireless World* told them from the very first just what kind of set was needed. "In the marketing of these export sets," writes one firm to me, "British manufacturers found that there was a considerable demand for an almost identical type of set amongst connoisseurs and short-wave enthusiasts in this country." In other words, what the overseas market—the Empire part of it anyhow—wants is a set that is first rate on the short waves as well as on the medium; not a medium- and long-wave set with a single short-wave range added as a make-weight. And that is also the kind of receiver that so many of us at home have been asking for for so long. Visit the export section of the Exhibition and see for yourself, if you haven't done so already.

High-speed Tuning

The chief innovation this year in the press-button receivers with motor-operated tuning is that the pointer travels literally in double-quick time from one station to the next when you dab with the forefinger. No bad thing, that; for in some of the early models you had to wait an unconscionably long time whilst the pointer crawled over the dial. There's one aid to quicker manual tuning, too, that I'd like to see on more receivers. That's a big tuning knob, with a recess or hole in or near the rim into which you can stick your forefinger when you've come to one end of the scale and want to go back to the other. I'm glad to see that automatic wave-range changing is to be found in many of the sets. It may seem a small thing, but I don't think it's altogether trifling; an automatic set should be as fully automatic as you can make it, and there's no sense in having to push two buttons if one will do the work.

Vision Receivers

A fine show of television receivers this year. I can't claim to have counted them, but I am told there are over a hundred different models on the stands of the twenty odd firms displaying them. I've just been talking to a cricket widow whose husband is reputed to wear out innumerable pairs of trousers each season on the benches of famous cricket grounds as he watches Test and county matches. She complains bitterly that she seldom sees him once the cricket season has started. "Why not," I asked, "put in a television set and keep the wanderer at home?" She is seriously thinking it over. She fears, though, that if the B.B.C. is televising from Lord's, he'll take it with him to the Oval and so be able to watch two matches at once. Anyway, there's a fine choice of vision receivers for cricket widows or others, and I'm very much impressed with the excellence of the reproduction given by even the least costly models. No one can say now that television hasn't genuine entertainment value.

The Conventions

To-day sees the last of the "popular technical conventions" which have been such an excellent feature of this year's show. In case you'd forgotten it, the subject to-day is "Television," and the rendezvous, the Conference Room at 6 p.m. Admission is free so long as you're inside Olympia. These conventions are just what has been wanted for a long time. The lay papers have mostly ceased to give their readers any information about the technical side of wireless, so that the man in the street has little idea of what progress is being made. All that he gathers in the ordinary way is that receivers have been getting cheaper for some time, though not changing much, and that, depending upon what paper he reads, the B.B.C. is either a magnificent provider of entertainment or the world's prize collection of incompetent half-wits. That being so,

he doesn't see any reason for discarding the old set in favour of a new one, so long as it makes some kind of intelligible noise when he switches on.

Wireless Back-numbers

Many manufacturers of wireless receivers would, I'm sure, be surprised if they knew the kind of reproduction that many people are content with, not knowing that there is anything better. It is no more and no less a fact that there are heaps of folk who put up with poor volume, with horrible background noises, with woolly speech and with music minus most of the treble plus carpet-beater "bass" because they believe that wireless can't be any better than that. Most of us have heard such sets; have also heard their owners express mild astonishment when it was hinted that their performance wasn't quite up to modern standards. It seems a pity that, with the transmissions as excellent as they are now, this kind of things should go on.

All-dry

LATELY I've been trying one of the newest "all-dry" portables to see how I liked it. I've had for some time an older portable of the suitcase type by a first-class maker and I thought it would be interesting to try the two against one another. I don't mean as station-getters, for there the "all-dry" would naturally win hands down, since it is a superhet while the other is a straight designed for short- rather than long-range working. It was volume and quality that I had in mind to compare. The old set wins as regards quality; it has a rather better loud speaker and the background is dead silent. But the "all-dry" can produce remarkable volume and handle it without undue distortion. In fact, what these little valves with their minute requirements in the way of LT and HT current can do is amazing. I was surprised to find how many foreign stations the "all-dry" would bring in—and not too badly either. After dusk, I was able to pick up at respectable strength a round score of stations in France, Holland, Germany, Italy and even further afield. It seems to me that now its use of dry batteries for all current supplies makes it really light, the portable is worth cultivating.

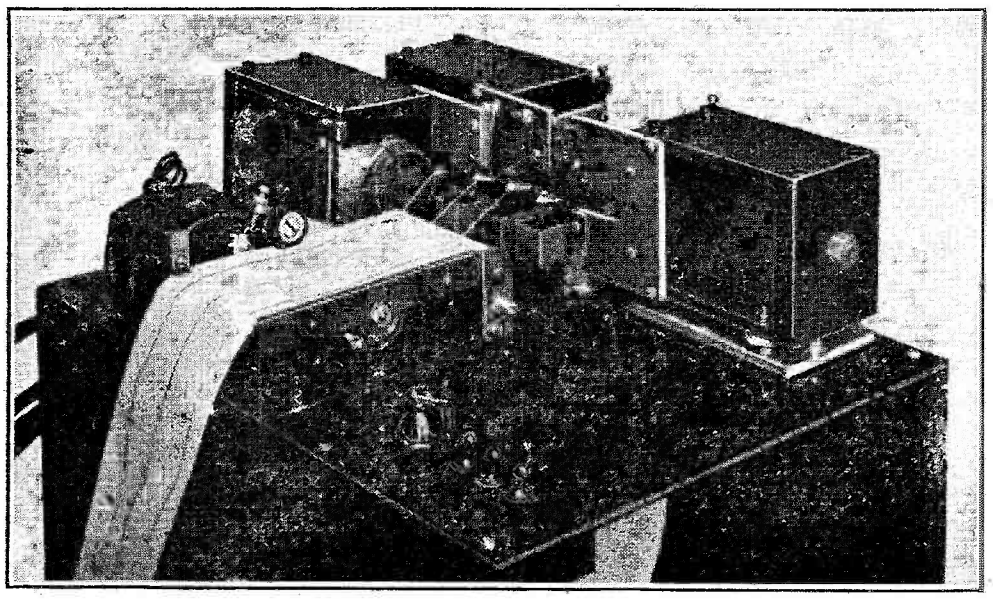
Virtues of the Frame

IT'S some time now since I used a frame aerial for DX purposes, and I must say that when I was trying that portable on foreign stations I was impressed by the useful addition to overall selectivity provided by the directional properties of that kind of collector. If it wasn't for the fact that it is so prone to pick up interference in the home to-day, I think I'd dig out an old frame that is lying about somewhere and adapt my big set for use with it. I once had a superhet which worked off a diamond-shaped frame with 18-inch sides. That was in the days before interference became so bad, and I used to say of it that its selectivity was such that you could almost separate a station from its own call-sign. Using a frame there is one kind of interference—not man-made—whose effects you can sometimes defeat. Atmospherics are often radiated from a definite centre of disturbance and so arrive from a fixed direction. When this is happening rotate the frame till you find the position that gives a minimum of atmospheric annoyance. Then listen to any stations that can be picked up without moving the frame, bringing up the volume when necessary by means of the volume control. The frame might, I suppose, be used in the same way against man-made static coming from a single source; but it can't do anything when it's arriving from all points of the compass.

HENRY FARRAD'S SOLUTION

(See page 216)

WHEN a battery is old its internal resistance is high; and changes in current through the output pentode cause changes in voltage across this battery resistance, which are passed through the coupling condenser, stepped up by the transformer, and applied to the grid. Whether they are in a direction that increases the current changes or reduces them depends on the way the transformer is connected. If the former, the amplification around the loop may be enough to cause continuous low-frequency oscillation; as appears to be so in the present case. By reversing one of the transformer windings the positive feedback is converted into negative feedback, with some loss of volume. If this loss is to be avoided, it is necessary to decouple the circuit, as, for example, by connecting a condenser of large capacity across the HT battery.



ELECTROENCEPHALOGRAPH: A feature of the Ediswan stand at Radiolympia is a device for recording brain activity. Known as the Electroencephalograph, it has been developed by Mr. Grey Walter and is manufactured by the Edison Swan Electric Co., Ltd. Four pads are placed on the head of the patient to give four points of electrical connection and are connected via high-gain amplifiers to three recording pens. Brain activity causes variations in the output and the presence and position of tumours can be gauged from a comparision of the three traces. The above photograph shows the recording mechanism; it is connected by cables to the amplifiers which are of special low-noise design.

Television Programmes

Sound 41.5 Mc/s Vision 45 Mc/s

The "Come and be Televised" feature from 11 a.m. to 12 noon will continue throughout the duration of Radiolympia, but from Monday, September 4th, the usual film for demonstration purposes will be given during that period. The National or Regional programme will be relayed on 41.5 Mc/s from approximately 7.45 to 9 p.m. daily.

THURSDAY, AUGUST 31st.

3, Fashion Parade with Bobby Howell's Band.* **3.30,** Gaumont-British News. **3.40,** 261st edition of Picture Page. **4-4.30,** The Zoo, O.B. from Regent's Park.

9, Elizabeth Welch in songs. **9.10,** Night shots from the Zoo. O.B. from Regent's Park. **9.30,** British Movietonews. **9.40-10.20,** 262nd edition of Picture Page.

FRIDAY, SEPTEMBER 1st.

3, Cabaret, with Bennett and Williams. **3.20,** British Movietonews. **3.30,** Cartoon Film. **3.35,** Mantovani and his Orchestra. **4.5-4.30,** The Zoo, O.B. from Regent's Park.

9, Variety, with Nosmo King and Hubert, Adelaide Hall and Bobby Howell's Band.* **9.30,** Ray Ventura et ses Collegiens. **10,** Gaumont-British News. **10.10,** Film. **10.20-10.30,** Pas Seul No. II.

SATURDAY, SEPTEMBER 2nd.

3, Punch and Judy. **3.10,** Cartoon Film. **3.15,** Gaumont-British News. **3.25,** "Bits and Pieces," light entertainment. **4-4.30,** The Zoo, O.B. from Regent's Park.

9, Cabaret Cartoons. Cartoons by Harry Rutherford. Cabaret with Trudi Binar. **9.40,** British Movietonews. **9.50,** Shove Ha'Penny. A match described by Charles Garner. **10.5,** Cartoon Film. **10.10-10.20,** Ena Baga, pianoforte.

SUNDAY, SEPTEMBER 3rd.

9.5-10.20, "The Circle" by Somerset Maugham. Cast includes Alan Wheatley and Belle Chrystall.

MONDAY, SEPTEMBER 4th.

3-4.15, "A Cup of Happiness," a comedy by Eden Phillpotts. Cast includes Leon M. Lion, Roger Livesey and Amy Veness.

9, Beatrice Lillie with Sam Walsh at the piano. **9.10,** Speaking Personally. **9.20,** British Movietonews. **9.30,** Cabaret. **9.50,** "Nancy's Puppets," presented by Nancy Worsfold and Elspeth Holland. **10.5,** Cartoon Film. **10.10-10.20,** Picture Story by Robert Gibbings.

TUESDAY, SEPTEMBER 5th.

3-4.20, "The Pelican," a play by F. Tennyson Jesse and H. M. Harwood. Cast includes Athole Stewart and Mabel Terry-Lewis.

9, Gaumont-British News. **9.10-10.25,** "Knock, or the Triumph of Medicine," a comedy by Jules Romains. Cast includes Marius Goring and Marjorie Bryce.

* O.B.'s from Radiolympia.

SITUATIONS VACANT

AIR Ministry.

REF. No. A.337 I. Draughtsmen, Grade I, required at the Royal Aircraft Establishment, South Farnborough, Hants, for each of the following classes of work:—

(A) Detail design work on light mechanical and electrical apparatus.

(B) In connection with the design of aircraft and other instruments.

(C) Detail design work on aircraft equipment. A knowledge of aircraft armament is desirable, but not essential.

(D) Illustration of technical publications. A general knowledge of aircraft and aircraft engines is desirable.

(E) In connection with the design of wireless apparatus. Candidates should have had good technical training in electrical engineering and drawing office, and workshops experience on radio, telephone or scientific instrument work, or work of an allied character.

CANDIDATES for the Above Posts should have had Good Technical Training and Workshops and Drawing Office Experience of a Character Appropriate to the Post for which application is made.

SALARY Scale:—£220 a year, rising by annual increment of £10 to £260 a year, and thence by £12 to £330 a year. Commencing salary up to £260 a year, according to qualifications and experience. Also

REF. No. A.338. I. Several Draughtsmen, Grade II, for work in the above categories.

SALARY Scale:—Up to 82s. a week, commencing salary according to qualifications and experience.

THE Appointments are Non-pensionable. Entrants to Grade I will be eligible for consideration for appointment to pensionable posts in the event of vacancies arising on the permanent establishment. Promotion from Grade II to Grade I is governed by merit.

REQUESTS for the Necessary Application Form should be made (quoting the appropriate reference No.) to the Chief Superintendent, Royal Aircraft Establishment, South Farnborough, Hants, enclosing stamped addressed envelope. The closing date for the receipt of form is 8th September, 1939. [8845

YOUNG Men with Experience of Wireless Operating.

REQUIRED for Three Years' Service as Constables in the Palestine Police Force. Pay £11 a month (plus trade pay of £3 per month when employed as Wireless Operators), uniform, rations and quarters. Free passages and leave on full pay. Candidates, age 21-28, must be single, of good physique and physically fit, and must hold a Postmaster-General's Certificate in wireless telegraphy.—Apply, stating exact age, height and particulars of education and training, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1. Head your letter "Palestine Police." [8851

EXPERIENCED Television Serviceman Required for Indoor and Outdoor Work. Also vacancy for Valve and C.R.T. Tester, with manufacturing experience; only written applications considered; state age, education, previous trade experience, and if owner-driver.—G.E.C. Service Depot, Greycoat St., Westminster, S.W.1. [8844

ELECTRIC DRY SHAVERS

REMINGTON, Rand, Shavemaster, Packard, Casco, Rabaldo.—Trade enquiries to Leonard Heys, 36, Henry St., Blackpool. [0633

MISCELLANEOUS

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EVERY Radio Dealer Who is Not a Regular Reader of "The Wireless and Electrical Trader" should send his trade card at once for a specimen copy and full details of the "Trader" Services. "The Wireless and Electrical Trader" has the widest influence, the largest weekly circulation, and is read by all the leading manufacturers and traders. Trade only. 15/- per annum, post free.—Published at Dorset House, Stamford St., London, S.E.1. [0615

"ENGINEER'S Guide to Success" Shows How to Qualify in Television Radio Engineering and Servicing, sound, recording, wireless communicating, etc., by studying at home with the T.I.G.B. Write to-day for this Great Guide—free—which gives full particulars, contains the world's widest choice of engineering courses—over 200—and alone gives the regulations for qualifications such as A.M.I.E.E., A.M.I.R.E., A.M.I.T.E., A.M.I.W.T., C. and G., etc. Training until successful guaranteed.—The Technological Institute of Great Britain, 82, Temple Bar House, London, E.C.4. (Founded 1917. 20,000 successes.) [8782

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RADIO Training.—P.M.G. exams. and I.E.E. Diploma; prospectus free.—Technical College, Hull. [0611

PRACTICAL Postal Courses, radio television; test equipment design; I.P.R.E. and I.W.T. exams.—Write I.P.E., 3, Shirley Rd., London, W.4. [8838

WIRELESS.—Complete training Marine, boadcast and television; posts waiting; mod. fees; boarders taken; approved college, prosp.—Dept. W., London Radio College, Grove Park Rd., London, W.4. (Chi. 3244.) [0580

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THE Wireless World" Diary for 1939 contains 77 pages of facts, formulæ and general information of the kind that is always wanted but is difficult to follow. Also a list of the most important European Broadcasting Stations and short-wave stations of the world. Twelve pages of circuit diagrams of receivers, amplifiers and units. —By post 1/7 from Iliffe and Sons Ltd., Dorset House Stamford Street, London, S.E.1.

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R

RADIO CLEARANCE, Ltd.

ALL Lines Previously Advertised Still Available.

ALL Orders Over 5/- Carriage Free; under this amount sufficient postage must be included with order.

ALL Enquiries Must Enclose 1½d. Stamp.

RADIO CLEARANCE, Ltd., 63, High Holborn, W.C.1. Holborn 4631. [8859

CHALLENGER Range for 1940.

CHALLENGER RADIO CORPORATION.—2d. stamp for illustrated catalogues of battery, battery-mains, car radio and mains sets; 63/- to £28.—Challenger Radio Corporation, 31, Craven Terrace, London, W.2. Nearest point Lancaster Gate Station. [8862

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AMAZING Offer.—Famous 7-valve push button 1939 models in maker's sealed cartons, issued 13½ gns.; £5/19/6; list free.—Shippers, 18, Corporation St., Manchester. [0639

ARMSTRONG Co.—After many years at our old premises at Camden Town we have removed to a new building in Warlters Rd., Holloway, N.7 (see displayed advertisement).

ARMSTRONG Amplifier Division Has Removed to New Premises at 94, Camden Rd., N.W.1. In addition to our standard range of 6- and 12-watt push-pull high fidelity amplifiers and local station feeder units, we manufacture equipment for special purposes, pre-stage units, electronic mixers, tone control units, etc.

ARMSTRONG Are Always Pleased to Assist in the Solution of Special Problems; details of standard equipment free on request.

ARMSTRONG Co. (Amplifier Division), 94, Camden Rd., N.W.1. [8752

£5/15.—Ambassador 6778 Universal 7-valve chassis and speaker (10in.), four band, R.F. stage; a few only, being surplus production, at this low price; cash with order, money refunded if not genuinely satisfied.—Ambassador Radio Works, Hutchinson Lane, Brighouse, Yorks. [8812

CAR RADIO

1939 Models from 4½ gns., 6 new car aerials, from 9/6; trade enquiries solicited; lists free.—Shippers, 18, Corporation St., Manchester. [0622

1939 Automatic, £3/15; aerials, 8/6; suppressors, 1/-; 12v. resistances, 3/6.—Superadio, Dantzic St., Manchester. [8853

ARMSTRONG

QUALITY YEAR

The age of "gadgets" has passed. To-day the marvel of radio has become commonplace through use and familiarity. In our opinion there is a vital reason for purchasing a new set—*Quality!* Since last season we have worked exclusively to this end and believe with these new chassis we have achieved our objective.

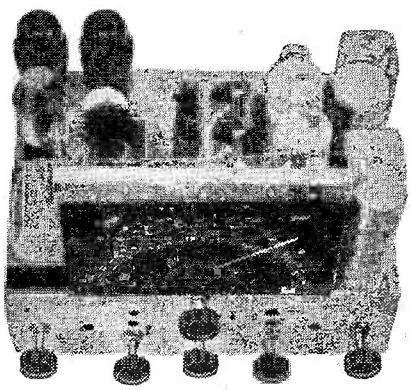
—OUR NEW 1940 CHASSIS—

include the following:

SUPERHET - STRAIGHT 10 - VALVE ALL-WAVE

HIGH FIDELITY RADIOGRAM. MODEL SS10

incorporating Two Independent Circuits, Superheterodyne and Straight, having R.F. Pre-amplifier and R.C. Coupled Push-Pull Triode Output capable of handling 8 watts.



The circuit of the SS10 is unique. When used as a STRAIGHT receiver two HF stages are in operation with A.V.C. Diode Detector is used for distortionless detection together with Triode Push-Pull output. A turn of only one knob is necessary to switch from "Superhet" to "Straight." The Gramophone Amplifier has been specially studied and records can be reproduced with *excellent* quality..... **12 gns.**

SEE AND HEAR THEM ON STAND 69 RADIOLYMPIA

MODEL SS2B — 10-V SUPERHET-STRAIGHT 2-WAVEBAND HIGH FIDELITY RADIOGRAM

This model has all the outstanding features of the SS10, the circuit being identical in every respect, except that the chassis is designed for Broadcast bands only, no provision being made for Short Waves. It has the same extremely lively performance on "Superhet" and high quality reproduction on "Straight"..... **11 gns.**

MODEL AW38 — 8-V ALL-WAVE SUPERHET

This radiogram chassis has R.C. Coupled Push-Pull Output capable of handling 6 watts.

This being our Quality Year we have carefully studied the design of our more economically priced models and it's now possible for those requiring quality with economy to satisfy their desire. **8 gns.**

MODEL AW125PP—12-V 5-BAND ALL-WAVE RADIOGRAM (12-550 continuous, 1000-2000 m)

with R.F. Pre-Amplifier, 2 I.F. stages with Variable Selectivity. Manual R.F. gain control and 10 watts R.C. coupled Triode P.P. Output.

Readers need no introduction to this most popular model, so favourably reviewed by *The Wireless World* on Jan. 5th last. Basically, it remains the same but the frequency response has been still further improved to conform to the higher standard of quality we have set ourselves this year..... **17 gns.**

Illustrated Art Catalogue giving full specification and details of our 8 Models will be sent upon request.

All chassis on 7 days' approval, carriage paid.

12 MONTHS' GUARANTEE.

ARMSTRONG MANUFACTURING CO.

WARLTERS ROAD, HOLLOWAY, LONDON, N.7

(Adjoining Holloway Arcade.) *'Phone: NORth 3213.*

PUBLIC ADDRESS

V

VORTEXION P.A. Equipment.

IMITATED, but unequalled.

WE Invite You to a Demonstration.

A.C.-D.C. Dance Band Amplifier, 10 watts output, complete in case, with moving coil microphone, speaker and cables, weight 22lb.; 12 gns.

A.C.-20-15-20-watt Amplifier, 38-18,000 cycles, independent mike and gram., inputs and controls, 0.037 volts required to full load, output for 4, 7.5, and 15 ohms speakers, or to specification, inaudible hum level, ready for use; 8½ gns. complete.

C.P. 20 12-volt Battery and A.C. Mains Model, as used by R.A.F., output as above; 12 gns.

A.C.-20, in portable case, with Collard motor, Piezo pick-up, etc., £14; C.P.20 ditto, £17/17.

50-WATT Output 6L6s, under 60-watt conditions, with negative feed back, separate rectifiers for anode screen and bias, with better than 4% regulation level response, 20-25,000 cycles, excellent driver, driver transformer, and output transformer matching 2-30 ohms impedance electronic mixing for mike and pick-up, with tone control, complete with valve and plugs; £15.

COMPLETE in Case, with turntable, B.T.H., Piezo pick-up and shielded microphone transformer; £20.

80-WATT Model, with negative feed back; £25, complete.

120-WATT Model, with negative feed back; £40, complete.

250-VOLT 250 m.a. Full Wave Speaker field supply unit: 25/-, with valve.

ALL P.A. Accessories in Stock; trade supplied.

VORTEXION, Ltd., 182, The Broadway, Wimbledon, S.W.19. 'Phone: Lib. 2814. [8241

TANNOY 25-watt Amplifier, Ad-on-Unit, A.C. mains, complete; £10.—Easco, 18w, Brixton Rd., S.W.9. [0643

"PARTRIDGE P.A. Manual," standard handbook on electro-acoustics, amplifiers, and audio circuits; price 2/6 (free to trade).

"PARTRIDGE Amplifier Circuits," describes many modern constructional amplifiers, 2w. to 45w. output, battery, A.C.-D.C., etc.; price 2/- (no free copies).

PARTRIDGE, N., B.Sc., A.M.I.E.E., King's Buildings, Dean Stanley St., London, S.W.1 [0630

MICROPHONES, moving coil, 29/6; bio-transverse, 37/6; Rothermel crystal, £3/5; Velodyne, £3/15.—Superadio, Dantzic St., Manchester. [8857

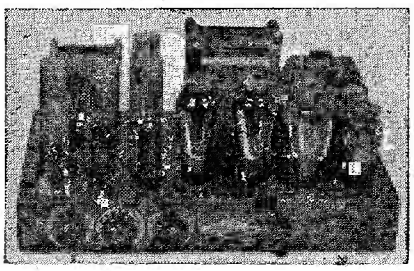
ALEXANDER BLACK, Ltd., pioneers of hiring microphone amplifying equipment since 1928. Booklet on request.—55, Ebury St., S.W.1. Sloane 6129. [0598

PUBLIC Address Contractors Can Hire P.A. Vans, loud speakers, microphones and equipments of all types from Hire Dept., Grampian Reproducers, Ltd., Kew Gardens, Surrey. Tel.: Richmond 1175-6-7. [0618

"Radio Data Charts," A Series of Abacs. Post free 4/10.

VORTEXION 50 W AMPLIFIER

£15 in Chassis Form



VORTEXION, LTD., are offering their new 50 W amplifier at £15 as a chassis with valves and plugs, or at £20 complete in black leatherette-covered cabinet with Collaro turntable, piezo-electric pick-up and shielded microphone transformer.

A pair of matched 6L6's with 10 per cent. negative feed-back is fitted in the output stage, and the separate HT supplies to the anode and screen have better than 4 per cent. regulation, while a separate rectifier provides bias.

The 6L6's are driven by a 6F6 triode connected through a driver transformer incorporating feed-back. This is preceded by a 6N7, electronic mixing for pick-up and microphone. The additional 6F5 operating as first stage on microphone only is suitable for any microphone. A tone control is fitted, and the large eight-section output transformer is available in three types:—2-8-15-30 ohms; 4-15-30-60 ohms or 15-60-125-250 ohms. These output lines can be matched using all sections of windings and will deliver the full response (40-18,000 c/s) to the loudspeakers with extremely low overall harmonic distortion.

Write for Illustrated Catalogue.

We are 25 minutes from Olympia and can give full demonstrations of any model.

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Vortexion, Ltd., 182 The Broadway, Wimbledon, S.W.19. 'Phone: LIBerty 2814.

AMBASSADOR

ALWAYS

FINEST PERFORMANCE & VALUE

Send for details

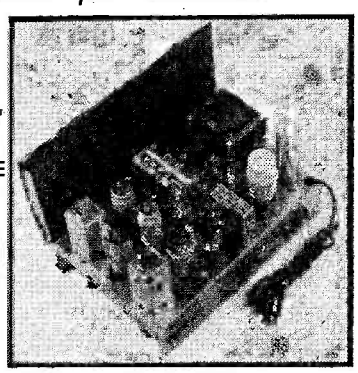
MODEL 6779

CASH PRICE

£11

with Valves and Speaker

A.C. ONLY



SPECIFICATION:

Six valve super-het chassis using MAZDA Octal valves. Powerful R.F. stage on all bands covering 12.5/52 metres, 175/550 metres, 1,000/2,000 metres. Large plate glass dial. Electrical Band Spreading. Sensitivity control. New High Speed A.V.C. Automatic distortion cancellation. Electro dynamic reproducer with 40/8,000 response. 6.8 watts output. Heavy plated chassis total weight 37 lbs.

Wholesale and Export Enquiries Invited

AMBASSADOR RADIO WORKS

HUTCHINSON LANE, BRIGHOUSE, YORKS

Telephone: 283

NEW MAINS EQUIPMENT

VORTEXION Supply G.P.O., B.B.C., L.P.T.B. Why not you?

ALL Models Super Shrouded, primaries screened and tapped, 200-250v., filaments C.T.

ANY Model Fitted 5v. or 6.3v. Filaments if Required.

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500-0-500 120 m.a., 4v. 4a., 4v. 2.5a., 4v. 1-2a., 4v. 1-2a., 28/-; 400v. or 450v., same price.

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350-0-350 75 m.a., 4v. 2-4a., 4v. 1-2a.; 18/-.

250-0-250 60 m.a., 4v. 2-4a., 4v. 1-2a.; 15/-.

AUTO Transformers, 100-120 to 200-240v., 80 watts, 11/-; 120 watts, 14/6; 200 watts, 21/-; 250 watts, 25/-; 300 watts, 28/-; 500 watts, 47/6.

W.W. Q.A. Output Transformer; 21/-.

MICROPHONE Transformers, in heavy magnetic shielding; 12/6.

CHOKES.—30h., 60 m.a., 7/6; 7-13h., 120 m.a., 12/6; 30h., 150 m.a., 15/-; 25h., 150 m.a., 21/-.

TRANSFORMERS and Chokes to Any Specification.

CAR Battery Charger, 6 and 12v., 1½ to 2 amperes; 30/- complete.

VORTEXION, Ltd., 182, The Broadway, Wimbledon, London, S.W.19. Telephone: Liberty 2814. [8860

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SINCLAIR Speakers for All Types.—Pulteney Terrace, Copenhagen St., N.1. [0603

BAKERS New Corner Horn Speakers, triple cone conversions; from 29/6, and surplus speaker bargains.—Bakers Selhurst Radio, 75, Sussex Rd., South Croydon. [8728

LOUD-SPEAKERS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

3,000 Speakers from 5/6 each, P.M. and energised 4in. to 14in., including several Epoch 18in.—Sinclair Speakers, Pulteney Terrace, Copenhagen St., N.1. [0591

TRANSMITTING APPARATUS

A.C.S. RADIO, specialists in short wave apparatus, communication receivers, including Hallicrafters, National and R.M.E. transmitting equipment, valves and components. Send for free catalogue to A.C.S. Radio, 16, Gray's Inn Rd., W.C.1. Holborn 9894-5. G2NK, Technical Manager. [0550

G5N1—The oldest and largest distributor of amateur equipment transmitting and receiving; short-wave catalogue, 1½d. G5N1 70-page Manual, 7½d., post free; authorised direct distributor for Collins, National, R.M.E., Thordarson, Hammerlund, Bliley, Taylor, Elmac, etc., etc.—44, Holloway Head, Birmingham. [0531

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A CABINET for Every Radio Purpose.

CONVERT Your Set into a Radiogram at Minimum Cost; surplus cabinets from noted makers under cost of manufacture (undrilled); 30/- upwards; motors at wholesale prices.

"FIT-A-GRAM" Cabinet, 31×17×15, 21/-.

UNDRILLED Table Console and Loud-Speaker Cabinets from 3/6.

INSPECTION Invited; photos loaned to country customers.

H. L. SMITH and Co., Ltd., 289, Edgware Rd., W.2. Tel.: Pad. 5891. [0485

DYNAMOS, MOTORS, ETC.

ALL Types of Rotary Converters, electric motors, battery chargers, petrol-electric generator sets, etc., in stock, new and second-hand.

A.C.-D.C. Conversion Units for Operating D.C. Receivers from A.C. Mains, 100 watts output, £2/10; 150 watts output, £3/10.

WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0518

RECORDING EQUIPMENT

ALL Recording Discs and Materials in Stock, tracker units, £4/7/6; recording motors, £3/17/6.—Write for further details, Will Day, Ltd., 19, Lisle St., W.C.2. [0595

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L·R·S

FOR

ARMSTRONG CHASSIS

on CASH, C.O.D. or

EASY TERMS

ALL MODELS IN STOCK

After thorough tests we can fully endorse all Messrs. Armstrong claim for their new MODEL SS10

SUPERHET-STRAIGHT

10-v. ALL-WAVE RADIOGRAM CHASSIS

(See advt. opposite page)

At the turn of a switch this chassis has the unrivalled quality of a STRAIGHT set and the far-reaching capabilities of the most sensitive SUPERHET.

Unless something revolutionary in radio technique is unexpectedly developed, we are convinced that this set will remain an outstanding leader for a very long time and will prove to be a good investment.

CASH or C.O.D. Price 12 guineas or 27/- with order and 12 monthly payments of 18/4.

Illustrated literature giving full particulars of all models will be sent free upon request, with details of our convenient terms.

FULL RANGE IN STOCK. WRITE TO-DAY!

In addition to the Armstrong range, we shall be glad to quote for all other high grade equipment, such as Sound Sales Amplifiers, Voigt Speakers, Haynes Radio, Avometers, etc.

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M·R· SUPPLIES

for Exclusive Modern Bargains

Did you see our interesting announcement in the advertisement columns of this journal last week? It will be well worth your while to refer back as we still have a few left of each item advertised—but we now have to advise early application. The following additional items are now offered:—

MINIATURE P.M. M/COIL UNITS. Only 3in. diameter. 15 ohms imp. perfect m/coil mikes—ideal for intercomm., **9/11.** (Courtesy note to "waiting list customers"—stocks have now arrived and goods are being despatched immediately.)

ISMAY ("Blue Spot") ENERGISED M/COIL SPEAKERS, 8in. dia., with transformer. Field 10,000 ohms—right for universal or D.C., well made, fine response, handle 8-watts, to clear **7/11** each.

G.E.C. SPEAKER COUPLERS. Remarkable offer of the last few of these brand new 19/6 instruments, complete with full instructions. They protect speaker windings, assist matching and overcome instability on extension speakers. Final opportunity, **3/6** each.

SINGLE 'PHONES. (Standard Telephones.) Here's a long-awaited opportunity. Highly sensitive and suitable for all receivers. In fine black moulded casing, 2¾in. dia., **1/6** ea., or **2/6** pair.

SLIDING RHEOSTATS. Totally enclosed with laminated sliding brushes. Capacity 120-watts. Ideal for control of cine and other small motors. 400 and 600 ohms, either, **9/11.**

WIRE-WOUND RESISTORS (Standard). On porcelain bobbin 1in. × 1in. Res. 400, 150, 120, 110, 85, 60 and 16 ohms. Capacity 15-watts. Tolerance 2 per cent. 4½d. each, **3/9** dozen, or **12/6** for 50 assorted.

MINIATURE 20-WATT RESISTORS, only 1in. long, vitreous, 2,000 ohms only. Makers, Standard Telephones), **3d.** each, **2/6** doz., or 50 for **8/-.**

STANDARD RESISTANCE BOXES, by Elliott, Paul, Gambrell, Muirhead, etc. (Second choice requested). Total 120-ohms in 17 taps. Manganin elements. New or as new—all perfect, **35/-.**

ELECTROLYTIC CONDENSERS. Two very special popular offers:—Plessey 8 mf. (450 v. S.) plus 24 mf. (350 v. S.) Can type with nut and leads, **2/6** each. Hunts cardboard tubular, 8 plus 8 mf. (120 v.) and 5 mf. (25 v.). Right for most midgets, **1/11** each to clear.

MILLIAMMETERS. First class spring controlled m/iron, A.C./D.C., 0/20, 0/50, or 0/250 m.a., 2in. dia. flush panel mounting, neat black finish, any one **7/9.** These meters have been very favourably commented upon by "W.W."

VALVES. Final offers of new Tungsram and Hivac. Following types at real clearance prices:—Battery:—VP/215B and DDT/215, any one **2/11,** or three for **8/6.** VX/2 (Var. mu. hex.) **3/6.** Mains:—DDT/13, DD/13, HL/13 (all useful types), any one **2/9,** or three for **7/6.**

LINE CORD RESISTANCES for all American Midgets. American socket at one end and combined plug-adaptor the other, well made, **3/9.**

G.E.C. MICROPHONE STANDS. Massively made, bronze, with square tilting frame within square outer frame. Telescopic Table, **15/6.** Floor, with heavy claw-foot (List £5), **32/6.** Heavy duty Tripod Floor Stands, completely rigid for rough outdoor positions and can be used as speaker tripods. Extend to 6½ft., **22/6.**

BIRCO ALL-WAVE ANTI-INTERFERENCE AERIALS (Latest from U.S.A.). Complete kit with two transformers, di-pole aerial, down-lead, insulators, etc., with fullest instructions, **14/11.** Essential for ideal listening. Latest supplementary list sent with each order. Buy with confidence from the firm which **NEVER DISAPPOINTED A CUSTOMER.**

M. R. SUPPLIES,

68, NEW OXFORD ST., LONDON, W.C.1

(MUSeum 2958)

"Foundations of Wireless," Second Edition. 4s. 6d. net. Post free 4s. 11d.

VALVES

SPECIAL Line of Rogers and Majestic Tubes, types 551, 227, 551s, 55s, 6B7, 56 and 58, 2B7, 6 red 5 and 53; 3/6.

ALL Types of American Tubes in Stock of Impex and Arcturus makes at competitive prices.

WE Can Also Supply a Full Range of Guaranteed Replacement Valves for Any British non-ring. American or Continental type at an appreciably lower price.

SEND for Lists of These, and also electrolytic condensers, line cords, resistances, etc.

CHAS. F. WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0452

AMERICAN, 2/9; 1,000 non-ring British from 1/9; bargains galore; lists free.—Shippers, 18, Corporation St., Manchester. [0607

AMERICAN, 2/8; Tungsram 2 amp, pentodes, 4/9; 4-pin vibrators, 6 or 12v., 9/6.—Superadio, Dantzic St., Manchester. [8854

METROPOLITAN RADIO SERVICE.—Special offer. American valves, in maker's cartons, 3/- each, Octals, 3/6 each; American valves, first grade, in all types; trade supplied.—1021, Finchley Rd., N.W.11. Speedwell 3000. [0436

METERS, ETC.

NEW Triplett 2,000 o.p.v. Meter, Model 1200A; offers.—Radio Ei8N, Longford, Ireland. [8842

TEST EQUIPMENT

BEEDE 0/1 M/A Meter, 3½in., 100 ohm internal, 1,000 opv shunts, 21/6.—Superadio, Dantzic St., Manchester. [8855

COMPONENTS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

RADIO CLEARANCE, Ltd.

ALL Lines Previously Advertised Still Available.

ALL Orders Over 5/- Carriage Free; under this amount sufficient postage must be included with order.

ALL Enquiries Must Enclose 1½d. Stamp.

RADIO CLEARANCE, Ltd., 63, High Holborn, W.C.1. Holborn 4631. [8858

PREMIER SUPPLY STORES.

PLEASE See Our Displayed Advertisement on page 11. [0488

RADIO SUPPLIES, Britain's Leading Mail Order House, offer the following brand new lines at unbeatable prices.

THE Latest 1939-40 "Crosley" 8-valve Receiver, 4 waveband, 7 push buttons, 10 watts output, massively built cabinet finished in selected veneers, all in sealed carto ; £6/5.

LIMITED Number of the Latest "Air-King" 11-valve High Fidelity Receiver, 4 wavebands, 12 watts output, twin speakers, large Magnavox auditorium and tweeter, variable selectivity, large floodlit dial, magic eye tuning indicator, beautifully finished cabinet, listed at 25 gns.; exceptional value at £10/10.

1940 Battery Portables, 4-valve superhet, medium and long waveband, no accumulator required, complete with battery, very light for carrying, no aerial or earth required; £4/10.

AIR-KING 4-valve Midgets, A.C./D.C., 100-250 volt, medium and long waves; £2/15.

SPECIAL Offer in Car Radios to Motorists, just a few left, 1939 Trav-ler, 6-valve, push button, 6OR12 volt, one wave model; £4/10. Two wave model; £5/5.

TUNGSRAM Double Diodes, 6/- a doz.; magic eye holders, with 7-way cable, 9d. or 7/6 a doz.

CENTRALAB Pots, less switch, long spindle, 10,000, 50,000, 500,000; 1/- each or 11/- a doz.

AMERICAN Goat Cans; 2/- a doz. with base. Magnavox output transformers; 1/9 each.

GUARANTEED Boxed American Valves, 1st grade; 2/3 each or 24/- a doz. 6A7, 78, 6D6, 6C6, 80, 84, 6X5, 6K7, 75, 6A8, 6Q7, 41, 42, 80, 39/44, 38, 25Z5, 43, 18 and 6H6.

ROLA 8in. P.M.'s with Universal transformer; 8/6 each. Ferranti, 7-pin H.F. pentodes, type SPT4A; 2/9 each.

PHILIPS Pots, long spindle, mixed sizes; 3/- a doz. medium and long waveband pass coils, ideal for replacements; 9d. each, 6/- a doz.

RADIO SUPPLIES, 22, Faraday Avenue, Manchester, 8. Tel.: Col. 1261. [8861

COULPHONE RADIO, Ormskirk.—6L6G octal valves, 3/6, boxed, guaranteed; 1½d. stamp catalogues. [8849

VAUXHALL.—All goods as previously advertised still available; write for free list.—Vauxhall Utilities, 163a, Strand, W.C.2. [8727

SOUTHERN RADIO, 46, Lisle St., London, W.C. Gerrard 6653.—Stocks of receivers and replacement components as previously advertised. [8548

"Radio Laboratory Handbook." *Price 8s. 6d. net. Post free 9s.*

COMPONENTS—SECOND-HAND CLEARANCE, SURPLUS, ETC.

MAINS RADIO DEVELOPMENT COMPANY Offer Immediate Carriage Paid Delivery; call mornings. Telephone Tudor 4046. Stamp for List 230 (100 new season's bargains).

MICA Tag Condensers, 0.0001 to 0.002 T.C.C., Ormond, etc., six different sizes in each parcel of twelve for 1/-, thirty for 2/-.

T.C.C. 8 mfd. 600v. Peak Metal Can Dry Electrolytics, one hole fixing, 2/3; T.C.C. midget tubular card ditto, 1/6.

ERIE One-watt Colour Coded Unused Resistors, any size, 50 ohms to 5 megohms, your selection, 3d., 2/6 dozen; two-watt, 6d.

CENTRALAB Latest Potentiometers, long standard spindle, unused, all sizes, 5,000 ohms to 2 megohms, 2/-; with switch, 2/3.

TUBULAR Condensers, 400v. working, wire ends, best make, 0.0001-0.05 mfd., 4d.; 0.1 mfd., 4d.; 0.25, 0.5 mfd., 6d.

CLIX Unused Chassis Valve Holders, 5-pin, 7-pin, 3d.; American sizes, 6d.; best sleeving, 1½d. yard.

FIFTY Unused N.S.F. ½, 1, 2-watt resistors, wire ends, marked and colour coded, 20 different useful sizes in each parcel; 50 for 2/6.

MAINS RADIO DEVELOPMENT COMPANY, 4-6, Muswell Hill Rd., London, N.6. Tudor 4046. [8778

600V. Test 8 mf. Tubular Condensers, 1/3; Coaxial cable, 6d. yd.; Collaro gramophone motors, AC37, complete pick-up tone arm, 35/-; mixer auto changer, £5/5.—Superadio, Dantzic St., Manchester. [8856

RYALL'S RADIO, 280, High Holborn, London, W.C.1. —Goods previously advertised still available. [8846

VOIGT Latest Light Twin Coil, with B.B.C. corrector, reflector horn, field rectifier, W.W. P.A. 12-watt amplifier and 3 valve-feeder, Haynes Model R.2 tuner, whistle filter, all perfect.—Offers to Sargeant, The Bristol, Paston Place, Brighton, 7. [8841

50 Assorted Condensers, 4/6; 50 assorted resistors, 4/6; 20 only Magic Eye tuning units with escutcheon, 2/6 each complete; 30 only American short wave coils, 4 in box, 10-200 meters, 2/6 per box; 4 only crystal mikes, 25/- each; stands for same, 5/- each; 1 only lapel mike, list price 2 gns., our price 25/-; 1 only 2½ to 10 meter receiver, used, 50/-; all the above goods are brand new.—Reeves, 23, Meanwood Rd., Leeds. [8848

REPAIRS AND SERVICE

"SERVICE with a Smile."

AMERICAN Valves, spares, linecords, rewinds, repairers, of all types of American and British receivers.—E.R.I., Ltd., 22, Howland St., W.1. Museum 5675. [0434

LOUD-SPEAKER Repairs, British, American, any make, 24-hours' service; moderate prices.—Sinclair Speakers, Pulteney Terrace, Copenhagen St., N.1. [0590

GUARANTEED Repairs, Any Transformers, choke, motor armature, converter, dynamo, etc., keenest prices, immediate quotation, prompt, dependable service. —See below.

L.T.P. (LONDON TRANSFORMER PRODUCTS, Ltd), Willesden, N.W.10. Willesden 6486 (3 lines). [6892

MAINS Transformer Service, Repairs, rewinds, or construction to specification of any type, competitive prices and prompt service.—Sturdy Electric Co., Dipton, Newcastle-on-Tyne. [0516

METROPOLITAN RADIO SERVICE.—Guaranteed repairs to American and British receivers; American valves, service parts and rewinds, trade supplied.—1021, Finchley Rd., N.W.1. Speedwell 3000. [0435

REPAIRS to Moving Coil Speakers a Speciality; cones and coils fitted, fields altered; prices, including eliminators quoted; loud speakers, 4/-; L.F. and output transformers, 4/-, post free, guaranteed satisfaction, trade invited, estimates free; prompt service.—Loud-Speaker Repair Works, 5, Balham Grove, London. Battersea 1321. [0394

SITUATIONS VACANT

CROWN AGENTS FOR THE COLONIES.

COLONIAL Government Appointments.

APPLICATIONS from Qualified Candidates are Invited for the Following Post :—

WIRELESS Engineer Required for the Posts and Telegraphs Department, Gold Coast, for three years, with possible permanency. Salary £450, rising to £720 a year. Free passages and quarters and liberal leave on full salary. Candidates, age 27-37, must possess the City and Guilds certificate in radio-communication, telephony and telegraphy, and have a thorough theoretical and practical knowledge of commercial wireless transmitters and receivers. They must be able to instal and maintain a wireless station, and to supervise repairs in the Department's Workshops. Preference will be given to General Post Office employees with some knowledge of modern trunk line circuits and to candidates with a knowledge of morse and ability to operate.

APPLY at Once by Letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper, to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/5976. [8850

DRAUGHTSMEN Required (in the Midlands); used to small part mechanisms; write, giving particulars of experience, also state age and salary required.—Box 921, c/o *The Wireless World.* [8843

Recent Inventions

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

SHORT-WAVE MAGNETRONS

A TYPE of short-wave magnetron has recently been developed in which a cathode is placed outside one end of a "split" cylindrical anode, the electrons from the cathode being forced by an external magnetic field to travel through the anode in a spiral path. They are then absorbed by a tuned Lecher-wire circuit shunted across the two split halves of the anode.

In one example of this type—called the Sentron—the anode is divided longitudinally into two semi-cylinders; whilst in another type, called the Osaka tube, the cylindrical anode is cut up at right-angles to its axis, into two or more rings. Alternatively, the anode could, with advantage to operating efficiency, be split up in both these ways, i.e., into rings and semi-cylinders, but this introduces difficulties in exciting the various parts of the anode in proper phase.

According to the invention the expedient is adopted of dividing the cylindrical anode by two "cuts" which run spirally along the main axis. In this way the electrons coming from one or both cathodes meet the magnetic field, across the slots or gaps in the anode, at right-angles to their own movement, thereby increasing the efficiency of the magnetron as a short-wave oscillator.

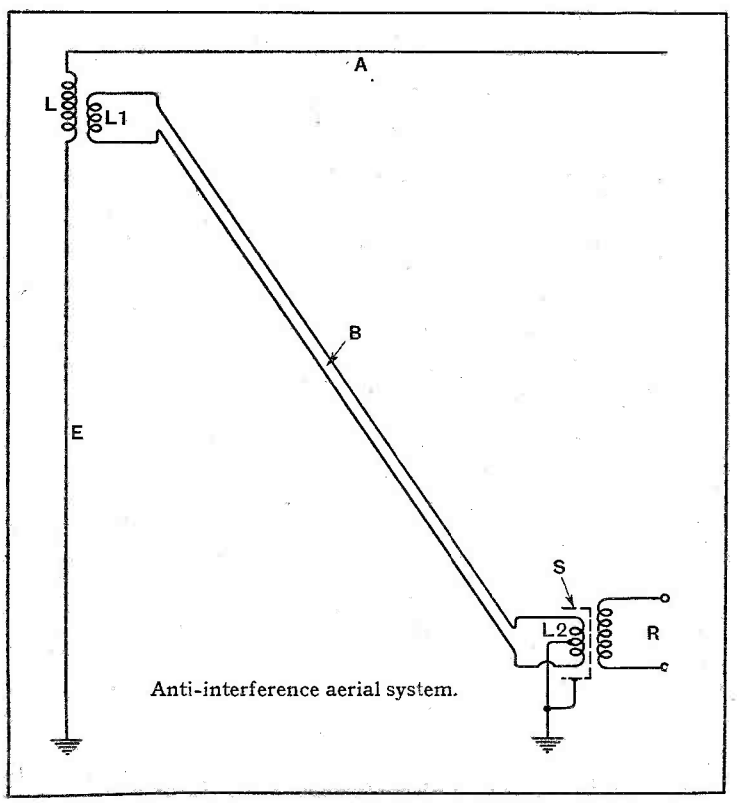
Telefunken Ges. für drahtlose telegraphie m.b.h. Convention date (Germany) January 26th, 1938. No. 505426.

o o o o

ELIMINATING INTERFERENCE

LOCAL interference due to inductive fields does not usually extend very far above the earth. The aerial A is therefore placed as high as possible, and is earthed through a coil L, which is coupled to a secondary coil L1 and a balanced transmission line B to the receiving set R. The primary winding L2 of the input transformer to the set is protected by an earthed screen S; and its midpoint is also earthed. The two wires of the transmission line are twisted, or spaced, so as to match the impedance of the two transformers. Since the line B is symmetrically connected to earth, it need not be screened since any inductive pick-up is automatically balanced out. The line B should be kept as far away as possible from the earth-lead E.

E. M. Lee; F. R. W. Stafford; H. G. Stedman; and Belling and Lee, Ltd. Application date, November 10th, 1937. No. 505838.



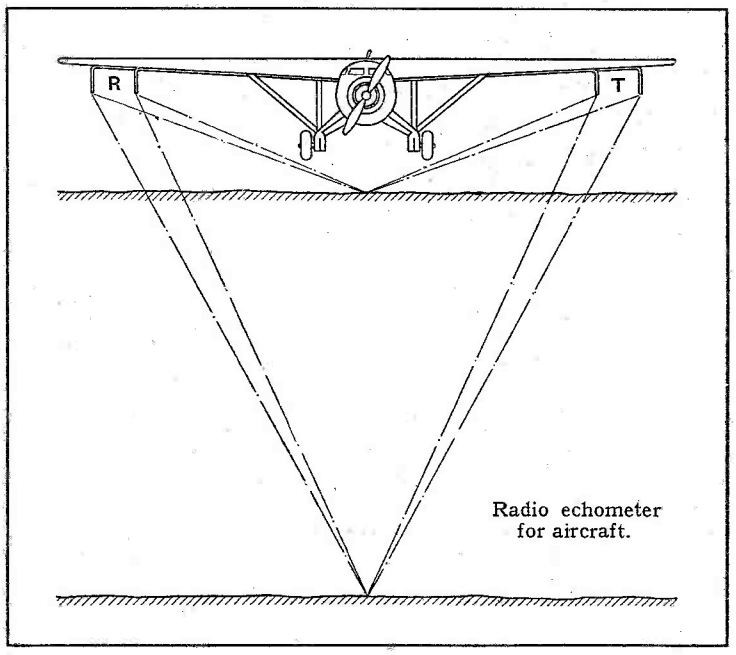
Anti-interference aerial system.

o o o o

USW RADIO ALTIMETER

THE figure shows a radio installation for determining the height of an aeroplane above the ground, particularly at night or in foggy weather. Ultra-short waves, from one to five metres in length, are transmitted from dipole aerials T, which are arranged to give minimum radiation in the direction of the corresponding receiving dipoles R, mounted at the other end of the wings. Other means are also provided to prevent direct pick-up, so that reception is substantially confined to the wave which is returned after reflection from the ground.

For altitudes up to three times the wing spread, unmodulated ultra-short waves give accurate results, the elevation being indicated by the phase difference between the reflected and outgoing wave as measured by a synchroscope. For higher altitudes, a short carrier wave is modulated by a longer wave, having a frequency of say, 60 kc/s for a cruising height of 2,000 feet. The phase of the reflected wave, after demodulation, is then compared in a synchroscope with the 60 kc/s frequency used to modulate the outgoing wave.



Standard Telephones and Cables Ltd. (Assignees of R. A. Heising). Convention date (U.S.A.), May 15th, 1937. No. 504767.

o o o o

AVC FOR TELEVISION

ALTHOUGH it is desirable to use automatic volume control to prevent the fading of television signals, a special difficulty arises owing to the fact that the general level of the carrier wave is deliberately varied at the transmitter in order to convey to the receiver a voltage representative of gradual changes in the average or background illumination of the picture. If the normal type of AVC were applied to such a signal, this valuable DC component would be automatically wiped out.

Accordingly, instead of using changes in the amplitude of the carrier wave as the source of the AVC voltage, the required control voltage is obtained from the synchronising impulses, which are first passed through a "storage" circuit consisting of a condenser shunted by a resistance. When fading occurs, the amplitude of the synchronising signals naturally falls off, and they develop an imperfect or truncated shape when discharged from the storage circuit. This change of shape is then utilised in the process of rectification to develop an AVC voltage of varying value.

Marconi's Wireless Telegraph Co., Ltd.; D. J. Fewings; and R. J. Kemp. Application date August 25th, 1937. No. 501349.

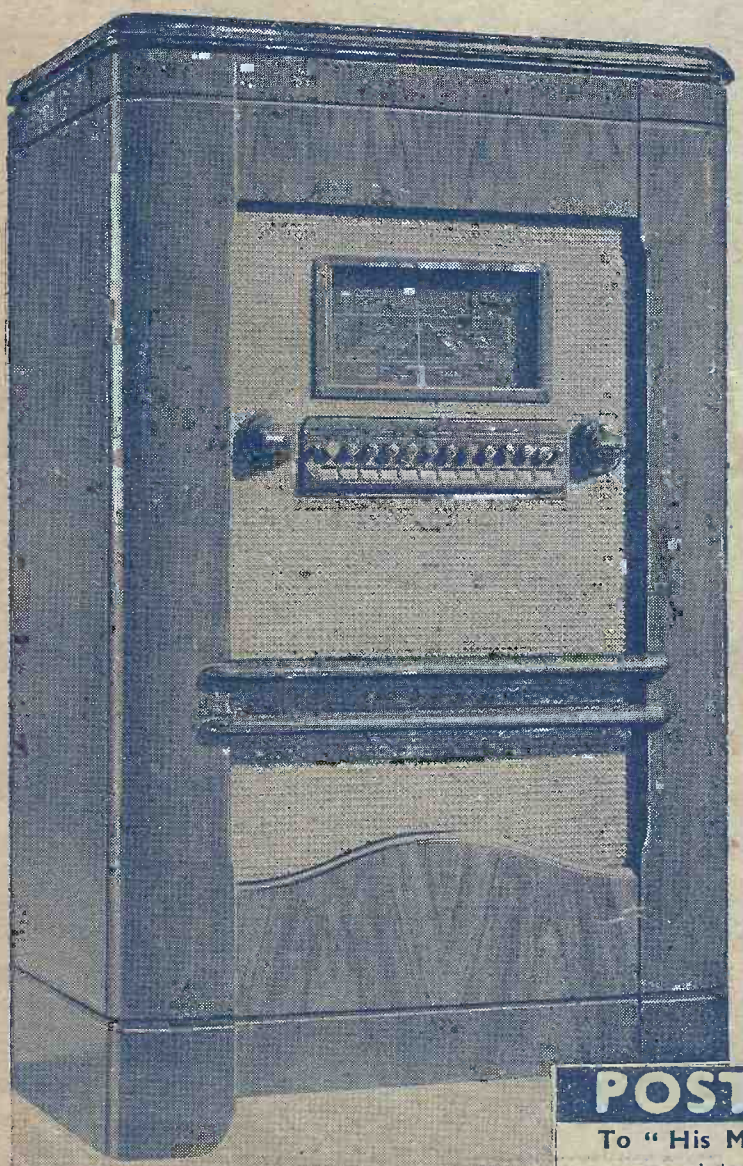
TELEVISING INVISIBLE OBJECTS

AN aeroplane or other object, even when hidden by fog or mist, can be "seen" by focusing a beam of infra-red light upon it, and then picking up the reflected rays on a special type of television transmitter. Infra-red light having, say a wavelength of 10 microns will pass through fog thick enough to disperse and scatter ordinary white light.

The ordinary photo-sensitive screen used in television will not respond to the long infra-red rays required for this kind of work. The inventors accordingly provide a special screen made of a sheet of mica coated with a very thin film of the rare metal germanium. This possesses a high thermo-electric coefficient, and so develops localised potential differences corresponding to the shape or outline of the invisible object.

Marconi's Wireless Telegraph Co., Ltd. (assignees of H. A. Iams). Convention date (U.S.A.) December 30th, 1936. No. 505686.

Advanced Listening in 1940 with "HIS MASTER'S VOICE"



MODEL 1500. "H.M.V." 6-valve all-world superhet Radiogram, with push-button tuning on radio, and music of your own choice on the electric gramophone - **24 GNS.** or by hire purchase.

By achieving perfect naturalness in the reproduction of every word, note and sound "His Master's Voice" technicians have provided radio enthusiasts with "advanced listening" for 1940 . . .

Important "H.M.V." technical advances enable you to derive greater enjoyment from broadcast transmissions, and to elicit from your favourite records a tonal realism hitherto unrealised . . . Beautiful cabinets combine accurate acoustic matching with the appeal of good furniture.

In high definition television, too, "H.M.V." offer you at popular prices, more vivid and reliable reception. Ask for a demonstration at your dealer, and/or post the coupon.

POST THIS COUPON NOW

To "His Master's Voice," 98-108, Clerkenwell Road, London, E.C.1.

I should be pleased to receive a copy of your coloured booklet illustrating the complete new range of "His Master's Voice" * { Radio Instruments. / Television Receivers.

NAME.....

ADDRESS.....

.....

* Cross out item not required. W.W. 31/8.