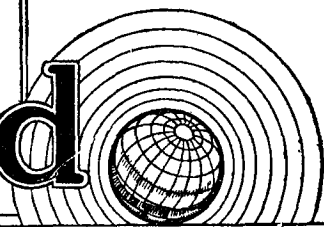
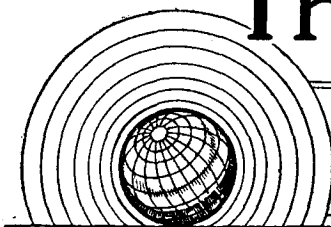


# The Wireless World

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

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## EDITORIAL COMMENT

### Stereophonic Broadcasting

*An Important Experiment for  
the B.B.C.*

**W**ITH very few exceptions, competition in every sphere of progress should be encouraged, as it provides the finest stimulant to effort. In the new sphere of broadcasting, although in many countries the transmissions are vested in a monopoly, a very healthy state of rivalry is growing up between these monopolies themselves.

We have seen evidence of this rivalry in the efforts to have the finest broadcasting headquarters; recently Germany and our own country have made great efforts in the direction of developing the ideal studio design based on new methods of wall construction. Television, too, has stimulated several countries to special efforts and there has been competition as to who should be first with a television service.

All this is good for progress, and we ought to do all we can to encourage our broadcasting authorities to lead in new spheres.

This is by way of introduction to a matter which, we feel, should receive the attention of the B.B.C. As long ago as September, 1933, we published correspondence and commented ourselves on the question of double-channel transmissions. We invited the B.B.C. to consider the possibility of conducting double-channel transmissions from two separate broadcasting stations at times when these stations are both taking the same programme. We pointed out that this would necessitate a duplication of microphones in the studio and of the amplifiers and connecting links to the transmitting stations, and at the receiving end

listeners would employ two independent receiving sets and loud speakers.

We repeat the view we expressed then, that an enormous number of listeners would be ready to set up two receivers for the purpose of testing out this experiment, if the B.B.C. would be prepared to do their part.

Whilst such transmissions have been conducted before under laboratory conditions, we believe it would be the first time for it to be done as between a broadcasting organisation and the public.

We would urge the B.B.C. to be first with such an enterprise, which, although not in the nature of a service, would provide a most interesting scientific experiment to demonstrate the possibilities of bi-aural reception.

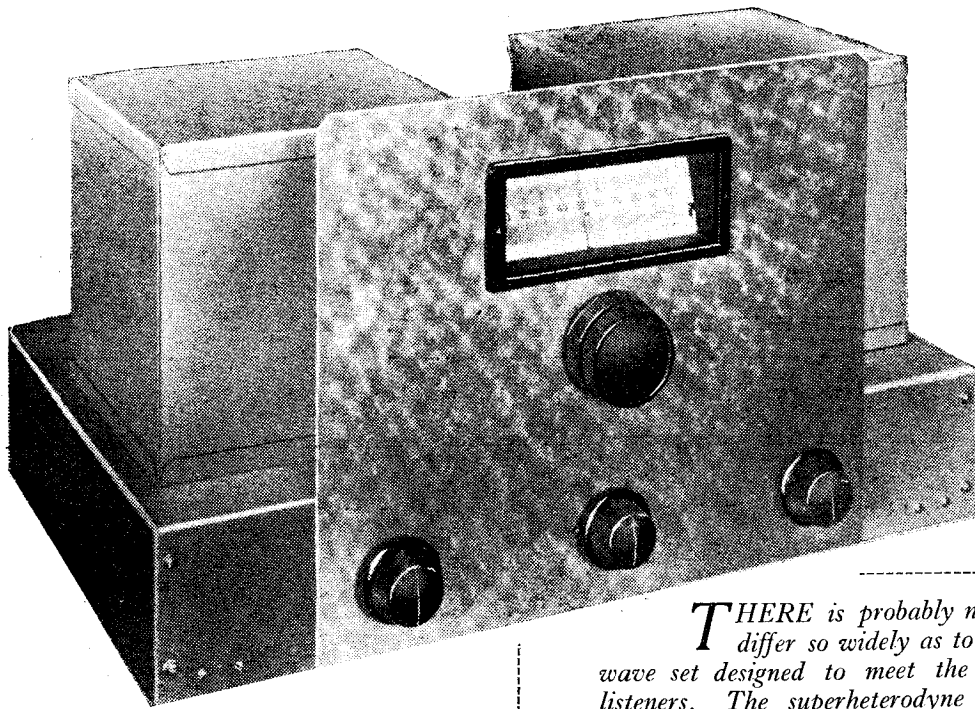
### Short Waves

*Growing Demand for Sets*

**T**HE Broadcast to the Empire by His Majesty The King on Christmas Day reminded us once again of the remarkable progress which short waves have made in linking up every corner of the earth.

A great increase in the number of short-wave stations has occurred especially during the past year, and although, in spite of our Empire associations, we are still far behind America in short-wave enterprise, there are to-day welcome signs of increasing activity here even on the part of set manufacturers.

The short-wave receiver described in this issue will, we think, prove very popular with our readers both here and abroad. The design has been greatly facilitated through the helpful suggestions contained in letters from many parts of the world and we take this opportunity of expressing our thanks for this co-operation.



# IMPERIAL

## Four-range Superheterodyne Covering a Waveband of 6 to 100 Metres

*T*HERE is probably no type of receiver on which opinions differ so widely as to the form it should take, than a short-wave set designed to meet the requirements of home and overseas listeners. The superheterodyne would appear to be the most satisfactory solution especially as selectivity, sensitivity and, most important of all, good AVC action is essential for a really satisfactory performance. These, therefore, comprise the salient features of the receiver described in this article.

**L**ISTENERS in this country are so well provided with alternative broadcast programmes from the home stations and also from those of our European neighbours that the potentialities of the short waves as an alternative source of broadcast entertainment have, for many years, been ignored by the average listener.

Those who have been sampling the short-wave fare and exploring these lesser known regions in the ether were bold enough to prophesy that sooner or later their own particular fields would become generally recognised as being well worth looking into, despite the fact that reception may not have that reliability and steadiness that we expect from the medium- and long-wave stations.

For on the short waves only is it possible to experience really long-distance reception, and then is the added attraction of programmes in our own tongue from the Colonies and the U.S.A.

### Overseas Requirements

The home listener undoubtedly has some justification for regarding the short waves as subsidiary to the principal broadcast interest, but there are many of our own kith and kin overseas who rely almost exclusively on the short waves for their broadcast programmes, as exemplified by the number of special Empire stations now in operation in this country.

The problem of designing a short-wave receiver to meet both home and overseas requirements is an exceptionally difficult one, added to which opinions differ very widely regarding the actual form this receiver should take, the wavebands it must cover, and the nature of the power supply, namely whether it should be a battery- or a mains-operated set.

In preparing the design of the receiver described here it was decided to adopt an arrangement best suited to the needs of the

overseas listener, not forgetting, however, that the potential user in this country has some claims for consideration.

It was decided that as the receiver must be capable of operation both from batteries and from the AC mains, the best compromise would be to use 13-volt indirectly heated valves. Where mains were not available the power supply could be derived from a 12-volt car starter battery. This supplies the LT direct, while the HT

Where an AC electric supply is available it is a relatively simple matter to build a mains power unit which can follow orthodox lines, only it should give 13 volts LT for the valves' heaters in place of the customary 4 volts. The heater current is 1.7 amp. and the dial lamps consume 0.2 amp., making a total of 1.9 amp., while a maximum of 60mA at about 200 volts will satisfy the HT requirements.

The power supply disposed of, attention could then be given to the all-important questions of the circuit arrangement. This did not present much difficulty, at least, so far as the general conception was concerned, for as it was decided that loud speaker reproduction was desirable, coupled with adequate sensitivity, good selectivity and AVC, no alternative was left but to employ a superheterodyne circuit.

A further desideratum was a good signal to noise ratio, and this led to the decision to include a stage of HF amplification at the signal frequency.

One tuned circuit before the frequency changer is not a very good barrier for image-signal rejection, and at least two such stages with good coils are essential to ensure freedom from

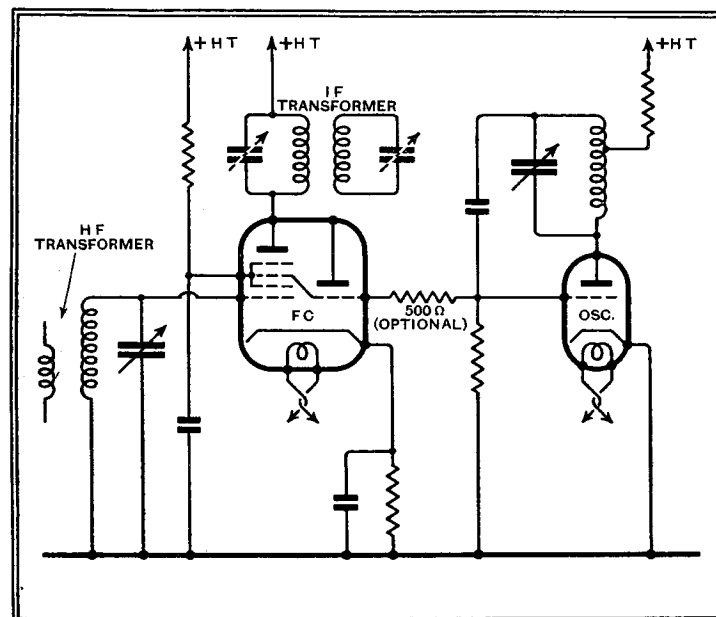
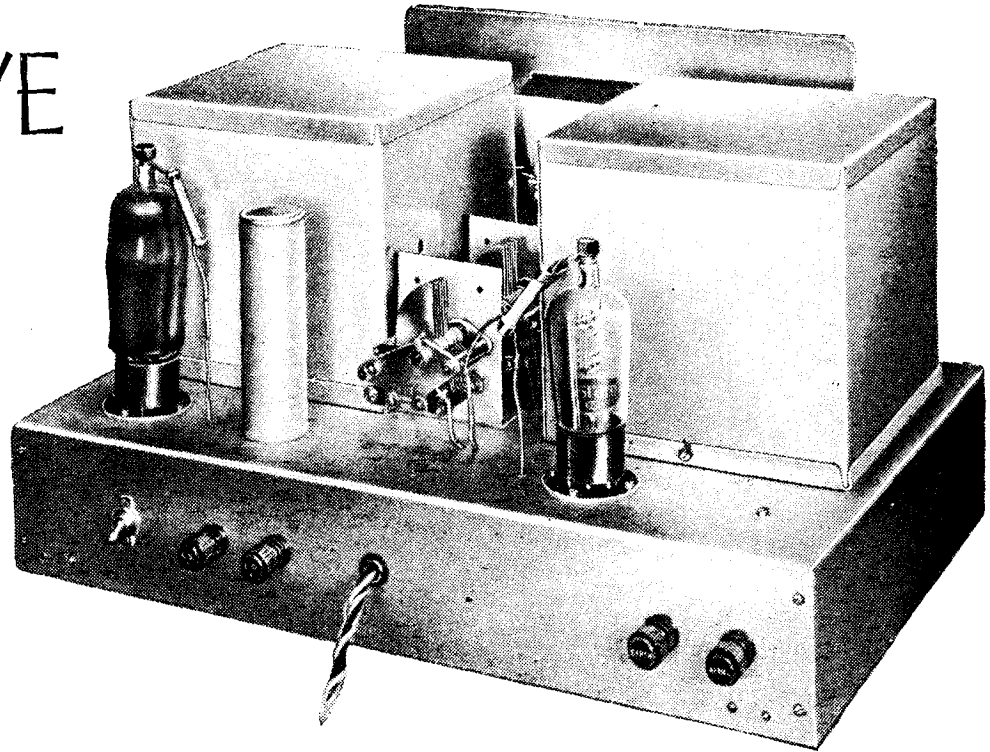


Fig. 1.—Among the frequency changers tried was a triode-hexode. The circuit with a separate oscillator is shown here.

—150 to 200 volts—could be obtained either from a Milnes Unit, charged from the 12-volt battery, or from a rotary converter run off the LT battery.

# SHORT-WAVE SIX



this type of interference. An initial HF stage, therefore, becomes obligatory.

On the highest frequency range, i.e., lowest wavelength, where the losses are relatively high, the HF transformer coupling this valve to the frequency changer has a one to one ratio, but on all other ranges smaller primaries are desirable for stability reasons. It may be of some interest to record that the dynamic resistance of the signal frequency tuned circuits was found to be approximately 2,000 ohms at 7 metres, rising to 20,000 ohms at 40 metres under working conditions, hence the difference in the HF transformer ratio.

At least three good IF transformers were deemed necessary to give the required selectivity, especially as an IF of 465 kc/s

changer was tried during the development of the receiver, the first arrangement being a triode-hexode, the X31 in this case, but some difficulty was experienced in developing the necessary optimum oscillator volts except on the highest wavelength ranges. Next, a separate triode was fitted for the oscillator, as shown in Fig. 1, the H30 being chosen by virtue of its high mutual conductance, to ascertain if the greater oscillator power would overcome this difficulty. No material improvement was found to

the signal to noise ratio. The best results were obtained on the lower wavelength ranges when a 500-ohm resistor was interposed between the oscillator grid on the H30 and the suppressor grid on the VP1321, these grids normally being joined together in this type of frequency changer.

An HF pentode with a close-mesh suppressor grid, high screen voltage—low capacity type, should be chosen in order to reduce the voltage swing required to modulate the valve anode current.

In order to complete the investigation a third form of frequency changer was tried, the common cathode resistor type of Fig. 3. At first this arrangement appeared to give good results, but further investigation revealed that equally good frequency changing could be obtained without the

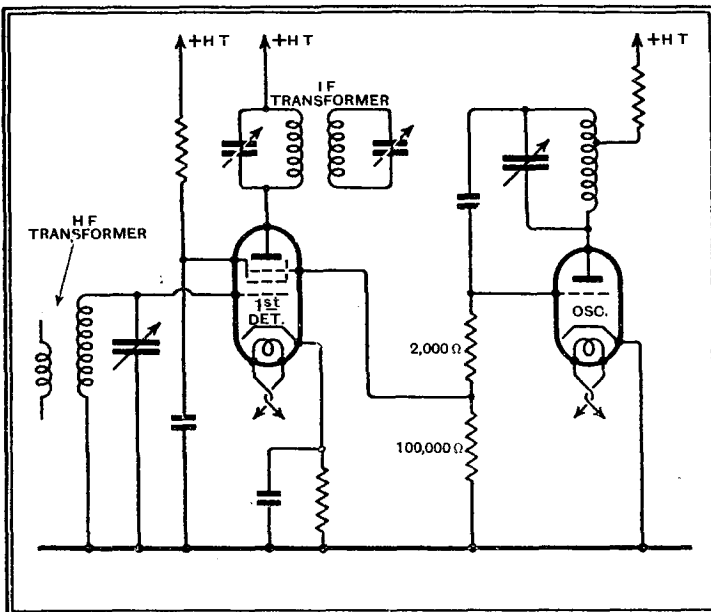


Fig. 2.—This arrangement proved a very satisfactory frequency changer especially on the ultra-short waverange.

was to be used, so two IF amplifying stages were added to the list. A further point in favour of these two stages was that it ensured a reasonably good measure of AVC action, since only the signal HF and the two IF valves could be so controlled, various reasons precluding the inclusion of the frequency changer. One of the principal difficulties that arise when this valve is included in the AVC chain is due to the flow of grid current, particularly on the higher frequency ranges, which seriously upsets the action of the AVC on the other valves in the system.

Practically every form of frequency

result on the lower wavelengths.

Suppressor grid injection using the circuit of Fig. 2 was the next step, the valves being a variable- $\mu$  HF pentode, VP1321, and an H30 as oscillator. This proved to be very satisfactory and definitely superior to the former scheme, especially in regard

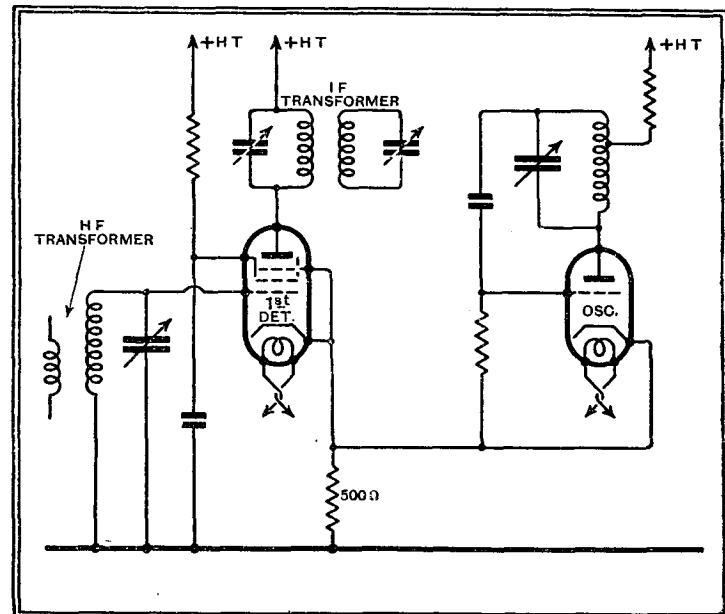


Fig. 3.—With this style of frequency changer mixing is effected by a cathode resistance common to both valves, but it proved unsatisfactory with a Hartley oscillator.

**Imperial Short-Wave Six—**

cathode resistor, for despite the reasonable amount of screening adopted, oscillator voltages were being picked up by the aerial, amplified by the HF stage and fed into the control grid of the mixing valve, anode bend rectification taking place. When this effect was avoided by more complete screening, then either with or without a common cathode resistor coupling, the frequency changing was unsatisfactory.

Detailed examination of the circuit will show that with the Hartley-type oscillator the cathode of the H30 is theoretically at zero HF potential so that HF currents do not circulate in the resistor, and mixing by this means is not practical.

This arrangement is included to complete the number of circuits tried and it may serve of some interest to others who have had success with the common cathode resistor scheme and two-valve frequency changers but using a different style of oscillator from that employed for these experiments.

After several other methods had been investigated, including direct injection into the control grid of the HF stage, which, while quite satisfactory as a frequency changer is not practicable in view of possible interference to other sets by radiation, it was decided finally to adopt suppressor grid injection as shown in Fig. 2. It will be noticed that a 2,000-

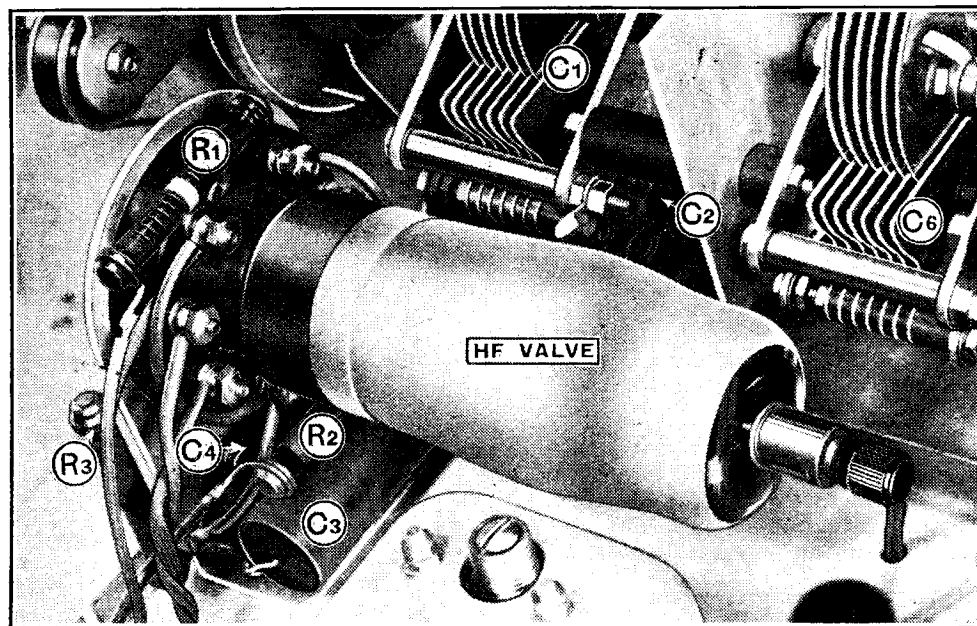
ohm resistor is inserted in series with the oscillator grid leak (R10 in Fig. 4), the lead to the suppressor grid in the mixing valve being taken from the junction of these two resistances. Incidentally, in some cases it may be advantageous to reduce this to 500 ohms, and the lowest value that gives satisfactory operation over the whole waveband should be employed. Having reached this stage it was then possible to plan the receiver in detail, the

stages, no LF amplifier being needed.

Four wave ranges are provided, three for the short waves and one for the ultra short. Ganged switches are employed, and the coils and padding condensers are arranged in the form of a unit which could be built as a complete item apart from the set, but this matter will be dealt with in greater detail later, when the constructional work is discussed.

The four ranges together cover a waveband of approximately 6 to 100 metres, the actual extent of each range being 5.5 to 11.2, 11 to 28, 27.5 to 55 and 50 to 105 metres respectively. An ultra-short waverange is included mainly for listeners in this country, for it takes in the wavelengths that will be used by the forthcoming high-definition television transmitters. Of course, this receiver is not suitable as a vision receiver, but it will enable the user to tune in to the accompanying sound transmissions. It covers also the 10-metre

amateur bands, on which considerable activity may be expected during the next year or so, while conditions remain favourable for long-distance communications on these very high frequencies, but does not tune down quite low enough to include the five-metre amateur wavelength. It is doubtful if any good purpose would have been served in bringing this band within

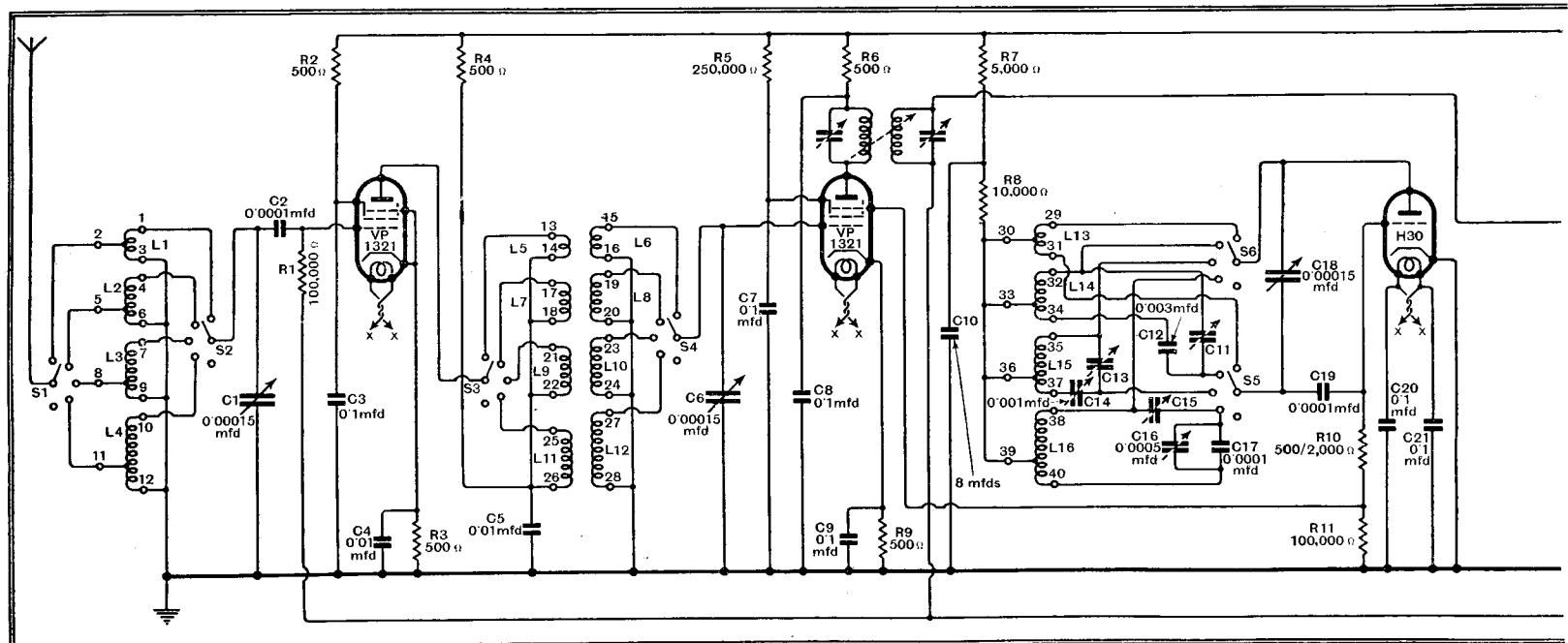


Close-up of the HF stage showing the method of mounting the valve holder, bias resistance and decoupling components.

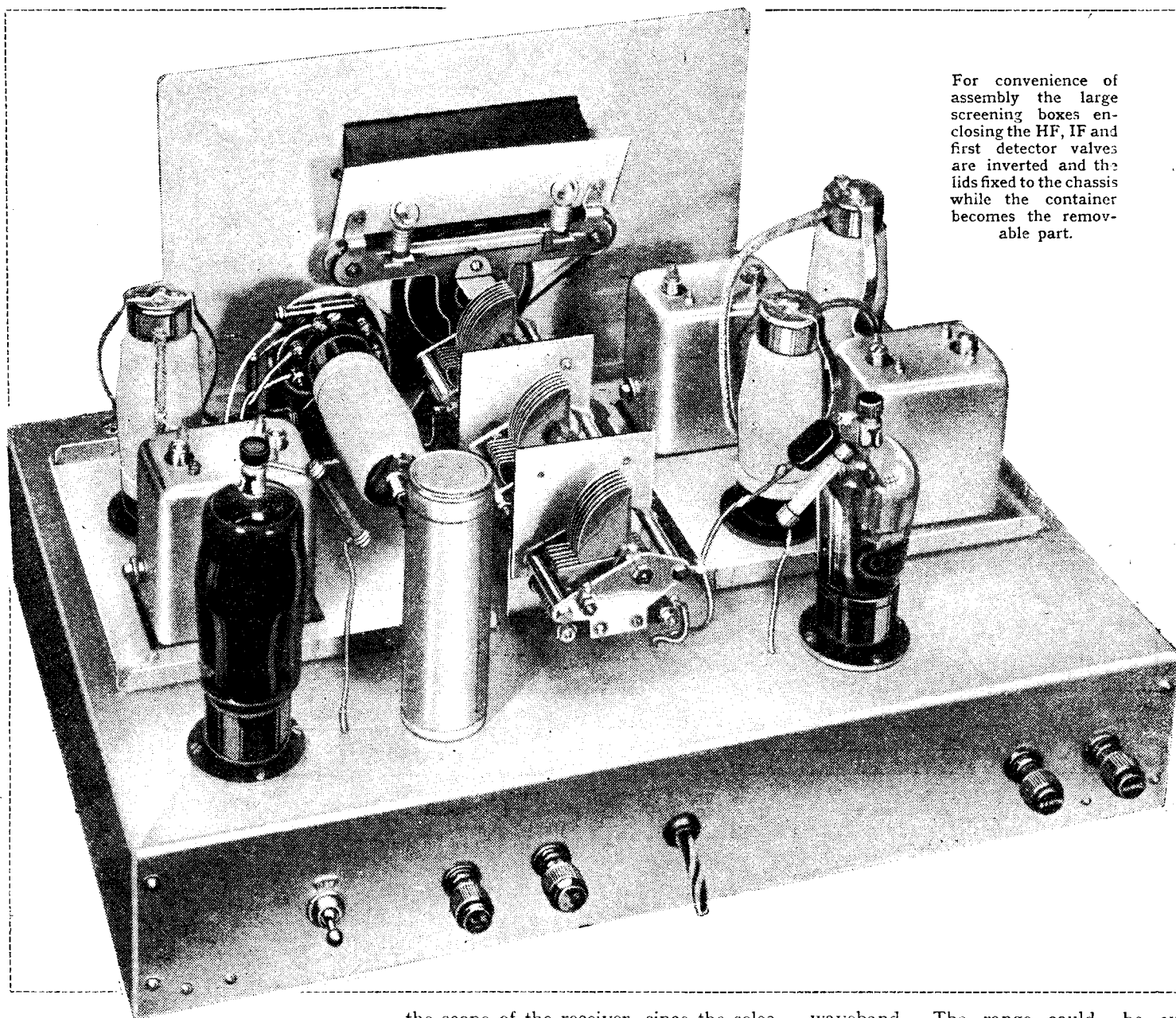
complete theoretical circuit being given in Fig. 4.

There are six valves in all, arranged as one signal frequency HF amplifier, a two-valve frequency changer comprising a triode oscillator and an HF pentode mixing valve, two IF amplifiers and a diode power pentode, combining the functions of second detector, AVC and output

Fig. 4.—The complete circuit of the receiver. Frequency changing is effected by two valves, with the oscillator volts injected into the suppressor grid of the first detector.







For convenience of assembly the large screening boxes enclosing the HF, IF and first detector valves are inverted and the lids fixed to the chassis while the container becomes the removable part.

the scope of the receiver, since the selectivity is far too high for satisfactory reception of the amateur ultra-short wave transmissions, which are not stabilised to anything like the same extent as on the longer wavelengths.

Whilst four ranges only are provided the switches are all five-way type, so there is a blank contact on each which could, if desired, be utilised for another range. Owing to the comparatively small size of the tuning condensers, 0.00015 mfd. each, it would not be possible to cover the whole of the medium broadcast waveband in one step; from about 200 to 420 metres would be the maximum coverage on this

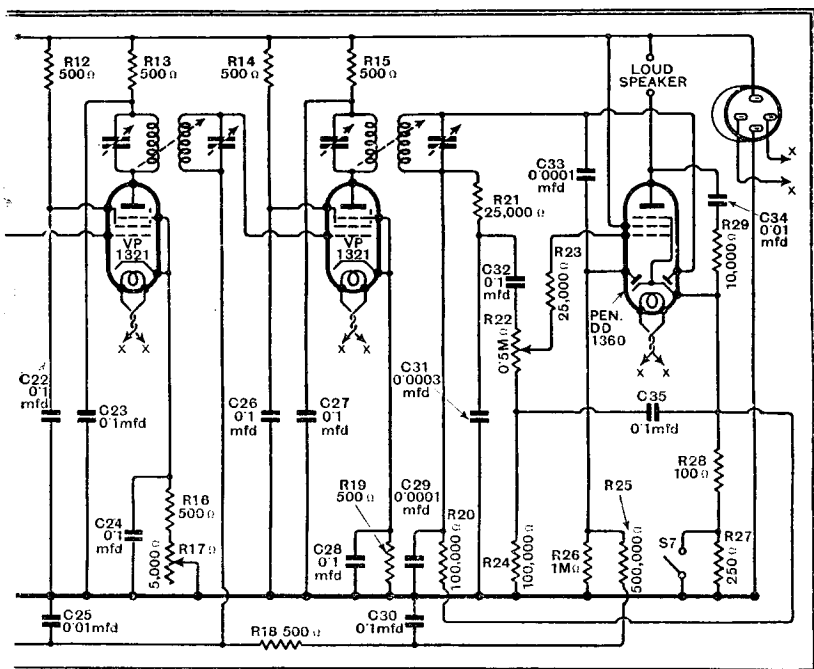
waveband. The range could be extended to 200 metres with an overlap on the top range now provided; however, there is not a great deal of broadcast interest in this part of the ether.

Although the type of frequency-changer embodied has been discussed, there are still several details which require explaining.

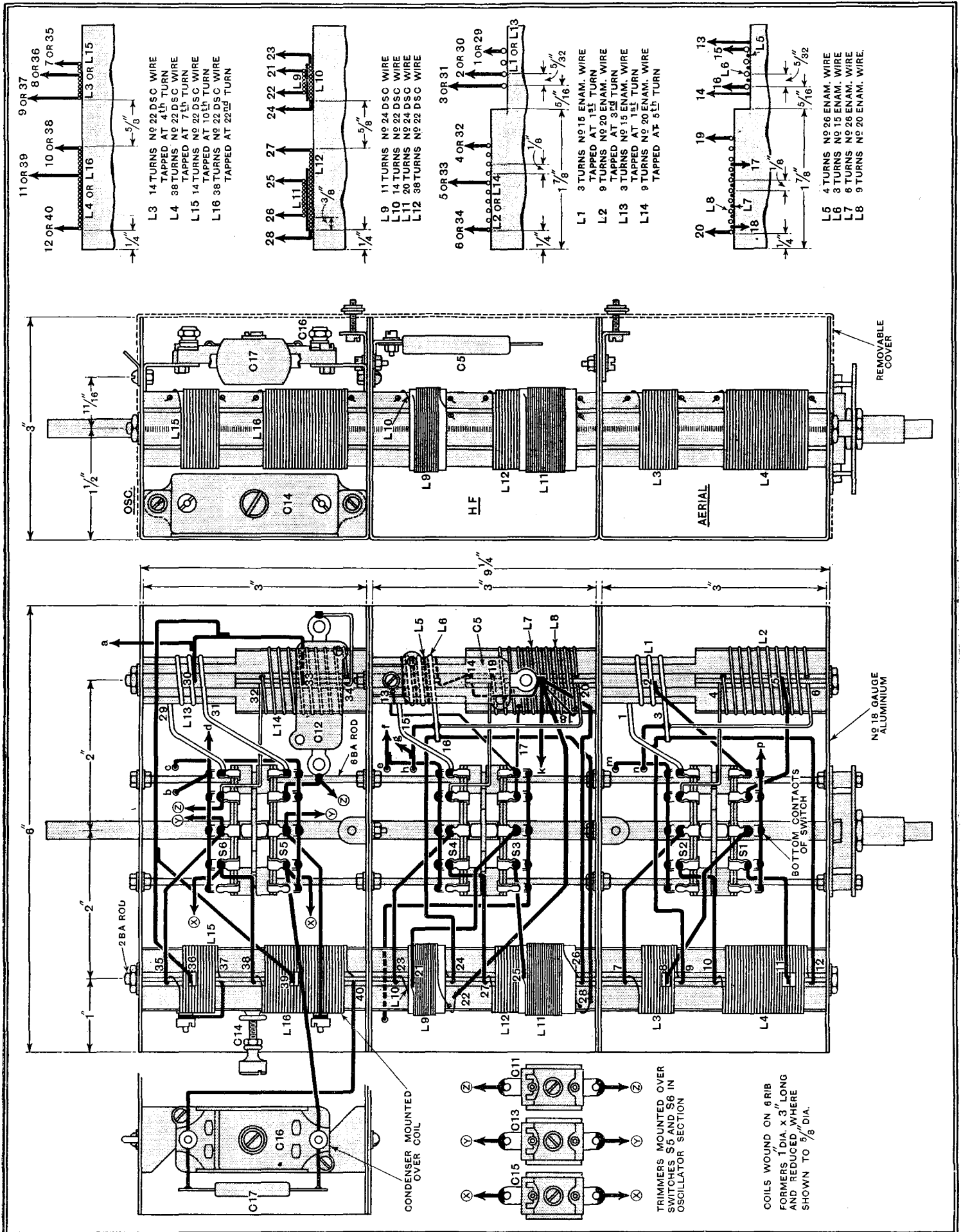
### Oscillator Circuit

A Hartley-type oscillator is adopted mainly because of the ease with which operation can be secured on the shorter wavelengths. Each range, with the exception of range one—6 to 11 metres—is fitted with both series and parallel padding condensers. The parallel padders are variable and each has a capacity of 30 m-mfds. maximum.

The series padding condensers are of the adjustable type only on ranges three and four, range two series padder being an 0.003 mfd. fixed condenser. Range three requires approximately 0.001 mfd., while for range four an 0.0001 mfd. fixed condenser is joined in parallel with an 0.0005 mfd. pre-set type. HT is fed to the



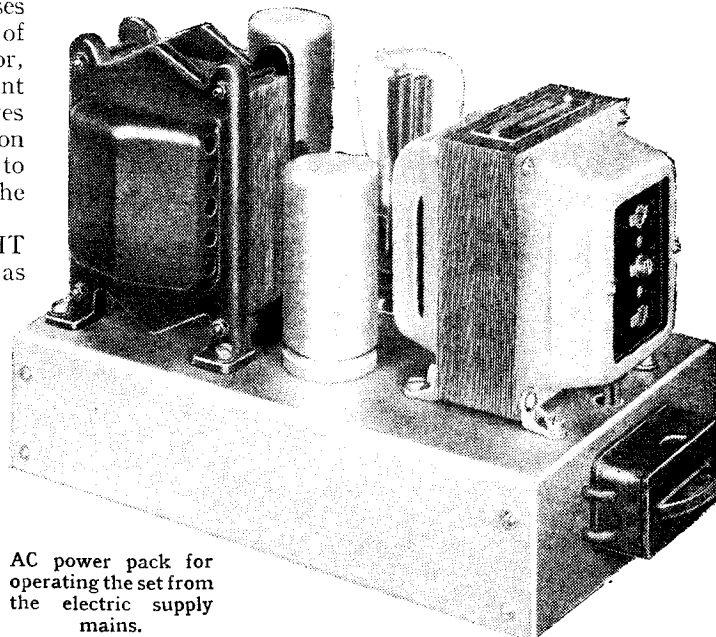
FULL DETAILS FOR MAKING THE COILS



**Imperial Short-Wave Six—**

oscillator anode through a 10,000-ohm resistance, with one of 5,000 ohms and an 8 mfd. condenser for decoupling. This is included in order to stabilise the oscillator frequency, for in cases where the regulation of the HT supply is poor, changes in anode current in the HF and IF valves due to the AVC action may probably lead to slight fluctuation in the HT voltage.

Where only a low HT voltage is available, as will most likely be the case if batteries are used, the 5,000-ohm resistance will have to be removed. It could be replaced by an LF choke, but this would seem hardly necessary as in such cases the battery should be capable of maintaining a steady voltage with a varying current load.



AC power pack for operating the set from the electric supply mains.

50-mfd. condenser has an impedance of some 60 ohms at 50 c/s, and can hardly be considered an adequate shunt to a 100-ohms bias resistance at this frequency.

(To be concluded.)

**LIST OF PARTS**

- 1 Variable condenser, 3-gang, 0.0015 mfd., C1, C6, C18  
Cyldon "Bebe Special" Utility W350
- 1 Dial  
Bulgin B620
- 2 Bulbs, 6 volts, 0.2 amps.  
Bulgin B620
- 3 IF transformers, 465 kc. s  
Varley Air Tune BP95
- 2 Screening boxes, 6½x6½x6 in.  
Magnum 1121
- Fixed Condensers**
- 5 0.001 mfd., C2, C19, C17, C29, C33  
Dubilier 665
- 1 0.003 mfd., C31  
Dubilier 665
- 1 0.003 mfd., C12  
Dubilier 670
- 4 0.01 mfd., C4, C5, C25, C34  
Dubilier 670
- 15 0.1 mfd. tubular, C3, C7, C8, C9, C20, C21, C22, C23, C24, C26, C27, C28, C30, C32, C35  
T.M.C.-Hydra T24
- 1 8 mfd., electrolytic, 440 volts DC working, C10  
T.C.C. 802
- 3 Pre-set condensers, 30 mmfds. (max.), mica, C11, C13, C15  
Bulgin SW95

- 1 Pre-set condenser, 0.0005 mfd., C16  
Colvern
- 1 Pre-set condenser, 0.001 mfd., C14  
Colvern
- Resistances, 1 watt
- 1 100 ohms, R28  
Polar-N.S.F.
- 1 250 ohms, R27  
Polar-N.S.F.
- 12 500 ohms, R2, R3, R4, R6, R9, R12, R13, R14  
Polar-N.S.F.
- 1 1,000 ohms, R7  
Polar-N.S.F.
- 2 10,000 ohms, R8, R29  
Polar-N.S.F.
- 2 25,000 ohms, R21, R23  
Polar-N.S.F.
- 4 100,000 ohms, R1, R11, R20, R29  
Polar-N.S.F.
- 1 250,000 ohms, R5  
Polar-N.S.F.
- 1 500,000 ohms, R25  
Polar-N.S.F.
- 1 1 megohm, R26  
Polar-N.S.F.
- 1 2,000 ohms, R10  
Dubilier
- 1 Potentiometer, wire wound, tapered, 5,000 ohms, R17  
Haynes Radio
- 1 Potentiometer, tapered (without switch), 500,000 ohms, R22  
Polar-N.S.F. V/4
- 1 5-way multi-switch, viz., 1 driver locator with 1200 square shaft  
Bulgin S152
- 3 Contact units, 2-pole, without bracket, S1 to S6  
Bulgin S154
- 1 Toggle on/off switch, S7  
Bulgin S80T
- 5 Valve holders, 7-pin (without terminals)  
Clix Chassis Mounting Type V2
- 1 Valve holder, 7-pin  
W.B. Baseboard Type
- 3 Valve hoods and connections  
Belling-Lee 1224
- 3 Valve connectors, plug top  
Belling-Lee 1167
- 4 Ebonite shrouded terminals, A, E, L.S. (2)  
Belling-Lee "B"
- 2 Lengths screened sleeving  
Goitone
- 6 Ebonite formers, 3in. length, 1in. o/a. dia., 6 wings  
Beacol No. 3
- or Eddystone special moulded formers.
- 2 lengths 12in. 2BA brass studding with 4 nuts and washers; 2 lengths 12in. 6BA with 30 nuts and washers.
- 4 oz. No. 18 and 4 oz. No. 20 tinned copper wire, 12 lengths systeflex, small quantity No. 15, No. 20 and No. 26 enamelled wire, 4oz. No. 22 and No. 24 D.S.C. wire, aluminium for coil assembly, etc.
- Screws:—**
- 45 6BA ½in. with nuts and washers, 2 6BA ½in. with nuts and washers, 9 4BA ½in. with nuts and washers, 8 wood screws ½in. R/hd.
- Metal chassis, 18x12x3 in., complete with screws, nuts and washers**  
B.T.S.
- Metal panel, 10x12 in., No. 18 gauge, complete with screws, nuts and washers**  
B.T.S.
- Valves:—**
- 4 VP1321 Mazda, 1 H30 Osram or Marconi, 1 Pen/DD1360 Mazda.
- POWER PACK**
- 1 Mains transformer, primary: 200/250 volts 50 cycles. Secondaries: 250-0-250 volts 60 mA., 4 volts 1 amp. C.T., 15 volts 2 amps. C.T.  
Sound Sales 6VS  
Hayberd 754
- 1 Smoothing choke, 45 henries
- Fixed condensers, electrolytic**
- 1 4 mfd., 500 volts DC working  
Polar-N.S.F.
- 1 8 mfd., 500 volts DC working  
Polar-N.S.F.
- 2 Valve holders, 4-pin (without terminals)  
Clix Chassis Mounting Type V1
- 1 Fused mains input connector with 1 amp. fuses  
Belling-Lee 1114
- Metal chassis, 9x5x2 in., complete with screws, nuts and washers**  
B.T.S.
- Valve: 1 500BU**  
Cossor

**DISTANT RECEPTION NOTES**

YOU may have noticed that the 500 kilowatt Moscow No. 1 is at present working on a rather higher wavelength than that officially assigned to it. Its proper wavelength is 1,724 metres, but it has now moved about 20 metres up. The reason, one supposes, is to avoid mutual interference with Radio-Paris; the new wavelength makes the separation between the two stations ten kilocycles instead of the original eight. Though Radio-Paris may welcome the change it cannot be very popular with the Finnish authorities, for Moscow No. 1 is now only six kilocycles removed from Lahti, which works on 1,807 metres. Radio-Paris is some 1,500 miles from Moscow, though the distance between Moscow and Lahti is less than half this figure.

I wonder whether anyone will manage to pick up Jerusalem, which will be in operation very shortly now. The station has an output rating of 20 kilowatts, but it is fated to share the wavelength of 449.1 metres with our own North Regional. Reception can be hoped for only at times when the North Regional is silent and Jerusalem at work. Jerusalem is a prize that many long-distance men will be eager to capture, and possibly somebody will be fortunate enough to log it. Should any reader do so, a report from him will be welcome.

The Saarbrücken station, which has now

been in action for some weeks, is occasionally received fairly well in this country. The output rating is only 0.7 kilowatt, and it has the 0.8 kilowatt Radio Côte d'Azur as a partner on the 240.2 metre wavelength. The best time to try for Saarbrücken is towards midnight.

Transatlantic reception on the medium waves is still good at times, though there are nights when very little is to be heard. WCAU on 256.3 metres is one of the best U.S.A. transmissions, but on good nights quite a few others may be picked up on wavelengths between about 220 and 300 metres. Whilst searching for U.S.A. stations you should be on the look out for South Americans. Some of the Argentine stations are often strongly received on nights when those in the U.S.A. are not too good. South American stations that have been recorded recently are LR2 and LR6, both of Buenos Aires. The former works on 329.6 metres, the latter on 344.6. It is rather interesting to note that the optimum wavelength for South America is somewhat higher than that for the United States.

You have probably succeeded in logging the 25 kilowatt Radio-Lyons on 251.4 metres. Radio-Midi works on the same wavelength, but as its power is only 0.3 kilowatt it does not cause noticeable interference.  
D. EXER.

**Grid Circuit Decoupling**

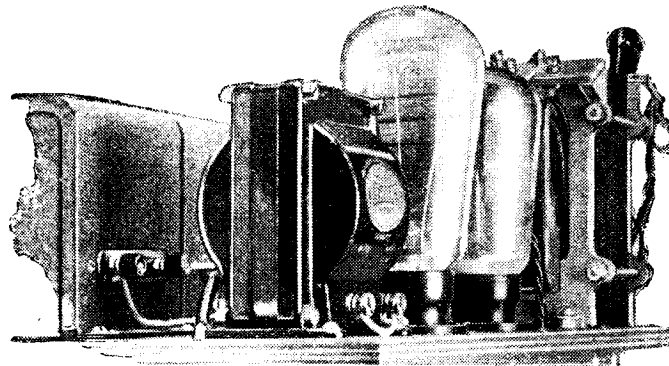
Operation of the diode circuits is fairly simple; one diode is used for signal rectification with its load resistance returned to the valve cathode, whilst the other acts as the AVC rectifier.

A delay bias equal to the grid bias on the pentode section of the output valve is applied to the AVC diode by returning its load resistance to the earth line. When there is no AVC voltage available, the controlled valves are operating with the grid bias determined by their respective cathode bias resistances.

It is interesting to note that the customary large capacity electrolytic condenser is omitted from the cathode circuit of the output pentode. Although the LF coupling circuit is of the resistance-capacity type, it is analogous in operation to a transformer-coupled circuit, at least as far as the development of LF voltages is concerned, since one cathode only is affected. Grid circuit decoupling, therefore, is permissible, and this is fortunate, for even a

# Biassing the Output Stage

By W. MacLANACHAN



## Methods Ordinarily Used in Commercial Sets

*WHEN tracing the circuit of a commercial receiver, with the object either of tracing a fault or making an alteration, the bias system of the output stage is often responsible for confusion. This article describes, in a particularly helpful way, the three systems in most common use.*

**T**RACING out and interpreting the circuit diagram of certain commercial receivers is, for some of the uninitiated, a more arduous task than would be the deciphering of a cuneiform inscription for a professor of archæology. Each firm, each country, has its own

LPA, the method of supplying bias requires very careful attention. Allowing a valve of this type to run for even a minute with zero grid bias or an open grid circuit when the full anode voltage is applied will cause a serious loss of emission.

Owing to the much greater amplification

obtainable from pentodes, these have been employed almost exclusively in "straight" receivers during the last few years, and are to be found on the majority of sets now on the second-hand market.

The biasing system almost exclusively used with indirectly-heated pentodes, such as the AC/Pen and the MPT4, as well as the triodes 41MP and 41MXP, was the elementary one of making the valve act as part of a potentiometer across the HT supply, the bias potential being derived from the voltage drop across the cathode resistance, as shown diagrammatically in Fig. 1. When fitting a receiver originally including an output pentode stage of this type with a directly-heated triode, one or other of the well-tried methods adopted by manufacturers for use with directly-heated pentodes, PT4 or PM24M, can be used. Although the two systems of Fig. 2 and Fig. 3 appear to be very much alike, there are several important differences.

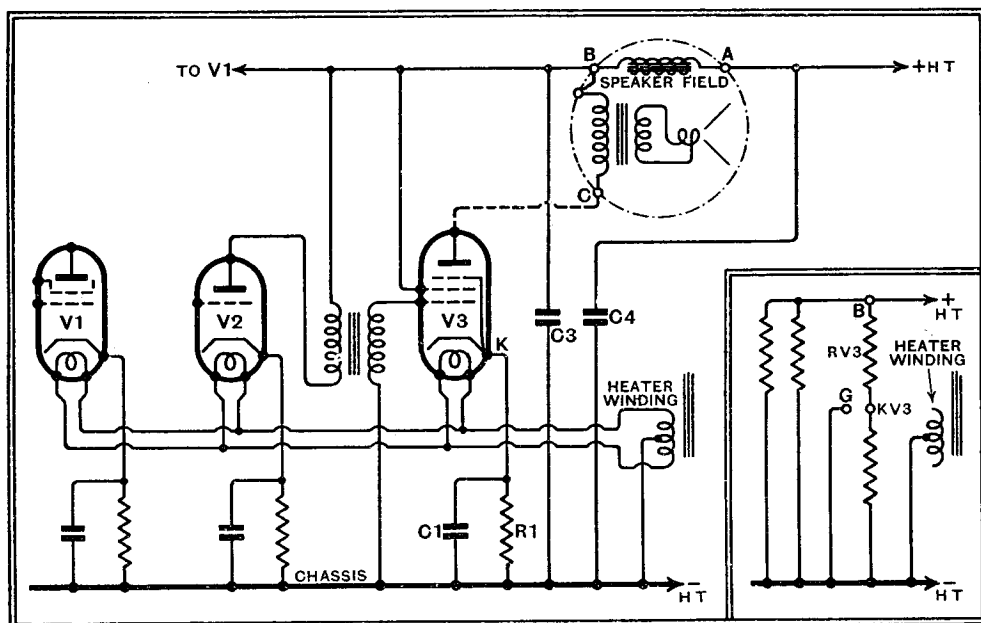


Fig. 1.—The orthodox output stage, with an indirectly-heated pentode. The lettering A, B, C shows points to which leads are connected on the speaker transformer. Inset is a diagram showing the distribution of DC potentials, in which the resistance of V3 is represented by RV3.

idiosyncrasies, any of which may confuse.

When the necessity arrives for tracing out the connections in a complicated receiver without even a circuit diagram the task almost always becomes a formidable one. Unless the general principles employed are thoroughly understood, serious mistakes are liable to occur when an enthusiast who has had no experience of commercial practice attempts to modernise an old receiver.

The provision of bias for a directly-heated valve in the output stage of a mains receiver is often particularly puzzling. If the modernisation to be effected involves the fitting of a new directly-heated triode, such as the PX4, PP3/250, ACO44, or

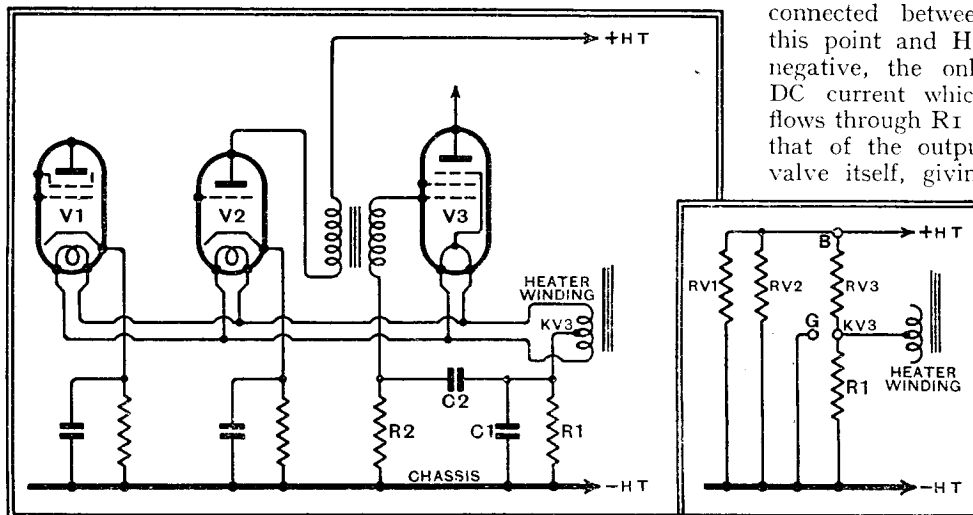


Fig. 2.—Another popular biasing arrangement, applicable to directly-heated pentodes or triodes. The centre-tapping of the common heater winding is the virtual cathode of the output valve, and the bias voltage for this valve is produced by the flow of its own anode current through R1. The equivalent DC circuit is shown in the inset.

### True Self-bias

In a receiver which incorporates the system of Fig. 2, the virtual cathode of the output valve is KV3, the centre tapping of the common heater winding, and despite the fact that the biasing resistance R1 is connected between this point and HT negative, the only DC current which flows through R1 is that of the output valve itself, giving

**Biassing the Output Stage—**

true automatic bias. This is achieved by connecting the cathode return leads of the remaining valves to HT negative, which in this case is most conveniently connected to chassis earth. The equivalent DC circuit shows that, as the cathode returns are connected to HT negative and the centre tapping of the heater winding is positive with relation to HT-, the cathodes are consequently negative with regard to their heaters by the voltage drop across R1 (less, of course, the individual bias of each valve). With this circuit the conventional decoupling of the grid circuit is used, and average values of the components are: R2, 100,000 ohms; C1, 1 to 2 mfd.; C2, 1 to 2 mfd.; while R1 depends on the current taken by the output valve and the bias required. A considerable improvement in bass response can be obtained by using the 50 mfd. 50 volt working condensers incorporated in most *Wireless World* sets in place of C1 and C2. In inserting these, note that the centre tapping (cathodes) end is positive.

With the circuit of Fig. 2, the value of the bias resistance must be calculated on the correct current taken by the output valve only, under proper operating conditions. In the other system, possibly more familiar to readers of *The Wireless World*, the biasing resistance is inserted in the HT negative lead, and the current for the whole set causes the voltage drop across it. There are actually several different methods of applying this type of circuit, and truly "free" grid bias can be obtained by utilising the voltage drop across the DC resistance of the field coil of the speaker, this also acting as the smoothing choke. In the majority of cases the voltage drop across the whole of the field is too high for biasing purposes, and the correct potential is obtained by (a) connecting a potentiometer of relatively high resistance across the speaker field, as shown at R1, R2, Fig. 3, or (b) providing the speaker field with a tapping which will effect the same purpose.

**Bias Voltage Fluctuations**

In the equivalent DC circuit it will be easily recognised that the current for the whole set must pass through the biasing resistances. Owing to the variation in the total set current caused by using the variable-mu characteristics of the HF valve or valves for controlling volume, this method is almost precluded, as any change in current would affect the bias in the output valve. When replacing the output valve in a receiver of this type, all that is required is an alteration of the values of

the resistances R1 and R2 to give the correct bias for the new valve.

Very frequently it is possible to tell quickly which type of circuit is employed merely by using a DC voltmeter and examining the terminals on the output

sign that the conventional method of biasing has been used.

Where a directly-heated output valve is employed with similar connections to the speaker, it may be surmised that the manufacturer has used the circuit of Fig.

2, or that he has gone to the expense of including a separate heater winding for the output valve. Connecting the voltmeter between the cathode and heater sockets on an HF valve holder will reveal whether or not this has been done.

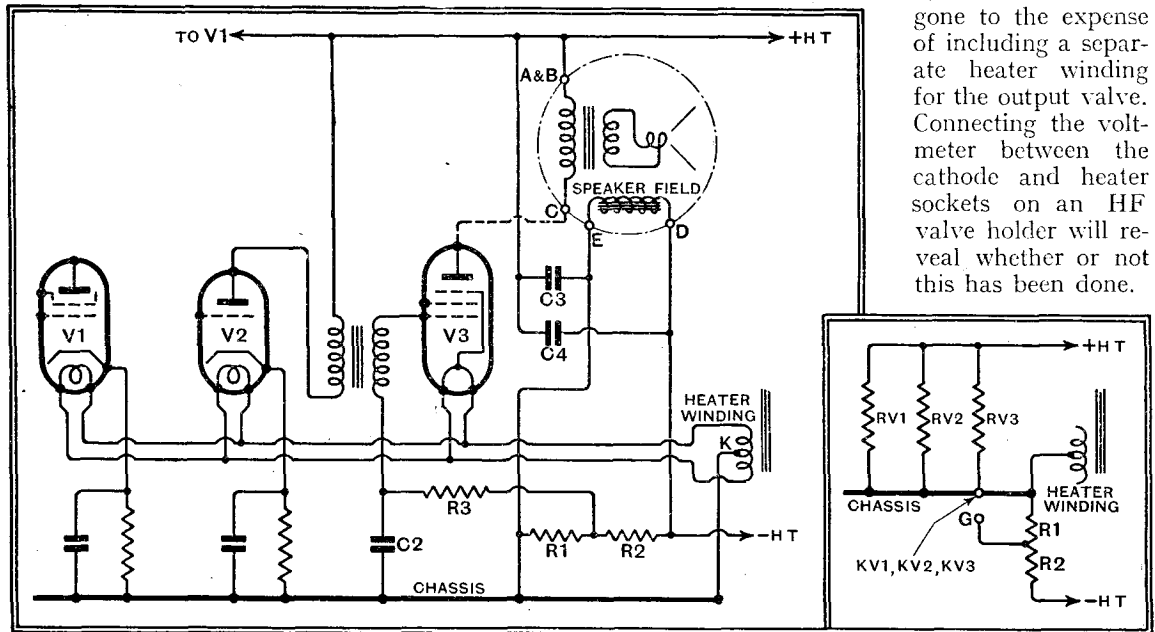


Fig. 3.—Bias from a resistance in the common negative lead. In this case the resistance is a speaker field coil and the desired bias voltage is "picked off" a potentiometer comprising R1 and R2. In the inset, RV1 and RV2 represent V1 and V2 with their respective bias resistances.

transformer. The standard connections for an indirectly-heated valve are shown within the chain-dotted circle in Fig. 1, where three leads connect the supply and the valve to the terminals A, B and C on the speaker. These leads are HT unsmoothed to A, HT smoothed to B (joined to one end of the output transformer), while the anode of the output valve is connected to C. The use of an indirectly-heated output valve with similar connections to the speaker is an almost certain

The third system can usually be recognised by the four (or five) connections to the speaker. The voltmeter will reveal whether or not any of the terminals are negative with relation to chassis. In the type of circuit shown in Fig. 3 the terminal indicated at D will be possibly go to 120 volts negative, while A, B and C will be positive. When an additional terminal is connected to a tapping on the field coil, this will also show a negative reading with respect to the chassis.

## At the Transmitting End

### Technical Criticisms of Recent Broadcasts

#### More Rumbles from Sadler's Wells

It seems a thousand pities that a number of otherwise first-rate outside broadcasts should be spoilt by seeming inattention to detail.

Take, for instance, the relay of Humperdinck's "Hänsel and Gretel" in the Regional programme on December 21st from Sadler's Wells.

For some reason or other the fidelity from this particular theatre is always good, and compares quite favourably with studio quality, and yet the performance must be ruined by the rumbling and stumbling of what sound like heavy feet.

And so it was in the previous week when "The Snow Maiden" was rendered intolerable with these noisy trappings which constantly intruded.

This sort of thing might have been ignored years ago, when anything in the nature of an "O-B" was a great novelty, but nowadays, when good quality is of supreme importance in a musical transmission, anything that mars that quality re-

moves one's interest and, for the most part, the justification for the broadcast.

It is difficult to understand why such things are allowed to happen, and why, if they are unavoidable, the concerts are broadcast at all, for, in the latter circumstances, they offer little attraction to the listener, and one is tempted to say with a one-time B.B.C. personality—though for a different reason—"Please don't do it."

#### A Restrained Audience

The Gala Variety of December 21st in the National Programme was a good show in every respect, although the audience—if there was one—was very restrained, and in consequence the atmosphere was not always what it might have been.

In a show of this nature an audience is almost of as much importance as the artistes themselves—a fact which the B.B.C. producers would not be slow to realise if they took an occasional holiday and heard the broadcast as the listener hears it.

H. C. H.



# HINTS and TIPS

## Practical Aids to Better Reception

**C**OUPLING condensers, as used in resistance amplifiers, do not often break down, especially if they are of the mica-dielectric type, as generally recommended, with an ample factor of safety in the matter of rated voltage. The risk of failure is certainly greater with paper condensers, especially if a rather unsuitable component is used in setting up an extemporised amplifier.

### Safeguarding Power Valves

If the condenser *does* fail, it is easy to see that a high positive bias will be applied to the grid of the succeeding output valve, which will probably be ruined unless the fault is detected at once.

Means of guarding locally against such accidents are none too easy to devise, although the use of a sensitive fuse in the anode circuit of the output valve should prevent its harmful effects. A fuse in series with the condenser would be useless,

lamp will have no effect on the functioning of the circuit, but, in the event of a condenser breakdown, HT voltage will be applied to it, and the consequent flow of current will "blow" the fuse, preventing damage to the output valve.

**A**LTHOUGH there is much to be said for the practice of combining the main on-off switch with the volume control, it is worth while to remember that the amount of wear and tear on the resistance track with this type of component is often considerable. Certainly it is far greater than with the simple type used for volume adjustments only, with which the amount of variation normally required is obtained with quite small movements of the wiping contact, and which, in some cases, may not require resetting more than two or three times even in a week.

### Switch-Cum-Volume Controls

So, bearing in mind that the volume control has already acquired a reputation for causing quite a large percentage of receiver troubles, it may possibly be preferable in some cases, particularly where reliability is the foremost consideration, to play for safety by mounting the switch separately.

**A**LMOST everyone knows that the carbon or central pole of a dry cell is positive, but apparently this knowledge is not always applied to the solution of a practical difficulty. At any rate, an amateur of some experience was noticed the other day to be puzzled over the question of polarity when confronted with a bias battery from which the indicating label had become detached.

A few words on this subject may therefore be offered, with due apologies to those who will find them redundant.

Referring to Fig. 2, it will be safe enough to presume that socket A connects to the carbon of the cell immediately below it, and so must be the positive pole. And it is a great deal more obvious and certain that B is asymmetrically disposed, not just to relieve the monotony, but for direct and easy connection to the zinc case; it must accordingly be negative.

Although a local-distance switch is less necessary than formerly, there is a limit to the variations of signal strength with which the best of AVC systems can cope satisfactorily, and it is consequently a desirable refinement under certain rather difficult conditions.

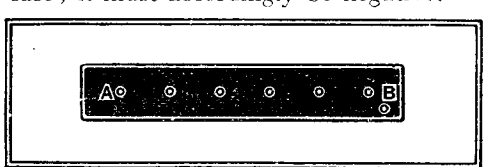


Fig. 2.—Puzzle: Which is the positive end of this bias battery?

**H**AVING once arrived at the best operating conditions for an electrostatic speaker, nothing further is usually done for months, or even years. It may in some cases come as somewhat of a shock to test the "old friend" against a new instrument; deterioration is often so gradual that it would otherwise have remained unnoticed.

### Electrostatic Speakers

The usual cause is not, as might be supposed, a breakdown of the dielectric, but a virtual disappearance of one electrode. The constant vibration has worn away the metal covering in places, perhaps most severely quite close to the positive terminal, so that a large part of the diaphragm may be actually disconnected and acting as a mere passenger.

In such instances a marked improvement may often be secured by transferring the positive terminal and clip to the opposite side of the speaker, where the foil is usually less worn and a larger area thus becomes available for useful work in reproducing the high notes.

**T**HERE is nothing wrong with the ordinary "local-distance" switch in principle, but the trouble usually is that one is apt to forget its presence. After a spell of listening to the home station the action of switching to "distance" when foreign reception is desired should become a habit, but it does not seem to do so in practice, and, until the switch comes to mind, one is usually perturbed at the apparent lack of sensitivity.

### Automatic Local-Distance Switch

Although a local-distance switch is less necessary than formerly, there is a limit to the variations of signal strength with which the best of AVC systems can cope satisfactorily, and it is consequently a desirable refinement under certain rather difficult conditions.

What is clearly wanted is a discriminating device, which will automatically set itself at the position desired without making any demands on the memory of the user of the set. It may not have occurred to many readers that in the old-fashioned wave-trap we have something that, up to a point, satisfies this requirement. If correctly tuned the trap will automatically reduce the input from the local station to a very considerable extent and at the same time will have no harmful effect on the reception of other stations; in fact, it can do nothing but good.

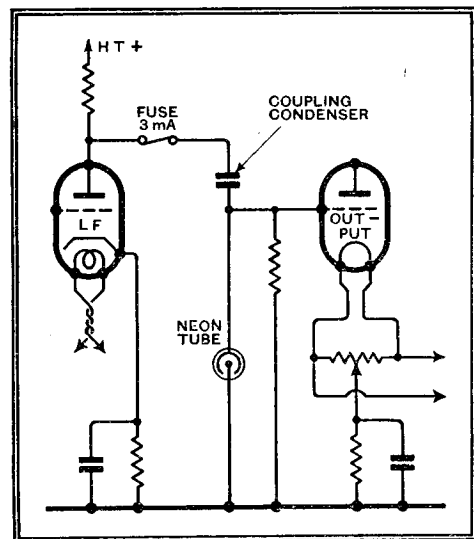


Fig. 1.—A neon "by-pass," which comes into operation only in the event of a short-circuit developing in the coupling condenser.

as the presence of the grid leak will automatically restrict the current to a very low value, even in the event of a complete condenser breakdown.

An ingenious way of using a neon lamp as a local protective device is suggested by a correspondent. It is strange that the peculiar properties of the neon tube are not more often turned to account for wireless purposes, and the present suggestion is, perhaps, more valuable as an indication of what may be done than for its own intrinsic advantages.

The scheme suggested is shown in Fig. 1, from which it will be seen that the neon tube is connected in parallel with the grid leak, and that a sensitive fuse is inserted in series with the HT supply. The lamp must be of a type with a "striking" voltage greater than the maximum peak voltage normally applied to the output valve.

While all is well, the presence of the

# Current Topics

## Another French Regional Station

MARSEILLE-REALTOR will be the next French Regional station to open a regular service probably within the next fortnight. The power is 90 kilowatts, and the wavelength 400.5 metres.

## New Anti-Pirate Scheme

AN anti-pirate suggestion from an Aberdeen correspondent in a daily newspaper: "Why not demand ten shillings from *everyone* on the Burgess roll, leaving him or her to send in a statutory declaration of non-possession of a wireless set if exemption is claimed?"

## £150 to Stop Interference

WORTHING listeners are rejoicing over the steps taken to stop interference from the Heene Place sub-station. Representations have been made to the English Electric Co., Ltd., which supplied the sub-station equipment, and while the company is under no legal obligation it has undertaken to share equally with the Corporation the cost of the apparatus necessary to prevent the interference, estimated at £150.

## Winding Up the Wireless League

THE recently announced Extraordinary General Meeting of the Wireless League to consider, and, if thought fit, to pass, a resolution authorising the Committee to take steps for the purpose of winding up the League was postponed. It will be held on Friday, January 10th, at 6.30, at the Royal Automobile Club, Pall Mall, London.

It is not suggested that the League should close down until the end of the financial year, viz., September 30th next, so all present members will receive full insurance and other service until the expiry of their annual subscription.

## Portsmouth-London 5-metre Contact

AN important ground-to-ground 5-metre contact has been set up by experimenters at the Portsmouth Municipal College and Radio G2PB of London. Calling on 40 metres, Portsmouth asked any station possessing a 56 mc. receiver to listen to a test transmission. G2PB responded and heard quite well, giving the report: "QSA 4-5 QRK 4 Tg. No. QSB." Subsequently G2PB listened on a two-valve super-regenerative receiver, minus aerial, with good results. The Portsmouth transmitter was using 1.8 watts.

## Short-wave News from Spain

BRIEF news bulletins in French, English, and Spanish are now broadcast daily at 11.30 p.m. (G.M.T.) by Transradio Espanola (EAQ) on 30.4 metres.

## King of Iraq's Choice

THE King of Iraq recently ordered a Philco dual-wave car radio. The set was fitted to the King's car in Bagdad, 4,000 miles away, forty-eight hours after leaving the factory at Perivale, Middlesex, being flown by Imperial Airways from Croydon.

## A Radio Week

FRANCE is to have a Radio Propaganda week in February. Public radio demonstrations will be organised by State and private stations in collaboration, special programmes being broadcast. Fixed and

## Events of the Week in Brief Review

motor of the electric clock type, the device is attached inconspicuously to the set. With the motor is a recording tape and a marking device operated by a magnet through which current flows only when the set is on.

At the end of January a number of these devices which have been in operation for the last three months will be examined, and it is hoped that valuable data will be forthcoming showing what classes of programme during that period interested various types of listener.

## Human But Dignified

AUSTRALIAN announcers have been accused of being dull. Now the Australian

and the sales are consequently lower.

U.S. radio manufacturers are searching round for "selling points" for 1936. The trouble appears to be that, having attained "control room reception," i.e., high fidelity reproduction, the last pinnacle has been reached in quality reception. Probably manufacturers will concentrate on additional receiver refinements and the simplification of tuning.

## A Necessity

THE inmates of the Arbour Hill prison have demanded the installation of a wireless set, according to a written reply in the Irish Dáil by Mr. Aiken, Minister for Defence.

## Berlin Television Resumed

BERLIN'S ultra-short-wave television and sound transmissions were resumed on December 23rd. The original transmitters were destroyed in the radio exhibition fire. The aerials are mounted on the Witzleben radio tower.

## Friday the Thirteenth

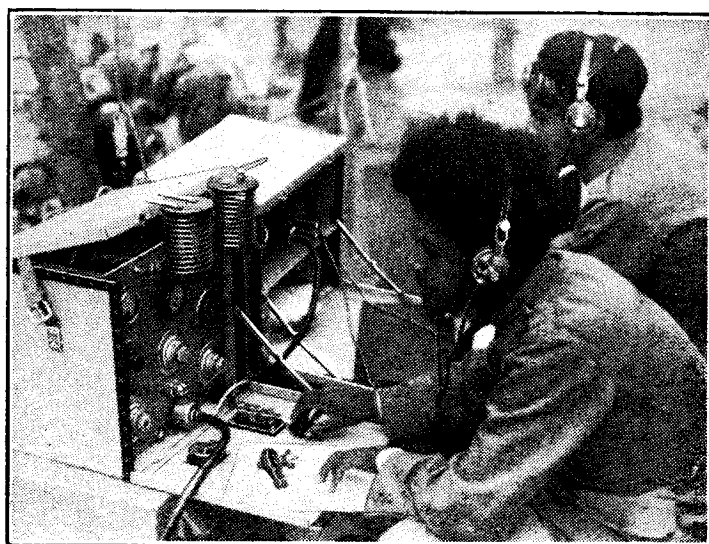
FRIDAY the 13th is a dreaded date in France. To brighten the outlook on Friday, December 13th, 1935, the private Paris station, *Radio Cité*, offered 13 tickets in the 13th national lottery to 13 children born as near as possible to 13 o'clock in the 13 maternity hospitals of Paris.

## British and American Television Compared

"THE American achievement surpasses that of Britain," writes a Washington correspondent who has just witnessed a demonstration of RCA television at Camden, New Jersey. Six months ago he attended a display of one of the British systems.

"As to what was revealed at Camden," he writes, "look at a good half-tone news picture measuring 6 x 7½ in. in any newspaper. Imagine it coming to life on a fluorescent screen, the bright greenish-yellow illumination throwing the images into sharp relief. You can enjoy it without appreciable eye-strain within five to eight feet from the screen. There are flickers, but they are not disturbing."

The Radio Corporation of America is using 343-line definition at the rate of sixty pictures per second.



IN THE WAR ZONE. Under supervision by Europeans, Abyssinian soldiers become expert radio operators. This picture, taken at Dessie, shows a transmitting and receiving station in operation.

mobile receiving stations will be in operation not only in Paris but in the provinces. Radio films will be featured at the cinemas during Radio Week, and a number of talks emphasising the value of broadcasting will be radiated.

## Measuring Listener Reaction

PROFESSOR ROBERT F. ELLIS, of the Massachusetts Institute of Technology, has invented a device which is being fitted to a hundred radio receiving sets a week, its object being to record mechanically at what times the set has been in action over a three-month period.

Fitted with a synchronous

Broadcasting Commission states that announcers are in future to be "a little brighter without being objectionably familiar."

## U.S. Radio's Banner Year

ONE proof of business recovery in America is the surprising success of the radio industry during 1935, which is described as a "banner year." It is estimated that five million radio sets were sold in the last twelve months as compared with 4,438,000 in the "good old days" of 1929. Probably the national turnover will exceed that of 1929, when the yield was 592,062,000 dollars. In valve sales profits may be lower because modern valves last longer

# Stabilised Grid Bias

Inexpensive Source of Auxiliary Voltages: Few Extra Components Required

By CHARLES LAWLER

**T**HE problem of providing grid bias for a Class "B" or similar amplifier such as the recently developed low-loading push-pull system cannot be met by the usual cathode resistance, since the variation in anode current causes a corresponding shifting of the bias potential, resulting in a variation of the effective AC impedance of the valve.

The method generally adopted is to provide an entirely separate system employing transformer, rectifier, etc., but, viewed in the light of a scheme which has recently been devised by Mr. W. Bryan Savage, this appears to involve unnecessary duplication of components.

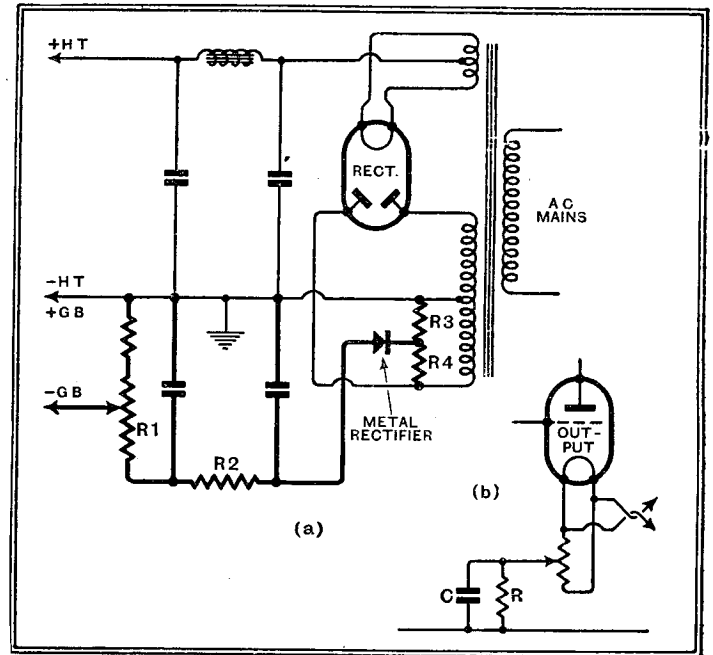
It is generally understood that, in the ordinary full-wave valve rectifier circuit employing a centre-tapped HT winding, only one-half of the winding is active at any given instant, the other half being idle.

The basic circuit of the bias system to be described is shown in Fig. 1, and it will be observed that the idle half-winding is made to deliver a suitable AC voltage to the cathode of a small half-wave rectifier—a reversal of the usual order of things—so that this valve is induced to deliver potential below HT-. The output from this rectifier is smoothed by the condensers C1 and C2, and the resistance R2, and

variable adjustment of bias potential. It is a wise precaution to insert a fixed resistance of suitable value in series with the potentiometer and HT to prevent the bias voltage from being taken below a predetermined level. The value of the potentiometer should, in such a case, be lower by an amount equal to the value of the fixed resistance.

Let us examine the means by which the resistance values are calculated. We will assume that a maximum bias voltage of 150 is required. The current drawn by the system is unimportant, provided that it does not exceed the rating for the rectifier and/or

Fig. 2. Illustrating (in dia. a) the use of a metal rectifier and also of an "artificial" transformer tapping. Dia. b represents the normal bias circuit for an output triode.



transformer. Since the current is unimportant we can choose a reasonably low value—say 5 mA.

Ohm's law shows us that 5 mA, flowing through 10,000 ohms (R2) will drop 50 volts. We must, therefore, make our tap on the transformer at 200 volts. The next step is to calculate the value of the load resistance. The voltage across C2 is to be 150, and we wish to cause a current of 5 mA. to flow through R1. This gives us  $150/0.005$ , or 30,000 ohms.

## Bias for Earlier Stages

If necessary, bias voltages may be obtained for pre-output stages by the use of a semi-variable resistance at R1. This resistance may be of the type in which the wire is coiled between the ribs of a porcelain former, additional contact clips being provided at suitable tapping points. While decoupling is in most cases unnecessary, it is wise to insert a resistance of 0.25 to 0.5 megohm in each bias lead, taking the output end of the resistance to HT- through a condenser on account of the additional smoothing afforded.

Variations of the idea will be apparent. For instance, should a spare heater winding not be available, a metal rectifier may

be employed, connected as in Fig. 2a. In cases where no tapping is available on the HT winding, such a tapping may be simulated by a potentiometer consisting of two fixed resistances, R3 and R4, joined in series across half of the HT winding.

There are many advantages associated with this arrangement, quite apart from the question of grid bias stabilisation.

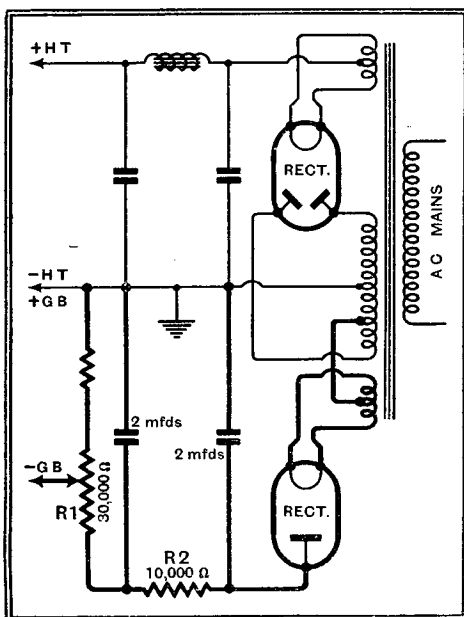


Fig. 1. Addition of bias supply system to a normal HT unit; extra wiring in heavy lines.

finally fed to the load R1. This load can conveniently be a potentiometer—or, where the output stage is push-pull, two potentiometers, thus affording infinitely

In "straight" amplifiers requiring bias of the order of 100 volts, or even less, the addition of this voltage to that of the HT as with conventional bias systems may well mean a greater expense for smoothing condensers.

## Improved Bass Response

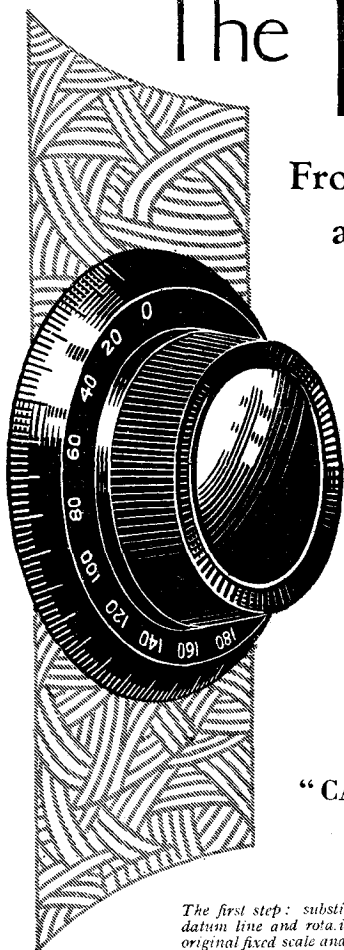
Another advantage which must not be overlooked lies in the greater output in the lower register, due to the removal of the bias resistance from the cathode circuit. Reference to Fig. 2b will make this clear. The reactance of C at low frequencies being comparable with that of R indicates that, in spite of the fact that C is provided for the express purpose of by-passing LF across R, there is still considerable impedance offered to the flow of very low frequencies. Also, one is hard put to it to obtain condensers of large enough capacity and sufficiently high working voltage to decouple automatic bias resistances of valves requiring above, say, 50 volts bias.

All things considered, the system has many points to recommend it, and one or more of its features should prove attractive to all users of amplifiers and particularly of the larger type of equipment used for public-address work.

# The Ideal Tuning Scale

From Dug-Out to Drawing Room—  
and Still in Process of Evolution

By  
"CATHODE  
RAY"

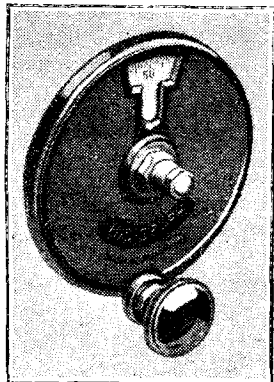


The first step: substitution of a fixed datum line and rotating scale for the original fixed scale and moving pointer.

LOOKING back on the broadcast receivers of the last thirteen years (2LO went "on the air" in 1922) we survey a wealth of evolution for which biology would demand more nearly thirteen million years. Of the features of a set, none has been the subject of so many diverse attempts to achieve the ideal as the tuning scale. And now, when most other things have shaken down into some semblance of standard practice, the scale question seems to be less settled than ever.

In the early days, when set construction in general was crude, the tuning scale was not lacking in ingenuity. It was certainly more standardised than it has ever been since. As a matter of fact, the device was taken over complete from the Service gear used during the War, five or six years previously. When you come to think of it, the obvious and unoriginal way of indicating the setting

The "Indigraph"; an early slow-motion dial.

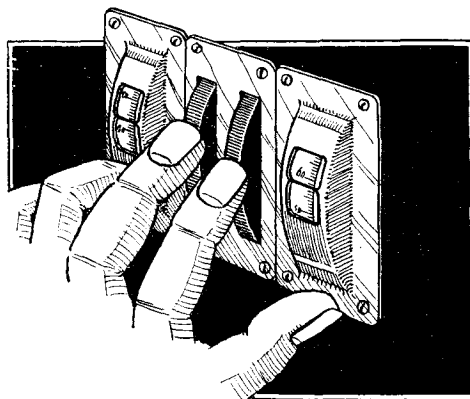


of a rotatable control is by means of a pointer moving over a fixed scale, as used everywhere to this day in clocks and electrical meters. The substitution of a fixed

pointer and a moving scale, then, so that the reading is always in the most convenient position for the eye, shows a thoughtful originality, even in the hurried war days, that has not always been displayed since.

So good was it that this rotating circular ebonite dial with white 180-degree engraving on a bevelled edge continued supreme and practically unmodified for several more years, and had not altogether died out even in 1930.

As receivers developed, the need arose for (1) slow-motion, and (2) more informative scale markings; and by 1926 the Igranic "Indigraph" and Burndept "Etholog," which embodied step-down gearing and provision for writing station names, became popular. Both of these types are still used in Post Office and aircraft stations, for example.



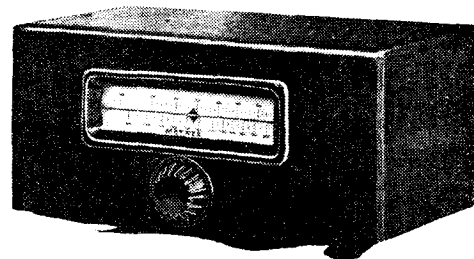
Groping towards single-knob tuning: edgewise side-by-side drums were evolved with the idea of facilitating the operation of maintaining a pair of circuits "in step."

At the same time a more complete departure from tradition appeared on the G.E.C. sets in the form of drum scales moving in a vertical plane behind small windows and thumb-controlled by milled discs peeping through slots. The ideas behind this seem to have been originality, neatness, and a desire to break with the "scientific instrument" conception of radio.

### Restricted Vision

For several years the edgewise drums flourished, until gradually the designers realised that the public preferred to grasp hold of something rather than "scratch for it." So in 1929 the ordinary knob control was revived, with a behind-the-panel revolving scale—disc or drum type—showing a small portion of itself through a window above the knob. Sometimes only one scale figure could be seen at a time, so that the user had to find

out by trial which way to turn the knob in order to go "up" or "down." Worse still, there was a tendency to adopt the medieval stronghold plan and make the

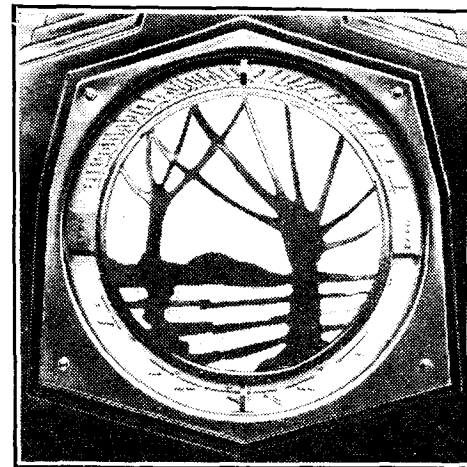


The first full-vision scale, with travelling pointer, as fitted to McMichael sets.

window more like a little tunnel through which the contorted "operator" had to peer to "find the place."

While this pernicious device was general in 1931, McMichael had shown the way to better things the year before with a scale that at one stride accomplished nearly all the most desirable features. It was fully visible, so that one could see where one was. It was horizontal, therefore there was no need to try to read figures on their sides. It was marked plainly in wavelengths. It was even illuminated.

Divers manufacturers had ventured to calibrate their scales prior to this date, and, having burned their fingers, went back once more to the 180-degree or 100-division scale that meant nothing. Admittedly the methods of component matching of the period were immature. But it was not to be foreseen that the public would adopt such an exacting atti-



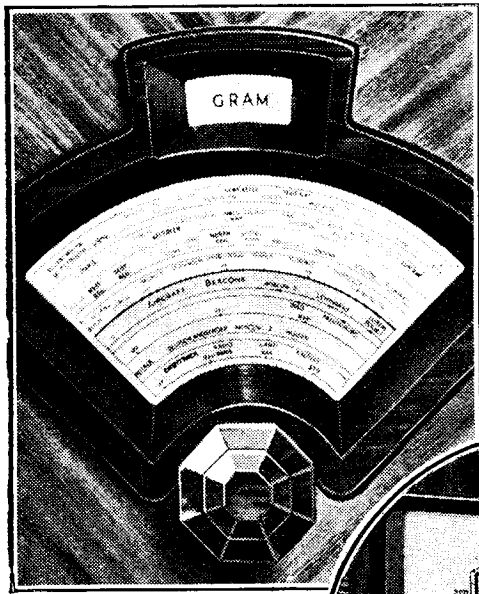
The early Ekco station-name dial, of large diameter, was easily legible, and represented an important step forward.

tude, instead of being thankful for small mercies. If Radio-Vitus (312.8 metres) was tuned for, and Cardiff (309.9 metres) came in instead, there was something wrong with the set (they said).

**The Ideal Tuning Scale.**

Every year there has been at least one attempt at a "press the button" tuner. One year it was a telephone dial; another a cash-register type of keyboard; yet another a map with the stations ready to pick like plums. These seem to give the complete answer to the demand for simple, foolproof operation. But they have never captured the field. Certainly some of them were mere stunts and failed to stand the racket of use. Perhaps some day this sort of control may come into its own—after all, it seems logically right. Or perhaps the public likes its food served neatly to the table but draws the line at spoon-feeding?

The only thing lacking in the early McMichael "full vision" scale was



The conflicting requirements of legibility and compactness have been ingeniously reconciled in the C.A.C. dial, as shown at the last Olympia Exhibition.

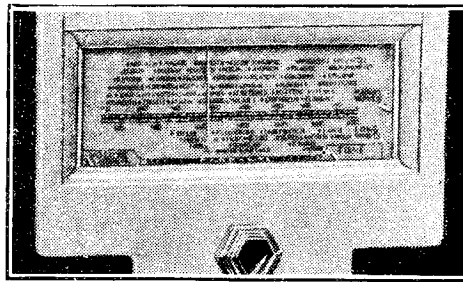
station naming; and presently Ekco included this in their daring innovation of an almost completely circular scale round the circumference of the loud speaker. Since then the open scales have gradually gained supremacy. But what a diversity of form!

**Originality at All Costs**

In this year of grace there are pseudo clock faces, oblong frames with single or multiple diagonal scales, "thermometer" type scales, circumferential scales, speedometer scales, straight and curved scales, spiral scales, and many more. Light is adapted in all sorts of ways; plain and coloured, lights controlled by the waveband switch, lights moved by the tuning knob, and even lights that change colour with the tone control.

However the details may differ, the following features seem to me to be desirable in a tuning scale.

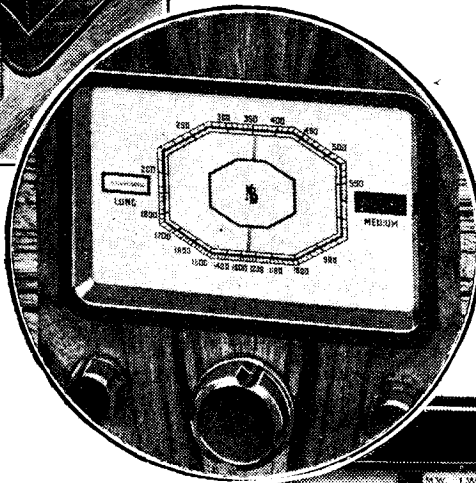
Without being unsightly, it should all be clearly visible at once. Otherwise the listener might laboriously turn from end



More than a tuning scale; the Ferranti "tell-tale" panel indicates settings of the subsidiary controls as well as tuning positions.

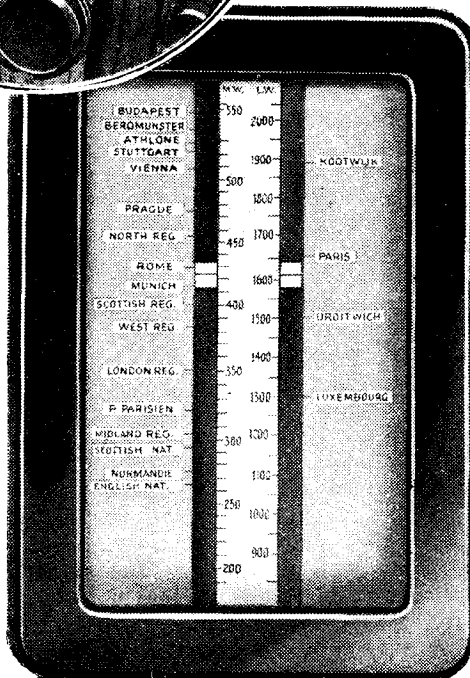
to end in search of a particular station, only to find it was not among those marked. It is more satisfactory to select a meal from a menu displaying the names of all the dishes than to have them recited one at a time.

There should be station names. Wavelength plans do not change so frequently that it is impracticable for revised scales to be issued when necessary. And wavelengths do not convey much to the majority of the 7,000,000 and their families. All the same, I think wavelengths should be there for reference. Personally, I should choose frequencies rather than wavelengths, but I realise that wave-



(Left) The K-B "Fototune" which shows only one station name at a time.

(Below) Parallax errors in reading are entirely avoided in the new Murphy dial; the travelling indicators are flush with the surface of the scale.



lengths are too firmly established in the British mind.

Horizontal or vertical straight or nearly straight scales are the clearest, I think. When they bend through big angles they are apt to involve neck twisting or to sacrifice something of clarity.

Lastly, only the waveband in action should be illuminated or exhibited. The alternative is to have a moving spot or line of light as a pointer; in this case the whole of the waveband in action should still be readable. Some of the all-wave sets have rows and rows of figures with a pointer moving over the lot, and nothing very obvious to show which applies. Not many people are accustomed to handling combination safe locks.

**American Police Radio on Ten Metres**

SHORT-WAVE listeners interested in the recent 10-metre activity will like to know that during the prevailing good conditions there are several interesting transmissions to be heard on still shorter wavelengths.

Stations W2XEN, W1XAC, W2XGC and W1NHC, American police radio-telephone transmitters in Newark, Hartford, and elsewhere have been heard "calling all cars" in the authentic "gangster-film" manner.

W2XEN is the most consistent station and is easily recognised as the carrier-wave is left on for fairly long periods with some kind of metronome "interval signal."

No accurate measurements have been made on these stations, but rough tests with Lecher wires indicate wavelengths of just under ten metres. An ordinary two-valve short-wave receiver was used for reception, with a special "ultra-short" coil wound on a valve base, but subsequently a super-regenerative receiver with a half-wave aerial gave rather better results.

American police transmissions have been heard in this country before on wavelengths between 100 and 200 metres, but it is believed that their reception on the ten-metre band is new.

The consistent reception of these police calls to patrol cars encouraged some rather patient exploring of still higher frequencies, but beyond a very strong ICW telegraph signal from Annapolis NSS, calling NPG, which may have been a harmonic, nothing of interest was heard.—R. H. McC.

**WITHOUT COMMENT**

From the "Evening Standard" of December 17th, 1935.

**"Balance in an Orchestral Broadcast"**

THE responsibilities of radio balance-engineers are engaging the attention of musicians.

"Orchestral tones range from *ppp* to *fff* or from 1 to 1,000,000 frequencies. The microphone, however, can only transmit from 10 to 10,000 frequencies, or from *pp* to *ff*, about ten times less volume. If the *pp* is exceeded, background noises, atmospheric and 'mush' supervene; if the *ff* is exceeded, the loudspeaker may be overloaded and 'blasting' set in. . . .

"Dr. Adrian Boult points out that electrical reproduction is not able to take the full range of tone, but he is satisfied that the control engineers of the B.B.C. are thoroughly capable musicians and able to look after this."



# Anti-Interference Aerials

## How to Ensure Best Results

By L. A. CHAPMAN

*ALTHOUGH the principle of the screened aerial down-lead is well known, comparatively little information has been published on the practical problems involved in its use. The following hints should be particularly useful to those who propose to install this valuable aid to noise-free reception*

IN considering the possibilities of screened aerials, it must be appreciated that radiated electrical interference is picked up by the aerial, or by its down-lead, and fed to the receiver in much the same way as the required radio signal. And the only way to prevent this electrical interference from reaching the aerial system is to erect the aerial proper outside the field of the radiations and to earth-screen the down-lead which connects the aerial to the receiver.

Unfortunately, the field of radiated interference varies enormously, according to the forces producing it. Thus, it is not possible, with any degree of accuracy, to stipulate how high or how far away from the source an aerial should be erected to avoid picking up the interference.

However, there are two methods of determining the most satisfactory way of erecting an aerial to ensure that it is outside the field of interference. The first entails the use of a powerful and sensitive portable set. When properly used it enables its operator to discover the confines of the field and the source of the radiations.

The *modus operandi* is almost too simple to call for much comment. Nevertheless, for the sake of making these notes as complete as is desirable, a brief explanation will be given. Obviously the first thing to do is to trace the apparent source of the radiations, so far as circumstances allow. The next thing to do is to walk away from this apparent source, keeping the frame aerial of the receiver pointing towards it, and observing at what distance the interference ceases to affect the receiver.

### By Trial and Error

If it can be arranged for the aerial proper to be erected anywhere beyond this point, and preferably at right angles to the final disposition of the portable set's frame aerial, elimination of the interference will almost invariably be accomplished so far as the aerial is concerned.

The expression "almost invariably" is used in order to qualify the following "if." If the aerial proper happens to be finally erected on a level with, or a little above, the source of the radiations, there is a bare possibility that slight interference

may still be experienced in the receiver. This is an eventuality with which one may have to contend, even though it may be considered by some to be very remote. And it also brings us to the second available course—the erection of the aerial by the trial and error method.

Where this course only can be adopted, the golden rule to follow is never to cut the aerial wire and/or the transmission cable to a length shorter than may ultimately be required for the final installation.

The aid of at least two friends will be needed here, to alter the position of the overhead wire whilst practical reception tests are being carried out with the receiver. Even when working on the roofs of eight and ten-storey buildings, the help of two assistants—supporting the aerial wire and associated equipment on light ten-foot poles—has been found adequate.

The actual circuit connections may vary a little according to what particular make of equipment is used. Nevertheless, soldered connections between the aerial wire and the screened aerial transformer and between the latter and the transmission line, and then again between the transmission line and the screened receiver transformer, are to be recommended in every instance. Furthermore, each connection so united should be bound up with rubber insulating tape as a precaution against current leakage, and, finally, with electricians' black adhesive tape to assist towards weather-proofing.

Where a transmission line comprising a single inner conductor is used (the outer screening mesh forming the earth return line) it is best policy to arrange that this be suspended from the aerial free from the walls of the house and other earthed ob-

jects to prevent points of different potentials developing in the earth line. In the case of transmission lines comprising twin inner conductors, this precaution may be ignored.

### Transmission Line Wiring

Where the transmission line is of the twin lead-cased cable variety, adequate anchorage every two or three feet is well-nigh essential in order to obviate fracturing of the lead casing.

No hard-and-fast rules can be laid down regarding the best point or points at which to earth the transmission-line screening. Whilst it is generally advised that the screening be bonded to earth at the point where the transmission line enters the house, it has been found that an additional earthing connection from the aerial end of the transmission line often has very beneficial effects. It has even been found, at times, better to have an earth connection only at the aerial end of the line and none elsewhere.

On the other hand, in cases of acute interference which have come under the author's notice, it has been found necessary to earth the transmission-line screening at frequent intervals along its entire length.

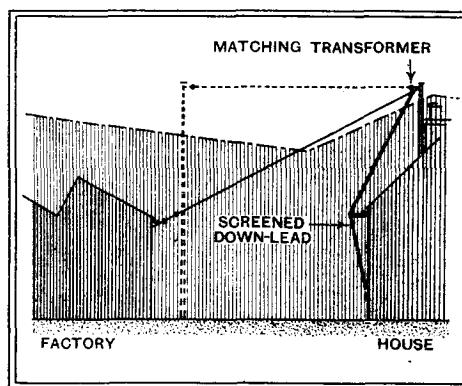
This proceeding has the effect of preventing eddy currents being set up in the screen which, in turn, can be induced into the inner conductor wires.

It will be appreciated that a really full measure of success can only be

assured from the system provided that the aerial itself is erected outside the field of interference. Moreover, a completely screened receiver prevents electrical interference from being picked up by its circuit wiring and component parts. Consequently, such a receiver is to be recommended where absolute freedom from interference is desired.

### A Service for Broadcasters

THE M.S.S. Recording Company, Ltd., of 99a, Charing Cross Road, London, W.C.2, conducts a service for recording B.B.C. broadcasts. Recordings, which are made to order, are supplied only for the exclusive use of the speaker or artist, etc., responsible for the item. The M.S.S. Recording System has been officially adopted by the B.B.C.



Courtesy Belling and Lee, Ltd.

Above the "fog" level: illustrating the result of practical investigation of a case where interference was found to extend up to the limits indicated by shading. A cure was effected by moving the aerial to the position shown in dotted lines. In the original position (full lines) the screened down-lead was ineffective, as part of the unscreened wire was within the field of interference.



#### KEEPING UP THE STANDARD

THE B.B.C. seems to have mastered the art of avoiding a "flop" after times of high festival. No serious critic could describe the coming week's programmes as falling far below the normal level, for there is good music in plenty, variety, drama, humour—everything that the most churlish listener could wish for.

Yet there have been times when the programmes in the first week of the year have resembled too closely the cold aftermath of the Christmas dinner.

#### DEATH AT THE ALTAR

How colourful history would be if the modern reporter could have been in the vicinity of such happenings as the Battle of Hastings or the murder of Thomas à Becket! The latter is being headlined by the B.B.C. on Sunday next in a poetical play, "Murder in the Cathedral," by T. S. Elliott, and one ventures to think that, but for the poetry, such a sensational episode would not have been featured on a Sabbath evening (Regional, 9.15). The part of Thomas à Becket is to be taken by Robert Speaight, and the scenes of the play, which has been adapted for broadcasting by Barbara Burnham, are in the cathedral and precincts of Canterbury. Time: A.D. 1170.

There will be a special chorus of women supported by the B.B.C. chorus.

#### THE SCARLET CAMEL

BURLESQUE flourished in the Victorian era, and the theatres gave good measure of such in-anities as "Faust on Toast," and "Richard III: A New

ENGLAND v. THE ALL-BLACKS—the Rugger match of the year—will be played to-morrow (Saturday) at Twickenham. The running commentary by Capt. H. B. T. Wakelam begins at 2.5 p.m. The above picture shows an interesting moment in the match between the All-Blacks and London Counties at Twickenham.

Front to an Old Dicky." In reviving the vogue the B.B.C. has an excellent exponent of the art in John Dighton, who wrote the successful radio burlesque on "Raffles." Now, with the generous permission of Baroness Orczy, he has perpetrated "The Scarlet Caramel"—a revolutionary rendering of the "Scarlet Pimpernel," which we are to hear on Monday (Regional, 7.45), with Claude Hulbert in the chief rôle as Sir Percy Vagueley. In this blood-curdling tale of the French Revolution Chauvelin becomes "Javelin," played by Bobbie Comber, and we also come up against Sir Andrew flukes in the person of Jack Clewes, and Citizen Blaggarde



WEBSTER BOOTH, the well-known tenor, broadcasts with Fred Hartley and his Novelty Quintet on Wednesday (Reg. 9). He is here seen recording for H.M.V.

played by William Ste. Doris Nichols will be the beautiful Lady Vagueley.

Max Kester will see that everything (and everybody?) is well executed.

#### CITY JARGON

PEOPLE who complain of wireless jargon should turn their attention to the strange language of the City, where men of undoubted respectability bandy such words as "contango," "settling day," "bulls" and "bears," "cann-pacs," "selling short," and other ominous terms. All knowledge is useful, so it should be worth while tuning in the second of the two talks, "City Pages of a Newspaper," which is to be given on Thursday at 7.30 (National).

Very often the intelligent reader can obtain a true picture of political crises from the financial columns. When the news columns forecast dire happenings about to occur in some country, the fluctuations in the stocks of that country are a good barometer as to the truth of such news.

#### BELA BARTOK'S CHALLENGE

THE world can be divided into three groups of people: those who detest modern music, those who keep on trying to like it, and those who like it. The name Bela Bartok is supposed to stand for all that is most advanced in music of to-day, so people of the second and third groups will avidly tune in the Regional wavelengths at 8 on Tuesday

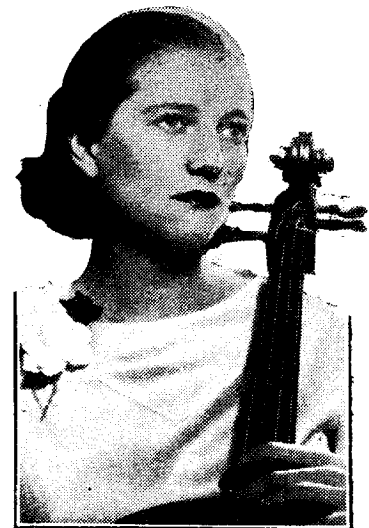
# Listeners'

to hear a Promenade concert that would have made our grandfathers hot and cold by turns. It begins with two Liszt items which would have warmed the cockles of their hearts, and then introduces Bela Bartok himself playing his pianoforte Concerto No. 2. Another notable modernist, Kodaly, will be present to conduct his suite, "Hary Janos," which follows immediately after the Bartok item.

Here is a chance for many listeners to have "one more try" at understanding what Bela Bartok is driving at.

#### B.B.C. GIVES A GERMAN PLAY

THE happy custom of exchanging radio programmes and artists with those of



THELMA REISS, 'cellist, appears with the New English Singers on Sunday evening (Nat. 7).

foreign countries is extending, the latest instance being the German radio drama, "Eine Kleine Melodie," which the B.B.C. is broadcasting in an English version, "Three for a Song," on Tuesday (National, 8.30). One imagines that the translation of Ernst Schmachbach's play will be a free one, for the leading characters are Bill Porterhouse, a sausage manufacturer, played by Maurice Harvey; Effie Atherton as Annie Porterhouse, his daughter, and Dino Galvani as Gaston, the proprietor of a night club. Greta Keller will be featured as Greta Roc, a Continental cabaret star.

The play is full of tuneful German melodies.

# Guide for the Week

## HIGHLIGHTS OF THE WEEK

FRIDAY, JANUARY 3rd.

Nat., 8, Beethoven Promenade Concert. 10.25, B.B.C. Theatre Orchestra.

Reg., 7.45, B.B.C. Dance Orchestra. 8.30, "The Snow Queen." 9.30, B.B.C. Orchestra.

Abroad.

Brussels I, 8, De Boeck and Thiebaux Anniversary Concert from the Conservatoire.

SATURDAY, JANUARY 4th.

Nat., 2.5, England v. New Zealand (All-Blacks). 8.30, Romance on Rhythm. (Geraldo and his Orchestra.) "Henry Hall's Hour." Reg., 8, "Die Fledermaus" (Strauss), from Sadler's Wells. "The Spirit of France." "Mantovani and his Tipica Orchestra."

Abroad.

Paris PTT, 8.30, Symphony Concert by French National Orchestra.

SUNDAY, JANUARY 5th.

Nat., Cellini Trio. "B.B.C. Military Band. 9.45, Albert Sandler and Park Lane Hotel Orchestra.

Reg., Eugene Pini and his Tango Orchestra. 6.30, B.B.C. Orchestra. 9.15, "Murder in the Cathedral."

Abroad.

Leipzig, 8, Georg Schumann conducts Dresden Philharmonic Orchestra in his own compositions.

MONDAY, JANUARY 6th.

Nat., 7.50, B.B.C. Orchestra. "Victorian Melodies" (B.B.C. Theatre Orchestra).

Reg., 7.45, "The Scarlet Caramel" (burlesque). "Piano Recital by Egon Petrie. 9.55, Part II Wagner Promenade Concert.

Abroad.

Hamburg, 7, Operetta: "The Lovely Galatea" (Suppé).

TUESDAY, JANUARY 7th.

Nat., 8.30, "Three for a Song." 10, "Is that the Law?"

Reg., 8, Bela Bartok in Promenade Concert. "Recital by Frank Mullings (tenor). "New Georgian Trio.

Abroad.

Frankfurt, 7.10, Opera: "Der Freischutz" (Weber).

WEDNESDAY, JANUARY 8th.

Nat., Music from the Movies. 8, Bach Promenade Concert.

Reg., "Three for a Song." 9, Fred Hartley and his Novelty Quintet.

Abroad.

Strasbourg, 8.30, Palais der Fêtes Symphony Concert.

THURSDAY, JANUARY 9th.

Nat., 8, Stanelli's Stag Party. "B.B.C. Orchestra. "B.B.C. Dance Orchestra.

Reg., Rocky Mountaineers. 8, "Jenny Meade," radio play by Philip Wade. "Part II of Russian Promenade Concert.

Abroad.

Luxembourg, 9.15, Gala Concert.

## BOISTEROUS B'HOYS

STANELLI'S parties have won a well-deserved niche for themselves, and, to judge from the "invitation" for next Thursday (National, 8), another good one is in the offing. It is described as being a Buoyant B'vy of Bouncing Boisterous B'hoys, with Norman Long, the dentist's dream; Sydney Jerome, the pianotuner's nightmare; Jack Wynne, the gentleman's gentleman; Vine, Moore, and Nevard, see charge sheet; and Russell and Marconi in Rhythmology. To crown all, of course, there will be the hilarious host, Stanelli.

## MUSIC FROM THE MOVIES

THE films nowadays seem to be getting the pick of the best tunes, so Louis Levy and his Symphony will have good material to work on for their "Music from the Movies" programme on Wednesday (National, 7.30).

Selections are to be played from "Broadway Melody of

scheme on which work is now proceeding rapidly. The top reaches of the Volga are already connected with the Baltic, which will soon be linked with the Caspian. Next year the canal between the Volga and the Moscow rivers will be finished; then the Volga and the Don will be joined, thus linking the Caspian and Black Seas. The White and the Baltic Seas are already linked.

## OPERA ABROAD

"LOVE WITHOUT STOCKINGS" is the week's most intriguing title in the Continental operatic programmes. It is described as an ultra-modern musical play of the operatic type, and is to be given by Kalundborg this evening at 7.

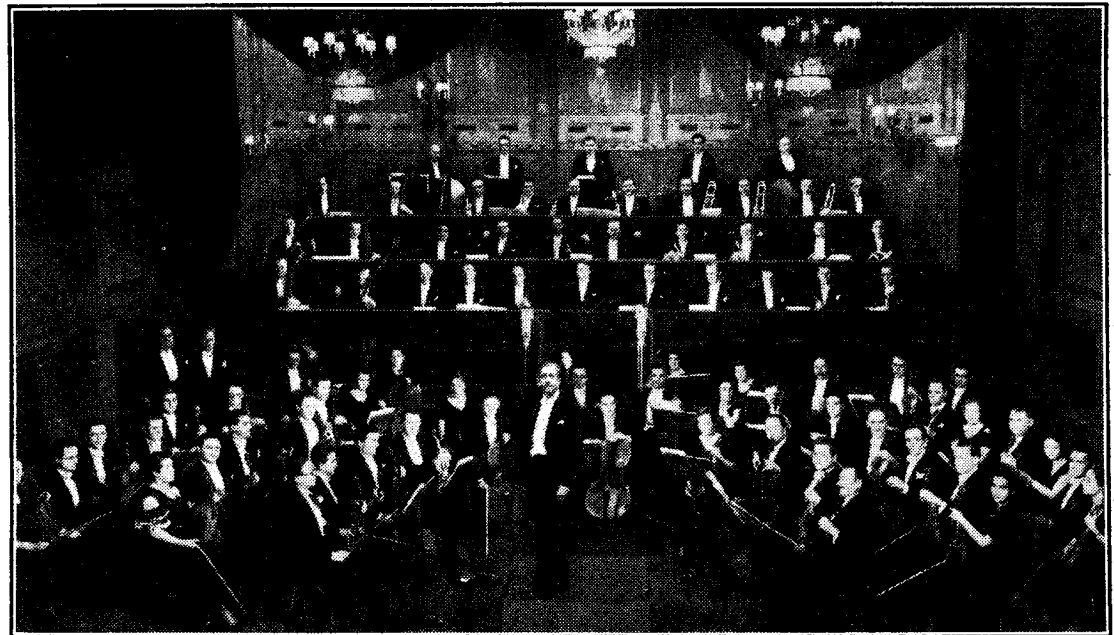
An historical opera, "Friedrich Wilhelm von Steuben" (Bullerian), is promised by Cologne at 7.15 to-night. The hero of this opera was a German general of the American revolutionary forces who offered his services to Congress

## Outstanding Broadcasts at Home and Abroad

opera lovers. Part of Rossini's "Barber of Seville" will be relayed from the Flemish Royal Opera, Antwerp, at 3; Radio-Paris gives a three-act opéra-comique, "Les Dragons de Villars," at 8.45; Strasbourg offers two one-act operas, "Les Charmeurs" and "Le Chalet," at 8.10. A lecture recital by Robert de Man on the evolution of Nationalism in opera, dealing especially with Mussorgsky and Rimsky-Korsakov, appears in the Brussels No. 2 programme at 6. Appropriately enough, Mussorgsky's "Boris Godounov" will be given by Radio Toulouse at 9 on Sunday, and Acts 3 and 4 of the same opera will come from Paris PTT at 8.30 on Tuesday.

## NATIONAL MUSIC

FOLK music is well to the fore this week. Stuttgart on



(Photo: Christian Dumivier)

THE FRENCH NATIONAL ORCHESTRA, since its foundation some eighteen months ago, has already won a great reputation on the Continent for its regular broadcasts from Radio-Paris, under the direction of Dr. Inghelbrecht, who is seen in the centre of the picture.

in 1777 after a wide experience gained in European wars. He fought at Yorktown.

To-morrow is a good day for

1936," "Top Hat," and "Invitation to the Waltz."

## A GREAT CANAL SCHEME

MOSCOW has a promising English talk at 9 o'clock this evening dealing with canals in the Soviet Union. The speaker is to describe how the four seas—Baltic, White, Caspian, and Black—will soon become one for navigational purposes by the completion of a vast canal

Sunday at 7 has a programme of folk songs and music conducted by Fritz Ganss; Strasbourg at 8.15 offers a concert of folk songs and music of Lorraine relayed from Stiring-Wendel in the Moselle district. Then on Monday at 7.40 Berlin (Funkstunde) offers humorous folk music with interludes of sketches in Swabian, Bavarian and Berlin dialect.

THE AUDITOR.

# Electron Beams in Receiving Valves

## The Electron-optics of Grid Control

*IN this article are described some of the results of experiments carried out with a valve specially designed and constructed to facilitate observation of the paths taken by electron beams in valves of the ordinary type.*

IN almost any descriptive account of the cathode-ray oscillograph one may expect to find a number of terms which, though they are applied to electrons, have been taken over with hardly any change of meaning from the apparently quite different subject of optics. Thus, there will be a reference to a "beam" of electrons, and discussion of "focusing," of "images," and so on.

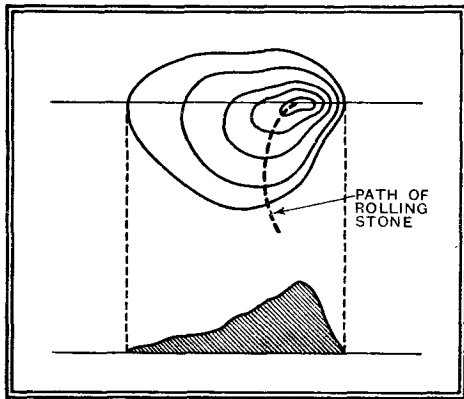


Fig. 1.—A geographical analogy; showing a "family" of contours illustrating the tendency of a rolling stone to run perpendicular to the contour lines.

More recently still we have heard of "electron microscopes" and of "electron lenses," all implying that in the field of electronics there are processes analogous to those of optics, with rays or beams of electrons behaving similarly to rays of light.

There is, indeed, a very close analogy, arising from the fact that free electrons in a vacuum (such as the electrons emitted by the filament into the space inside a valve) tend to move along the lines of electric force in the space in which they find themselves. Another way of saying the same thing is that they tend to move perpendicular to the "equipotential lines" (or surfaces) of the electric field. This may sound like advanced theory, but the idea is really quite a simple one. An equipotential line is no more than a kind of electrical contour line, similar to those one is accustomed to see on a contour map, and just as, in a contour map, the contours are lines joining points which lie at the same height above sea-level, so, in an electric field, the equipotential lines, or electrical contours, are lines joining points which are at the same potential, or electrical height. One knows that on a contour map the contour lines crowd to-

gether where the slope of the ground is steepest, as illustrated in Fig. 1. One also knows that if a round pebble is allowed to roll freely on a hill, such as that shown in Fig. 1, it will, whatever direction it may have initially, tend to take the shortest and steepest way down. It will tend, that is to say, to take the shortest route from one contour to the next, and this shortest route is, of course, the line perpendicular to the contours. Such a route is shown dotted in Fig. 1. Similarly, a free electron, whatever its initial direction of motion, will tend to be deflected in a direction more nearly perpendicular to the electrical contours or "equipotentials" of the electrical field.

### Electrical Contour Lines

Suppose, for example, that the point S in Fig. 2 is a source of electrons, and that potentials are applied to certain electrodes in the vicinity in such a way as to produce an electric field of which the equipotentials, or contour lines, are as shown in the figure; then electrons emitted from S will follow curved paths similar to those shown dotted, and in certain cases may even be definitely focused on a point such as S'. This, rather crudely portrayed, is the essential mechanism of the so-called electron-microscope. If the electrons emitted from S are made to converge on some sort of fluorescent screen at S', then the latter will show an enlarged image of the source. Briefly, curved equipotential surfaces bend or "refract" beams of electrons in much the same way that the

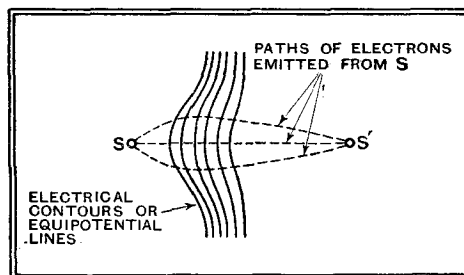


Fig. 2.—Focusing effect of curved equipotential lines.

curved surfaces of glass lenses refract rays of light.

Now consider the configuration of the

electric field in, say, a triode valve. In Fig. 3 let the line AA represent a section of the anode, and the line of black circles GG represent sections of the grid wires. With a high potential on the anode and a low or zero potential on the grid, the "contours" of the electric field (not the lines of electric force, but lines everywhere perpendicular to the lines of electric force) will be somewhat as shown in the figure. The curved lines in the grid spaces can be thought of as sections of cylindrical lenses, which will tend to break up the stream of electrons travelling towards the anode into a number of separate streams or bundles, more or less convergent, depending upon the actual potentials of the electrodes. Such streams may or may not be actually focused on the anode, but it is clear that in any case

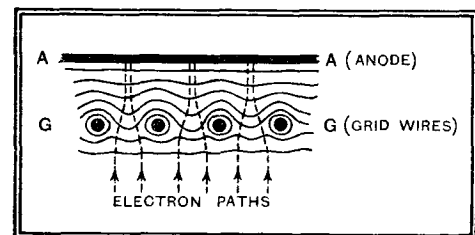


Fig. 3.—Electrical contours of grid-anode space in an ordinary valve, showing formation of electron beams.

there will be a tendency for the electron current-distribution over the anode to be, not uniform, as is usually assumed in simple descriptions of the operation of the valve, but non-uniform, possibly even discontinuous, with separate patches or strips corresponding to the separate meshes or strip-shaped spaces of the grid.

So much might be expected on general qualitative grounds, but there would still be uncertainty as to whether the actual electron velocities and the field curvatures would in practice be such as to produce any very marked breaking up of the initial uniform electron stream. The actual electrode system is too complicated to permit of any exact and convincing theoretical analysis, and it is therefore very satisfactory to have a clear, positive, and visible demonstration of this effect, such as that produced by M. Knoll and J. Schloemilch, of the Telefunken Gesellschaft, and described by them in the *Archiv für Elektrotechnik*.

**Electron Beams in Receiving Valves—**

In order that the effect, if it existed, could be observed visually, a very special valve was constructed in the form shown in Fig. 4. The sloping sides of the funnel-shaped glass container were metallised and used as the anode, and a thin film of fluorescent material was deposited on this anode, in order that the impingement of electrons might give rise to patches or areas of light which could be observed from above through the clear glass top.

**Interrupted Electron Stream**

It was found that the electron stream was, in fact, broken up by the various "lenses" of the grid structure, and that the anode fluorescence was, in consequence, patchy or striated. A variety of patterns was produced, depending upon

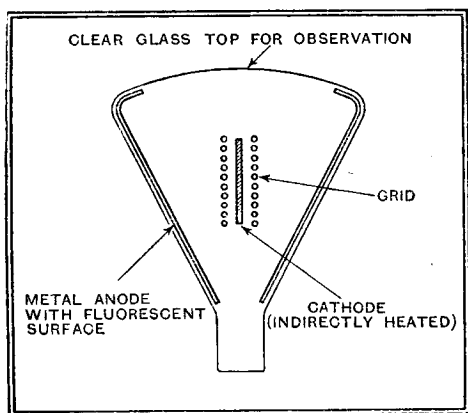


Fig. 4.—Sectional schematic diagram of triode valve for observation of electron beams.

the relation between the grid and anode voltages. Some of these patterns are shown in Figs. 5a, b, and c, the shaded patches representing areas of fluorescence on the anode. (The vertical gaps between the shaded patches shown in these figures were due to the four stout wires used to support the spiral grid winding. The gaps are not exactly electron shadows of the supporting wires, for the width of the gaps was found to vary considerably in the different patterns. In one case, when the main segments of fluorescence were made to overlap at their sides, the gaps were actually transformed into lines of brighter fluorescence.)

The observed variety of pattern obviously arises from variation of the effective "focal lengths" of the individual "cylindrical lenses" of the grid structure. Each such "lens" will tend to produce its own more or less convergent beam of electrons, which may be focused on, in front of, or behind, the anode, depending upon the electrode potentials. Except where the beams are focused, there will, of course, be a certain overlapping of the beams. Thus, Fig. 5b shows a fairly sharply focused condition, but in Fig. 5c it would seem that the separate striations of Fig. 5b have been widened enough to overlap at the edges and give a more nearly uniform distribution.

The most significant of these patterns, from a practical point of view, is probably the striated form shown in Fig. 5b.

On a continuous anode, such as was used in these experiments, the precise nature of the electron distribution will probably not produce any appreciable effect on the

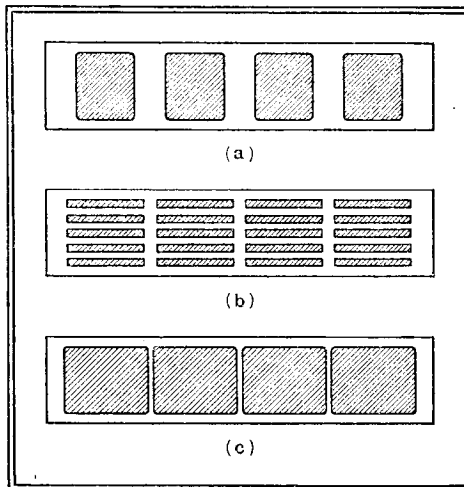


Fig. 5.—Types of fluorescent patterns produced on the anode by electron beams. Sketches based on photographs by Knoll and Schloemilch; the anode is assumed to be cylindrical and opened out flat to show the patterns.

observed characteristics, but there are clearly possibilities of very pronounced effects on characteristics when the electron stream flows through another grid, as in the tetrode or screen-grid valve. Thus, for example, one would expect the effect of the second grid to depend considerably on whether its wires were in or between the separate electron beams formed by the first, or control, grid.

This feature of the subject has not, of course, been overlooked. In a later publication\* M. Knoll describes some measurements with tetrode valves of special construction in which the outer-grid wires were placed alternatively as shown in Figs. 6a and 6b, i.e., either in or between the planes of the inner-grid wires. He states that in the two configurations, the screen-grid currents differed by as much as ten to one, and the slopes by two to one.

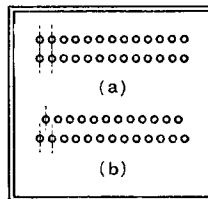


Fig. 6.—Alternative arrangement of grid wires in a double-grid valve.

This realisation of the occurrence, in ordinary valves, of a separate beam structure of the electron stream is of comparatively recent date, and its practical significance has not yet been fully explored. It is already clear, however, that it may be a very significant factor in operation and that it offers some interesting possibilities in design. Knoll points out, for example, that a cathode having cylindrical or cup-like recesses itself produces elementary beams, and that grid current can be minimised by locating the grid openings opposite to these recesses.

\* *Zeitschrift für Technische Physik*, Dec., 1934.

**Letters to the Editor**

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

**Abbreviations**

STILL they come! I am not certain which abbreviation established the precedent, but it appears to have been popular and followed religiously. If the practice continues we shall have to refer to a technological alphabet, or a table, say, as follows:

- ABC = Automatic Bass Compensation.
- AGC = Automatic Gain Control.
- ASC = Automatic Selectivity Control.
- ATC = Automatic Tone Control.
- ATC = Automatic Tuning Control.
- ATC = Automatic Tuning Correction.
- AVC = Automatic Volume Control.
- AVE = Automatic Volume Expansion.

(An additional letter may have to be included to differentiate between the same abbreviations, e.g., ATC.)

May I plead for what is becoming, I suppose, a hackneyed good cause? Namely, please do not let us introduce into our technical language terms or specific designations without careful consideration of their appositeness and the extent of their being accurately self-explanatory.

This is not such a platitude as, perhaps, it seems, because the nomenclature and symbolisation of radio and allied engineering is bespattered with anomalies and misnomers. In fact, the novice of to-day cannot help but be confused by some of the equivocal, if not erroneous, terms in use.

Of course, advertising agents must, or at least they do, provide the lay-public with catch-phrases, but responsible technicians and the technical Press must be more discriminating. DONALD W. ALDOUS.

Ilford, Essex.

**PA Equipment**

REGARDING the less-known uses of public address equipment, I have seen or heard it used for the following purposes:—

1. Giving alarm and "stand-to" orders in police stations, fire brigade headquarters, and barracks.
2. Announcing guests at receptions and similar functions.
3. Directing chorus drill in a theatre, the producer being seated at the back of the auditorium to view the effect.
4. Giving orders to traffic and pedestrians in connection with processions and in railway stations.
5. Calling-off prices in a cattle market and at public sales.
6. Ordering performers on and off the scene in open-air pageants (long lines are used, connecting small loud speakers behind the scenes to a booth on top of the stand).
7. Conveying orders on large military parades.
8. Cheering the hands in a shoe factory by telling stories, and most important of all,
9. Requesting neighbours to turn down their noisy loud speakers on a fine summer evening!

R. A. DE RAADT.  
Utrecht.

**The Hot Cathode.**

"CATHODE RAY," in his article in *The Wireless World* of December 6th, says that in 1911 the hot cathode had not been invented. Frank Murphy (now of



Murphy Radio, Ltd.) and I used one in a cathode-ray oscillograph in 1909. The cathode we used consisted of a strip of platinum foil heated to a red heat. Electron emission was increased by lime coating. We used an anode potential of 400-500 volts.

The hot cathode was not our idea. In that respect we were merely copying earlier tubes. I cannot suggest a date when the hot cathode was first used. Possibly Professor MacGregor-Morris, under whom we were working, could give it.

A. G. WARREN.

Eltham, S.E.9.

### Contrast Expansion

MR. SAYERS and some others appear to have missed Mr. Hartley's point. Undoubtedly, few people will want more than 18 watts peak output for domestic listening. The fact is that this large output is necessary even with the B.B.C.'s degree of control. Any "artificial re-expansion" immediately forces the listener to tolerate either overloading on peak passages or unreasonably low average and minimum volume levels. Mr. Ashworth comes nearer the truth when he hints that, far from in-

cluding any decontrol, a still greater degree of control is necessary with the more usual power outputs.

No one was suggesting that we should try to reproduce the original absolute intensities; but unless this is done, as in the famous case of the Philadelphia Symphony Orchestra relay, it seems difficult to see how any volume range expansion can be practicable.

M. CAMPBELL.

S. Croydon.

### Valve Data

MAY I point out that in the otherwise excellent list of commercial valve characteristics in *The Wireless World* of November 22nd last there is one classification with which I disagree.

On page xviii the four Hivac Harries output valves Y220, Z220, AC/Y and AC/Z are listed as pentodes. These valves are really tetrodes, and not pentodes, although designed to have special characteristics to take the place of pentodes.

HARRIES THERMIONICS, LTD.,

J. H. Owen Harries,  
London, W.C.1. Director.

## Linguaphone Recordiogram

### An AC Operated Radiogramophone Embodying Home Recording Equipment

WHILST very little has been heard of home recorders during the past year or so, the possibility of being able to make one's own records is such an attractive one that some interest was bound to survive the first wave of popularity. Experimenters who may have found some difficulty hitherto in obtaining the necessary apparatus will doubtlessly be interested to learn that development in this field has so far progressed that home recording equipment, or a complete home recording radiogramophone, is now obtainable from the Linguaphone Institute.

A demonstration of this apparatus was given recently to *The Wireless World*, and it would appear that most of the defects that beset some of the early recorders have been successfully rectified, and that exceedingly good records can be made with relatively simple and inexpensive apparatus. Furthermore, the Linguaphone equipment is so designed that it can be embodied in the construction of a radiogramophone, and the principal parts are used in the orthodox manner when not required for record making.

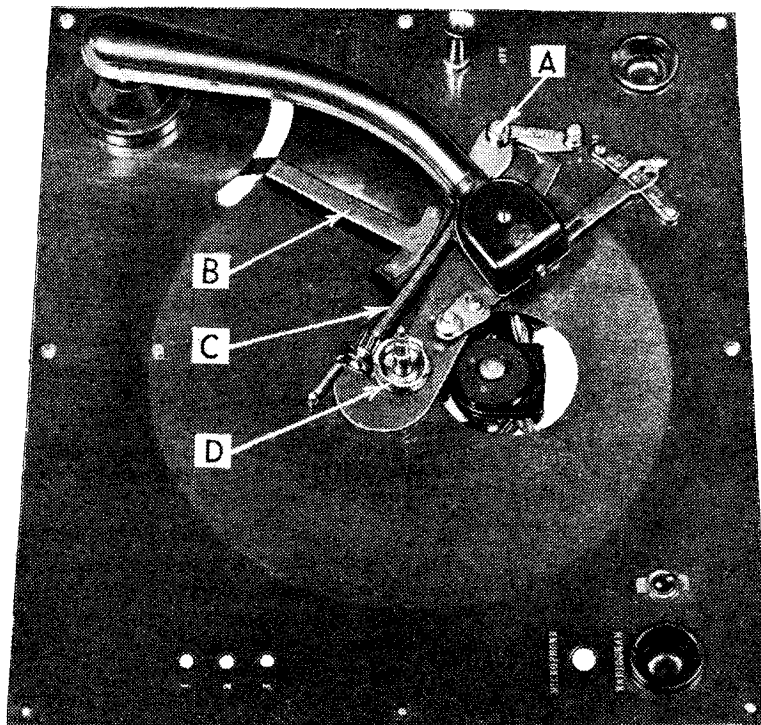
### Recording Unit

The recording equipment consists very largely of standard parts, the whole being assembled on a Garrard Radio-Gram unit, the plate of which measures 16 x 14 in., or the same overall size as the existing Type A Garrard unit. Sundry extra fittings have been added, and these must be embodied in the manufacture of the unit as several large holes and slots are required in the main plate. It is, therefore, not practicable to modify an existing gramophone unit and add the few extra parts.

The pick-up head is used for recording and also for reproducing, though a special steel needle is required for the former, and this can be used from ten to fifteen times.

For recording, which incidentally is made on a specially prepared aluminium disc, the

pick-up head is driven by a worm and pinion from the turntable shaft. In order to render the apparatus as trouble-free as possible, and to prevent damage to the gearing or stripping of the fine thread on the traversing screw, the pick-up arm is driven through a spring-loaded quadrant



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Linguaphone recording motor unit with the turntable removed to show the mechanism. A is the recording-playing switch, B pick-up driving arm, C traversing screw and D its driving gears.

faced with raw hide. This arrangement is quite satisfactory in practice and does not appear to give rise to slip.

The mechanism for bringing the traversing drive into use is integral with a switch, which, in the recording position, connects the pick-up in parallel with the primary winding on the output transformer, and in

the reproducing position joins it to the input of the LF amplifier, which in an orthodox receiver would be the gramophone terminals. Any good receiver chassis can be employed with this special motor unit.

Provision is made, also, for recording from a microphone, in which case the output from the microphone is amplified by the LF stages in the usual way by joining the secondary of its transformer to the pick-up terminals of the receiver. With microphones giving only a small output, a pre-amplifier may be necessary. To prevent acoustic feed back when the microphone is used, it is suggested that a switch be included to break the secondary of the output transformer, so disconnecting the loud speaker and this switch can be embodied in the one that brings the microphone into use.

### Output Valve Switching

We think that in cases where a large power output valve is used, with the likelihood of damage to the valve accruing by removing the output load, it would be advisable to arrange this switching so that a resistance equal to the impedance of the loud speaker is connected across the secondary of the transformer rather than to leave it open-circuited. Holes for all the extra switches and for the microphone terminals are provided in the motor plate.

Apart from the microphone connections there are actually only two more wires for interconnecting the recording motor unit and the receiver chassis than are required for a standard gramophone unit.

The complete Linguaphone Recordiogram embodies the gramophone unit described in detail, while the radio receiver is a five-valve superheterodyne of more or less orthodox pattern. It is AC operated and includes a mains energised transverse current microphone;

it costs 25 guineas. Special steel recording needles cost 1s. for five and thorn-type playing needles ten for 1s. Double-sided chemically treated recording discs are available in 10in. and in 6in. sizes, the former cost 9d. and the latter 4½d. each.

It is interesting to note that the

metal discs do not require lubrication or treatment of any kind before or after recording, and they are instantly replayable by merely changing the needle.

The recording motor with all the accessories will shortly be available as a separate unit for AC operation, and the price will be £5 5s. H. B. D.

# Random Radiations

By "DIALLIST"

## Blueglow

THOSE of us who were wireless enthusiasts in the years not long after the war were mostly familiar with the phenomenon known as blueglow in our valves. There was only one British-made valve available to the public at that time, the famous old R type, and it was not prone to blueglowing unless it became "soft" after much use or you applied an unconscionably high plate voltage. The other valve that many of us used when we could get hold of it—and it was not always that we could, for supplies were uncertain—was the Dutch valve. This was a soft valve, though I was never quite sure whether its softness was by design or due to the fact that the makers hadn't the appliances to pump it hard. So much gas was left that particular specimens would blueglow with as little as 18 volts on the plate. A jolly fine detector it was if you operated it just below the blueglow point. Modern valves sometimes also have blueglow tendencies, and it is not always realised that the phenomenon can occur in two quite different ways. One of these is detrimental to performance, whilst the other is not.

## In Modern Valves

The kind of blueglow that does not matter at all is that which appears at the inside surface of the glass bulb. It is actually caused by electron bombardment, and it can vary considerably in intensity when strong or weak signals are coming in. The second kind of blueglowing is the same as that that we used to know in the old soft valve, and its presence is due once more to the fact that there is too much gas within the bulb. The blueglow due to softness always appears in the neighbourhood of the electrodes, and not on the inner surface of the bulb. It is quite definitely a bad thing in the modern set, in which the soft valve can find no place. It leads both to distortion and to variations in performance, and any valve which suffers from it should be regarded as a candidate for the dustbin.

If you are not quite sure after a visual inspection whether the harmful or the harmless blueglow is occurring, I believe you can make certain with the help of a magnet. Hold it close to the outside of the bulb and move it slowly. The harmless blueglow caused by electron bombardment will be found to change position as the magnet is moved. But the undesirable blueglow due to softness will remain completely unaffected as the magnet travels about.

## Why Not an Annual Overhaul?

THOSE who go in for statistics and things have worked out that the average owner of a receiving set renews his apparatus every three or four years. I should think that figure must be just about right. Some people, of course, make a change every year, whilst others continue using their sets for five or six years. I am sure that those who have their sets in use for some little time would get far better service from them if they made a regular practice of having them thoroughly overhauled once a year. Often when a set has been in use for twelve months or so it begins to develop certain little weaknesses. If dealt with in time these are of no

great importance, but should they be allowed to get worse and worse there is trouble in store. The overhaul need not be an expensive business, and there are, I believe, firms which will quote a modest flat rate.

## A Radiogram Oddity

IT is rather curious that in the United States, the birthplace of the gramophone, the radiogram seems to find very little favour. Looking through the pages of an American wireless paper I don't see a single one advertised. Nor, again, do you find that pick-up terminals are provided in sets designed for home constructors or in those sold ready-made. Perhaps Americans prefer to use separate electric gramophones—though I don't see many announcements of these. Or it may be that such an enormous amount of entertainment is always available from broadcasting stations that the receiving set has supplanted the gramophone as a provider of entertainment in that country. Perhaps some American reader, or one of our own countrymen who has recently been in the States, will tell us why it is that the radiogram is apparently so rare an object there.

## Transatlantic Reception

ON the short waves the approach of the sunspot maximum is making itself felt in no uncertain manner; but the medium waves are hardly running quite true to form up to the present. I should have expected two things to happen: first of all, a slow but marked change in the optimum belt of wavelengths, and, secondly, a considerable falling-off both in the number of stations receivable and in the volume obtainable from them. My experience is that neither of these things has yet come to pass, though it must be admitted that the big sunspot group which was recently visible on the face of the sun had its effect, as will doubtless be the case again when it reappears after its journey round the far side of the sun. So long as the group of spots was in evidence, atmospherics were bad, and I never succeeded in receiving American stations on the medium waves when I tried for them. At other times, though, reception has been extraordinarily good, but the optimum belt of wavelengths seems to be more or less unchanged. Last year and the year before it lay between about 220 and 290 metres. All of those who remember what happened during the last approach of a sunspot maximum expected the optimum belt to move upwards. Eleven years ago we were hearing little of American stations with wavelengths below about 280 metres, and good reception was obtained from those using wavelengths up to 480 metres or so.

## An Interesting Point

So far, I have heard nothing working on wavelengths higher than that of WGY, which transmits on 379.5 metres. There are plenty of high-powered stations in the United States on wavelengths above this, and I shall be glad to hear from readers who manage to identify any of them during the next few weeks. As it is, the good old stand-bys of former years are still the stars

among American stations. The list is a short one, and readers who are interested in Transatlantic reception may care to make a note of the pick of the bunch. Here they are: WCAU, WKAQ, WHAM, WTIC, WABC, WPG, and WIOD. The last-mentioned is one of the world's most remarkable broadcasting stations. It operates on 230.6 metres with a power rating of only one kilowatt; and yet, year in, year out, it provides in the small hours of the morning good loud-speaker reception in this country, whilst some of the high-powered stations on wavelengths not very far away may be completely unreceivable. When I first received WIOD, a good many years ago, I thought that one kilowatt must be a misprint for ten, and set enquiries afoot. It was then established beyond a peradventure that one kilowatt really was the figure; and it still is, for I have the latest official list of U.S.A. stations before me as I write.

## The Set of the Future

I DON'T think one needs to be a prophet to forecast that within a few years the all-wave set will be almost the only kind seen, except, of course, for receivers of the very cheap class, for which there will always be a market of some kind. In America there is hardly a set made to-day by the best known firms which does not cover the short waves (usually in two or three bands), the medium waves and the long waves. Over there the purchaser of "a radio" wants to be able to tune in anything that is going, and he has realised that he is missing a lot if his set does not take in wavelengths between about 15 and 80 metres. Some American all-wave sets go a good deal farther down the scale. I know of one which claims to tune from 4½ metres upwards. Why the Americans should want anything above about 560 metres I can't think, for there is nothing but Morse to be heard on the longer wavelengths in that country. Possibly manufacturers design their sets with one eye on Europe, where, of course, the wave-band between 1,000 and 2,000 metres has much to offer. Our receiving sets are bound to work out in very much the same way, particularly as the short waves should grow better and better for long-distance reception during the next three or four years. The man in the street used to fight shy of short-wave reception in the old days when tuning in a station on 20 metres was almost as much of a feat as walking the greasy pole or putting together the bits and pieces of a dismembered watch. But now that the up-to-date superhet with band-spread tuning has shown him that no uncanny skill is required, he is rapidly becoming short-wave-conscious.

## Money - Making by Wireless

IF this bright, even breezy, book\* is not strictly applicable to conditions in this country, it contains a lot of horse sense without which no-one can reach the cigar-and-oysters standard of living in any country.

Thus, in hints to radio servicemen: "Never run down the merits of a customer's

\**Making a Living in Radio.* By Zeh Bouck, M.I.R.E. Pp. 222, with numerous illustrations. London: McGraw-Hill Publishing Company, Ltd., Aldwych House, W.C.2. Price 12/- net.

**Money-making by Wireless—**

receiver—no matter how bad it really is, or how much you would like to sell him a new set. Compliment him upon his choice and judgment, for which, let him think, you have the greatest respect. If you would like to interest him in a new receiver, leave one with him while you repair his own set. The contrast will do more than any sales talk. . . ."

And so on. And so on.

Radio, the neophyte will gather, is not easy money now that the ballyhoo is fading, but our author believes that the old virtues of grit and industry, plus intelligence, will win through, for there are still openings, even in the servicing business. Supposing that the 25,000,000 radio sets in the U.S. call for repairs twice a year—rather an optimistic estimate (or pessimistic, whichever way one looks at it)—there is scope for 50,000,000 calls. Taking three dollars as an average service charge, there is a grand total of 15,000,000 dollars looking for a landing-ground, and offering a livelihood to, say, 37,500 servicemen.

On the big assumption that British radio sets break down twice a year, we can divide these figures by four and get an approximation of parallel conditions over here.

With 37,500 young Americans busily atoning for the shortcomings of their factory colleagues, what is to happen to the other odd-million young men who want to *Make Good in Radio*? They can't all fill the rôle of announcer—"that blithe lad who

so facily switches allegiance from cosmetics to cigarettes or coffee"—nor do they all crave for the job of ship's radio officer, though there are good openings here for the man who hates home at any price and is lured by "the perpetual seduction of the sea." Mr. Bouck paints a rosy picture of marine operating, gilding it with practical advice on how to secure a berth, but is careful to add: "There is obviously no future for the radio operator who remains at sea. He merely, economically and otherwise, remains at sea!"

Possibly the best section of the book is that devoted to "The Engineer." Of all engineers, the radio engineer is happiest, for this branch "provides a scientific background of living of bright, imaginative colour. . . . The opportunities are doubly attractive in that the graduate engineer is almost invariably also an electrical engineer."

How to reach this enviable state is the subject of many pitiful pages packed with advice relating to the respective merits of universities, correspondence schools, and home study, and in connection with the last there is a valuable appendix recommending a graduated series of books which the student can obtain for himself.

Radio can still bring returns, as Dr. Alfred N. Goldsmith remarks in the preface, "but they will not fall automatically into the laps of careless passers-by." By which he probably means that you must study, i.e., sit down, before you can have a lap to catch them in. E. C. T.

agreed, the E.R.A. proceeded to design and construct a 3-HF radio noise-measuring set covering the 200-2,000-metre band, sufficiently sensitive to measure a disturbing field of 1 microvolt per metre, and also a short-wave set covering the 5-80 metre band with the same sensitivity.

The time constants of the diode circuits are arranged to be identical with those used in the low-frequency measuring instrument devised by the last Berlin Conference, i.e., the meter used to record the diode output reads proportionally to the degree of annoyance for different types of interference. This receiver is used for either field strength measurement, or as a high-frequency voltmeter for the purpose of determining the disturbing voltage at the terminals of an interfering item.

Investigation of trolley-bus interference showed that the most efficient combination of suppression arrangements consists of the use of low-current control circuit filters, together with condenser suppressors fitted at intervals on the overhead lines. This method not only gives greater suppression than the original trolley-arm chokes alone, but avoids the fitting of a considerable weight on the roof of the bus.

There is the further advantage that this method is not likely to be regarded as unworkable on the grounds of expense. This research has established that radiated disturbance from a given trolley-bus system can be reduced to a level where it will no longer interfere with a local broadcasting service.

Extended tests on both glass-bulb and the larger steel-tank rectifiers of the mercury arc type, and measurements of the HF voltage appearing at the DC output, have been made for both unsuppressed and suppressed conditions, and similar measurements have been made on the AC side where low-tension supply has been used.

The choice of suppression methods, whether condensers alone or chokes in the output leads in combination with condensers, is dependent on the nature and operation of the rectifier. For example, grid-controlled rectifiers, in general, produce more interference than the straight type, and usually require more extensive apparatus.

Investigation of interference from ignition systems has been confined mainly to the short-wave band, extending from 60.3 megacycles. At these frequencies strong interference is experienced which may be serious when television services are put into operation.

Methods of suppression have been devised, the more efficient being resistances of the "distributed" type whose self-capacity is low, inserted at the sparking points (the plug and the distributor) in order to prevent high-frequency currents from reaching the high-tension leads which act as radiating aerials.

Carefully conducted investigations have shown that interference from electric lifts is transmitted along the supply mains and radiated by the wiring of the lift equipment, in particular from the unscreened trailing leads running from the car to the half-way box situated in the lift shaft. Mains-borne lift interference can be effectively suppressed by the use of chokes and condensers in combination.

The foregoing survey will serve to show that the major technical difficulties associated with the problem of radio interference have not only been overcome, but in a satisfactory manner, as the methods of suppression indicated involve very little expense.

## Work of the E.R.A.

**A**T the request of the Institution of Electrical Engineers, the British Electrical Research Association undertook, some time ago, to conduct an extensive in-

### INVESTIGATING RADIO INTERFERENCE

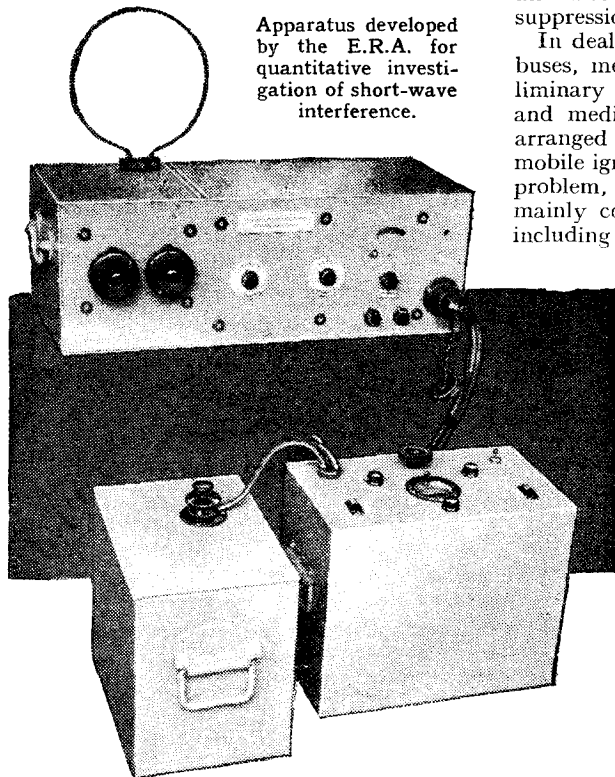
and also the development of methods of suppression.

In dealing with interference from trolley-buses, mercury arc rectifiers and lifts, preliminary work was carried out on the long and medium wavebands with a voltmeter arranged to read the audio output. Automobile ignition systems presented a different problem, as this type of disturbance is mainly confined to the short wavelengths, including the band at present in use for television. For preliminary measurements at these frequencies a super-regenerative receiver and valve voltmeter were employed. Using the foregoing simple methods of measurement it was found possible to determine the relative merits of the various methods of suppression and the actual degree of suppression effected.

It was quickly recognised, however, that information obtained in this way, whilst valuable for immediate use, would not prove sufficiently quantitative for future needs, such, for example, as the basis of any restrictive proposals, since the latter, to be effective, must define the level at which a given disturbance or noise must be suppressed.

The desirability of arriving at measurements on an absolute basis having been

Apparatus developed by the E.R.A. for quantitative investigation of short-wave interference.



investigation involving tests and country-wide experiments on the measurement of the intensity of interference from various sources,

# BROADCAST

By Our Special Correspondent

## Acoustic Problems at Maida Vale

MR. JACK PAYNE is not alone in condemning the acoustics of the new Maida Vale studios. I hear that the B.B.C. is considering the installation of a cinema organ in St. George's Hall. Why? Because Maida Vale has been tried and found wanting.

Engineers carried out long and meticulous tests in the new studios with a unit organ, but, no matter where they put the box of pipes, echoes persisted. If echoes possessed smell, Maida Vale would seem like a tannery.

## Uphill Struggle

So Eric Maschwitz is trying hard to persuade the higher powers that St. George's Hall will not be complete until a cinema organ is part of the equipment. Unfortunately, the hall is not B.B.C. property, and the lease will run out in two or three years' time. If Mr. Maschwitz gets his organ it will be yet more proof of the amazing abilities of this amazing young man.

## Another £1,000,000?

EVEN if, as seems likely, another £1,000,000 is vouchsafed to the B.B.C. through the findings of the Uliswater Committee, it will practically all be swallowed up by the commitments into which the Corporation has entered in connection with new stations and general constructional development, not to mention television.

This means that there will be precious little extra money left over for the sound programmes.

## "Perfect" Programme

It is, of course, a debatable point whether the ordinary broadcast programmes stand in need of extra expenditure. The B.B.C. itself considers that the programmes have already reached a pinnacle of perfection and that any extra money would only go towards gilding the lily. (Don't smile; this is a genuine official pronouncement.)

## Artistes at a Premium

As the officials point out, it is more or less true that more money would not purchase the services of any more first-class artistes, for the simple reason that there are no more first-class artistes available. All the best performers are eager to broadcast, but their appearances have to be carefully spaced, for nothing tarnishes so quickly as the reputation of the artiste who faces the microphone too often.

# BREVITIES

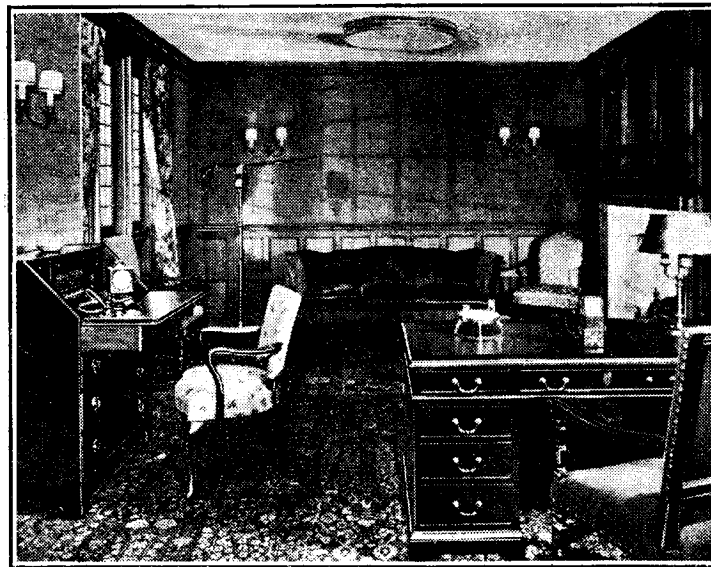
Unlike the stage actor, the microphone performer must bring something fresh to the ether audience every time he appears.

## Where More Money Could be Spent

What the officials at Broadcasting House are less quick to recognise is that more money could make for better presentation of the available material and would also subsidise efforts to find those mute, inglorious

## Hospital Wireless: A Grouse

WHILE we all admire the Hospital Wireless movement, I think attention should be drawn to the detestable practice which still obtains in certain hospitals of installing loud speakers in the wards. Nothing is more calculated to antagonise a man towards the B.B.C. and all its works than to have to listen to the programmes from a sick bed whether he wants them or not.



NOT A MILLIONAIRE'S STUDY but a camouflaged talks studio in the N.B.C. Radio City, New York. The design is Tudor, with wainscot, fireplace, mantel and panelled wall in English oak.

Miltons who languish outside the realm of stardom. More money, again, could be offered for original radio plays. Few dramatists with any pretensions to eminence will at present waste time in writing for the microphone; the money is not nearly good enough. Yet Mr. Cecil Graves spoke almost imploringly at the last Press conference at Broadcasting House when he said: "We do really need new plays more than anything."

## A Desirable State

When the B.B.C. has an audience which swears by it, instead of at it—a solid phalanx of devotees such as is possessed by our national newspapers—it will be time to talk of having reached that desirable state when no additional expenditure is necessary.

The time seems a long way off.

I recently had a talk with an elderly gentleman who has just managed to survive this refinement of torture in a Middlesex hospital. Restored to his family, his one desire now is that the wireless switch should remain "off" at all times—so his family, too, are victims of the thoughtlessness of the hospital authorities.

## So Nice for the Nurses

Headphones in bulk cost more than a loud speaker and require more technical supervision, but against this one must consider the welfare of the patients. It seems a wrong-headed economy to kill off the patients even if the nurses do so enjoy Henry Hall and his Boys.

## N.B.C. and Vesuvius

IN a recent issue I made a passing reference to the broadcast from Vesuvius last summer,

stating that it was relayed over the Columbia network in America. Actually, this very successful event was carried out by the American National Broadcasting Company, which has scored quite a number of O.B. coups in recent months, notably from Abyssinia.

## Safety-valve Station

I LIKE the suggestion of M. Leon Blum, the French Socialist leader, that a "free tribune" should be accorded on the ether to all shades of thought, with regular programmes by Monarchists, Radicals, Christians, agnostics, free-thinkers, exponents of the flat-earth theory, and all the rest. M. Blum would have these programmes interlarded with the ordinary offerings from the French stations, but a more advanced thinker pleads that a special station should be set apart as a safety-valve for all broadcasters who wish to defy one or other of the conventions.

## Hyde Park of the Ether

It seems remarkable that Great Britain, with its reputation for free speech, has not set the fashion with a station of this kind. Not only would it let off a lot of hot air, like the soap boxes in Hyde Park, but it would provide a constant source of diversion for listeners who grew bored with the more stereotyped broadcasts from Portland Place.

## Drama-dissection at the Microphone

DISCUSSION groups should find plenty to discuss in a new series of twelve weekly talks which starts on January 13th. These will deal entirely with the works of John Galsworthy. A comparison will be made between Galsworthy's propagandist methods and those of other modern dramatists, including Ibsen and Shaw.

Attention will be drawn to Galsworthy's attitude to the law, as exemplified by "The Silver Box," towards social issues, as in "The Skin Game," and towards the struggle between Labour and Capital, as shown in "Strife."

The talks are to be given by Mr. Eric Gillett, a well-known lecturer who specialises in modern drama.

## A. J. Alan

PEOPLE are asking me what has become of the master yarn-spinner.

# PRINCIPAL BROADCASTING STATIONS OF EUROPE

## Arranged in Order of Frequency and Wavelength

(This list is included in the first issue of each month. Stations with an aerial power of 50 kW. and above in heavy type)

Station.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	kc/s.	Tuning Positions.	Metres.	kW.
Kaunas (Lithuania)	155	.....	1935	7	Graz (Austria). (Relays Vienna)	886	.....	338.6	7
Brazov (Romania)	160	.....	1875	150	Helsinki (Finland)	895	.....	335.2	10
Kootwijk (Holland) (Relays Hilversum) (10 kW. till 2.40 p.m.)	160	.....	1875	100	Hamburg (Germany)	904	.....	331.9	100
Lahti (Finland)	166	.....	1807	40	Toulouse (Radio Toulouse) (France)	913	.....	328.6	60
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	174	.....	1724	500	Brno (Czechoslovakia)	922	.....	325.4	32
Paris (Radio Paris) (France)	182	.....	1648	80	Brussels, No. 2 (Belgium). (Flemish Programme)	932	.....	321.9	15
Istanbul (Turkey)	187.5	.....	1600	5	Algiers, P.T.T. (Radio Alger) (Algeria)	941	.....	318.8	12
Berlin (Deutschlandsender Zeesen) (Germany)	191	.....	1571	60	Göteborg (Sweden). (Relays Stockholm)	941	.....	318.8	10
Droitwich	200	.....	1500	150	Breslau (Germany)	950	.....	315.8	100
Minsk, RW10 (U.S.S.R.)	208	.....	1442	35	Paris (Poste Parisien) (France)	959	.....	312.8	60
Reykjavik (Iceland)	208	.....	1442	16	Odessa (U.S.S.R.)	968	.....	309.9	10
Motala (Sweden). (Relays Stockholm)	216	.....	1389	150	Belfast	977	.....	307.1	1
Novosibirsk, RW76 (U.S.S.R.)	217.5	.....	1379	100	Genoa (Italy). (Relays Milan)	986	.....	304.3	10
Warsaw, No. 1 (Raszyn) (Poland)	224	.....	1339	120	Torun (Poland)	986	.....	304.3	24
Luxembourg	230	.....	1304	150	Hilversum (Holland). (15 kW. till 4.40 p.m.)	995	.....	301.5	60
Ankara (Turkey)	230	.....	1304	7	Bratislava (Czechoslovakia)	1004	.....	298.8	13.5
Kharkov, RW20 (U.S.S.R.)	232	.....	1293	20	Midland Regional (Droitwich)	1013	.....	296.2	50
Kalundborg (Denmark)	238	.....	1261	60	Chernigov (U.S.S.R.)	1013	.....	296.2	5
Leningrad, RW53 (Kopino) (U.S.S.R.)	245	.....	1224	100	Barcelona, EAJ15 (Radio Asociación) (Spain)	1022	.....	293.5	3
Tashkent, RWH (U.S.S.R.)	256.4	.....	1170	25	Cracow (Poland)	1022	.....	293.5	2
Oslo (Norway)	260	.....	1153.8	60	Heilsberg (Königsberg Ermland) (Germany)	1031	.....	291	100
Moscow, No. 2, RW49 (Stechkovo) (U.S.S.R.)	271	.....	1107	100	Paredo (Radio Club Português) (Portugal)	1031	.....	291	5
Tiflis, RW7 (U.S.S.R.)	280	.....	1071.4	35	Leningrad, No. 2, RW70 (U.S.S.R.)	1040	.....	288.5	10
Finmark (Norway)	355	.....	845.1	10	Rennes-Bretagne, P.T.T. (Thourle) (France)	1040	.....	288.5	120
Rostov-on-Don, RW12 (U.S.S.R.)	355	.....	845.1	20	Scottish National (Falkirk)	1050	.....	285.7	50
Budapest, No. 2 (Hungary)	359.5	.....	834.5	20	Bari (Italy)	1059	.....	283.3	20
Sverdlovsk, RW5 (U.S.S.R.)	375	.....	800	50	Paris (Radio Cité) (France)	1068	.....	280.9	0.8
Banska-Bystrica (Czechoslovakia)	392	.....	765	30	Tiraspol, RW57 (U.S.S.R.)	1068	.....	280.9	4
Geneva (Switzerland). (Relays Sottens)	401	.....	748	1.3	Bordeaux, P.T.T. (Lafayette) (France)	1077	.....	278.6	50
Moscow, No. 3 (RCZ) (U.S.S.R.)	401	.....	748	100	Zagreb (Yugoslavia)	1086	.....	278.2	0.7
Voroneje, RW25 (U.S.S.R.)	413.5	.....	726	10	Falun (Sweden)	1086	.....	276.2	2
Oulu (Finland)	431	.....	696	1.2	Madrid, EAJ7 (Union Radio) (Spain)	1095	.....	274	10
Ufa, RW22 (U.S.S.R.)	436	.....	688	10	Madona (Latvia)	1104	.....	271.7	50
Hamar (Norway). (Relays Oslo)	519	.....	578	0.7	Naples (Italy). (Relays Rome)	1104	.....	271.7	1.5
Innsbruck (Austria). (Relays Vienna)	519	.....	578	1	Moravska-Ostrava (Czechoslovakia)	1113	.....	269.5	11.2
Ljubljana (Yugoslavia)	527	.....	569.3	5	Fécamp (Radio Normandie) (France)	1113	.....	269.5	5
Viipuri (Finland)	527	.....	569.3	10	Alexandria (Egypt)	1122	.....	267.4	0.25
Bolzano (Italy)	536	.....	559.7	1	Newcastle	1122	.....	267.4	1
Wilno (Poland)	536	.....	559.7	16	Nyiregyhaza (Hungary)	1122	.....	267.4	6.2
Budapest, No. 1 (Hungary)	546	.....	549.5	120	Hörby (Sweden). (Relays Stockholm)	1131	.....	265.3	10
Beromünster (Switzerland)	556	.....	539.6	100	Turin, No. 1 (Italy). (Relays Milan)	1140	.....	263.2	7
Athlone (Irish Free State)	565	.....	531	60	London National (Brookmans Park)	1149	.....	261.1	20
Palermo (Italy)	565	.....	531	4	North National (Slaithwaite)	1149	.....	261.1	20
Stuttgart (Mühlacker) (Germany)	574	.....	522.6	100	West National (Washford Cross)	1149	.....	261.1	20
Grenoble, P.T.T. (France)	583	.....	514.6	15	Kosice (Czechoslovakia). (Relays Prague)	1158	.....	259.1	2.6
Riga (Latvia)	583	.....	514.6	15	Monte Ceneri (Switzerland)	1167	.....	257.1	15
Vienna (Bisamberg) (Austria)	592	.....	506.8	100	Copenhagen (Denmark). (Relays Kalundborg)	1176	.....	255.1	10
Rabat (Radio Maroc) (Morocco)	601	.....	499.2	25	Kharkov, No. 2, RW4 (U.S.S.R.)	1185	.....	253.2	10
Sundsvall (Sweden). (Relays Stockholm)	601	.....	499.2	10	Nice (La Brague) (France)	1185	.....	253.2	60
Florence (Italy). (Relays Milan)	610	.....	491.8	20	Frankfurt (Germany)	1195	.....	251	25
Cairo (Abu Zabal) (Egypt)	620	.....	483.9	20	Prague, No. 2 (Czechoslovakia)	1204	.....	249.2	5
Brussels, No. 1 (Belgium). (French Programme)	620	.....	483.9	15	Lille, P.T.T. (Camphin) (France)	1213	.....	247.3	60
Lisbon (Bacarena) (Portugal)	629	.....	476.9	20	Trieste (Italy)	1222	.....	245.5	10
Trøndelag (Norway)	629	.....	476.9	20	Gleitwitz (Germany). (Relays Breslau)	1231	.....	243.7	5
Prague, No. 1 (Czechoslovakia)	638	.....	470.2	120	Cork (Irish Free State). (Relays Athlone)	1240	.....	241.9	1
Lyons, P.T.T. (La Doua Tramoyes) (France)	648	.....	463	90	Swedish Relay Stations	1240	.....	241.9	1
Cologne (Langenberg) (Germany)	658	.....	455.9	100	Juan-les-Pins (Radio Côte d'Azur) (France)	1249	.....	240.2	0.8
North Regional (Slaithwaite)	668	.....	449.1	50	Kuldiga (Latvia)	1258	.....	238.5	10
Sottens (Radio Suisse Romande) (Switzerland)	677	.....	443.1	25	Rome, No. 3 (Italy)	1258	.....	238.5	1
Belgrade (Yugoslavia)	686	.....	437.3	2.5	San Sebastian (Spain)	1258	.....	238.5	1
Paris, P.T.T. (Palaiseau Villebon) (France)	695	.....	431.7	120	Nürnberg and Augsburg (Germany). (Relays Munich.)	1267	.....	236.8	2
Stockholm (Sweden)	704	.....	428.1	55	Christiansand and Stavanger (Norway)	1276	.....	235.1	0.5
Rome, No. 1 (Italy)	713	.....	420.8	50	Dresden (Germany). (Relays Leipzig)	1285	.....	233.5	0.25
Kiev, RW9 (U.S.S.R.)	722	.....	415.5	36	Aberdeen	1285	.....	233.5	1
Tallinn (Esthonia)	731	.....	410.4	20	Austrian Relay Stations	1294	.....	231.8	0.5
Madrid, EAJ2 (Radio España) (Spain)	731	.....	410.4	3	Danzig. (Relays Königsberg)	1303	.....	230.2	0.5
Seville (Spain)	731	.....	410.4	5.5	Swedish Relay Stations	1312	.....	228.7	1.25
Munich (Germany)	740	.....	405.4	100	Magyarovar (Hungary)	1321	.....	227.1	1.25
Marseilles, P.T.T. (Realtor) (France)	749	.....	400.5	90	German Relay Stations	1330	.....	225.6	2
Katowice (Poland)	758	.....	395.8	12	Montpellier, P.T.T. (France)	1339	.....	224	0.8
Scottish Regional (Falkirk)	767	.....	391.1	50	Lodz (Poland)	1339	.....	224	1.7
Stalino (U.S.S.R.)	776	.....	386.6	10	Dublin (Irish Free State). (Relays Athlone)	1348	.....	222.6	0.5
Toulouse, P.T.T. (Muret) (France)	776	.....	386.6	120	Milan, No. 2 (Italy). (Relays Rome)	1357	.....	221.1	4
Leipzig (Germany)	785	.....	382.2	120	Turin, No. 2 (Italy). (Relays Rome)	1357	.....	221.1	0.2
Barcelona, EAJ1 (Spain)	795	.....	377.4	7.5	Basle and Berne (Switzerland)	1375	.....	218.2	0.5
Lwow (Poland)	795	.....	377.4	16	Warsaw, No. 2 (Poland)	1384	.....	216.8	2
West Regional (Washford Cross)	804	.....	373.1	50	Lyons (Radio Lyons) (France)	1393	.....	215.4	25
Milan (Italy)	814	.....	368.6	50	Tampere (Finland)	1420	.....	211.3	0.7
Bucharest (Romania)	823	.....	364.5	12	Miskolc (Hungary)	1438	.....	208.6	1.25
Moscow, No. 4, RW39 (Stalino) (U.S.S.R.)	832	.....	360.6	100	Paris (Eiffel Tower) (France)	1456	.....	206	20
Berlin (Funkstunde Tegel) (Germany)	841	.....	356.7	100	Pecs (Hungary)	1465	.....	204.8	1.25
Bergen (Norway)	850	.....	352.9	1	Antwerp (Belgium)	1465	.....	204.8	0.1
Sofia (Bulgaria)	850	.....	352.9	50	Bournemouth	1474	.....	203.5	1
Valencia (Spain)	850	.....	352.9	3	Plymouth	1474	.....	203.5	0.3
Simferopol, RW52 (U.S.S.R.)	859	.....	349.2	10	International Common Wave	1492	.....	201.1	0.5
Strasbourg, P.T.T. (France)	859	.....	349.2	100	International Common Wave	1500	.....	200	0.25
Poznan (Poland)	868	.....	345.6	16	Liepāja (Latvia)	1737	.....	173	0.1
London Regional (Brookmans Park)	877	.....	342.1	50					



SHORT-WAVE STATIONS OF THE WORLD

Arranged in Order of Wavelength and Frequency

(N.B.—Times of Transmission given in parentheses are approximate only and represent G.M.T.)

Table with columns: Metres, kc/s, Call Sign, Station, Tuning Positions, Metres, kc/s, Call Sign, Station, Tuning Positions. Lists various radio stations worldwide with their frequencies and call signs.

# Recent Inventions

The following abstracts are prepared with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

**Brief descriptions of interesting radio devices and improvements issued as patents are included in this section**

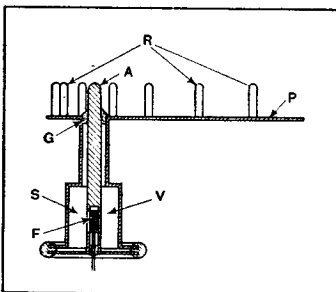
## VARIABLE-SELECTIVITY CIRCUITS

THE intermediate frequency amplifiers of a superhet set are coupled by transformers of which both the primary and secondary windings are adjustably tuned. There are two limits of coupling. In one, the first transformer is over-critically coupled (i.e., the resonance-curve shows no sag) and is slightly damped, whilst the second transformer is critically coupled and is strongly damped. In the other limit the first transformer is critically coupled and the second less-than-critically coupled. The arrangement is designed to give a wide variation of selectivity.

Patent issued to N. V. Philips' Gloeilampenfabrieken. Convention date (Germany) 18th June, 1934. No. 433273.

## SHORT-WAVE AERIALS

A SHORT-WAVE directional aerial consists of quarter-wave oscillator A, which forms an extension of the anode of a special type of generating-valve V, and is disposed at the focal point of a parabolic series of reflectors R. The reflectors are mounted on a common plate P, which is insulated by a bridge of fused glass G from the main oscillator. The chamber S inside the valve-generator acts as a "resonator" for electrons emitted from the filament F, so that a potential loop of oscillations is formed in the centre, and a potential node (or a current loop) at the upper and lower ends of the



Short-wave aerial.

chamber. The effective wavelength is, therefore, twice the length of the resonator S. The aerial and valve together form a unitary structure.

Patent issued to N. V. "Meaf." Convention date (Germany) 3rd March, 1934. No. 433026.

## TELEVISION AMPLIFIERS

TWO forms of distortion are inherent in the initial stage of an amplifier handling the output from a light-sensitive cell. One is due to thermal disturbances in the grid circuit (Johnson effect), and the other is caused by the inter-electrode capacity inside the valve (Miller effect).

In the circuit shown, the ratio of signal to both forms of disturbance is materially improved by coupling the output from the photo-electric cell C to an amplifier

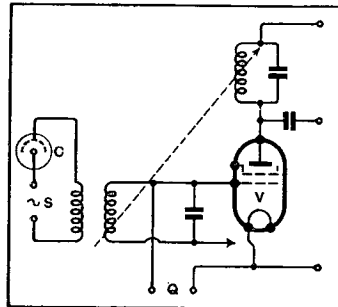


Photo-cell circuit.

V of the super-regenerative type. The output from the cell C is first cut up into a series of flat-topped impulses by an A.C. source S inserted in the cell circuit, and the "quenching" frequency applied to the valve at Q is made high compared with the highest of the signal frequencies. Actually the ordinary resistance load across the P.E. cell has been converted into a dynamic load (the quenched valve), the cutting-up of the signals being introduced in order to preserve the high-frequency components at their proper value.

D. M. Johnstone and Baird Television, Ltd. Application date 11th April, 1934. No. 435574.

## DIRECTIONAL AERIALS

IN order to identify the direction of any received signal, each one of a fan-shaped array of individually directive receiving aerials is linked to a common central point through indicating means which show at once from what part of the compass the signal is coming. Preferably each indicator is of the glow-lamp type, the maximum column of light being given by the aerial nearest in line with the source of transmission.

Patent issued to Marconi's Wireless Telegraph Co., Ltd., and C. S. Franklin. Application date 27th January, 1934. No. 432500.

## CATHODE-RAY TUBES

WHEN the intensity of the electron stream is varied by a signal voltage, it is known that the response of the effect on the fluorescent screen is not strictly proportional. Part of the curve relating the potential on the control-electrode to the resulting brightness of the spot on the screen is straight, but for negative potentials it tends to become convex, and for positive potentials concave.

In order to offset the resulting distortion, a non-ohmic resistance, such as a valve with a curved

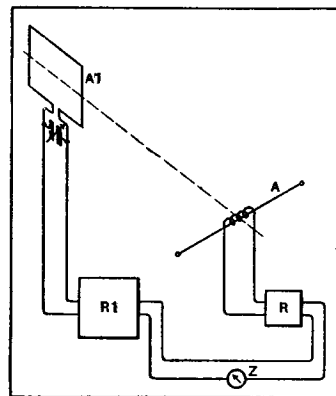
characteristic, or a dry-contact rectifier, is introduced into the path of the signal. The non-linear response of one then counter-balances that of the other, thus restoring the true balance of the picture as seen on the screen.

General Electric Co., Ltd., and D. C. Espley. Application date 10th August, 1934. No. 435639.

## DIRECTION FINDING

A DIPLOLE aerial A is combined with a frame aerial A1 and mounted so that its axis is always perpendicular to the plane of the frame and on a line passing through the diameter of the plane. Both aerials are mounted on a common support (not shown) and the combination is used to ascertain the absolute direction of a transmitter from a point in space, such as on an aeroplane. The frame aerial is coupled to an amplifier and rectifier R1, and the dipole is similarly coupled to the amplifier-rectifier R, both feeding a common indicator Z.

When the aerial combination is turned into a position where the indicator shows zero deflection, the magnetic as well as the electric lines of force of the incoming waves lie in the plane of the frame



Aerial combination.

aerial A1, and the transmitting station lies along the axis of the dipole A.

Telefunken Ges für Drahtlose Telegraphie m.b.h. Convention date (Germany) 23rd January, 1934. No. 436186.

## COMMUNITY AERIALS

A SINGLE aerial feeds several different receivers so that each can be separately tuned to a desired programme without causing mutual interference. The aerial A is made substantially aperiodic,

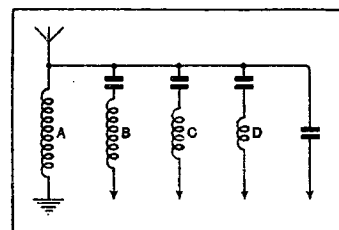


Fig. 1. — Separately tuned aerials.

and frequency-discriminating leads B, C, D, for the various sets are coupled to it as shown schematically in Fig. 1. Fig. 1A shows an arrangement in which two-channel reception is provided with the minimum of apparatus. The frequency-discriminating leads B, C

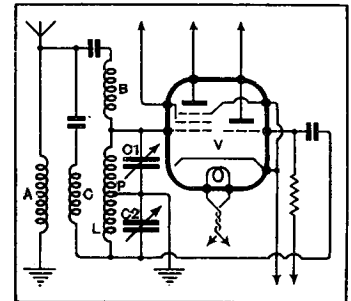


Fig. 1A. — Two-channel circuit.

are branched to the two ends of a tapped coil L, the two sections of which are separately tuned by condensers C1, C2. The tapping P may be earthed directly as shown, or through a decoupling network. The two ends of the coil L may be taken to separate amplifiers, or, as shown, they are coupled to the two control grids of a combined triode-pentode valve V.

E. W. Hobbs. Application date 13th April, 1934. No. 436233.

## MIXING VALVES FOR SUPERHETS

IN order to maintain a high degree of electrical separation between the oscillation-generating circuits and the signal-amplifying or modulating circuits of the mixer valve used in a superhet set the electrode system of the valve is so arranged that in addition to the main discharge path there is a separate auxiliary discharge path, preferably in the opposite direction to the main discharge. The auxiliary discharge is used for generating the local oscillations. One grid, which surrounds the cathode, is common to both paths, whilst at least two other grids are in the path of the main discharge only.

Patent issued to Telefunken Ges für Drahtlose Telegraphie m.b.h. Convention date (Germany) 5th July, 1933. No. 433089.

## AIRCRAFT WIRELESS

IN order to prevent collisions in fog or at night, the proximity of a second aeroplane (which is transmitting a warning signal) automatically sets a wireless transmitter going on the first craft, which thereupon starts to radiate its own warning signal. The transmitter is triggered into action by a receiver of the super-regenerative type directly the latter is energised by the incoming warning signal. A meter on the dashboard of the aeroplane gives the pilot visual notice that another craft is in the vicinity.

H. Diamond and F. W. Dunmore (Assignors to U.S.A. Government). No. 1989086.

# The Wireless World

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

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## Editorial Comment

### The Radio Show

#### Should the Date be Changed ?

**M**OST French manufacturers are rejoicing that a decision has just been made to change the date of the annual Radio Show of 1936 from the customary time in September to a period in May or June. It is interesting to consider the arguments which have been put forward in France in favour of a Spring exhibition, especially in view of the fact that there is a considerable and growing body of opinion amongst exhibitors that our own show date should be changed from the early Autumn to the Spring.

In France, one of the factors which has most influenced the present decision is that manufacturers there are extremely cautious, and, in consequence, do not feel justified in entering upon a big production programme until the Radio Exhibition has made it possible for them to gauge the likely demand for their sets or the relative demand for individual models. They also feel that they cannot very well go in for big production until they see how serious may be the competition of models of other manufacturers. The result of a September show in France has always been that production only starts about the time that the demand is greatest and deliveries are always behind, and those who buy sets on a big scale exaggerate their orders in the hope that by so doing they will at least encourage the manufacturer to produce to meet their requirements.

In this way the manufacturer is frequently left at the end of the season with a surplus of unsold sets.

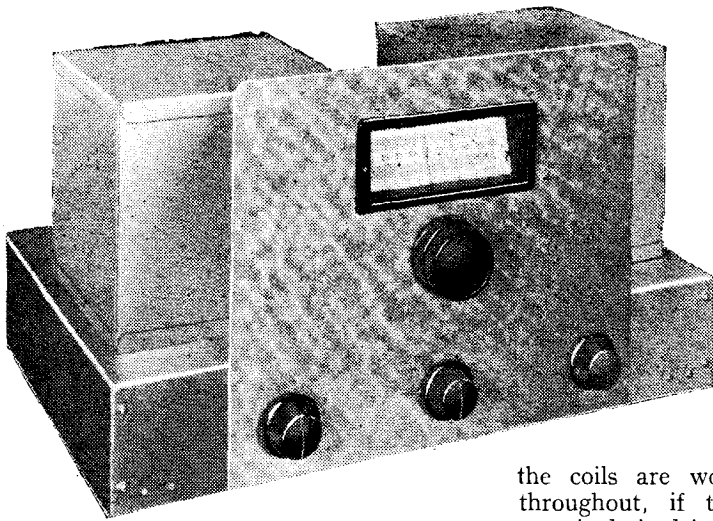
#### Small Firms Suffer Most

Only in the case of the largest manufacturers does the Autumn Show appear to operate in their favour, because in their case they cannot wait to start production until after the Show and they are consequently nearly always in the position to meet orders far more promptly than their smaller competitors.

Another objection is one which relates more directly to the public visiting the Show. In September, public interest in wireless is probably at its lowest ebb for the year, and by changing the date to early in the year it is felt that the Exhibition will take place at a time when the public are enthusiastically interested and will, in consequence, attend the Show in much greater numbers and place their orders for new models for delivery later on. The manufacturers will be able to form a better estimate of public demand, and will then have two or three clear months in which to go ahead with production and ensure that nothing suffers from panic rush methods in manufacture.

It is pointed out that another result of an Autumn Show is that every component associated with the set is produced at high speed. The result is that the orders go not to those manufacturers who can produce the best article, but to those who can produce quickest, with the almost inevitable result that they are poor in quality.

Practically all these arguments seem to us to be equally applicable to the radio industry in this country, and whilst it may be that the industry is already committed to an August or September date for the Show in 1936, it seems most desirable that the closest consideration should be given to the whole question before any further commitments are made for so late in the year.



# IMPERIAL SHORT

## Construction and Operation

**T**HE construction of the receiver is not unduly difficult as, apart from the coil unit, it resolves itself largely into the assemblage of standard components on the chassis. This may be made either of aluminium or of cadmium-plated steel, the latter would undoubtedly be preferable for tropical use, though elsewhere aluminium will be quite satisfactory. It measures 18 x 12 x 3 in. deep and has two wooden battens fitted, as shown in the illustrations, and on which four rubber feet are screwed. If the wooden battens are for any particular reason inconvenient and it is decided to omit them, the chassis will have to be made about  $\frac{1}{2}$  in. deeper to provide sufficient clearance for the nuts securing the cover of the coil unit.

The most important item in the receiver is the coil unit. In designing this apparently rather complicated piece of mechanism the fact was not overlooked that it may have to be fabricated with such tools that might reasonably be expected to comprise the average home constructor's kit. The possession of a lathe was not regarded as a permissible assumption.

Wherever possible the parts are made identical. Only two styles of formers are employed, and both can be made from the same material. All three coils for each waveband have exactly the same number of turns on the tuned windings. In two cases, namely, for the aerial and oscillator circuits, the coils are tapped, but for the HF circuit a transformer is used.

The primaries are overwound on the coils for the two higher ranges but interwound for the two lower-range coils where spaced windings are employed.

Although in standard form,

the coils are wound with copper wire throughout, if the very best performance is desired it is an advantage to wind at least the 11 to 28 metre range coils with silver wire. No. 22 SWG will be satisfactory, and the wire can be obtained from almost any watchmaker's or jeweller's shop. A specimen piece of wire of the gauge required may have to be produced, as silversmiths apparently have gauges of their own. The wire usually available will be found rather hard and not so supple as "electrical" annealed copper wire.

The coils are wound on 3 in. lengths of

one-inch outside diameter ribbed ebonite, or high-grade bakelite, former. For tropical use it would be better to use the latter.

Each former carries the coils for two wave ranges, so actually there are only two coil formers in each compartment of the unit. Looking at the set from the underside and with the front towards the observer, on the left-hand side are the coils for the two higher ranges, 27.5 to 55 metres and 50 to 105 metres respectively. In the centre are the switches, of which more anon, while on the right are the ultra-short and the lowest short-wave coils. It will be observed that this right-hand former differs from the one on the left in that for a portion of its length it is reduced in diameter by turning off or filing down the ribs to  $\frac{5}{8}$  in.

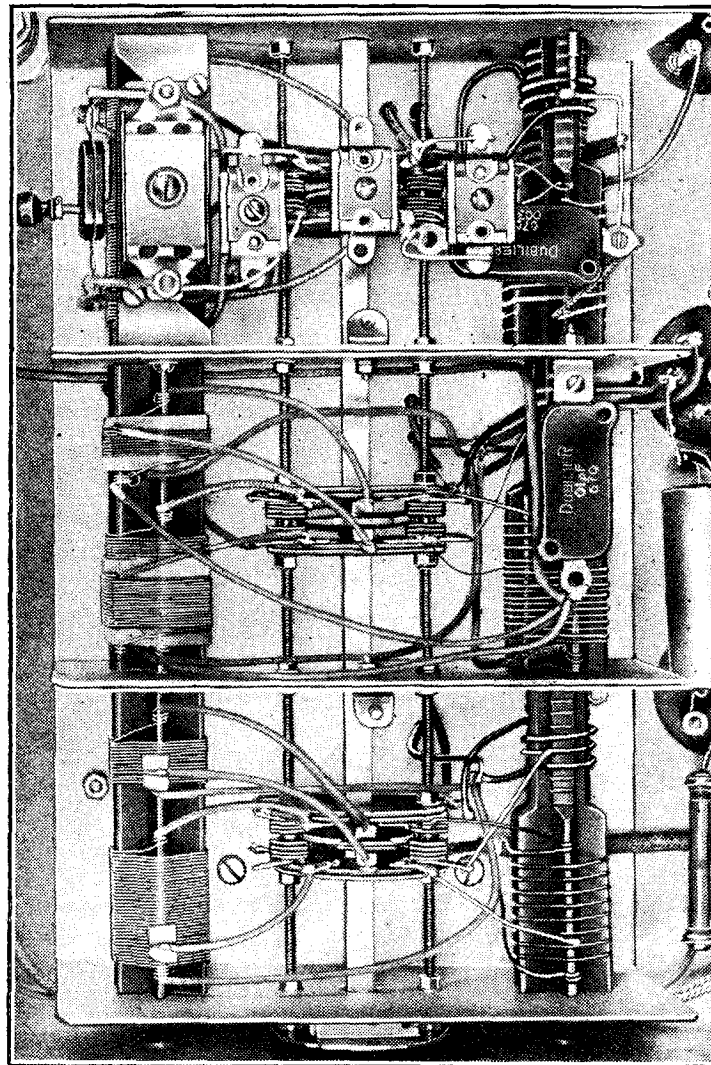
In all probability moulded formers of the correct size will be available by the time this appears in print, and, incidentally, a drilled chassis should be obtainable also.

The coils on the right-hand former are wound with enamelled copper wire, or silver wire if possible, with spaced turns, but the windings on the left-hand coils are put on with adjacent turns touching, or close-wound, using double silk-covered wire. The number of turns required for each coil, the spacing where necessary, and the gauge of wire, also style of insulation, assuming copper wire is employed, are given in the detailed drawing of the coil unit.

### Waveband Switching

The switches are Bulgin five-way multi-contact type, with one switch unit in each compartment, and all are held in position by threading them on to two lengths of No. 6 BA screwed rod and fixing securely by nuts on either side of the switch plate. Before doing this, however, the lower contacts on the separate switches should be joined together since it may be a little awkward to reach them for soldering after assembly.

The position locator section of this switch is fitted on to the *outside* of the front



This view of the coil unit shows clearly the position of the coils, the switches and the padding condensers in the oscillator section.

# WAVE SIX

*LAST week we explained the principal features of this short-wave receiver and discussed at some length the circuit arrangement, also the reasons for the choice of the two-valve frequency-changer. In this issue the construction of the receiver is described, together with the procedure for lining-up the various circuits and some notes on its operation.*

section of the coil unit by means of the two 6 BA rods already mentioned. The long square shaft should be assembled *before* the various switch units and the location unit are securely fixed in position, so that the whole can be correctly lined up.

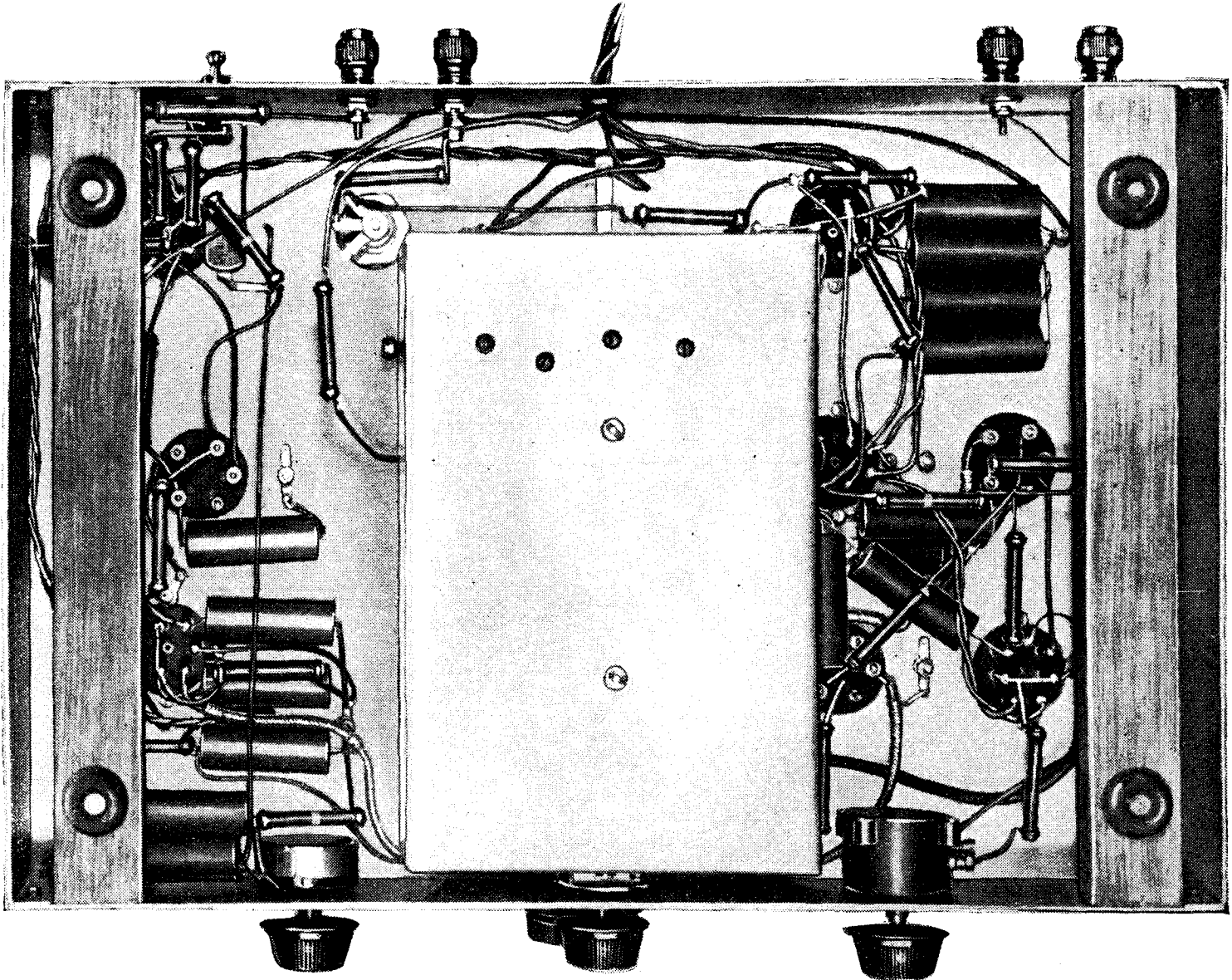
Like the switches, the coil formers are held in position by threading through the centre of each a long 2BA screwed rod. This is secured by nuts at each end of the

to wire the coil unit and assemble the various padding condensers.

It is very important to note that on the very shortest range of all—6 to 11 metres—the connections between the tuning condenser and the switch form a large percentage of the total inductance in this circuit. Therefore, the same gauge

condenser terminals, for, if taken to the switch points, the efficiency of the oscillator will suffer on the ultra-short wave range owing to the tapped down effect, for the valve will not then be joined across the whole of the tuned circuit but to tapings on the inductance.

When assembling the coil unit on the



The underside of the chassis is devoted largely to the coil unit seen here with its cover in place. There is ample space for the various small components on each side of it.

frame, and both the right- and the left-hand set of coils are mounted in the same manner.

The coil unit chassis is made from three pieces of aluminium bent "U" shaped and held together by the switch and coil fixing rods. It will need a cover, for which the dimensions can be obtained from the drawings. The next process is

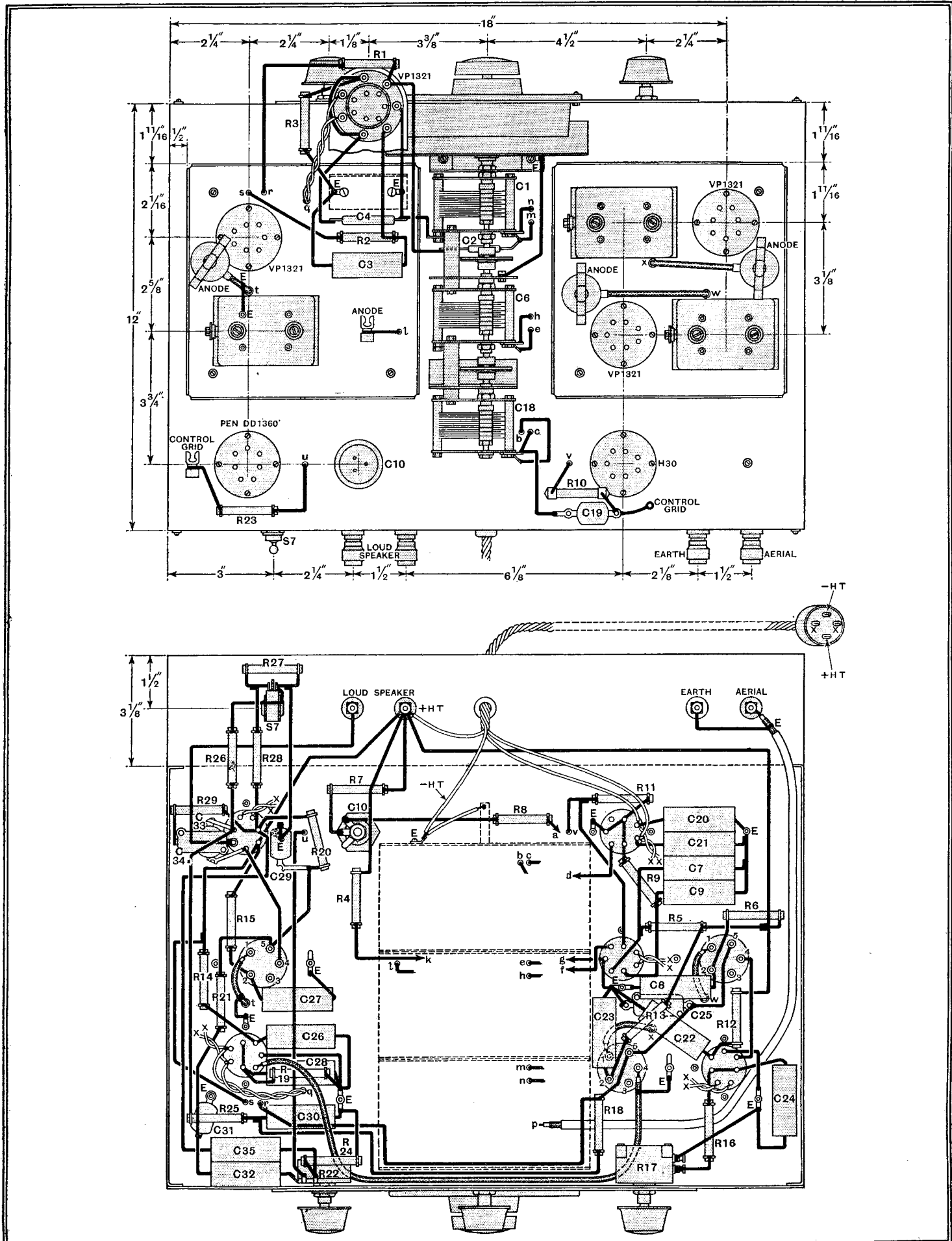
wire as used for the coils should be employed for these leads.

An examination of the sketch in Fig. 5 will show that there are two alternative points to which the grid and anode of the oscillator valve may be joined. They may be taken either to the condenser terminals, a-b, or to the switch points x-y. The correct points are the

chassis it should be borne in mind that some of the securing bolts serve also to position the tuning condensers. The three gang condenser is secured in position by a bent bracket bolted to the screen between the rear, or oscillator section, and the centre, or HF circuit section. It is bolted to the chassis by two 4BA screws and nuts. Another small



# HOW TO WIRE UP THE RECEIVER



Layout of the components and practical wiring plan.

**Imperial Short-wave Six—**

bracket is employed for the front support, which is so shaped that the screws securing it hold in place also the slow-motion drive.

Reference to the illustrations will show that apart from the tuning condensers, oscillator and output valve, and an 8 mfd. electrolytic condenser, almost everything else on the top of the chassis is enclosed in one or other of two large screening boxes. For convenience of assembly and wiring these boxes are turned upside down so that the original lid becomes a base-piece and the container proper the removable part. The two lids must, therefore, be placed in

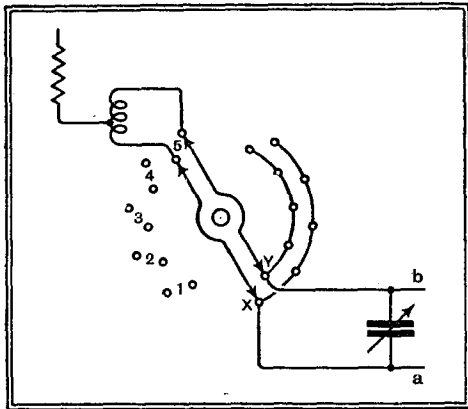


Fig. 5.—The efficiency of the oscillator on the ultra-short-waverange will suffer unless the grid and anode leads are joined to the correct points. These are at the condenser (a — b), as explained in the text.

position and have the necessary holes for the valve holders and IF transformers drilled at the same time as the corresponding holes in the chassis. If the chassis is purchased ready drilled, it will no doubt be possible to obtain these boxes also drilled.

From this stage onwards no definite order need be followed in the assembly, for all parts will be found readily accessible. All valve holders, with the exception of that for the signal frequency HF stage, are of the chassis mounting type. A baseboard-type holder is employed for the HF valve, and it is mounted on a bent aluminium bracket so that the valve lies horizontal. This enables both anode and grid leads to be kept reasonably short.

It is more convenient to mount the other valves in the more orthodox manner, as the IF transformer connections are on the underside of the chassis, and so, also, is the bulk of the wiring associated with the diode detector, AVC and output circuits.

Screened sleeving is used for all IF anode leads, the grid lead for the second IF valve, which has to pass from the left side of the coil unit to the right as the transformer is in the left-hand box whilst the valve is in the right-hand one, and also for the lead joining the aerial terminal to the switch in the coil unit.

If a modulated test oscillator is available, lining up the IF amplifier will be relatively easy, but in its absence the fol-

lowing procedure can be adopted. First test the LF circuit by connecting the aerial, *via* a small fixed condenser, to the anode lead of the last IF transformer. This lead is live to the HT supply so must not be allowed to come in contact with the chassis. Some input noise will usually be heard and possible spark signals from the ship and shore stations working on 600 metres.

If a fairly loud click is heard on joining or disconnecting the aerial lead to the IF valve it might be safe to assume, even in the absence of other indications, that the signal diode and the output stage at least are correct. Absolute silence may be due to forgetting to turn up the LF volume control—right-hand knob—or to a defect in the wiring. It is useless to proceed further until any possible errors in this part of the circuit have been rectified.

By connecting the aerial to each IF valve anode, and also to the mixing valve of the frequency changer, the IF amplifier can be lined up sufficiently well to enable a strong signal to get through if the aerial is transferred to its correct point. More accurate adjustments of the IF amplifier can then be effected.

**Oscillator Gauging**

It must not be forgotten that the IF transformers have a pre-set control for selectivity, and incidentally sensitivity, since this varies the coupling of the primary and the secondary circuits. During the initial lining up it will suffice to set the small milled-head screw on the side of each transformer case to about the middle of the movement allowed.

The next step is the adjustment of the

oscillator tracking condensers. Ranges two to four are fitted with 30 m-mfds. pre-set variable trimmers in parallel with the coils: they are marked C11, C13 and

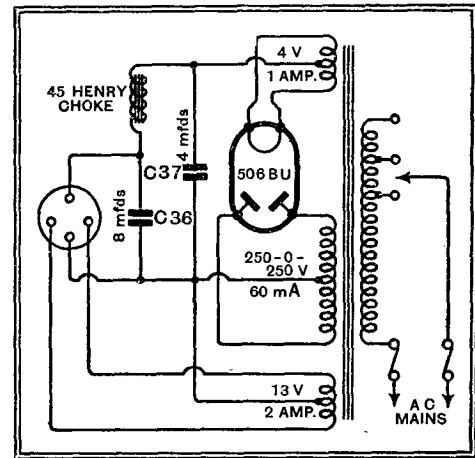
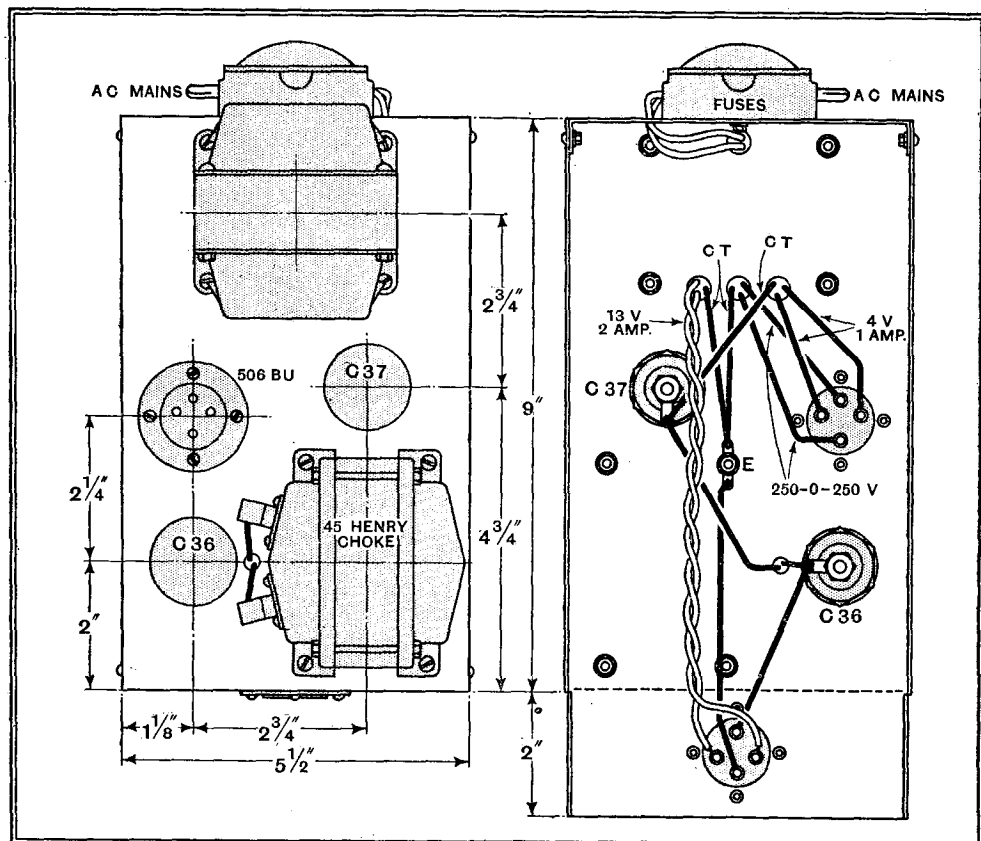


Fig. 6.—Theoretical circuit diagram of the AC mains power pack.

C15 respectively. Their purpose is to fix the minimum capacity across each oscillator coil so that with the main condenser at zero the oscillator is tuned to a frequency higher than that of the signal circuit by an amount equal to the IF frequency, in the present case 465 kc/s.

In practice it is often best to make the adjustment at about the tenth graduation of the dial, endeavouring, if possible, to locate a signal thereabouts on which to make the adjustments. This condenser setting represents about 50 metres on range four, 28 metres on range three, and 12 metres on range two.

Each of these ranges has, also, a series



Chassis layout and wiring plan of the power pack.

**Imperial Short-wave Six—**

padding condenser, two only, however, are variable, as it was found that on range two a fixed condenser of 0.003 mfd., C12, gave quite satisfactory tracking.

Range three series padding condenser is a 0.001 mfd. pre-set type, marked C14 in the diagram, and will be found below the coils in the oscillator section on the left of the wave-change switch. Padding of the highest range is effected by a 0.0001 mfd. fixed condenser in parallel with a 0.0005 mfd. pre-set. These are marked C17 and C16, respectively, and are also on the left of the switch, but above the coils in this case, as seen in the illustrations.

As a check on the trimming of the circuits, the 31-metre broadcast band should tune in on range three centred about 34 on the 0-100 graduated scale. The 40-metre amateur band should commence at about 67, also on range three, while the 19-metre broadcast band, which falls in range two, will be found about 57 on the scale.

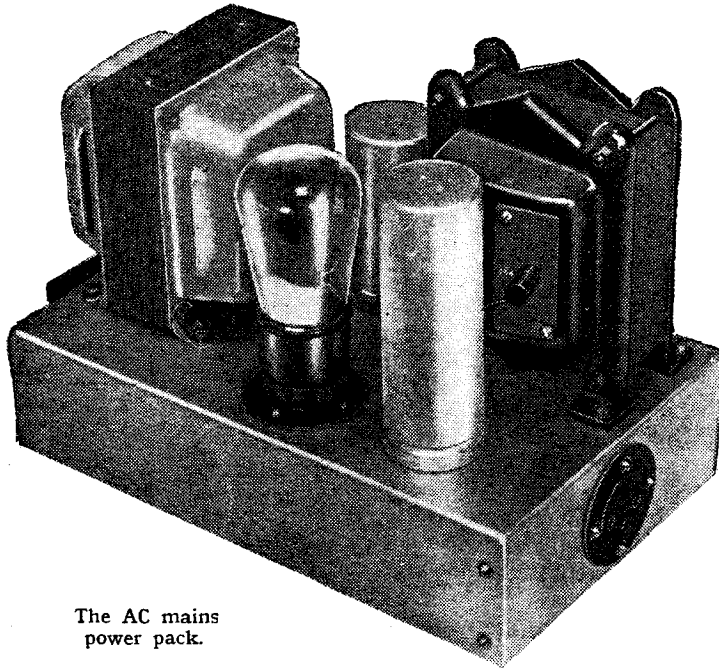
The 80-metre amateur band can be taken as a key position for range four, it falling about 70 on the scale. Of course, these dial readings are approximate only and the trimming should be carried out to give the best signal strength, and not to bring the various key points chosen exactly to the dial readings enumerated.

**IF Selectivity Adjustment**

Various settings of the coupling screws on the IF transformers should be tried, though the midway position suggested earlier should give adequate selectivity and good sensitivity. Rotation of the adjusting screws anti-clockwise loosens the coupling between primary and secondary, the amplification is lowered

but the selectivity improves. Clockwise rotation gives greater amplification but a wider band width. The best adjustment can only be found by trial.

There is one feature of this set that so far has not been mentioned. This is the



The AC mains power pack.

extra grid bias resistor R27, and its short-circuiting switch located on the back of the chassis. It has been included as an economy measure when the receiver is battery operated and enables a 30 per cent. reduction to be effected in the HT current consumption. Owing to the overbiased condition of the output valve, some deterioration in the quality of the reproduction must be expected, especially on strong signals. When a period of listening to one station is contemplated the switch can be put in the down position, which short-circuits the extra bias resistor and so reverts to normal working conditions.

With 150 volts HT the normal anode current is 39.5 mA, and with the extra bias resistor in circuit, i.e., switch up, 27.5 mA. These values increase to 55 and 38.5 mA. respectively, with 200 volts HT.

If a permanent magnet loud speaker is used the simple power pack shown in the illustration will suffice for operating the set from the AC supply mains. This gives about 230 volts on full load and 13 volts at 2 amps. for the heaters. Its construction is quite straightforward and hardly calls for comment here, the theoretical circuit and wiring diagrams providing all the necessary information.

Since completing the receiver the screened valve top connectors have been changed to another style of the same make, as the type first employed is not so readily obtainable as the other style. The old type, however, are shown in the illustrations. That specified is without side wings, but it is fitted with a suitable length of low-capacity screened wire.

It should be noted that the width of the power pack chassis is 5½ in. and not 5 in. as stated in the list of parts last week.

**Mullard Cathode Ray Tubes**

A RANGE of cathode ray tubes suitable for television purposes is being produced by Mullard. The type 6001 is one of the most interesting of these, and has a heater rated for 1 ampere at 4 volts. The diameter of the tube is 22 cms., and it has an overall length of 49 cms.; the screen is of a green-yellow colour.

The tube is of the three-anode type and is rated for a third-anode potential of 6,000 volts. Normal operating conditions, however, are 5,000 volts for the 3rd, 1,000 volts for the 2nd, and 400 volts for the 1st anode. The voltage required by the control electrode for current cut-off is 60 volts. The deflection sensitivity is 0.11 mm/V. for the P1 plates and 0.08 mm/V. for the P2 plates. The maximum input for full modulation is some 30-50 volts according to the anode voltages employed.

Smaller tubes are the 4001 and 4002 types. These are similar characteristics, but have only two anodes and require lower operating voltages. The screens are smaller and the deflection sensitivities rather greater.

**Superhet Kit Set**

A CONSTRUCTIONAL chart for an up-to-date three-valve A.C. superheterodyne receiver has recently been issued by Wright and Weaire, Ltd., 740, High Road, Tottenham, London, N.17. The chart includes a theoretical diagram, clear half-size wiring plans, list of parts, and instructions.

A triode-hexode frequency-changer is employed, while a double-diode-pentode combines the functions of second detector, source of AVC voltage, and output. The simple and straightforward circuit arrangement chosen should be effective, and the layout is neat and workmanlike. All coils, the mains transformer, and a number of other components are of Wearite manufacture.

**For The Man In The  
(German) Street****Wireless and Television Explained**

WUNDER DES WELLEN (The Wonder of the Waves) is the title of a new book published from the offices of the German wireless journal "Sieben Tage." The author, Eduard Rhein, has had great experience of readers' difficulties through dealing with all technical queries addressed to that paper.

The book sets out to describe wireless and television to the man in the street, avoiding heavy technicalities, and the book is written in an interesting and amusing style, whilst retaining a good standard of technical accuracy. It is illustrated with explanatory drawings or diagrams.

Whilst the language difficulty will discourage many from buying the book, those who have a knowledge of German will find the book both entertaining and useful in the information which it imparts on wireless telephony, broadcasting, and television.

Address: Verlag Ullstein, Berlin, SW68, Kochstrasse 22-26.

**BLUE PRINTS**

The following full-size blue prints are available:

Complete winding data and wiring connections of the coil unit.

Layout of components and wiring connections of the receiver.

Layout of components and wiring connections of the power unit.

Price 1s. 6d. each, post free, from the Publishers, Dorset House, Stamford Street, London, S.E.1

# Automatic Tuning Control

## HOW ATC SYSTEMS WORK

By W. T. COCKING

*METHODS of automatic tuning are of considerable interest since they prevent a set being mistuned by an unskilled operator and hence help a set to give of its best under all conditions. The principles underlying such systems are described in this article and it is shown that it is feasible to apply the arrangement only to the superheterodyne at the present time.*

IT is well known that the tuning control of a selective receiver requires careful setting if the best quality of reproduction is to be obtained, and that the tuning of a receiver consequently calls for some slight degree of skill. In an effort to overcome this necessity and make it impossible for a receiver to be tuned inaccurately, methods have been devised whereby once the set is tuned approximately to a signal it will itself take charge and automatically complete the operation of tuning. It is then impossible to obtain poor-quality reproduction through mishandling the tuning control, and tuning can be carried out as well by the novice as by the expert. A further advantage of more technical importance results from the use of ATC, and this is that it prevents the tuning of the set from changing with variations in the supply voltages or as the valves warm up.

### The IF Circuits

The methods at present devised for automatic tuning control are really only applicable to the superheterodyne, and arrangements are made for the oscillator frequency to be dependent upon the detector input in such a way that the oscillator always tends to settle down at a frequency such that the detector input is a maximum. The ATC circuits may be divided into two parts—first, a system for providing a suitable controlling voltage, and, secondly, a circuit which will react suitably upon the oscillator frequency when controlled by the output voltage of the first system.

The basic diagram of Fig. 1 shows the arrangement of a typical control voltage generator. The circuit L<sub>1</sub> C<sub>1</sub> is the primary of the last IF transformer which feeds the conventional diode detector D<sub>1</sub> from the secondary L<sub>2</sub> C<sub>2</sub> in the usual way. The diode load resistance R<sub>1</sub> and its by-pass condenser C<sub>5</sub> fulfil their normal purposes, and this portion of the circuit differs in no way from ordinary practice, AVC being obtained where required by conventional methods. The ATC circuit comprises the two additional tuned circuits L<sub>3</sub> C<sub>3</sub> and L<sub>4</sub> C<sub>4</sub> and their associated equipment. The normal circuits, L<sub>1</sub> C<sub>1</sub> and L<sub>2</sub> C<sub>2</sub>, are both tuned to the inter-

mediate frequency and suitably coupled to produce the required band-width.

The other circuits are not tuned to the intermediate frequency but to frequencies slightly different. Thus, if the intermediate frequency be 465 kc/s, L<sub>4</sub> C<sub>4</sub> may be tuned to 472 kc/s, and L<sub>3</sub> C<sub>3</sub> to 458 kc/s, 7 kc/s on either side of resonance. The exact degree of mistuning, of course, depends upon the band-width of the IF amplifier, the degree of control desired, and the selectivity of the circuits. Now, when a signal is tuned in exactly, each ATC circuit has exactly the same voltage induced in it, but if the signal is not exactly tuned

circuit L<sub>4</sub> C<sub>4</sub> will pick up a much bigger voltage than L<sub>3</sub> C<sub>3</sub>, for it is more nearly tuned to the signal. There will, however, be some voltage picked up by L<sub>3</sub> C<sub>3</sub>. The voltage set up in the circuit L<sub>4</sub> C<sub>4</sub> is applied to the diode rectifier D<sub>3</sub> through C<sub>7</sub>; rectification occurs, and a steady potential appears across R<sub>3</sub>, the magnitude of which is nearly proportional to the voltage across L<sub>4</sub> C<sub>4</sub>. This potential is in such a direction that the cathode of D<sub>3</sub> becomes positive with respect to the earth line.

Now, in the second circuit, the voltage across L<sub>3</sub> C<sub>3</sub> is applied to D<sub>2</sub> through C<sub>6</sub>, and rectification occurs as before, with the result that a potential appears across R<sub>2</sub> in such a direction that the anode side of R<sub>2</sub> becomes negative with respect to the cathode. It is clear that with the method of connection adopted in Fig. 1 the potentials across R<sub>2</sub> and R<sub>3</sub> appear in series between the earth and ATC lines, but that the potentials are in opposite directions. In the case of an IF signal at 470 kc/s a considerable voltage appears across R<sub>3</sub>, tending to make the ATC line positive with respect to the earth line, while a small voltage in the opposite sense appears across

R<sub>2</sub>. The effective voltage of the ATC line is thus the difference between the voltages across R<sub>2</sub> and R<sub>3</sub>. If the circuit constants be such that 10 volts is developed across R<sub>3</sub> for 1 volt across R<sub>2</sub>, the ATC line is 9 volts more positive than earth. If the signal be at 460 kc/s, however, L<sub>3</sub> C<sub>3</sub> will pick up the greater voltage, and the 10 volts signal will appear across R<sub>2</sub> and 1 volt across R<sub>3</sub>. The ATC line will then be 9 volts negative with respect to earth.

When the signal is exactly at the intermediate frequency, 465 kc/s, each circuit will pick up the same voltage, and the

voltages across R<sub>2</sub> and R<sub>3</sub> will be equal and opposite, so that the ATC voltage will be zero, however great the actual voltages across R<sub>2</sub> or R<sub>3</sub> may be. In this way it is possible to produce a voltage on the ATC line which is zero at resonance, but which rises rapidly in one direction when the signal is mistuned one way, and rises rapidly in the other direction when the signal is mistuned the other way. A positive voltage is produced when the signal is of higher frequency than the intermediate frequency, and a negative when it is lower.

The next step is to produce a circuit

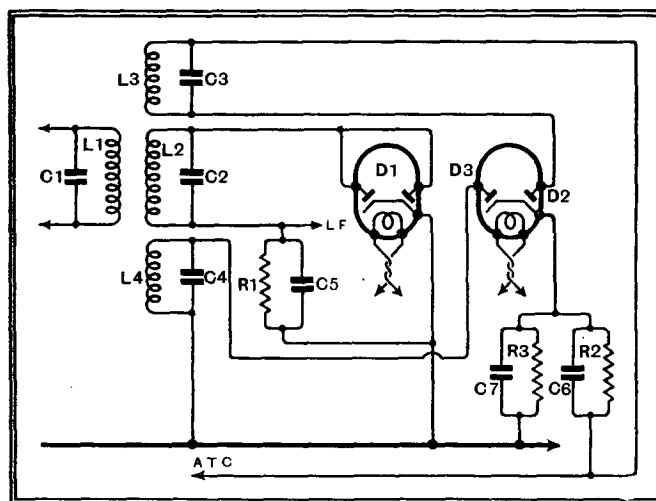


Fig. 1.—The method of obtaining a voltage which varies in amplitude with the degree of mistuning and in polarity with the direction of mistuning is shown in this diagram. Two diode detectors are used and their outputs connected in series.

one circuit will have a greater voltage than the other, for it will be more nearly resonant with the frequency passing through the IF amplifier.

### Differential Detector System

Connected to each ATC circuit is a diode detector with load resistance and by-pass condenser, so that a disparity in IF voltages in the tuned circuits gives rise to an inequality in the outputs of the two diode rectifiers. Suppose, for instance, that the receiver is so mistuned that the frequency passing through the IF amplifier is 470 kc/s instead of the correct 465 kc/s. The

**Automatic Tuning Control—**

such that this voltage will react suitably on the oscillator frequency. In normal practice the oscillator is always at a higher frequency than the signal, so that if the intermediate frequency produced at a given setting of the tuning control is slightly too high, it means that the difference between the signal and oscillator frequencies is slightly too great, and for correct tuning the oscillator must generate a slightly lower frequency. The control circuit must, therefore, operate in such a manner that the positive voltage on the ATC line increases the effective inductance or capacity of the oscillator circuit.

There are many possible methods of doing this, both mechanical and electrical, but one of the simplest employs the input capacity of a valve as the controlling element. It is well known that if a valve has an appreciable grid-anode capacity and it is operated with a resistive or capacitive anode circuit load impedance, its effective input capacity depends upon the amplification of the stage, and the amplification can be controlled by the grid bias.

Fig. 2 shows an outline of one possible arrangement of this nature. The triode oscillator can be of any conventional type, including heptodes, octodes, triode-hexodes, and triode-pentodes, and tracking and padding condensers and wave-band switching are omitted for clarity. The variable- $\mu$  valve is operated with the screen-grid at a fixed potential derived from the potentiometer R3 R4, while the anode is connected to the HT line through the load resistance R2. The initial grid bias is that derived across the cathode resistance R5 and is fairly high.

**Controlling the Oscillator Frequency**

The grid-cathode circuit of the valve is connected directly across the oscillator-tuned circuit, the condenser C1 being interposed merely to prevent a short-circuit of the ATC bias. Now, the input capacity of this control stage is made up in part of the fixed grid-cathode capacity of the valve and in part of a capacity transferred from the anode circuit which is equal to  $(1+A)$  times the grid-anode capacity represented in Fig. 2 by C2, and which will only have existence as a separate component if the inherent valve capacity is too small. The symbol A represents the amplification of the valve with its associated circuit constants.

The valve is given a fairly high initial bias, perhaps 10-15 volts, and the receiver is ganged with this value of bias and ATC inoperative. Suppose now that ATC is functioning and the set is tuned to a frequency very slightly higher than the

signal. The difference between the signal and oscillator frequencies is then too great to produce the correct intermediate frequency, and it produces instead one slightly too high. The output of D3 (Fig. 1) then predominates, and a positive voltage is developed on the ATC line and applied to the grid of the controlling valve where it partially offsets the initial grid bias and increases the mutual conductance of the valve. This increases the amplification of this valve, and hence its input

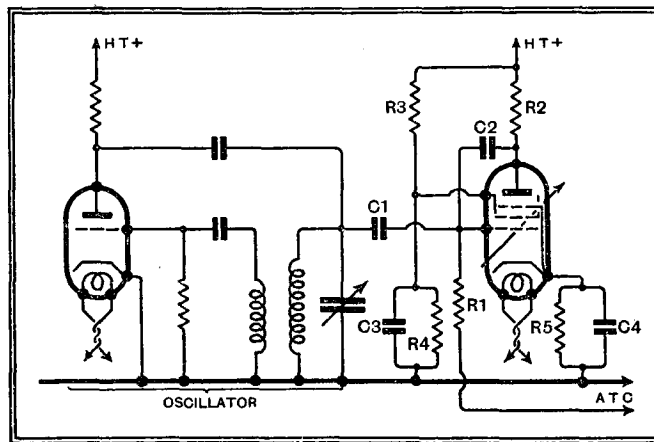


Fig. 2.—One method of controlling the frequency of an oscillator is through the Miller effect of a valve, for the input capacity varies with the grid bias applied to it.

capacity. The increased input capacity tunes the oscillator to a lower frequency, and the intermediate frequency produced is nearer the correct frequency. This, of course, means a fall in the ATC voltage and a lowering of the capacity thrown on the tuned circuit. Equilibrium is reached, however, when a small positive voltage exists on the ATC line and the capacity on the oscillator circuit is higher than its initial value, and the intermediate frequency only very slightly higher than the correct frequency.

It can be seen that when the mistuning is in the other direction, a negative voltage appears on the ATC line, thus reducing the amplification of the control valve and lowering its input capacity and so increasing the oscillator frequency. Thus, whichever way the set be mistuned, the ATC circuit functions to bring it into resonance, but, although it can never do this exactly, it can do so with very slight error indeed.

The circuits shown are, of course, of a simplified nature, and would require some modification in practice, chiefly the introduction of suitable decoupling. The speed of operation of the system is also of importance, and can be controlled by a suitable choice of time constant for the decoupling circuit. The amount of apparatus required is by no means negligible, but it cannot be considered excessive in view of the complicated nature of the function which the ATC system has to perform. The chief difficulty in practice lies in the initial adjustments, for the circuits L3 C3 and L4 C4 (Fig. 1) must be tuned, not to the intermediate frequency, but to definite frequencies some 5-9 kc/s on either side of it. These circuits, therefore, cannot be

trimmed by any normal procedure, and elaborate apparatus is necessary for their correct adjustment. In view of this it seems likely that ATC will not find its way rapidly into the cheaper class of receivers, and in any case will be for the present confined to the products of those manufacturers who have unusual laboratory facilities.

**The Effect of Fading**

It might be thought that ATC would lead to difficulties in the reception of a fading signal, for it is conceivable that during a deep fade the set would tune itself to a station on an adjacent channel. In fact, one can imagine that if two fading stations were adjacent in wavelength, the set might alternate between them in sympathy with the fading! The avoidance of such effects must depend very largely upon the choice of resonance frequencies for the controlling circuits, upon their accurate adjustment to those frequencies, and upon the time constant of the system. In practice no trace of the effects are found in a correctly designed and adjusted system, but it is necessary to include an automatic switch to render ATC inoperative during the actual process of tuning.

It should not be thought that the method of ATC described in this article is the only one, or necessarily the best in all circumstances. Many alternative arrangements are possible, but it seems probable that electrical systems will prove to be the best, and it will be remembered that such an arrangement is employed in the Murphy receiver recently reviewed in *The Wireless World*.

**Book Review****The Radio Amateurs' Handbook—1936**

**Edition.** 480 pp. with approximately 500 diagrams, illustrations and charts. Published by The American Relay League, West Hartford, Conn., U.S.A. Price with paper cover \$1.15, or \$2.50 with linen cover, post free.

THE latest edition of this useful handbook far and away surpasses in size and in scope any of the previous twelve editions. It is a well-conceived and up-to-date reference book for the amateur wireless experimenter, and as such deals exclusively with short- and ultra-short-wave practice.

Every section of the book has been revised and new material added where necessary. The ultra-short-wave chapters in particular are considerably larger than hitherto, and much useful practical data is given relating to the 224 Mc/s, the 112 Mc/s and the 56 Mc/s frequencies.

There is a thirty-page chapter on valves with operating data and characteristics in tabulated form, also base connections, of practically every American type likely to be used in short-wave receivers and transmitters. A receiver design section is a new addition, while the enlarged chapters on construction of apparatus and station layout contain a wealth of practical information that probably could not be found within the covers of any other short-wave reference book.

H. B. D.



# CURRENT TOPICS

## Television 'Phone ?

WITH the completion by the Post Office of a high-frequency cable between the G.P.O. and Birmingham, the question of a television 'phone service is being discussed.

## Kilocycles in Metre

A NOVELTY in technical radio books is that of a German writer, Herr E. Rehin, who, in "The Mirage of the Waves," explains the functions of aerials, condensers, kilocycles, etc., in terms of poetry.

## Lahti on 220 Kilowatts

THE new high-power transmitter at Lahti, Finland, is reported to be carrying out tests in the early morning hours. The station is expected to begin daily operation with a power of 220 kilowatts within the next week or two.

If reception is not good in the Karelia district the power may be doubled.

## What is Your Field Strength ?

"KNOW your own field strength!" is the latest sales catchword in America. Dealers are urging customers to listen only to stations with a high field strength, supplying a good local signal. A low signal-to-noise ratio means disturbing crackles in receivers and, in consequence, loss of customers' good will.

## Operators Losing Caste ?

WIRELESS operating has lost some of its glamour owing to the development of the telewriter, according to the latest Ministry of Labour "Choice of Career" pamphlet. The radio operator's job, which formerly required considerable skill and dexterity, is greatly simplified through the increasing reliability of instruments, and it is suggested that the introduction of the telewriter has tended to reduce the operator's status to that of a typist!

## Eiffel Tower Survives

TELEVISION is saving the Eiffel Tower. The demolition of the Trocadero, writes our Paris correspondent, started a campaign in favour of similar treatment for the Tower itself, and this has led to a widespread outcry for the retention of the "Steeple of Paris," if only for its splendid properties as a television aerial.

The new high-power television

transmitter will commence operations in April next.

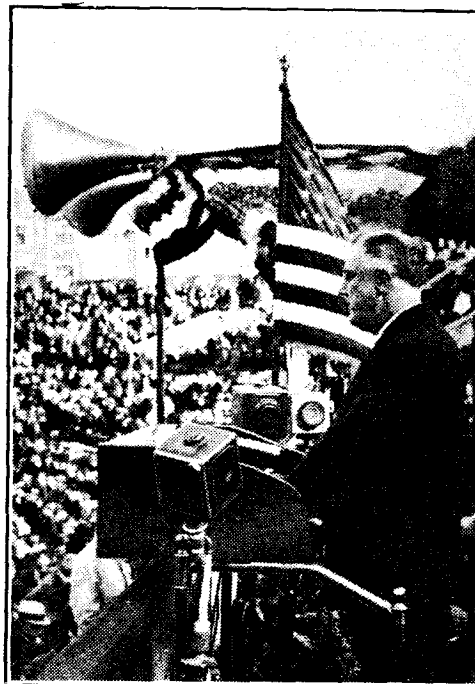
## Royal Radio Invention

KING GUSTAF of Sweden, well known as a wireless "fan" and builder of receivers, has designed a tuning dial installed in a commercial set which is selling "like hot cakes." The dial incorporates a map of Europe. When the set is switched on, a light spot travels over the map from behind, focusing itself upon the name of the station to which the receiver is tuned.

## West London Radio Society

THE inaugural meeting of the West London Radio Society is to be held on Wednesday next, January 15th, in the Lecture Room of the Ealing Town Hall at 8.30 p.m. All wireless enthusiasts in the district are cordially invited to attend. Fuller particulars can be obtained from the hon. sec. (*pro tem.*), Mr. H. A. Williamson, 22, Camborne Avenue, West Ealing, W.13.

PRESIDENT ROOSEVELT using his new "mike" stand during a recent broadcast over the networks. Including a portable desk, the stand replaces a two-year-old contrivance which had grown wobbly after a hundred Presidential speeches.



## "Ultra-short-wave Broadcasting"

SIR NOEL ASHBRIDGE, B.Sc. (Eng.), will open a discussion on "Ultra-short-waves for Broadcasting" at an informal meeting of the Institution of Electrical Engineers on Tuesday next, January 14th, at 6.30. The meeting will be held at the Institution, Savoy Place, London, W.C.2.

## N.R.E.A.

MR. P. A. VOIGT, of Voigt Patents, Ltd., is to lecture and demonstrate before the Romford section of the National Radio Engineers' Association on Wednesday, January 15th, at the Victoria Hotel, Victoria Road, Romford.

Central meetings are held at

the Star Hotel, City Road, E.C.1, on Thursdays, at fortnightly intervals, the next meeting being on January 16th.

Hon. secretary: Mr. Harold W. King, 34, Bush Elm Road, Romford, Essex.

## Broadcasting "The Times"

THE new season's English lessons from Swedish broadcasting stations are based, not on a text-book, but on the issue of *The Times* newspaper for January 3rd, 50,000 copies of which have been ordered from London by the Swedish Broadcasting Co. for distribution to listeners. The whole of the issue, including news, articles and advertisements, will be used for the broadcast studies.

## Events of the Week in Brief Review

possibility of danger to the aircraft and its occupants. Aerials should always be reeled in or out slowly and uniformly.

Effective maintenance of an aerial is essential, and the Air Ministry advises that aerial wires and joints should be inspected after every flight.

## Lectures on Television

AN advanced course of twelve lectures on television opens to-night (Friday) at 7.30 at Morley College, 61, Westminster Bridge Road, S.E. The fee for the course is 7s.

## New Marconi Managing Director

MR. H. C. VAN DER VELDE became managing director of the Marconi International Marine Communication Co. on January 1st. He has been associated with the Marconi companies for the past sixteen years.

## German Actress as Television Announcer

FOR reasons of "national defence," foreign Press representatives were excluded from the opening ceremony a fortnight ago of the new German ultra-short-wave television transmitters at Witzleben, which replace those burnt at the Radio Exhibition.

The television service has been handed over to the Minister for Propaganda and has undergone a complete re-organisation. An extended television programme service is to open on Wednesday next, January 15th, and a charming young Berlin actress has been engaged as announcer.

The definition will remain the same, viz., 180 lines, 25 frames per second.

## Compliments

M. PELLENC, Director of French State broadcasting, in a recent speech at Limoges, paid a remarkable tribute to M. Mandel, the P.M.G., for his activities in the radio sphere.

Thanks to the activities of the P.M.G., he said, 110,000 sources of interference had been located; the number of licensed listeners had been increased from 1,700,000, when M. Mandel took office, to 2,700,000, and in the television domain France had acquired in less than six months the premier place in Europe.

## "P.A." and Broadcasting

MR. DEREK FARRER, who installed the public address gear at the Regent's Park Open-Air Theatre, is frequently heard announcing well-known dance bands from North Regional. He is now with Tannoy Products.

## Trailing Aerials : Air Ministry Warning

DANGERS arising from mishandling of trailing aerials from aircraft are the subject of an Air Ministry notice. There is a tendency, says the notice, for trailing aerials to whip and to spin round in circles during reeling in or out, and this tendency is greatly increased if the reeling is effected rapidly or in a jerky manner, with the

# Does

# Broadcasting

By

LESLIE BAILY

Mr. Andrew Stewart, Scottish Programme Director, promises big things when the new recording van arrives.



*VISITS to the Scottish Regional Station at Falkirk and to the Edinburgh headquarters are described in this instalment. Travelling through the heart of Scotland, Mr. Baily discovered that the long waves of Droitwich are quite inadequate to fill gaps in the Falkirk service area. In an interview with the Regional Director, Mr. Melville Dinwiddie, he learnt interesting facts concerning Scotland's "untouched material which awaits exploitation."*

## VIII.—Falkirk and Edinburgh

**W**E have seen in the two preceding instalments of this series how, by the introduction of new studios at Glasgow and improved studios at Aberdeen, and the erection of the new transmitter at Burghead, steps are being taken to improve very considerably the B.B.C.'s service to its listeners in Scotland. From Aberdeen I turned south, bound for Falkirk and Edinburgh, having left the Regional headquarters until the last so that I might make my summing-up of the broadcasting situation in Scotland whilst in conversation with the Regional Director and his staff.

Passing en route through Dundee I recalled that on the occasion of my last visit this town had its own 200-watt transmitter. The inauguration of the Scottish

Regional station at Falkirk in 1932 swept 2DE away, and, as Dundee is 50 miles from Falkirk, I was anxious to know whether local listeners have suffered.

The change was a hardship for crystal set users, who were quite numerous in this population of 175,000. But on a simple valve set I found that Scottish Regional came in quite well, without fading—although a few miles farther north, at Stonehaven, I had experienced bad fading (this, in fact, is a poor spot for reception; Aberdeen is smothered in mush, and Droitwich is apt to fade).

So to Falkirk. The Scottish Regional station stands in the "neck" of Scotland, mid-way between Edinburgh and Glasgow, on a bleak hill-top 500 feet above sea level. You get a magnificent view across the valley of the Forth towards the Ochils and Grampians, those obstructive mountains that have spelt so much trouble to B.B.C. engineers, who have given this station every possible advantage in its fight against a difficult terrain. The Regional transmitter has the next-best British medium wave to North Regional, while Scottish National (unlike other "little Nationals")

enjoys its own exclusive wavelength and full scheduled power of 50 kilowatts.

Yet these transmitters cannot pretend to cover Scotland—and Droitwich is unreliable. The ideal arrangement, as once suggested, would have been for the B.B.C. to utilise two long-wave stations, one in Scotland and one in the South, but the international wavelength situation would



"Progress must be along every line of development," said Mr. Melville Dinwiddie, Scottish Regional Director.

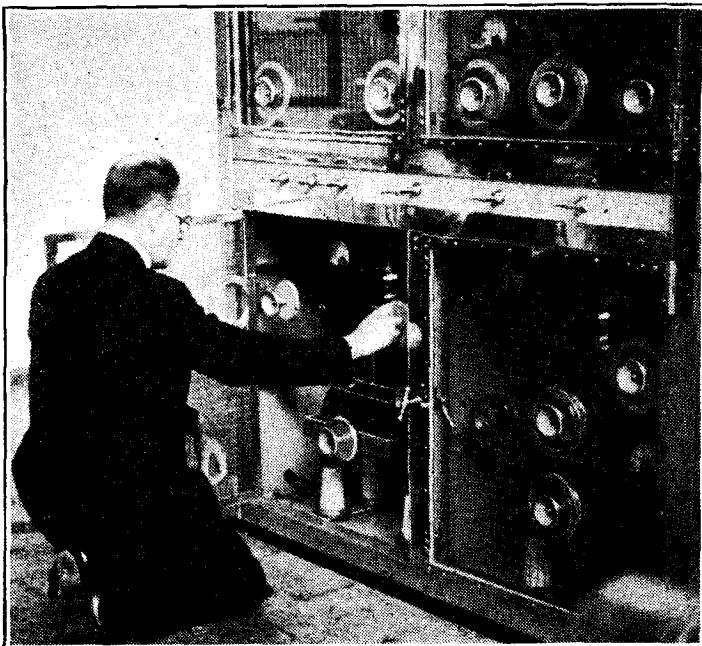
not run to that. In face of all the difficulties, it seems to me that the engineers have done all they can for Scotland except, as I said last week, that there should be a National transmitter at Burghead as well as a Regional.

The deficiency of Droitwich is illustrated by the fact that at Falkirk a receiver, with directional aerial, has been installed (similar to Aberdeen's) for emergency relaying of the long-wave National in case of landline failure. The directional equipment is necessitated by Continental interference.

### An Ideal Record

Apart from this equipment, Engineer-in-Charge Bird told me that there has been no serious change at this station since he came here at its birth, four years ago. A life without incident: the ideal record of a good wireless station!

The headquarters of Scottish broadcasting, in Edinburgh, is a venerable and dignified grey building, flaunting a B.B.C. flag. As I passed inside, the sound of cold chisels met me and I beheld a scene of devastation. Improvements are afoot,



Mr. Bird, engineer-in-charge at Falkirk, adjusts a neutrodyne condenser in the drive stage of "A" unit.

# Serve Britain ?

## OF INVESTIGATION

including the provision of a new talks studio. This will make five altogether, the others being a small drama studio, effects, a tiny room with twin turntables for gramophone recitals and talks, and the huge "No. 1," lately remodelled acoustically. The felt-over-plaster has been torn away and the walls re-covered with building board. Result: a brighter acoustic.

Best of all, Mr. Ian Whyte (Scottish Music Director) now has an orchestra worth putting into this magnificent studio, for the old "nonet" has just been increased to 35 players. Here, as in England, Regional broadcasting is gaining strength—yet I noticed that the amount of actual Scots material on the Scottish Regional wavelength is very much less than the "50 to 70 per cent." which, I remember, the local officials were promising when I was here four years ago, when they were planning the Regional scheme.

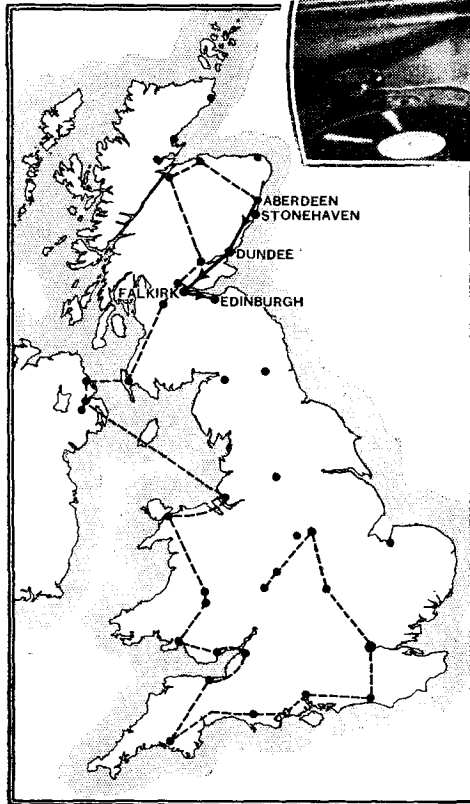


A touch of realism in the Scottish Children's Hour.

On this point Mr. Andrew Stewart, the Scottish Programme Director, said to me:—

"Our business is to mirror Scottish life and character—that doesn't mean an all-Scots programme, for *the Scot was a good European before the Englishman*, so I make a point of relaying from London

Mr. Adrian Thomson, announcer, conducts a gramophone recital.

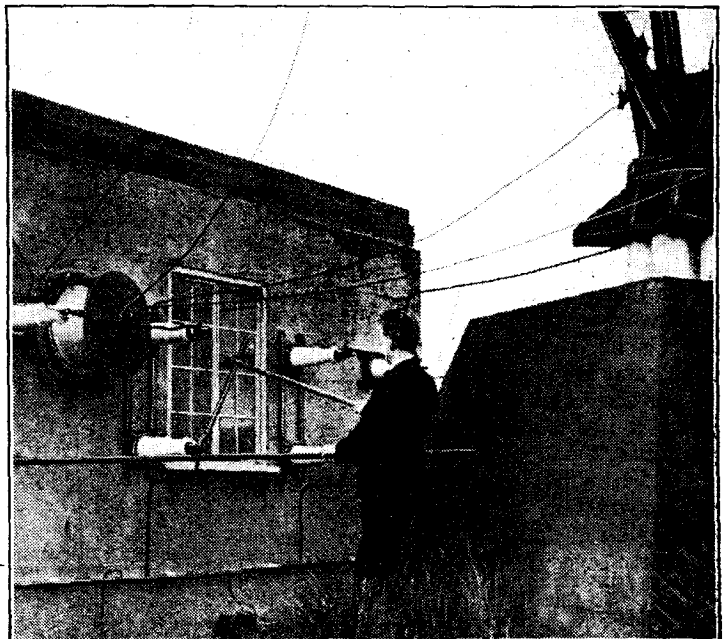


The map shows the ground already covered by Mr. Baily in his "radio tour."

Regional the more cosmopolitan material. "There are going to be important developments in our programmes," Mr. Stewart continued, "as a result of our acquisition shortly of a recording van. This will overcome the difficulties of communication which face us in Scotland in broadcasting from the outlying areas, often miles away from the nearest landline. We shall take the van to the Hebrides, for instance. We shall link up all the most colourful parts of this country."

There are some respects in which the Scottish Regional extends its programme activities beyond the limits in other Regions. They have.

Scottish Regional "starts up." Unearthing the aerial.



for instance, their own broadcasts to schools. Cultural purposes apart, one reason for this may be that Scottish children, or some of them, find it difficult to understand the speech of certain of our English speakers to schools! I heard of schools where the South of England dialect of some London broadcasters was quite incomprehensible to the unfortunate scholars.

And in Aberdeen, by the way, a listener told me he could never see anything to smile about in Mabel Constanduros (in naming her he obviously meant all Cockney humorists). Which shows what a job the B.B.C. has to serve Britain. However, to return to Edinburgh.

### A Tattoo of Chisels

Escorted by Mr. George Burnett, the B.B.C.'s Public Relations Officer in Scotland, I proceeded along passages ringing with the tattoo of chisels to the D.C. Room, pausing there to watch Drama Producer Gordon Gildard twisting the knobs of a nice modern control panel; then climbed stairs while Burnett remarked that the staff in this building totals 66, and only one is not Scottish—

**Does Broadcasting Serve Britain?—**

and so to the Control Room, with its standardised equipment, under the care of 15 engineers led by Mr. J. A. Beveridge, one of the real old-stagers, who has been Engineer-in-Charge at Edinburgh ever since there was Edinburgh broadcasting. At last we came to the Regional Director's Office.

Mr. Melville Dinwiddie came to broadcasting from the Church two years ago. On his mantelshelf stands a portrait of Sir John Reith. Against the far wall is an immense map of Scotland, on which the Regional Director traced out for me the motor tours he has been making, not only to survey the radio potentialities of Scotland, but to get into close contact with listeners. He has brought back some most interesting facts about radio-listening in the far-scattered isles off the stormy coast of Scotland.

"On Iona," said Mr. Dinwiddie, "I was told that everyone has a wireless set. The teacher at Fair Island, between the Orkneys and Shetlands, told me that they depend on their loudspeakers for everything—news, entertainment, religion.

"In winter such isolated places don't get newspapers for weeks on end; that is why, every Friday, we announce on Scottish Regional the National programme for Sunday, Monday, and Tuesday—because they get their *Radio Times* several days late."

**Untouched Material**

I remarked that, pending the advent of the recording van or the provision of a studio at Inverness, broadcasters from the Orkneys and Shetlands have to be brought right down to the Aberdeen studios. Mr. Dinwiddie agreed, and added that any amount of untouched material awaits exploitation.

"Those Isles," he said, "teem with tradition, are full of interesting customs. Did you see the film 'Man of Aran'? In Scotland we have every kind of life—industrial, agricultural, depressed areas, prosperous areas, fishing communities, sheep farming, mountains—and we have three languages, braid Scots, Gaelic, and the Scottish dialects, which give infinite variety."

Recalling the appointment of Mr. MacPhee as Gaelic Assistant at the Aberdeen studios, I queried the place of Gaelic in the programme, for I had heard people in the cities (where the sound of Gaelic is not) speak with scorn of the Gaelic broadcast features.

"Gaelic," replied Mr. Dinwiddie, "is a cultural language with a great tradition in our song and poetry and romance. As such, it has a definite place in our programmes."

Of future policy, he said: "We shall see progress in feature programmes reflecting Scottish life. But progress must be along every line of development. I personally am naturally interested in religion, but I am also keen to develop the entertainment side."

So I left Mr. Dinwiddie, and Scotland. My tour in Scotland, both through the contacts it brought with B.B.C. officials (as keen a bunch as you'll find anywhere), and through the renewal of acquaintance with a country I admire immensely, impressed me very much with the endless purposes to which the microphone can be put to tell the story of such a historic, such an individualistic, country. I look forward to the results of the energetic drive in that direction.

But that is not enough. There is Mr. Dinwiddie's reference to the "entertainment side." It would be interesting to learn from qualified observers resident in Scotland whether there is, as I suspect, a paucity of entertainment talent of good standard in Scotland, particularly in the realm of variety. One trusts that the Scottish Regional staff's very natural enthusiasm for "reflecting Scotland" through feature programmes will proceed alongside equal enthusiasm to discover entertainers, to "groom" them if they are not good enough, and to present them with up-to-date showmanship, the technical facilities for which are now at the service of producers in the Scottish studios.

*Next Tour: Across the Border to Newcastle.*

## Random Radiations

By "DIALLIST"

**At It Again!**

HERE is a little gem from a book by an eminent author: "Imperial (Airways) pilots are the only ones who use radiotelephony. The others use wireless."

**Opportunities Not to be Lost**

IN a letter that I have just had from him, a young relative of mine stationed in Northern India tells me with pride that he has bought himself a wireless set to help while away the time in a lonely spot. So far so good. But it was with some regret that I read that he had had to buy an American receiver, since no suitable instrument of British manufacture was available. It had to be an all-wave set, for the Empire and other short-wave programmes form no small part of the entertainment receivable. It was necessary also that it should be able to withstand big variations in temperature and difficult climatic conditions. The American set was the only one on offer which filled the bill.

There's a big market awaiting our manufacturers in India as well as in other parts of the Empire if only they will awaken to the fact. India now has several broadcasting stations of her own, and interest in wireless is rapidly increasing amongst the native population as well as amongst British people who are living in the country. Further, there is electric lighting in many of the larger towns, and the development of grid systems is extending supplies to the

smaller towns and even to villages. As India contains nearly one-fifth of the entire population of the world, the country surely offers a market that should not be neglected.

**This Dance Band Business**

THOUGH I am sorry that Mr. Jack Payne and the B.B.C. have decided to part brass rags, I can't help feeling that the latter took the right line in the recent dispute. After all, the B.B.C.'s funds are limited, and they can pay any turn only what they estimate to be its worth from the entertainment point of view. For many years the standard fee for late night dance bands has been forty guineas for the hour and twenty-five minutes between 10.35 and midnight, and Mr. Payne knew the figure when he applied for his band to be placed on the list. It would be folly for the authorities to pay heavily for a broadcast which is received by a comparatively small proportion of listeners, and I believe that those who tune in the late dance music are not nowadays very numerous. There is no means of telling how many receiving sets are in use at any particular time, but a pretty good idea of the popularity or otherwise of any item can be obtained from the load readings of the relay companies. I understand that these show a heavy fall after 11 p.m.

**Is Dance Music Popular?**

That there is such a fall does not necessarily prove that dance music is not popular; it might just as well be taken as showing that 11 o'clock is bedtime for the majority of listeners. I do, though, find in discussing broadcasting topics with people here, there and everywhere that dance music is not so welcome as once it was. Another comment that I frequently hear is that if dance music is broadcast every week-night by both Droitwich and the Regionals between 11 o'clock and midnight there might well be an alternative programme from the "little" Nationals. There is something in this, though many people would oppose the suggestion, since the fact that the medium-wave Nationals are silent usually for the hour before midnight gives listeners who live in "swamp" areas a chance to use their sets for the reception of foreign stations.

**A Voice from the Air**

ROYAL Air Force detachments on duty in the North-West Frontier Province have found an even better way of dealing with unruly tribesmen on the warpath than bombing them from aloft. Some time ago a wireless enthusiast fitted his 'plane with a hook-up microphone-cum-amplifier-cum-loud-speaker, and tried the effect of broadcasting verbal warnings in the local language as he flew over the villages. It worked like a charm, for the warriors heard the Great Voice from the Skies with superstitious awe, regarding it as something supernatural. So good were the results, in fact, that Vickers-Valentia aeroplanes have been specially fitted with microphones, amplifiers and twin loud-speakers of large size built in to the lower part of the fuselage. Other machines similarly equipped are to be used not only on the North-West Frontier, but also in other places where the Air Force has to deal from time to time with spots of bother. Many valuable lives will be saved, and once more the wireless valve shows its usefulness to humanity.

# The Petoscope

## A NEW DETECTOR OF MOVING OBJECTS

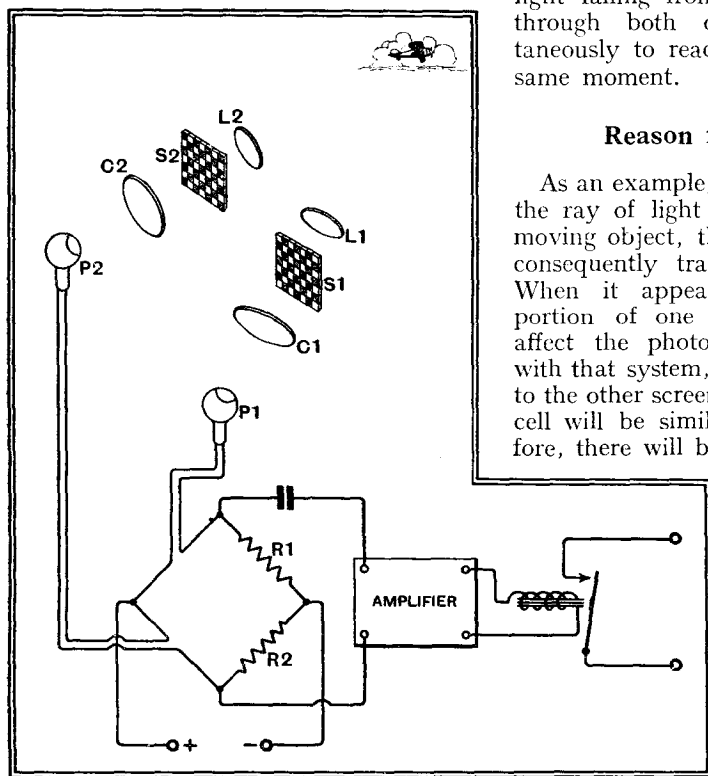
By E. S. LANCASTER

THE photo-electric cell has been applied in many ways and to various uses industrially and commercially, and the number of purposes to which this cell can be put still appears to be by no means exhausted. An interesting adaptation of it is a new instrument named the "Petoscope."

This apparatus employs a somewhat unusual method of applying the photo-cell, no local light source being necessary. It can be employed quite successfully in daylight, and it also has a wider field of vision than that of the normal photo-electric cell which, having a restricted field, might be likened to a person viewing an object through a pipe.

### Like a Camera

The apparatus can be directed towards any scene in the same manner as one can employ an ordinary camera. It is extremely sensitive, and its sensitivity is greater than that of the ordinary light beam apparatus, whilst its essential feature is that it is responsive to objects in motion.



In Fig. 1 the general arrangements of the system employed in this instrument are shown. First of all a pair of lenses, L1 and L2 embrace a field of view in which is situated a moving object such as an aeroplane, a motor car or a person. These lenses throw an image on to each of the screens, S1 and S2, which are situ-

ated in the camera device behind. A photograph of the camera with its amplifier is shown in Fig. 2.

These screens are divided into small squares, alternatively opaque and transparent. An interesting feature is, however, that although so divided the screens have opposite characteristics. Each square which is opaque on the one screen would be transparent on the other. Suppose, for example, the square in the left-hand top corner of screen S1 was opaque, then upon screen S2 it would be transparent, or *vice versa*, so that although we have light falling upon the objective lenses and being transmitted in duplicate as far as the screens, when this light reaches the screens in one instance it falls upon an opaque portion, and in the other case that of a transparent portion of the screen. The light passing through the screens then reaches the condensing lenses C1 and C2 and thence the photo-electric cell. So we see that light falling from any area cannot pass through both of the screens simultaneously to reach the photo-cells at the same moment.

### Reason for Duplication

As an example, if the point from which the ray of light is derived is part of a moving object, the duplicate images will consequently travel across the screens. When it appears on the transparent portion of one screen it will therefore affect the photo-electric cell associated with that system, and as it travels across to the other screen the other photo-electric cell will be similarly actuated. Therefore, there will be a series of alternations taking place between the two photo-electric cells, due to the variations in the intensity of the light falling upon each of

Fig. 1.—Schematic diagram of the locating equipment.

them in turn. The speed of the alternations will depend upon the size and number of divisions on the screens and the distance of the object from the apparatus. If there is no appreciable movement in the field of vision the light falling upon the two cells will consequently be the same, so that a variation in the relative

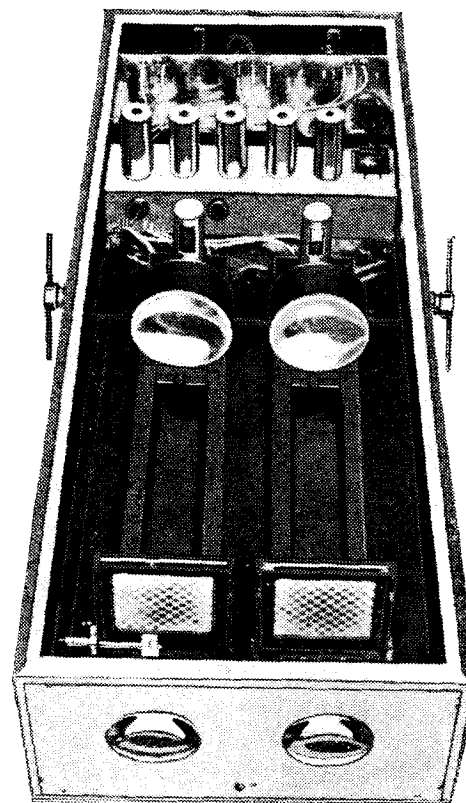


Fig 2.—Photograph of the "Petoscope."

intensity of daylight due to cloud, light and shade will not have any appreciable effect on the photo-cells.

By connecting the photo-cells in a bridge circuit as shown in Fig. 1, and coupling them to an amplifier, a variation in the quantity of light received by the two photo-cells, when focused upon some moving object in the field of vision, will occur. This variation will unbalance the bridge arrangement and will consequently cause a fluctuating out-of-balance voltage to affect the amplifier.

### Standard Amplifier

This amplifier is quite a normal arrangement, employing four stages, resistance capacity coupled, followed by a fifth stage employing a power valve. A sensitive relay is connected in the anode circuit of this valve which can be employed to operate a bell, electric horn, or other device.

An account of the performance of the "Petoscope" is given in a recent issue of *Electronics*. In actual practice it was found that the "Petoscope" would detect persons walking at a distance of approximately 50 yards from it and a motor car at about 100 yards. It has an angle of vision of approximately 25 degrees, and it can be mounted on a tripod so that it can be tilted upwards or in the required direction with ease.

There is no doubt that this instrument, which has been developed in America by Messrs. H. A. Little and Lewis Bremer, possesses interesting potentialities. It should be suitable for use in the timing of aircraft or motor cars, and it is also interesting to note that it can be employed in connection with infra-red rays if necessary.



# UNBIASED

## Outwitting an Aunt

ALTHOUGH the set manufacturers' passion for the carpet-beater type of set—all bass-thump and very little else—is decidedly abating, there are still specimens of this type of receiver in otherwise respectable households. This I discovered recently when called in as a consultant by a radio doctor whose client wanted help in a matter of very peculiar difficulty.

It appeared that the client in question lived next door to a particularly cantankerous aunt who owned one of these obnoxious receivers. Although the houses in the district were old and substantial and not of the modern type in

## By FREE GRID

which the builders have to take care not to remove the scaffolding until the wall-paper is on, the thumping still penetrated to his house and kept the children awake at night. This carpet-beating was, in fact, the only sound that *did* penetrate, the remainder of the music being quite inaudible, with the result that a very weird and ghostly effect was produced.

The obvious course was for the sufferer to speak to his aunt about it and induce her to buy an up-to-date set, but, as he explained, in the first place her cantankerous nature was such that she certainly would not change the set even if she were asked to do so, and in the second place, he had expectations from her and did not wish to run the risk of giving offence. I suggested that he present her with an up-to-date set without disclosing the true reason for the gift. He quickly pointed out, however, that she would immediately say that if he could afford to do this he had no need of any legacy from her, and would probably alter her will in favour of the Cats' Home.

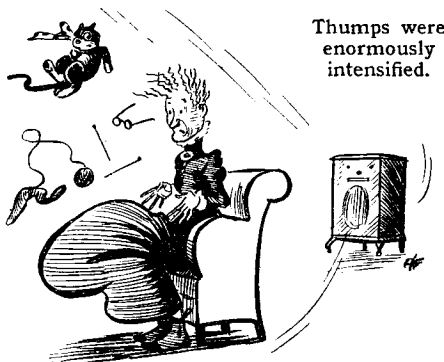
There was, therefore, nothing for it but for me to bring science to bear upon the problem and rescue him from his unfortunate predicament. I at first suggested that he install an ordinary violet-ray outfit and use it to interrupt the good lady's reception with excessive interference, thus leading her to believe that the set had gone wrong. My friend, the radio doctor, could, I added, arrange for a circular, pointing out the advantages of a 1936 set, to reach her on the day that the interference commenced.

I pointed out that it is quite easy to regulate the "range" of these devices so that more distant neighbours are not seriously affected, but the foolish fellow would have none of it on the puerile grounds that it would interfere with his own reception, he having fallen into the reprehensible practice of listening-in in

bed with headphones, a habit which, to my mind, is only a shade less indefensible than smoking in bed.

I had no option, therefore, but to prepare something more elaborate. Eventually I rigged up an HF oscillator radiating on the wavelength of the station being received by the carpet-beater next door. This oscillator was modulated by an audio-oscillator to a deep bass note corresponding to the thumps complained of. This apparatus was just prevented from doing its stuff by a little dose of over-bias, but included in the bias circuit was a special device comprising a microphone associated with a special audio-frequency circuit which resonated to the thumps.

The result was that the thumps automatically set the apparatus in action and appeared in greatly magnified form in the good lady's loud speaker. No actual sound was emitted by the apparatus itself, of course, so it was not a case of its giving a continuous roar once it started, like an ordinary acoustic feed-back effect.

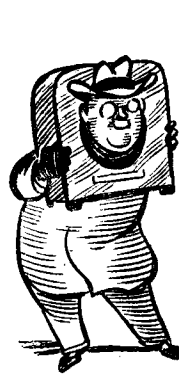


The effect of this was that the thumps from the good lady's set were so enormously intensified by my little device that eventually complaints were received by her from the contractor who was erecting a steel-framed building nearby to the effect that his riveters could not hear themselves speak. Eventually she was compelled to yield to *force majeure*.

## Pup Included

IT appears from reports that have reached me that, as in the case of other commodities, the general public indulge in an orgy of buying just before Christmas and then wantonly forbear to keep up the pace in January, to the great financial embarrassment of shopkeepers.

Some genius, however, solved the problem by inventing the January Sale, in which the public naively suppose that they can get things cheaper than at other times. Unfortunately, however, radio manufacturers find it quite impossible to lower their dignity by having an annual



Trained to attack on sight.



Sale, and for some time past the wolf has appeared very near the humble cottage of the set-maker during January.

Things got so bad, in fact, that something simply had to be done about it, and a truly amazing plan has just come to my ears for increasing the sale of wireless sets, not only during the present January, but for all time. The germ of the idea arose from a news report which came from Marseilles some months ago telling how a listener's dog, angered at the sound of another member of his tribe barking in the studio of a broadcasting company, flew at and demolished his master's set.

All through the past few weeks the radio manufacturers, in association with the dog fanciers, have been busily evolving a new breed of dog having an innate antipathy to the barking of their fellows, and great efforts were made to induce the B.B.C. to co-operate by including a canine broadcast in each programme. But I am pleased to report that the Corporation maintained that lofty moral tone for which they have always been notorious, and declined to have anything to do with the sordid business.

## A Secret Date

The United Dog and Radio Receiver Breeding Association (hereinafter referred to as the U.D.R.R.B.A.), apparently took umbrage at this and resolved to adopt much stronger methods than they had at first contemplated. The newly bred pups are, therefore, being intensively trained to attack a wireless receiver on sight. The purchaser of each receiver, after a certain date in January, is to be presented with one of the pups.

The anticipated result is the wholesale destruction of wireless sets all over the country, thus necessitating their replacement and enabling the manufacturer to soften his dry crust with a little margarine. The Exchequer will, of course, benefit from the sale of dog licences.

The beauty of the idea is that the benefits will be permanent, since the new set will naturally share the same fate as the other, and thus further renewal will be necessary, and the process will, of course, go on *ad infinitum*. It is realised, of course, that, just as in the case of human beings, dogs are liable to succumb eventually to sickness and old age apart from the destructive effects of condensers and transformers on their teeth, and arrangements are being made, therefore, to renew worn-out dogs free of charge.

# Inventions and Inventors

## Not-so-Bright Ideas—and Their Probable Fate

By "CATHODE RAY"

**D**URING the last dozen years it has fallen to me to investigate the merits of scores of inventions put forward with a view to manufacture. The inventions are very diverse, but the inventors have much in common. They are all sublimely confident that their invention is what the world is waiting for—if the world only knew it. They are also convinced that the entire industry has entered into an unholy alliance to preserve its outworn and obsolete methods from violation by Progress, and so to impede and thwart her ambassador, the struggling inventor; or, alternatively, to filch from him the fruits of his toil and defraud him of its just reward.

These impressions, however unjustified, are quite easy to explain. First, in my experience—which I gather is not altogether remarkable in this respect—not one of the inventions put forward has been acceptable. I shall explain why in a minute. But the inventor has been devoting himself so intently to his own particular joy and pride that the possibility of any genuine objection to it may have escaped his attention. No wonder, then, that the indifference or disparagement of vested interests takes on a sinister significance in his sight.

But there is more than inertia or professional jealousy to account for the discouragement the inventor so often has to face. In the first place, nobody can be expected to pay him for ideas that are not original. The Preacher of Ecclesiastes has said, "There is no new thing under the sun. Is there any thing whereof it may be said, See, this is new? It hath been already of old time, which was before us." While that dictum may be a trifle sweeping, it is astonishingly true. A genuinely original idea is one of the rarest things.

The number of completed patents in this country alone is in the neighbourhood of a million (can you visualise a million?). There are many more schemes that cannot be patented because they were disclosed in books or papers. Even the professional expert in some specialised subject finds it incredibly difficult to draw up a patent which is not overlapped, or perhaps entirely anticipated, by another. Almost certainly the majority of accepted patents could be invalidated by making a sufficiently exhaustive search. The amateur who hits on something new is either abnormally brilliant or abnormally lucky. For one thing, few amateurs have the time or opportunity to acquaint themselves with what other people have been doing all over the world.

Another reason why bright ideas are often turned down by the business man within about 0.1 second is that they are completely mad. It has been well said

that the boundary between genius and lunacy is very narrow. In my opinion it is sometimes non-existent.

I wish I had kept a note of the funnier ones that have appeared. One inventor succeeded in persuading a prominent, but entirely non-technical, public man to advance the money for a radio manufacturer to make up the subsidiary apparatus for his device, which was enclosed in a mysterious sealed box with four terminals. The money was good, so the manufacturer carried out the job, looking forward with interest to the "showdown." The great day arrived for the mysterious box to be connected up to the corresponding terminals on the apparatus. But to avoid risk of short-circuits the manufacturer had to have some idea of the impedance across the terminals. The inventor was reluctant; but when pressed he asked leave to go out of the room to make an adjustment to his box. He never returned . . .

### Foredoomed to Failure

Then there was the marvellous loud speaker modelled on the lines of the Mexican hat. And the high-definition television system depending on a chain of massive mechanical relays. And the radio road-accident preventer, to be installed in all cars, which made a loud noise on coming within a specified distance of any other car. The poor pedestrian seemed to be left out of account, as usual.

Some proposals are basically sane, and perhaps even do their job creditably. But there are other things to be considered before embarking on manufacture. Is it reasonably cheap? Is it at least as simple and reliable as existing methods? Is it as light, as compact, as strong, as good-looking? Does it appeal to the market as a whole, or only to a section? Has it any substantial asset beyond the ingenuity

or labour expended on it by its inventor? Is it capable of rapid and economical production? A device may be ever so admirable in all other respects, and yet be thrown out because it involves an impossible piece of bakelite moulding or the machining of aluminium-nickel magnetic alloy.

So much for the disappointed inventor. Then there is the suspicious inventor. He is the sort who comes forward with a glowing account of the capabilities of his scheme and expects large bags of gold to be eagerly exchanged for it, if only to prevent such a marvel falling into the hands of rivals!

"What exactly is it?"

Do you think he is going to reveal the particulars and then have the invention exploited without reward or acknowledgment? No, Sir! he knows the wicked world too well for that! Isn't it enough to know that it is an entirely new sort of wireless receiver, proves all accepted theories to be entirely wrong, is 169 per cent. more efficient than any other, is 56 per cent. more selective, uses no valves, and works off AC or DC of any voltage?

Finally—and what more proof of the genuineness and value could one wish?—*it is provisionally patented!* Surely it is only a face hardened by unscrupulous duplicity that can remain unmoved by this disclosure! Or perhaps it is because its owner knows—and the inventor evidently doesn't—that a "provisional patent" can be obtained for absolutely anything so long as it is lodged on the prescribed form and accompanied by the statutory fee!

Blessed is the inventor who expecteth no reward, for he shall not be disappointed!

## TUNING-IN

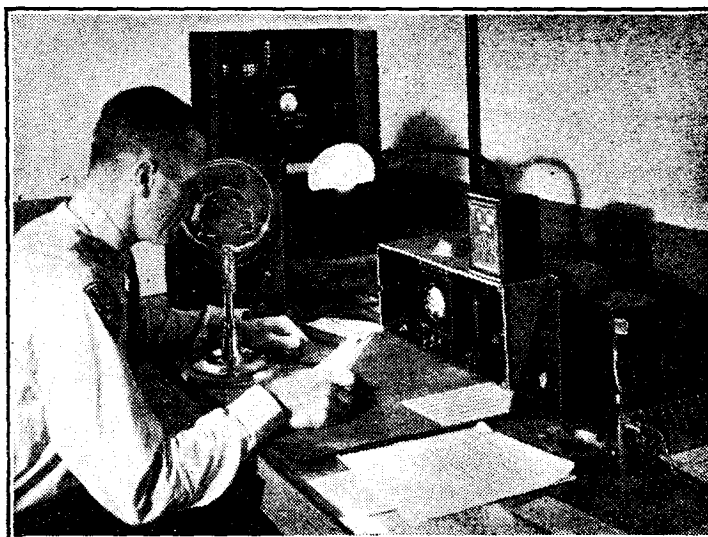
### AMERICAN POLICE CALLS

**W**ITH regard to the note in our last issue by "R. H. McC." on his 10-metre reception of American police calls from stations in Newark, Hartford and elsewhere, a letter has now been received from Mr. Garrett J. Farrell, Chief of Police at Hartford, Connecticut, confirming our contributor's reception of the Hartford station, W1XHC (not W1XAC, as formerly stated), and sending transmitter details.

The transmissions are on a frequency of 30,100 kilocycles with a power of 150 watts in a vertical aerial 300ft. high. The maximum ground-wave range when working to patrol cars is in the region of 18 to 20 miles, but within the City of Hartford the average signal is at least 10 decibels above noise level.

W2XEN, the station of the Newark, New Jersey, police, operates on the same frequency but with a power of 500 watts.

The photograph was taken in the office of the station chief at Newark.





# Listeners' C

## Outstanding Bro

especially—are authoritative. He has found time to compose eight operas, five symphonies, many choral and orchestral pieces, and several volumes of songs. His literary work, too, is greatly valued, ranging from his book on conducting to an autobiography of distinctive charm. He is still principal conductor of the Vienna State Opera House.

### REAL OLD DEVONSHIRE

BRISTOL is contributing on Tuesday (Nat., 8) what may be the best dramatic broadcast of the week, with Jan Stewer in his original part of George Crowsell in his own play, "Barnet's Folly." This is a real old Devonshire comedy in which you can sniff the cream and cider in the very names of the characters—Hannah Mudge, Lucy Lannacott, and Sam Burrigge—as they weave and unravel the matrimonial tangles of Melston Farm.

### HIGH-SPEED PROGRAMME

THE "Romantic Young Ladies" are supporting Gerardo and his Orchestra in their programme of high-speed music on Monday (Nat., 8.30), so we may expect something quite out of the ordinary, more especially as the Top Hatters will also take part with Angela Parselles.

### CAFÉ COLETTE RETURNS

MANY listeners will feel that the event of the week is the return of the Café Colette Orchestra—that perfect musical hoax. Though the myth is exploded, and the Café Colette is known to have no more solid background of fact than the Equator or the Man in the Moon, we still relish the make-believe, hazard guesses as to the real appearance of the effervescent *maitre d'hotel*, and wonder whether Walford Hyden is a Jekyll and Hyde—genuine Continental and true-born Englishman.

They will be back there in the aromatic smoke-laden air of the Café at 7.30 on Thursday (Reg.), when the orchestra, supporting Cyril Lidington and Leo de Pokorny, will give the cream of dance music from the Continent and other parts of the world.

### SURPRISES FROM THE PAST

It is, I gather, to be an old-fashioned almanac of the past year that Laurence Gilliam is putting over on Sunday evening (Nat., 9.30) under the title, "Twelve Months Back." Not that the programme itself will be at all Victorian; 1935 was too exciting a year for such treatment. The intention is to mix art and reality in equal proportions. Original material has been written, but there will also be "shots" from last year's programmes which will be interweaved with actuality scenes and incidents which

"TWELVE MONTHS BACK" is the title of a retrospective programme on Sunday (Nat., 9.30), reviewing world activities and important broadcast events of 1935. Laurence Gilliam is the producer.

made 1935 one of the most historically distinctive years since the Great War.

It seems almost a paradox that the surprise element can be included in a programme ranging over the past, but I understand that Laurence Gilliam will have several startling episodes to offer us.

### ONE-STUDIO DRAMA

AN unusually brilliant cast has been assembled for Peter Cresswell's production of "Twelfth Night" on Sunday (Nat., 5.20). That great actress and comedienne, Irene Vanbrugh, will play the part of Maria, Viola and Sebastian will be played by Mary Hinton, while Jan van der Gucht will be heard as Feste. The jolly and immortal pair, Sir Andrew Aguecheek and Sir Toby Belch, will be played by Charles Heslop and Frederick Lloyd respectively.

Musical "scenery" will be used, an Elizabethan atmosphere being obtained by the playing of contemporary music only. We shall hear a consort of viols, recorders and lute, played by the members of the famous Dolmetsch family, Rudolf and Millicent, while Diana Poulton will perform on the lute. To strengthen the quiet and intimate atmosphere of the play it is to be given in one studio only.

### WEINGARTNER AT THE QUEEN'S HALL

WITHOUT being invidious we can say that the most attractive musical item of next week is the Royal Philharmonic Society's concert on Thursday (Reg., 8.15), conducted by Felix Weingartner and relayed from the Queen's Hall. It is a Brahms programme, including the Tragic Overture and the Symphony No. 3 in F.

Weingartner is looked up to all over Europe and America as one whose readings of the great classics—of Beethoven



PETER DAWSON, the popular baritone, has a programme to himself on Monday (Nat., 8). This cheery picture, taken in the H.M.V. studios, shows Peter Dawson at the "mike" with the Wireless Male Quartet and (on left) Leonard Henry.

# Guide for the Week

## roadcasts at Home and Abroad

### HIGHLIGHTS OF THE WEEK

FRIDAY, JANUARY 10th.

Nat., 8.15, Radio Play: "Jenny Meade," by Philip Wade. 10.20, B.B.C. Theatre Orchestra.

Reg., 8.30, "Floor Show": Carroll Gibbons and the Savoy Hotel Orpheans. 10, Promenade Concert, Part II.

Abroad.

Hilversum (301.5 m.), 7.55, Maastricht Municipal Orchestra.

SATURDAY, JANUARY 11th.

Nat., 7, Saturday Magazine. 8, Last Night of the "Proms." "Happy Week-end."

Reg., 8.30, Music Hall. "B.B.C. Orchestra.

Abroad.

Frankfurt, 7.10, Operetta: "Der arme Jonathan" (Millöcker).

SUNDAY, JANUARY 12th.

Nat., 12.30, Crystal Palace Band.

"Troise and his Mandoliers.

"Twelfth Night," 9.30,

"Twelve Months Back."

Reg., 5.30, B.B.C. Military Band.

"Recital by Megan Foster (soprano) and Lucille Wallace (harp-sichord). 10, Kodaly's Choral Music.

Abroad.

Leipzig, 7, "Under the Banner"—programme for Young German Soldiers.

MONDAY, JANUARY 13th.

Nat., 7.30, Plays of John Galsworthy—I., by Eric Gillet. 8.30, Geraldo and his Orchestra.

Reg., Fred Hartley and his Novelty Quintet. 8, "Barnet's Folly."

Abroad.

Deutschlandsender, 8, "Waltzes from Vienna."

TUESDAY, JANUARY 14th.

Nat., 8.15, "Barnet's Folly."

"B.B.C. Theatre Orchestra.

Reg., 8.15, Songs from the Shows: Noel Coward and Jerome Kern. 9.15, B.B.C. Orchestra, conducted by Sir Dan Godfrey.

Abroad.

Paris P.T.T., 8.30, "Molière and Music": French National Orchestra.

WEDNESDAY, JANUARY 15th.

Nat., 7.30, Songs from the Shows.

"Recital by Thibaud (violin) and Miriam Licette (soprano). 10, Nelson Keys in "The Little Show."

Reg., 8.5, Chopin Recital (from Warsaw). "Anona Winn and her Winners.

Abroad.

Königsberg, 11.5, "How to Build a Short-Wave Transmitter."

THURSDAY, JANUARY 16th.

Nat., 8.30, Comic Opera: Offenbach, Edward German, Hermann Finck. "Gershom Parkington Quintet.

Reg., 7.30, Return of the Café Colette Orchestra. 8.15, Weingartner conducts Royal Philharmonic Concert.

Abroad.

Stuttgart. 9.30, Singing Concert, commemorating composer's 80th birthday.

### HARDENED DEBATERS

THE sparks may be expected to fly at to-morrow's Unrehearsed Debate (Reg., 7.45) on "That a second Chamber is neither necessary nor desirable." Both the speakers—Harold J. Laski, proposing, and Robert J. G. Boothby, M.P., opposing—are hardened debaters with strong convictions on House of Lords reform and a purposeful manner in projecting those convictions. Sir Henry Bunbury is "referee"—and let us hope that the control room will not fade out the conflict before he blows the whistle.

### OPERA ABROAD

MOZART—beloved of the high- and low-brow alike—is represented in this week's opera programme by his "Idomeneo" from Bero-munster at 8.10 to-night (Friday). The composer thought very highly of this opera, which was originally intended for a carnival at Munich in 1781, but was



REGINALD KING, whose compositions will be featured in a programme by the Alfredo Campoli Trio on Thursday (Nat., 8).

eventually produced five years later by a company of distinguished amateurs in Vienna.

From Warsaw at 8.30 to-night comes "La Serva Pedrona," the popular operacomique by Pergolesi, who was only twenty-six when he died exactly two hundred years ago.

A rarely heard Saint-Saëns work, "Etienne Marcel," comes from Radio-Paris at 8.45 to-morrow (Saturday).



THE FLOWER MARKET, STRASBOURG. The Municipal Orchestra will broadcast a concert from the Palais des Fetes on Wednesday at 8.30. Marcelle Bunlet (soprano) is the soloist.

Another musical curiosity will be Mascagni's opera, "Nero," which is being relayed by Rome at 6.35 from the Carlo Felice Theatre, Genoa. Radio-Normandie completes the Saturday programmes with its 9 o'clock transmission of Ravel's "L'heure espagnole." A sparkling opera of the ultra-modern school—"L'echanson du roi d'Yvetot"—by Mathe—is in the Strasbourg programme for Sunday at 8.30.

A at 10.35, and to-morrow Brussels No. 2, at 10.10, offers Beethoven and Rachmaninov violin and pianoforte sonatas.

### OPERETTA

Two ever-popular light operettas: Strauss's "The Gipsy Baron" from Prague at 6.15 to-night (Friday), and Lehár's "Land of Smiles" in a concert version at 9 on Tuesday from Radio-Toulouse.

### PICTURES IN MUSIC

CAN images of famous paintings be translated into music? We can imagine that "colourable imitations" might be attempted in music of the bold and unrestrained canvases of a Rubens or even a Hogarth, but is it possible to reproduce in sound those quiet, almost commonplace domestic interiors of the old Dutch masters? This is to be attempted in the Königsberg programme at 8.10 on Wednesday, and the experiment should be distinctly interesting.

### SPECIAL ITEMS

SATURDAY, Cologne, 7.10: "Evening of Surprises."

Wednesday, Kalundborg, 8 p.m. to 1 a.m.: Radio Ball from Copenhagen restaurants.

Saturday, Stuttgart, 8.15: "Nothing but Wizardry"—Puppet play with music.

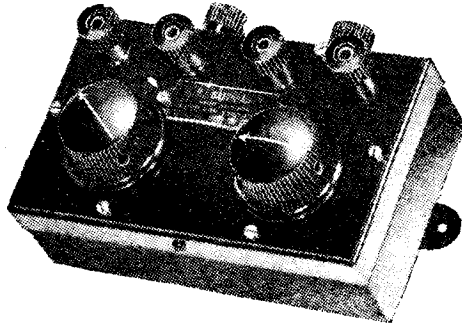
THE AUDITOR.

# New Apparatus Reviewed

## Recent Products of the Manufacturers

### M.R. GRAMO-MICROPHONE CONTROL UNIT

THIS instrument has been introduced by M.R. Supplies primarily for use with public address equipment, its functions be-



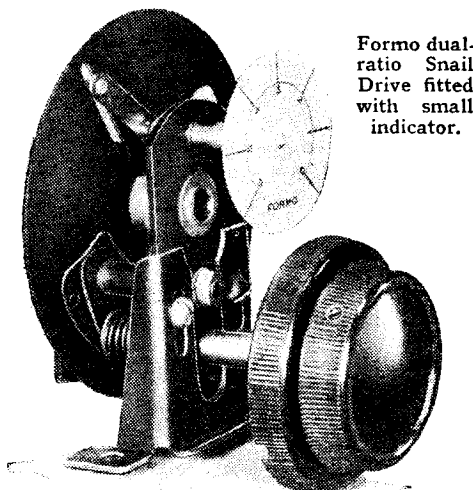
M.R. fading and mixing control unit.

ing an input fader and mixing control. It comprises two high-resistance volume controls mounted in a metal case and internally connected so that each acts as a volume control on one input line. The output is common to both input sources, so that by adjustment of the two volume controls either source can be utilised separately, or one superimposed on the other, or one can be faded out while the other is slowly brought up to full volume.

The input sources can be either radio, gramophone, or microphone, and any combination of two can be employed. The unit is neat and compact and costs 12s. 6d.

### FORMO REACTION SNAIL DRIVE

THE Snail Drive reduction mechanism made by Formo Products, Ltd., for use on ganged condensers is now available fitted with a miniature indicator disc that takes the place of the pointer and large dial. With this fitting the Snail Drive forms a particularly useful slow-motion control for



Formo dual-ratio Snail Drive fitted with small indicator.

the reaction condenser in a short-wave set. The dual ratio, of which one is virtually a vernier movement, is an added advantage.

The small indicator plate, actually it measures 1 1/4 in. in diameter, costs 6d., and the complete drive, as illustrated, 3s. 6d.

### B.T.H. "PEZOLECTRIC" PICK-UP

NOW that many sets are appearing in which the pick-up terminals are connected directly to the grid circuit of the output valve it is more than ever important to choose a pick-up with an adequate output. The B.T.H. "Pezolectric" model gives an ample reserve for this particular application, and, in addition, has an excellent characteristic with an output in the top which is maintained at frequencies well above those at which the majority of moving-iron pick-ups commence to cut off.

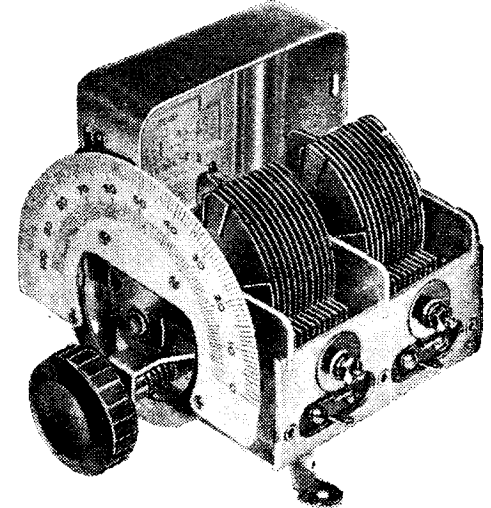
The movement is of the piezo-electric type and is very lightly damped, so that there is a complete absence of chatter at wide amplitudes and very low record wear.



B.T.H. "Pezolectric" pick-up.

Since the impedance of the crystal is mainly capacitative, a high-resistance volume control (500,000 ohms) must be used if the bass is not to be curtailed. Some correction for the slight excess bass response shown by the curve could, however, be introduced by using a volume control of lower resistance. The top end of the potentiometer, being in series with the pick-up at low volume settings, may result in some loss of top, but this can be corrected by connecting a con-

Pressed aluminium chassis are used, the material being of very heavy gauge and designed to withstand the stress encountered in normal use without distorting, so that these condensers should retain their matching. Rotor and stator vanes are assembled in die-cast holders, the former being fitted with a 1/4 in. steel shaft supported by brass end-bearings.



Telsen two-gang condenser with which is included a slow-motion drive.

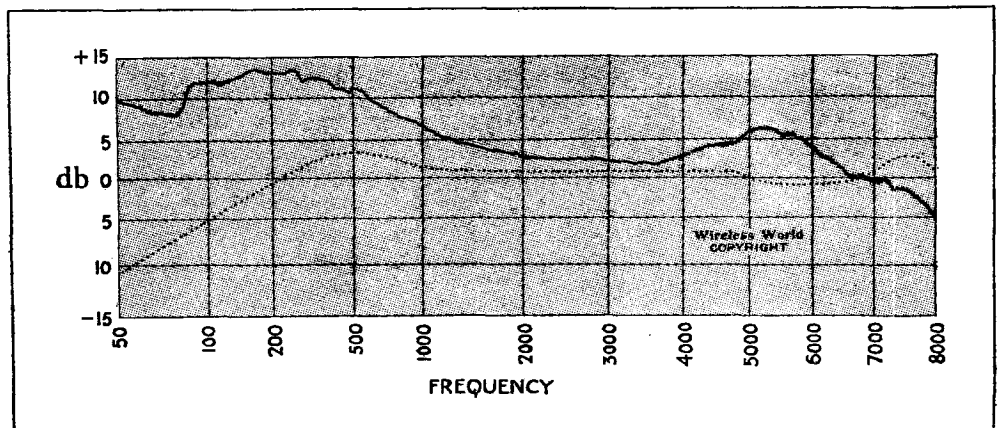
A useful feature of these condensers is that the rotor shaft extends beyond the back of the frame so that it would be possible to gang several units.

Measurements made with a specimen two-gang model are given in the accompanying

Scale.	Front section.	Rear section.	Percentage difference.
0	27 m-mfds.	27 m-mfds.	—
20	81 "	80 "	1.2
40	155 "	154 "	0.6
60	276 "	273 "	1.1
80	396 "	393 "	0.75
100	534 "	528 "	1.1

table, from which it will be seen that the greatest discrepancy in the capacities of the two sections was but 1.2 per cent.

Small trimmers are fitted to each section,



Automatic record of output from B.T.H. "Pezolectric" pick-up shunted by 500,000 ohms and using H.M.V. loud tone needle. The dotted curve is the characteristic of the standard frequency record used for the test, and 0 db. on the vertical scale is equivalent to 1 volt RMS.

denser of 0.005 to 0.01 mfd. between the slider and the top end of the resistance.

The pick-up is issued by the Edison Swan Electric Co., Ltd., and the price is 42s.

### TELSEN GANGED CONDENSERS

TELSEN ganged condensers are made in twin and triple types with each section having a nominal capacity of 0.005 mfds.

and these afforded a variation of approximately 60 m-mfds. Connection to the fixed vanes can be made from either side of the frame.

This model is supplied with a 0-100 division scale, panel escutcheon and slow-motion drive having a ratio of 6 to 1, also a dial lampholder; it costs 9s. 6d. and the triple-gang model 14s.



# New Constant-Current Device

## BARRETTTER WITH A SEPARATE HEATING ELEMENT

By T. A. LEDWARD, Assoc.I.E.E.

*AN ingenious method of maintaining current in a circuit at a sensibly constant value, even when the voltage of the supply is fluctuating over wide limits.*

**V**ARIOUS types of apparatus have been devised for maintaining a constant current in a circuit when the supply voltage is varying. The type of apparatus best suited to given conditions is determined principally by the amount of power to be dealt with. For heavy power work low losses are essential, and expensive apparatus is justified, but for very small currents, such as those encountered in instrument work, simplicity and cost are usually of prime importance. For this class of work the barretter is the most widely used constant-current device.

The barretter, in its usual form, comprises a wire or strip of iron mounted in a glass bulb filled with hydrogen gas. The

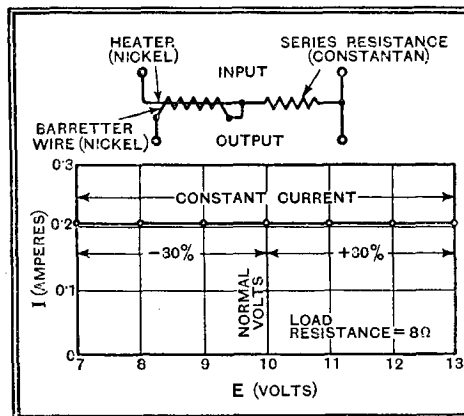
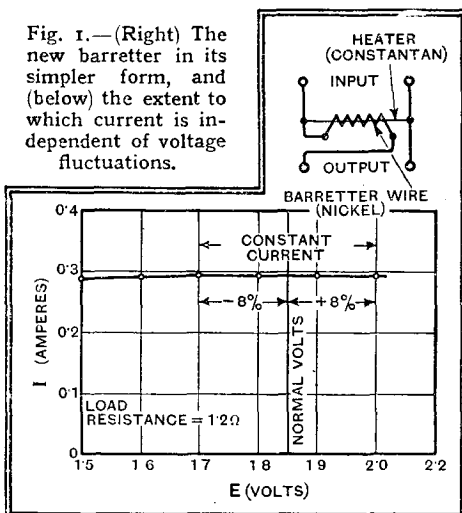


Fig. 2.—A slightly more elaborate barretter embodying the principle shown in Fig. 1. As indicated by the graph, constant current is maintained over a much wider range of voltage variations.

Fig. 1.—(Right) The new barretter in its simpler form, and (below) the extent to which current is independent of voltage fluctuations.



resistance of the iron increases very rapidly with increase of temperature, and this is determined by the current, so that if the barretter is connected in series with any apparatus the current does not vary in proportion to the voltage. In fact, the current may be almost constant over a fairly wide voltage range. It is clear, however, that the current must increase slightly to produce an increase of temperature, and so the current cannot remain absolutely constant.

It was with the object of overcoming this disability of the ordinary barretter that the apparatus to be described was devised. If an ordinary barretter wire of iron or nickel, either substance giving a large variation of resistance with variation of temperature, is provided with a separate heater, as in Fig. 1, and this heater is connected directly across the supply voltage, then a variation of the tempera-

ture of the barretter wire may be produced without variation of current in this wire, and by suitably proportioning the heater and barretter wire the current may be made to remain constant over a limited range of voltage. The graph shows results obtained with an arrangement of this type. Improved results, giving control over a wider voltage range, may be obtained with the slightly more elaborate arrangement shown in Fig. 2. In this arrangement the heater also is of iron or nickel, but there is a series resistance of constantan or similar substance having a very low temperature coefficient of resistance. By this means the variation of the heater temperature for a given voltage variation is increased and the result is a higher efficiency and wider range of control. The control exercised by this arrangement is shown in the accompanying graph.

Where the supply is alternating current a choke may be substituted for the series resistance and the losses thereby reduced. The control effect is further increased by running the choke near to saturation. This, however, is only per-

missible where the waveform is not of importance, as the saturated choke introduces a pronounced third-harmonic content into the output.

Fig. 3 shows a section through an actual model made on the principle described. It is of interest to note that this apparatus does not require an atmosphere of hydrogen, the results shown in the graphs being obtained in air. Hydrogen will, however, increase the load-handling capacity of a given size of element, but increases the time of response to a given voltage change. Another point of interest is that by suitably proportioning the elements a falling current may be obtained with a rising voltage if required.

## At the Transmitting End

### Technical Criticisms of Recent Broadcasts

#### The Piano-gram

It was unfortunate for listeners that the piano was chosen for the gramophone recital of December 27th in the Regional programme, for the piano is, perhaps, the most difficult of all instruments to reproduce realistically from a record. Of the half-dozen or so played in that half-hour, not one was worthy of serious consideration as a musical entertainment because of the bad quality.

We have long been accustomed to surface noise, regarding it largely as a necessary evil to be borne with patience, but in this particular broadcast it was more than usually prominent and was, indeed, emphasised still further at times by the very obvious manually operated gain control which was used to bring up the level on most of the quiet passages. This control, in itself, is both unnecessary and wrong, for, although it might be tolerable in microphone work, it serves no useful purpose with a gramophone transmission.

#### Broken Notes

No comparison can be made with any studio piano recitals, for I have yet to hear such an outrageous number of cracked and broken notes transmitted via the microphone. The breaking-up was so severe that I switched over to the National programme on one occasion as a check, only to find that each of my three speech coils were still central and that the transmission was to blame.

This bad quality cannot wholly be laid at the door of the recording companies. Records are not perfect, but I fancy that better quality and clarity could be obtained from a good acoustic machine than we were offered on this occasion, and I suggest that some improvement would have resulted if more care in the selection of pick-up had been exercised.

H. C. H.

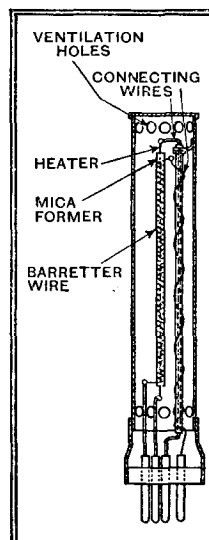


Fig. 3.—Construction of the "series-parallel" barretter.

# Readers' Problems

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers.

Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

## An Unreliable "Earth"

AS most readers are aware, domestic electrical "outlets" are often provided with three sockets; the third socket is intended to be earthed in order that the casing, etc., of portable electrical appliances may be joined to earth as a safety measure.

At first sight this third socket might seem to offer a convenient earthing point for a receiver, but we do not consider that it is desirable to use it for this purpose. Writing on the subject, a querist asks us to suggest the reason why it makes no difference to the working of his receiver whether the earth terminal is left entirely free or connected to the earthing socket of his wall "point."

There are two possible explanations for this. It may be that the set is already moderately well earthed through its connection to the mains, and that nothing is added to the efficiency of the earthing system by the extra connection. Again, there is the possibility—by no means a remote one in our experience—that the earth socket on the wall fitting has not been wired to anything! It would be worth while to investigate.

## An Erratic Contact

IT is not always possible to offer definite advice to querists who have encountered HF instability, but here is a case which seems to be an exception to the rule.

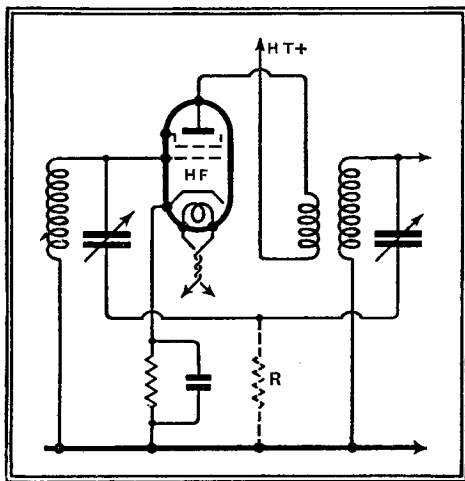


Fig. 1.—Showing why a high-resistance contact between ganged condensers and earth may cause instability.

Briefly, our correspondent's trouble is that uncontrollable self-oscillation manifests itself at all tuning positions of his "2 HF" receiver, but stability can be restored by pressing firmly on the casing of the ganged tuning condenser.

This proves as conclusively as need be that our old enemy—high-resistance contact between the frame of the condenser and the chassis—is responsible. What is happening is illustrated diagrammatically in

Fig. 1, where the incidental resistance between the condenser and the earth line is represented by the "phantom" resistance R. This resistance, being common to two circuits (or, in our reader's set, to probably more than two circuits), is acting as an unwanted inter-stage coupling and so is undoubtedly responsible for the trouble.

To effect a cure, the condenser frame should be earthed through low-resistance contacts at several points.

## Electrical or Mechanical?

TO judge from a reader's letter, the poor quality of reproduction of which he complains is probably due to a mechanical rather than to an electrical fault. The distortion manifests itself by a rattling sound which is particularly noticeable when certain notes are being reproduced.

Rattling of this nature might be due to any kind of mechanical looseness, either in the loud speaker or its baffle. A loose fixing bolt is often responsible, as is vibration of the fabric which is often used as a backing to the loud speaker aperture.

## The Variable Selectivity IV.

SEVERAL queries with regard to this popular receiver (described in our issues of November 1st and 8th, 1935) relate to the use of the set for gramophone reproduction. It should be emphasised that the set was primarily intended for use with a piezo-electric pick-up, and that the average pick-up of conventional design has barely sufficient output. However, this disability may in most cases be overcome fairly satisfactorily by interposing a step-up transformer between the pick-up and its terminals; an ordinary intervalve coupling component with a ratio of 1:4 or 1:6 will do.

Other queries deal with the substitution of a directly heated rectifying valve for the indirectly heated type that was specified. This alteration is hardly to be countenanced; the valves in the set are all indirectly heated, and so will warm up slowly, with the result that the electrolytic condensers will be subjected to an unfair strain on starting up.

Those who wish to use a permanent-magnet speaker with the set are reminded that, as the field winding will no longer be available as a smoothing choke, it will be necessary to use a so-called "speaker field replacement choke" with a resistance of 2,500 ohms.

## The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

## No HT Volts

A READER who has built a universal AC/DC three-valve set for operation on 220-volt DC mains has so far been unable to obtain results. Systematic tests of each individual circuit have been made, and everything seems to be in order except for the fact that the HT voltage, so far as can be measured with a rather unsuitable meter, appears to be excessively low—20 volts or so. We are asked to suggest what is likely to be wrong.

It occurs to us that the most probable cause of the excessively low voltage is simply transposition of the HT feed lead connection. The possibility of making an error of this kind is by no means remote, and the position will be appreciated by studying Fig. 2, which represents in their simplest possible form the power supply circuits of a single-valve set. Correctly connected, the full mains voltage, less a small drop in the smoothing choke, will be avail-

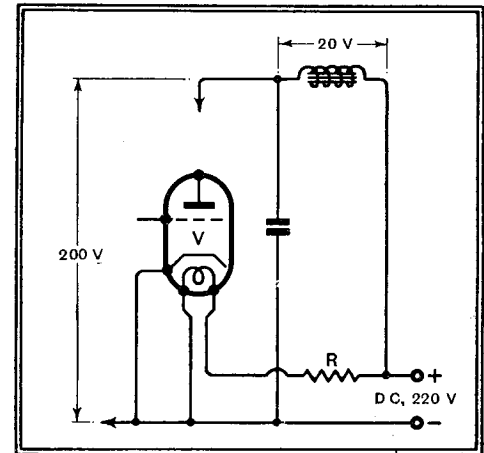


Fig. 2.—Basic heater and anode supply system of a universal AC/DC receiver.

able for HT supply, but if the HT feed lead be moved to the wrong side of the resistance R the voltage drop across the heater only will be available.

We suggest, therefore, that our correspondent should carefully check this point.

## Suppression: A Difficult Case

A QUERIST who is using a self-contained AC mains receiver with built-in frame aerial has found that reception of distant stations is marred by electrical interference. He realises that the question of suppressing the interference is by no means a simple one, but asks if we can offer any suggestions.

As a frame aerial is a relatively insensitive collector of signals, and is likely to be situated in a fairly intense field of disturbance, it will be rather difficult to improve matters. However, as a first step, we suggest the fitting of a condenser suppressor to the incoming mains; if most of the interference is re-radiated from the household wiring, this cure will, with a little luck, be reasonably effective. In addition, it might be worth while to fit a choke-condenser suppressor to the socket from which the set derives its power.

If our correspondent has not already tried the effect of moving the set to different positions in the room, it would be worth his while to do so.

# BROADCAST

By Our Special Correspondent

## BREVITIES

### B.B.C. and a Film Threat

I FIND that the Cinematograph Exhibitors' Association has failed to strike terror into the B.B.C. by considering the banning of films for television transmission until these are three months old.

The ban is apparently chiefly designed to prevent the transmission of news films, but the movie people probably forget that news films are the easiest to make. It is extremely likely that the B.B.C. will have its own News Film unit, or something like it, directly the regular transmissions begin.

### No Feature Films ?

News films and "shorts" are expected to form the bulk of the television programmes. Big feature films will not be in demand, at any rate in the early stages.

### First World Broadcasting Conference

DESPITE its all-embracing title, the International Broadcasting Union has always been a very European affair. Now its horizon is being enlarged.

For the first time in the history of radio all the broadcasting organisations of the world will take part—or have been invited to take part—in an Inter-Continental Conference which will be held in Paris on February 27th and, if there is enough business to discuss, will continue in session for ten days.

### Short Waves Create a Stir

Why such a meeting should be held can be explained in two words: Short Waves.

Most authorities agree that we are only on the threshold of short-wave development, and that in ten years' time the whole world will be contained in the short-wave network. Australians will tune in Radio Paris as casually as we in England tune it in to-day, and unless drastic steps are taken to formulate some sort of Lucerne Plan embracing the whole world, the ether will be just one jamb thing after another.

### Governments Involved

The Paris Conference will not be a Government one, but it has been arranged that Government representatives shall be present in the case of those countries in which broadcasting is State-owned.

Actually Governments rule the broadcasting roost in the majority of countries, so the Conference will carry a good deal of official weight and may reach some worthwhile agreement.

### Uncle Tom Cobby and All

The British contingent will consist of Sir Noel Ashbridge; Mr. L. W. Hayes (who has never missed a European broadcasting conference since the Union was formed in 1925); Miss Benzie, the B.B.C.'s foreign representative, and Major Atkinson. Very probably Mr. Cecil Graves will also attend, not, of course, as B.B.C. Programme Controller, but as a member of the Council of the International Broadcasting Union.

### Barefaced Propaganda

And what are they all going to talk about? The agenda is secret, but I understand that wavelengths, power outputs and the use of directional antennæ will be the staple topic. If there is time, there may be a few straight words on the question of barefaced propaganda and a gentlemanly discussion as to why certain countries so thoughtfully transmit in the languages of other countries.

### Between You and Me

Preceding the Inter-Continental Conference will be the ordinary meeting of the International Broadcasting Union at which the usual questions of European wavelengths, copy-right, gramophone transmissions and international relays will be argued about amid clouds of tobacco smoke. Little will

be decided upon at the meetings, the most important decisions being reached by individuals in quiet confab in the corridors.

I was present at the London Conference in 1934, so I know.

### Belfast's Great Day

THERE is to be no gradual fading-in process with the new North of Ireland Regional station at Lisburn, which is to be opened by the Duke of Abercorn on March 20th. This is the second B.B.C. station to start at full speed ahead, the other being Midland Regional at Droitwich, but in the case of Lisburn the effect should be far more spectacular.

### Shocks for Listeners ?

The old Daventry transmitter put out quite a good signal so there was no overwhelming rise in millivolts in the receiving aerials. But Lisburn, with its 100 kilowatts will be suddenly supplanting a ten-year-old transmitter of 1 kilowatt, and some of the good folk of Belfast may have the shock of their lives.

### In the Pillory

VICE-ADMIRAL SIR CHARLES CARPENDALE and Sir Noel Ashbridge have promised to appear at a Press Conference at Broadcasting House on Tuesday next.

### What Henry Hall Says

I HAVE had an interesting statement from Mr. Henry Hall supplementing the bare official announcement of last week of important changes in the constitution of the B.B.C.'s Dance Band to celebrate its fourth anniversary.

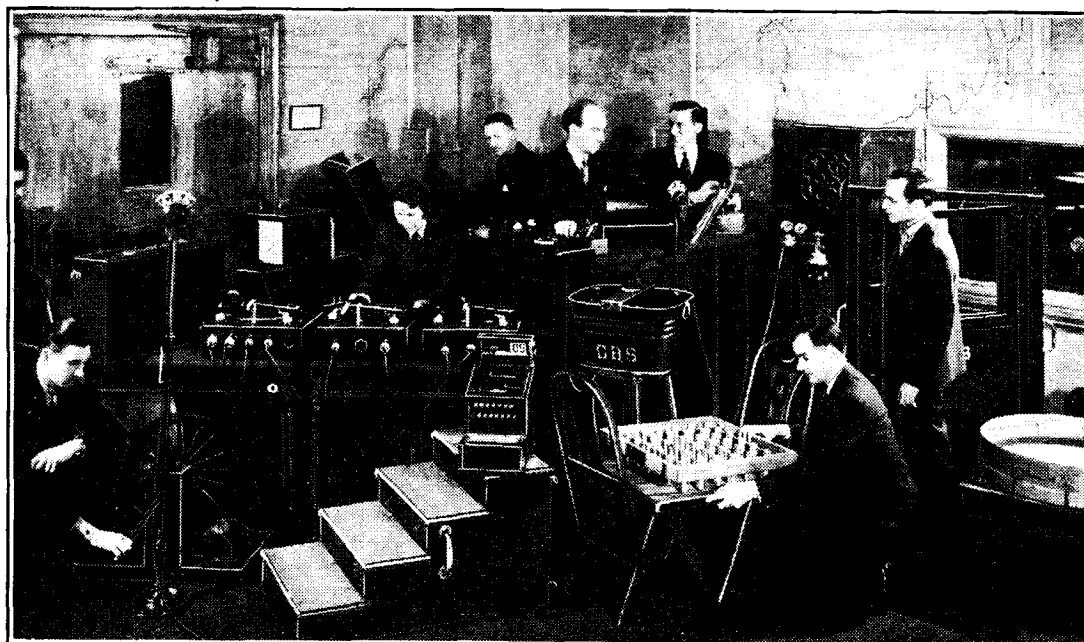
"Popular dance tunes presented in an interesting fashion," said Mr. Hall, "will still be the backbone of the programmes. The method of presenting 'Henry Hall's Hour' will be extended to other programmes, and material will be chosen for its 'production value' as a breakaway from the established tradition of the three-minute dance tune. The music will be chosen from a much wider field.

### Experts to Help

"Two expert arrangers are being appointed who will work exclusively on the preparation of material, and they will begin their work some time before the new series of programmes starts on March 16th."

### Vocal Trios

It will be four years on March 15th since Henry Hall was hurriedly summoned from Manchester to sign the £2,000 a year contract appointing him successor to Jack Payne as Chief of B.B.C. Dance Music. His orchestra then consisted of fourteen players. Now it numbers sixteen, and is to be augmented to twenty-one on March 16th. In addition, there are to be two vocal trios—one male and one female.



NOISES OFF. A photograph taken in the Sound Effects studio at the Columbia headquarters in New York during a radio play. Most of the devices are explained by their appearance. The "box of tricks" on the chair in the foreground is for simulating the tramp of a marching army.

# Below 100 Metres

## Notes from a Listener's Log Book

LOOKING through my last notes, which appeared in the issue of December 27th, I find that the most outstanding point was the extreme range of wavelengths encountered during a day's listening, and this remark holds equally true for the period December 11th to 31st, with which I am now dealing.

The most outstanding ultra-short wave station heard during this period was W2XEN on about 9 metres, the Newark, N.J., police transmitter, and the most outstanding infra-short station, the ship-shore 'phone transmitter WOO Ocean Gate on 63 metres. I make no apologies for the use of the word "infra-short." It adequately describes the region between 50-150 metres, above which we have "medium" waves and below which are "short" waves. The infra-short waves are, of course, akin to the short waves in characteristics.

A lot has been written recently about the possibilities of long-distance propagation in the ultra-short wave band, and it is interesting to recall that the half-wave of the Buenos Aires transmitter LSL (14.18 metres) was heard in England for the first time on 7.1 metres during the summer of 1933; at times this harmonic was stronger than the fundamental, and nearly always showed a different fading characteristic. On one day a German telegraph transmission D4ACD<sup>1</sup> was also very strongly heard at noon on 7.5 metres.

It was noted at the time, and confirmed subsequently, that this ultra-short wave reception coincided with the appearance of sunspots, or with a complete absence of sunspots, more often the former (especially near the Meridian passage period), but never in the "intermediate" period between noticeable sunspot activity and no activity!

The large outburst of ultra-short wave activity which started this autumn, about September-October, and is still continuing unabated during the daylight hours, coincided with a similar increase in solar activity which has continued relatively undiminished.

The point which interests many of us is, what is going to happen in February, which month regularly sees a large increase in sunspot activity; and will the 5-metre "Blue Riband," i.e., two-way communication on 5 metres, be established between this country and the North American Continent? I am told by G2MV that he has already heard W2JN<sup>2</sup> on this waveband!

It should be borne in mind that many of the "stations" so far heard on the ultra-short waves are harmonics of commercial stations (spurious uncontrolled radiation, in fact); therefore, may we not expect rather better signals when high-powered transmitters with correctly designed aerials are brought into operation?

So much for our fortnightly discussion; now let us turn to the day-to-day results.

Wednesday, December 11th, provided at 9 p.m. both W3XAL on 16.87 metres at R5 Merit 2 and WEG, a Rocky Point commercial, on 40 metres at R9+ by contrast, whilst W8XK on 19.72 metres was

really excellent. W2XE on 19.64 metres was also good at this time. Conditions on Thursday, however, showed a decided change, and even W2XAD on 19.56 metres was very weak at 8 p.m. (close down), and only Rome and GSB could be heard on 31 metres.

The Zeesen transmitter DJE on 16.89 metres was extremely good at 1.30 p.m. on Saturday, December 14th, and GSG Davenry was also very good, accompanied by a slight round-the-world echo, whilst another strong quasi-local signal was PHI on 25.57 metres.

Good to excellent results were also obtained during the afternoon from W3XAL on 16.87 metres, but conditions during the evening were poor, W2XAF being heard only fairly well.

There was considerable 10-metre activity, however, on Sunday afternoon, and W3AIR, W2AOG and W2HFS were in particular very good 'phone signals. It was interesting to note that many of the Americans audible in this land were coming from the third district (W3's). No explanation for this phenomenon is offered!

### Evening Reception

Strangely enough, in the evening conditions were very "long wave," and it was noted that Tokio had moved up to his 50-metre wave JNM (first time this winter?), which was coming in at a good R9.

Conditions were poor again on Monday evening, as far as waves below 40 metres were concerned. W3XAL again put up an excellent show on 16.87 metres during Tuesday afternoon, December 17th.

A new German station, taking the same programme as DJJ, was heard on 20.7 metres at 7 p.m. Tuesday evening. This is probably DZH on 20.75 metres.

Conditions remained very "long-wavish" during the evenings throughout the remainder of the week, a stillness broken only by the continued very good performance of W3XAL during the afternoons and PRF5 and the quasi-locals during the evenings, with some periods of good reception from VP3MR (300 watts), Georgetown, British Guiana, which is operating in the 40-metre amateur band (on 42.68 metres) and which gives surprisingly good reception at times, generally around 10 p.m.

Some improvement in the evening reception seems to have set in on Saturday,

December 21st, and both W3XAL and W2XAD were very good during the "Five Hours Back" period.

Very strong signals were intercepted from Budapest, HAS3, on 19.52 metres at 1.55 p.m. on Sunday afternoon, the broadcast proper being preceded by a chime-like interval signal, and later in the day improved results were obtained from W2XAF on 31.48 metres at 9.25 p.m.

A further night-time improvement seems to have taken place on Monday, and W2XAF was extremely good at 10.35 p.m.!

At 11.20 p.m. on Christmas Eve COCD, Havana, on 48.92 metres (with lady announcer) was quite good, but suffered slightly from QRM from RKK. It was noted that the N.B.C. chimes (G.E.C.) were used. W3XAL on 16.87 metres was also a good signal at 6.30 p.m. on Christmas Eve.

The Newark (Roselle) police transmitter W2XEN, previously mentioned, was a particularly good signal on Christmas afternoon, and later, in the evening, both W1XX on 31.35 metres and W2XAF on 31.48 metres were good. This evening W1XX appeared to be more stable, and, apart from the usual hum, a better signal than W2XAF.

There was considerable commercial activity on 9-10 metres at noon on Boxing Day, and the Sardinia 'phone transmitter IAG was heard calling IAF on 9.8 metres with Hullo-Roma (?).

Conditions were again rather long-wave during the evening, and HJ4ABL Manizales on 49.45 metres appears to have been the best dx 49-metre signal.

Afternoon conditions still remained good during the remainder of the period under review, and W3XAL has continued to give very steady and excellent programme value signals on every occasion monitored. W2XE has also given very fair results on 13.9 metres up to 4 p.m., when he changes to 19.64 metres, operation on 16.89 metres having been discontinued.

W2XAD on 19.56 metres has also been giving a very strong signal during his earlier schedule on Saturdays and Sundays, but is often surpassed in merit by W8XK in the same band, a weaker but better modulated and more hum-free signal. It is interesting to note that W2XAD uses high-power modulation and W2XAF low power, the 500-watt screen-grid stage being modulated in the case of W2XAF. It is believed that W8XK uses high power, Class C<sup>3</sup> modulation on all waves.

<sup>3</sup> The general Class B designation is more often than not a misnomer. Class A implies no grid current and no bottom bending, Class B no grid current but bottom bending (the anode bend detector, also QPP), whilst Class C, the most efficient method of operation (i.e., 75% DC to AC conversion on peaks) implies driving from the bottom bend or beyond it into grid current.

## Letters to the Editor

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

### HOME RECORDING

I HAVE noted Mr. Smith's request in your issue of December 13th for any information that would assist your readers interested in home recording, and hope that my remarks may be useful.

As one of the experimenters with sound recording, I have used metal, gelatine and cellulose discs, and the difficulty has been to obtain a disc that will give decent volume

and good reproduction for immediate play back, at the same time being reasonably permanent; by that I mean, can be played repeatedly up to 100 to 200 times.

Mr. Gellatly asks for a disc with a soft wax surface that can be hardened by baking. There is a very good disc of this description on the market. There are also two other discs which are hardened after

<sup>1</sup> June 17th, 1933.

<sup>2</sup> November 23rd, R3 with AC ripple

cutting by a fluid, which are also permanent, and one of these on which I have recently carried out a number of tests the results have been very promising. A coated glass disc is used which cuts extremely well; the thread never comes under the cutting needle, and lying very nicely round the centre, can be played back at once with plenty of volume.

For the driving power I am using a special reasonably cheap B.T.H. motor, No. B.Y.C.1505, that gives ample power even for a 12in. disc, and is free from vibration. A good tracking device is all-important; the pick-up or cutting head can be any standard make, provided its weight is balanced. There will be no difficulty about grooves running into each other if the tracking device is properly designed without either back lash or side play; for this I find the best equipment is Continental and costs about £15, and with the motor the total is about £20.

If there are any other points with which I can assist your readers I will be very pleased to give what information I can.

Acton, W.3.

T. B. MARTIN.

AS late chief engineer of one of the original pioneers in the art of home recording (and, of course, the usual age-old reader of your excellent journal), I venture to take the liberty of voicing my opinion to the prominence which you have recently given this subject, particularly in reference to your Editorial Comment in this week's issue.

There is undoubtedly a tremendous future for any manufacturer who has the courage and experience to launch a home-recording machine upon the English market which will compare favourably in price and performance with those offered by our German competitors.

The very first consideration for the intended manufacturer should be the recording medium, and it must here be stated that the days of aluminium alloy, either hard or soft, are dead, although I still advocate this form of master if it is intended to make a quick strike for the production of a single negative copper stamper for producing, say, up to fifty really satisfactory pressings. (From experience I have found that after this number is exceeded the surface level rises and impairs the upper-frequency response.)

Recording head damping, angle and type of stylus, apart from the all-important "balancing-up," are all items of initial importance, which should be carefully studied and experimented with upon alloy before the more expensive types of coated discs are used.

As regards processing (and I have yet to hear a direct recording which really compares with a genuine shellac pressing), as far as frequency response is concerned, owing, of course, to the loss of top in the angle of the trailing needle in the case of coated discs and the distorted cut produced by those which require baking, there is not the slightest difficulty experienced in obtaining a satisfactory copper strike upon any of the better-known forms of Continental recording mediums, practically all of which I have found take easily to a graphite application.

I would, therefore, further reciprocate your remarks by suggesting that some British manufacturer should produce an efficient coated disc to retail at about 1s. 6d. (10in. double-sided); a hardened-steel spade knife at 1d. each—I am per-

fectly convinced that both of these should be easily possible, and, finally, a universal tracking machine of either the synchronous motor or gravity type to retail in the region of £20.

Counter-balanced trunnions and matched moving-iron heads could be introduced after the experimenter had gained sufficient experience upon hard alloy and diamond stylus.

Finally, I am in a position to confirm your evidence to the effect that home-recording apparatus is definitely in demand, and, further, would be pleased to assist any newcomers in the "teething troubles."

Wishing *The Wireless World* a long continuation of the success it has so well deserved.

H. FIELD.

Woking, Surrey.

I READ with interest the correspondence which has appeared in *The Wireless World* during the last few weeks on the subject of home recording.

I have been experimenting for several years in this field, and as my apparatus is entirely home-made I feel it may be of interest to your readers.

My experiments have been confined for the most part to aluminium discs, with which I have obtained for some time past highly successful results, well comparable to commercial pressings.

The equipment I use and find necessary for good results is as follows:—

1. Recording Turntable.—Endless belt driven from  $\frac{1}{4}$ th h.p. synchronous motor. The use of a synchronous motor stops all troubles of slowing up.

2. Tracking Device—*Inside to outside* not more than eighty grooves per inch. This is very rigidly built and uses Meccano worm and rack for traversing; rack engages worm only when cutting head is lowered on to record.

3. Discs.—Cairns - Morrison are un-

doubtedly the best I have tried, the scratch level being low compared to others.

4. Recording Stylus.—Cairn or  $\frac{1}{16}$  Diamond. This scribes a V-groove, with bottom angle of about 120 deg. Sufficient weight is used to get a fairly wide groove. The fibre needle rests in this and not on rough edges, thus lasting longer owing to reduced wear, and scratch is less.

5. Lubricant.—5 parts paraffin, 1 part heavy motor oil. Thoroughly removed with soap and water before reproducing.

6. Cutting Head.—Modified old-type B.T.H. pick-up. Slightly more heavily damped and with pole pieces cut away to accommodate a larger voice coil of low impedance.

7. Output.—Two PX4s in push-pull.

8. Bass attenuator to compensate for high-note loss—variable.

9. Neon tube output meter to avoid overloading of cutter.

10. Special home-made reproducing needle. Burmese colour needle encased in  $\frac{1}{16}$ in. hardened-steel tube. This undoubtedly improves the top notes.

11. Microphone similar to *The Wireless World* transverse, but in marble.

I have got excellent results with Permarec records, but find that the time and nuisance of baking, the smell, also the cost, preclude their everyday use.

Of records of the acid-hardening type I have found those of the make the B.B.C. use the best. These are somewhat cheaper than Permarec, and are supplied both single- and double-sided.

I am afraid I have not been able to go into very great detail, but I hope this brief description will be of interest and assistance.

In conclusion, I hope this enquiry, so timely initiated, will ginger up manufacturers, so that those who cannot make their own apparatus can delight in the pleasures of home recording.

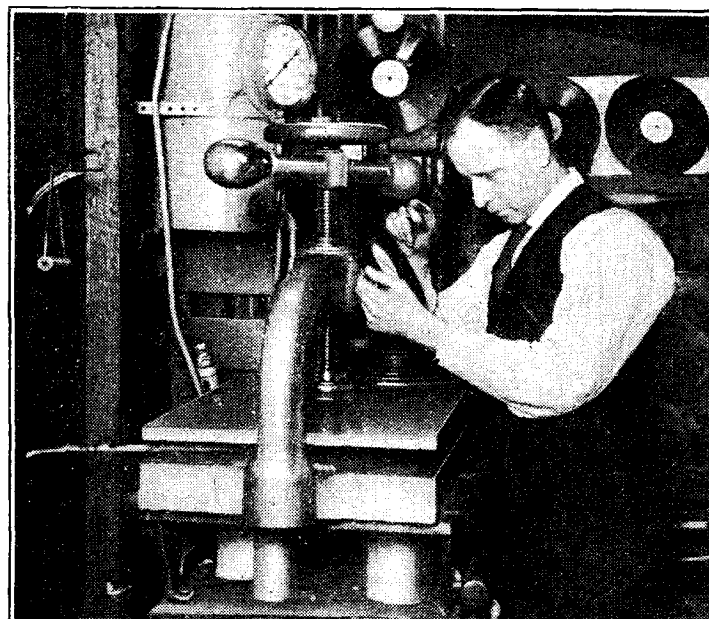
D. ROE.

Tunbridge Wells.

## HOME PRESSING

IN view of the present revival in home recording, some particulars regarding the supplementary process of pressing may be of interest.

The accompanying photograph shows the pressing plant installed by Mr. James F. Callender in a galvanised iron shed in his garden. As a part-time activity, Mr.



SMALL-SCALE RECORD MAKING.—Mr. Callender examining a record from his hand-operated press.

Callender manufactures records, all of a sacred nature, using matrices purchased from the now defunct Piccadilly Record Company and the British Homophone Company. His process has been specially adapted for small-scale production; a disc of fibre board with a surface layer applied as a solution is used in place of the usual composition. The matrix and embryo are placed in a home-made stamping press, steam heated and water cooled. Pressure is applied by hand, and, after completion of the formation cycle, the finished record is withdrawn from the press.



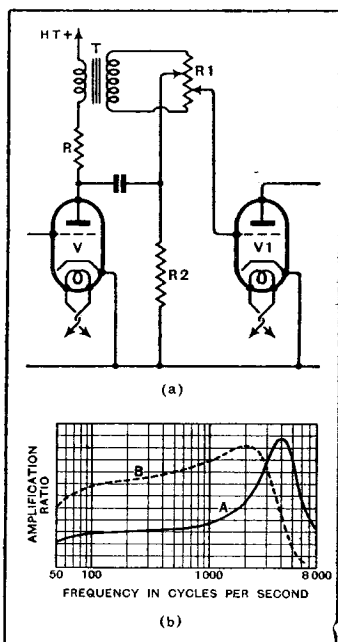
# Recent Inventions

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

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

## RESISTANCE-COUPLED AMPLIFIER

TO offset attenuation of the higher frequencies the output circuit of the amplifier V comprises (1) a resistance R of less value than that required to give maximum amplification, and (2) the primary winding of a powder-cored transformer T. The latter is shunted by a resistance R<sub>1</sub> which is tapped both to the grid-leak resistance R<sub>2</sub> and to grid of the following valve V<sub>1</sub>, as shown



Circuit and response curves of RC amplifier.

in Fig. (a). The voltage developed across the transformer increases with frequency, thus balancing the loss which would otherwise occur. The tapplings to the resistance R<sub>1</sub> can be adjusted to vary the shape of the "fidelity" response curve as shown in Fig. (b).

*Ferranti, Ltd., A. Hall, and M. K. Taylor. Application date April 30th, 1934. No. 435878.*

## DIRECTIVE AERIALS

IN a directive aerial array where the conductors are all energised in phase with each other, or with such differences in phase as will produce maximum radiation in a desired direction, it is advantageous to arrange matters so that the current-wave set up in each aerial element shows no reversal along the length of the wire, and for this reason alternate half wavelengths of the aerial wire are often doubled back on themselves so as to suppress the undesired out-of-phase wave.

The invention aims to secure the same result by coupling together consecutive lengths of the aerial wire through series con-

densers, which have the effect of increasing the average value of the current wave in one direction. At least one of the lengths of wire so coupled together must be less than half the working wavelength.

*H. L. Kirke. Application date July 18th, 1934. No. 436254.*

## RECEIVING SETS

THE main cabinet contains the usual circuit components, including a ganged series of tuning-condensers and trimmers. A separate unit, containing a series of screened inductance coils, is arranged to plug-in on top of the main cabinet. This covers one wave-band. To change over to another wave-band, the plug-in unit is removed and replaced by a separate set of coils, fitted with contacts which automatically complete the necessary circuits.

*B. Trevor (Assignor to Radio Corp. of America. No. 2000677).*

## FILTERING BRIDGES

IN order to prevent D.C. components from passing through loud speaker windings, or through inter-valve coupling transformers or chokes, the terminals of the latter are connected across one of the diagonals of a Wheatstone bridge, the other diagonal of which is connected across the HT supply. One of the arms of the bridge contains the valve amplifier, whilst the neighbouring arm consists of the valve output circuit. The two remaining arms contain reactances, one of which is adjusted to balance the bridge for steady currents.

*W. Aull. No. 1989394.*

## VARIABLE-SELECTIVITY CIRCUITS

THE HF circuits 1, 2 are so arranged that the average response is kept constant throughout

the whole tuning-range for a given strength of signal, but if signal strength increases then the response curve tends to broaden, and vice versa. Each of the tuned stages includes an inductance coil L, L<sub>1</sub> provided with a powder iron core, which is magnetised by a separate coil carrying the output current from the selectivity "control" valves V, V<sub>1</sub>. These valves are biased from a potentiometer resistance R carrying the rectified output from the first detector valve D.

The arrangement is such that an increase in signal strength applies a bias from R which increases the plate current from valve V, and so tends to saturate the powder core of the coil L. This, in turn, lowers the effective inductance of the tuned circuit 1, and so raises its resonant frequency. At the same time the output current from valve V<sub>1</sub> lowers the resonant frequency of the tuned circuit 2 by an equal amount. For normal signal strength, therefore, the two tuned circuits 1, 2 maintain a pre-determined bandpass width, which is automatically extended to accept more of the upper and lower sidebands—and so improve the quality—as the signal increases in strength.

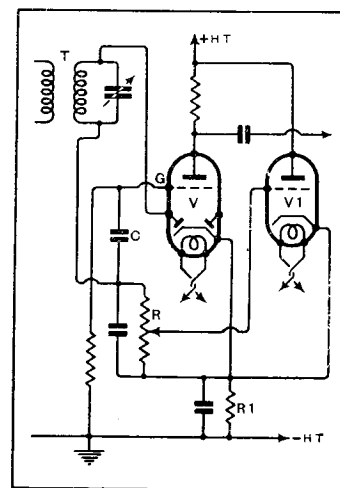
*Marconi's Wireless Telegraph Co., Ltd. (Assignees of R. A. Braden). American convention date October 16th, 1933. No. 436482.*

## "QUIET" AVC CIRCUIT

SIGNALS are fed from a transformer T to the diode portion of the valve V, the rectified voltage developed across the load resistance R being fed back through a condenser C to the grid G for LF amplification. Bias for the grid G is produced in the anode-cathode resistance R<sub>1</sub>, through which the anode current of a compensating valve V<sub>1</sub> also passes. The grid of the latter valve is biased from a tapping on the load resistance R.

In the absence of any signal the valve V<sub>1</sub> passes a large current, so that a blocking voltage is placed

on the grid G from resistance R<sub>1</sub>, and extraneous "noise" is shut out from the loud speaker. An incoming signal, however, throws



AVC system.

the grid of valve V<sub>1</sub> negative, and this in turn drops the bias on the grid G of valve V to restore that valve to normal operation.

*Ferranti, Ltd. and M. K. Taylor. Application date February 15th, 1934. No. 436856.*

## TELEVISION SYSTEM

PICTURES are reproduced on the fluorescent screen of a cathode ray tube by causing the area of the spot to vary, though its total intensity is kept constant at all times. To secure this result the picture signals are applied so as to vary the voltage of the screen electrode and the first anode in opposite directions, the distribution of the voltage following a formula which is set out in the specification.

This method of reproduction is distinguished from the known systems of velocity and intensity modulation respectively.

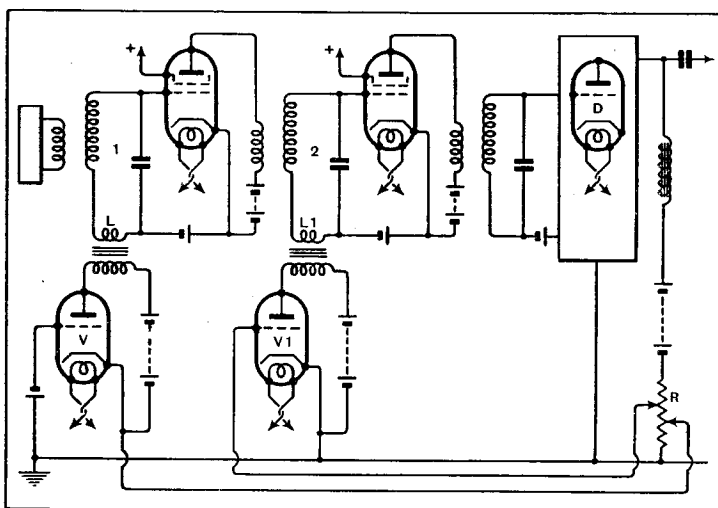
*Marconi's Wireless Telegraph Co., Ltd., L. E. Q. Walker, and W. E. Benham. Application dates March 29th and October 12th, 1934. No. 435814.*

## CATHODE RAY RECEIVERS

IN order to eliminate the so-called "White Cross" effect—which is produced on the screen of a cathode ray tube by the ionising action of the voltages applied to the deflecting plates—the electrode system is so arranged that, in the absence of deflecting potentials, the electron stream passes closer to one plate of each of the two pairs than to the opposite plate. When so arranged, it is found as a further advantage that the tube will work satisfactorily with about half the normal deflecting voltage.

To counteract the initial asymmetry, the end of the bulb that carries the fluorescent screen is offset, so that it is out of line with the main axis of the tube.

*Fernseh Akt. German convention date May 11th, 1933. No. 436314.*



Circuit for automatic selectivity.

# The Wireless World

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

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## Editorial Comment

### Home Recording

#### The Standard to be Aimed At

**W**HAT results are expected by those who experiment with home recording apparatus? There would seem to be a very wide divergence of opinion on this point, extending from those who sneer at anything which does not produce results equal to, or better than, the best commercial records, to those who can derive a good deal of pleasure out of the production of records which are only just good enough to be identified with the original, and that at the price of very considerable background noise.

Whilst very few people could be satisfied with the lower standard, it seems altogether absurd to dismiss amateur recording as impracticable unless ideal conditions can attend our efforts. On the score of cost alone apparatus which is up to a commercial standard seems at present to be denied to all but a fortunate few, and so the necessity for a compromise must be recognised, but it is by no means to be considered that on this account it is not worth while.

Up to a point the experimenter is at the mercy of the equipment he has available, the rest depends upon his skill in manipulation.

#### The Choice of Motor and Amplifier

In the process of record cutting it is necessary that the motor should be capable of standing up to the work without any change in speed, and consequently a more powerful motor than would be required for reproduction is essential if we employ discs of material which does not cut easily; the motor, too, must be as free as possible from vibration and, therefore, the motor should be as good in respect of these qualities as the user's purse permits. A less powerful motor can often be used if the diameter of the record is restricted.

The next essential is a sufficient output from the amplifier to operate the recording head effectively. It is probably safe to say that anything below an output of 2 watts without serious distortion is inadequate with recording systems at present available unless a poor result with a noisy background is to be regarded as acceptable.

Given these two conditions, experimenters may look forward to obtaining quite good recording results which will steadily improve as experience is gained. Whilst it is scarcely worth while to spend much time with what may be classed as toy equipment, there is no doubt that very successful results are obtainable long before an expenditure such as would be required for commercial standards is approached.

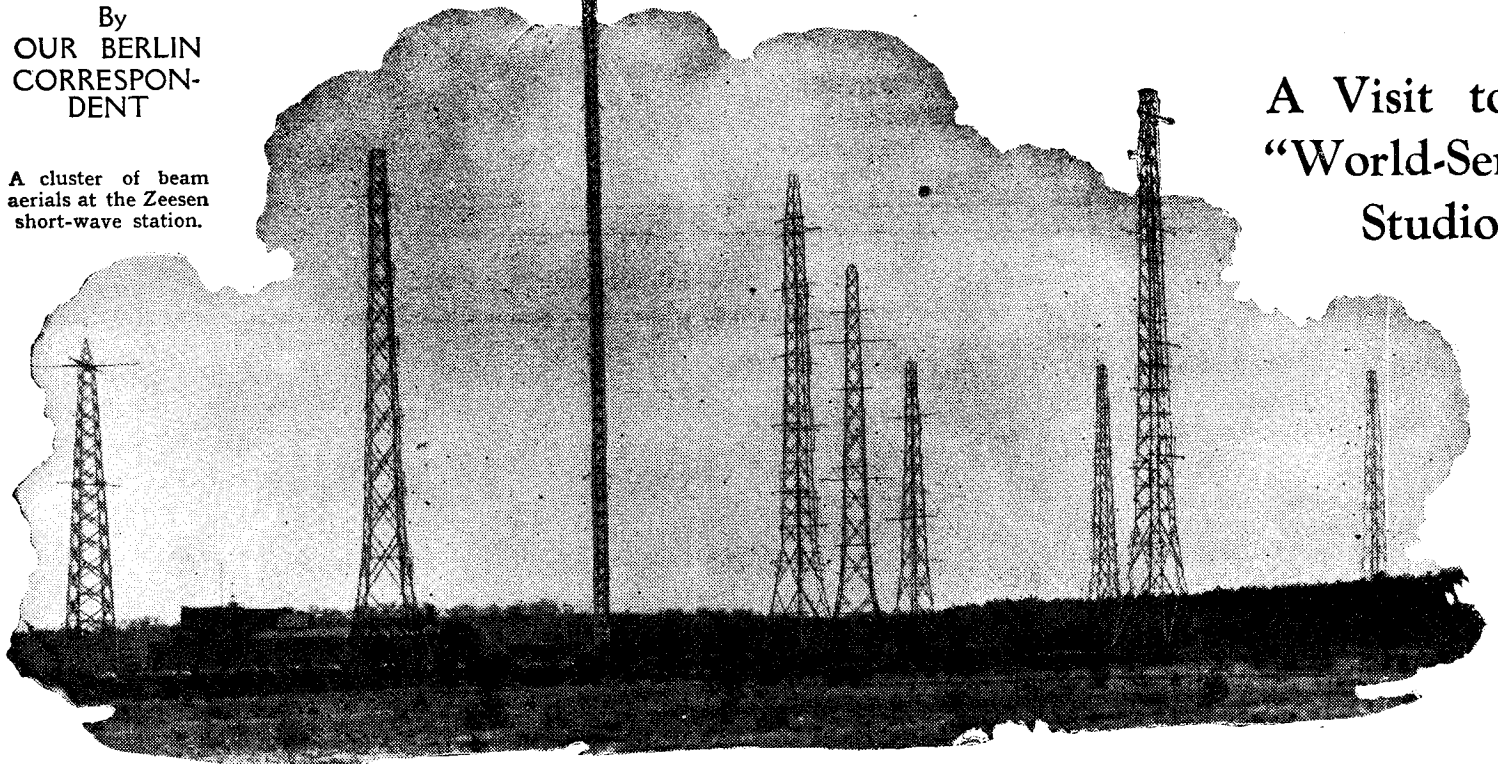
#### Future Possibilities

The remarks which we have made above do not take into consideration future possible improvements in recording outfits. We do not consider that finality has yet been approached. For some reason these equipments are more popular on the Continent than here, and in Germany, especially, there are examples of inexpensive sets which we should like to see available here if some British concern would undertake the manufacture.

# Short-wave Broadcasting

By  
OUR BERLIN  
CORRESPONDENT

A cluster of beam  
aerials at the Zeesen  
short-wave station.



A Visit to the  
"World-Sender"  
Studios

**B**Y the spring of this year the German short-wave station will have two transmitters of 7 kW., one of 9 kW., and two of 20 kW., with a vast forest of over twenty beam aerials. At the time of writing the two 20 kW. transmitters have not been completed, but the dozen or so new aerial masts, each of them 300ft. in height, are *in situ*, and the new transmitter building is nearly ready for the electrical engineers.

Many people ask why Germany should organise a well-equipped short-wave service for broadcasting overseas. These people perhaps forget that although Germany has no overseas possessions, about 15 million Germans or descendants of Germans live abroad. The German officials will tell you that the short-wave station is primarily intended to act as a link between these people and the home country. Latterly it has been found that very often the local overseas Press is antagonistically inclined towards Germany. Germans living abroad and others who speak the language may not get home papers until many weeks after publication. For this reason Germany considers it all important to give her nationals and their descendants a means of rapid and direct information of happenings in the Fatherland.

## Listeners' Demands

In short-wave broadcasting it is hardly possible to speak of national requirements or local service in the same way as when dealing with European broadcasting. The United States were probably the first to inaugurate regular short-wave programmes. Nowadays, nearly every

country in the world is endeavouring to provide at least a few hours' short-wave broadcasting daily for possible distant listeners. Following the general trend and the demand of listeners expressed in their letters, the German short-wave station has

developed its service so as to supply, at least in some measure, a programme in their language to those people who do not understand German.

## News in Five Languages

To the ordinary European listener the broadcast news bulletins are usually regarded as a contents list of the next morning's newspaper. In a great number of countries and places overseas things are entirely different. The broadcast news bulletins may sometimes be the only means of outside information. The German short-wave station attempts to cater for this need by supplying news bulletins as many as twenty-two times a day in five different languages: German, English, Spanish, Portuguese and Dutch. The "Drahtlose Dienst," a department of the German Ministry of Propaganda which is also responsible for the news bulletins broadcast by the German medium-wave stations, supplies the bulletins for the short-wave station, ready translated. It is a curious fact that happenings of more or less local interest in some of the smallest German towns are found a place in the German short-wave station's news bulletins to satisfy the local patriotism of people living many thousand miles away who happen to come from these towns. Items regarding the activities of Germans overseas are also part of the bulletins which, however, are not limited to German interests, but also cover important happenings in the international sphere.

On April 1st, 1933, Dr. Kurt Rathke, now Head of the Foreign Programme Exchange Department of the Reichs-Rund-



Dr. Schroder, publicity officer, at the entrance to the short-wave studios in the Adolf Hitler Platz, Berlin.

# in Germany

*It is less than three years since the first regular German short-wave service was opened. Since then developments have proceeded rapidly, and the cluster of short-wave aerials at Zeesen now propel news, propaganda and entertainment to six "zones," which virtually include the whole world. This article gives first-hand details of how the service is carried out.*

funk-Gesellschaft, inaugurated the first regular German short-wave service, beginning with a two-hours' programme for the United States. The former Director of the Munich station, Dr. von Boeckmann, took over the Directorship of the short-wave station in the summer of 1933. It is largely due to Dr. Rathke's initiative and Dr. von Boeckmann's steady productive work that the German short-wave station has arrived at its present successful position. Prior to the regular programme service, experimental S.W. broadcasts had operated since 1929.

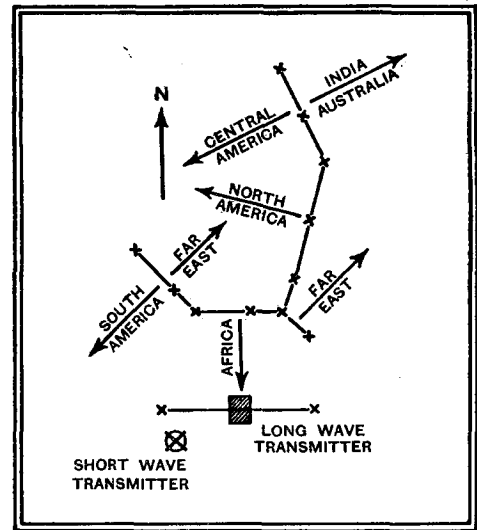
### Service to Six Zones

On February 1st, 1934, programme services were opened to Africa, East Asia and South America. In December of the same year a further zone was added for South Asia, and on September 1st, 1935, the sixth zone, that to Central America, was opened. Each of these six zones obtains a programme service of its own which is broadcast *via* one of the Zeesen stations on a beam aerial. It is the aim of the German short-wave station to provide a service to all parts of the world on a shorter and a longer wavelength during a certain period of the evening in the country of reception. This ideal will only be reached after the opening of the two new transmitters next spring.

In German short-wave broadcasting, as in the case of the national broadcasting service, the Post Office is responsible for the erection and operation of the transmitters. The two well-known German firms Telefunken and Lorenz have supplied the short-wave transmitters and Telefunken the aerials. Some of the dozen or so special new aerials being put up at Zeesen are specially constructed for point-to-point communication and will be used for

international programme exchanges, notably for the provision of commentaries on the Olympic Games, to be held this year in Berlin.

Owing to time differences in the various zones a longer programme service has to be provided than many would think necessary. South Asia, for instance, obtains eight hours and three-quarters; East Asia five and a quarter; South America seven and three-quarters; Central America five and three-quarters, and North America six and three-quarters, making a total of thirty-four and one-quarter hours of programmes per day. At one period in the day as many as three programmes have to be broadcast simultaneously. In spite of this, the German short-wave station makes use of the least possible number of electrical recordings. Of roughly 1,340 programmes, only 330 were broadcast from wax



Plan showing the arrangement of beam aerials at Zeesen. A second system of aerials and two new transmitters will shortly be ready for relaying the Olympic Games.

records, i.e., 75 per cent. consisted of original programmes.

The German short-wave station em-



A unique picture showing three announcers speaking simultaneously on different wavelengths. The man in the background is talking to Southern Asia, the one in the centre to North Africa, and the nearest to East Asia. News bulletins are broadcast in five different languages 22 times per day.



This photo was taken during the broadcasting of a drama. The producer and sound monitor are behind the sound-proof windows. The engineer on the right is inspecting an effects record. Note the signal lights. When the photo was taken the red was "on."

ploy eight announcers. All Germans, some of them have passed most of their life abroad. They are able linguists; three of them speak German and English, two German and Spanish, one announcer is efficient in three languages, German, English and Spanish; a second does German, Dutch and English, and another one announces in German and Portuguese. They are allowed considerable latitude in their announcements and do their best to make these informal and personal. Letters from listeners pour in at a rate of about 2,500 per month, over half of these being from Germans. This total does not include purely technical reception reports, which are invited by the short-wave station. For these, reliable amateurs are supplied with a special day-to-day log book.



**Short-wave Broadcasting in Germany—**

Faithful listeners are sometimes rewarded with the gift of a tiny gramophone record having German text on one side and any one of five languages on the other. As I write I have one of these lying before me. The German inscription reads: "German, your Homeland Speaks to You Through the German Short-wave Station." On the other side is an English inscription (this particular record is intended for listeners in the United States zone), reading: "Let's Make Short-wave Broadcasting Stand for Good Fellowship." If you put the record on the gramophone you first hear the short-wave station's interval signal: "Ueb' immer Treu' und Redlichkeit," the same as that of the long-wave Deutschlandsender. Then comes the announcer with his cheery: "This is Germany calling you; we invite you to enjoy a German folk-song," then the folk-song, a closing announcement, and again the interval signal. Further to enhance the value of letters received from listeners the short-wave station sends questionnaires with its replies so that when the listener writes a second time he will be able to include valuable information to help the station to meet listeners' individual tastes and requirements.

The studios of the German short-wave station are situated in the ground and first floors of the "Germany House" on the Adolf Hitler Square in Berlin. This is close to the Broadcasting House. Plans for a new Broadcasting House are at present being prepared, and it is generally expected that these will provide for studios for the short-wave station.

In this way practically the whole of the administrative side of German broadcasting, as well as many of the studios, will be concentrated under one roof.

**Wavelengths and frequencies reserved for use by the short-wave station at Zeesen.**

Those frequencies marked "B" are exclusively for broadcasting.

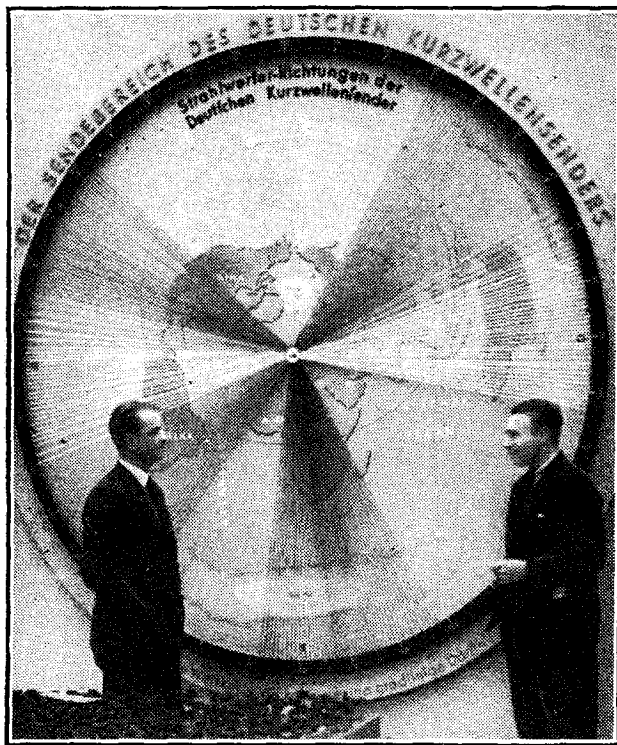
"DIP" indicates point-to-point work.

Frequencies at present in use are marked \*.

	Wavelength (metres)	Frequency (Kc/sec.)	
DIP	20.82	14 410	
*DJA (B)*	31.38	9 560	
*DJB (B)*	57.1	5 255	15200
*DJC (B)*	49.83	6 020	
*DJD (B)*	25.49	11 770	
*DJE (B)*	16.89	17 760	
DJL (B)	19.85	15 110	
DJM (B)	49.35	6 079	
*DJN (B)*	31.45	9 540	
DJO (B)	25.43	11 795	
DJP (B)	25.31	11 855	
*DJQ (B)*	19.63	15 280	
DJR (B)	19.56	15 340	

**DISTANT RECEPTION NOTES**

**I**F at times you hear Radio-Paris carrier wave accompanied by a heterodyne, this is in all probability due to Istanbul, the 5-kilowatt Turkish station which has moved from its allotted 187.5 kilocycles (1,600 metres) to 185 kilocycles (1,621.3 metres).



On the left is Dr. Von Boeckmann, Director of the short-wave station. Note the curious "zone" map.

The move appears to have been made with a view to avoiding interference in Turkey from the Deutschlandsender. Originally there were only 3.5 kilocycles between Istanbul and the Deutschlandsender; now the separation is 6 kilocycles.

Sottens is now providing excellent reception on 443.1 metres for those whose sets are sufficiently selective to separate it from the North Regional on 449 metres and Paris P.T.T. on 431.7. The reason for the great improvement that has taken place is that the new 100-kilowatt transmitter is in action instead of the original 25-kilowatt plant. Both the French-speaking and the German-speaking portions of Switzerland are now very well served, the former by Sottens and the latter by the 100-kilowatt Beromünster on 539.6 metres. The Italian-speaking cantons, however, are not so well off since they must rely on the 15-kilowatt Monte Ceneri, whose wavelength is 257.1 metres. This short wavelength and modest power do not make for a wide service area, particularly in a mountainous country. Switzerland has actually a fourth wavelength of 748 metres on the intermediate band which is used by the small Geneva relay station. It will never be of any value to her for a large transmitter intended to serve a big area, since it is shared by the 100-kilowatt Moscow III. and the new Czechoslovakian Banska-Bystrica, which is already making tests in the evenings with a power of 30-kilowatts behind its transmissions. This last station may be a tempting quarry for long-distance enthusiasts who possess receiving sets capable of covering the intermediate band, whose theoretical extent is from 600

to 1,000 metres, though actually it contains no station with a wavelength shorter than 688 metres, and none whose wavelength is above 845.1.

Another Continental station which has just left the ranks of the small fry and moved into the medium-powered class is Saarbrücken. Until recently this station was working on 240.2 metres with an output rating of only 0.7 kilowatt. A 17-kilowatt transmitter has now come into play and good reception is reported. Saarbrücken has to serve a fairly big area, and the intention of the German authorities is to erect eventually a 60-kilowatt transmitter.

I wonder if you have heard the 60-kilowatt transmitters of Marseilles P.T.T. and Toulouse P.T.T. at work. Both of them are in action, the former on 400.5 metres and the latter on 386.6, after 11 p.m. As soon as the tests are completed they will take over the full programme service from the present 1.6-kilowatt transmitter at Marseilles and the 2-kilowatt plant at Toulouse.

D. EXER.

**At the Transmitting End****Technical Criticisms of Recent Programmes****Irritating Verbiage**

**O**NE of the best programmes we have had for weeks was Geraldo's "Romance in Rhythm" (London National, January 4th). This transmission was practically flawless, which, considering the size of his orchestra, the many vocalists, and the solo performances, was a pretty good piece of work. But yes—there *had* to be a snag: how we did tire of the aggressively dramatic way in which the announcer bellowed his not-very-short piece between each item!

If it is considered necessary to write a story around every tune, then by all means do so, but print it in the *Radio Times* and leave us to read it in peace instead of declaiming it from the housetops with a voice worthy of the sausages of This and the pills of That.

This sort of programme requires very little assistance from the spoken word and it should be no very difficult task to give an entertainment of this nature a smoothly flowing continuity without this irritating verbiage.

**Technical Side of Radio Plays**

**H**OWEVER unsuitable as to title "Murder in the Cathedral" (London Regional, January 5th) may be considered, it must be freely admitted that as a radio play it left little to be desired, and proved a story of absorbing interest extremely well spoken and produced.

Technically speaking, it is not necessarily easier to produce plays than, say, a musical entertainment, in spite of the smaller frequency range involved—although, contrary to a common belief, it is not *very* much smaller for really high quality—and the B.B.C. usually seem to take a good deal of trouble to ensure faithful transmission with plays; which, of course, adds considerably to *our* appreciation.

In this particular instance, a little more echo judiciously used would have assisted in conveying the "cathedral" atmosphere more convincingly.

H. C. H.



# Suppressing Second-Channel Interference

## Reducing Whistles in Superheterodynes

By W. T. COCKING

*It is well known that second-channel interference can always be reduced by increasing the number of signal-frequency tuned circuits, but it is not always realised that there are many ways of obtaining increased pre-selection without increasing the number of variably tuned circuits. The chief systems of this nature are described in this article and the limitations of the methods pointed out.*

ONE of the greatest advantages of the superheterodyne over the straight set is that the adjacent channel selectivity can be made as high as desired without in any way complicating its operation. The number of tuned circuits employed in the IF amplifier can be increased at will without introducing any ganging or waveband switching difficulties. To offset this in some degree, however, the superheterodyne is open to certain special forms of interference which are absent in the straight set

fore, there are two different signal frequencies, one higher and one lower, which can beat with it to produce the intermediate frequency. Only one of these is required, and the other causes interference if it be present. The signal which can thus cause interference is on a frequency higher than that of the wanted signal by twice the intermediate frequency.

The only method of removing second-channel interference is to provide an adequate degree of selectivity in the circuits which precede the frequency changer, and it is obvious that the arrangements necessary depend upon the intermediate frequency used. Thus, suppose that reception of a station on 700 kc/s be desired. With an intermediate frequency of 110 kc/s second-channel interference may occur from a station on 920 kc/s, so that the signal-frequency circuits must be selective enough to attenuate the latter frequency very greatly. If the intermediate frequency be 465 kc/s, however, a station causing second-channel interference will be on 1,630 kc/s, and this is so much further removed from resonance that fewer signal-frequency circuits are needed to produce the requisite attenuation.

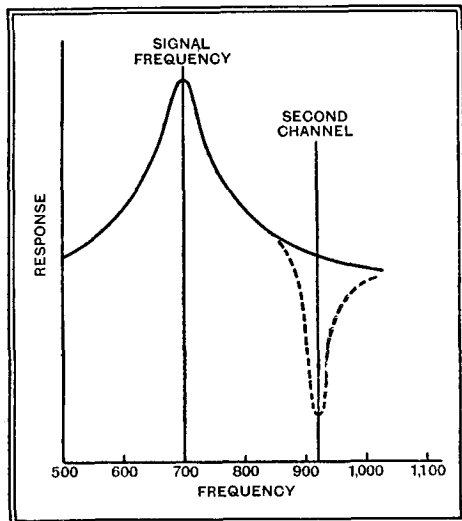


Fig. 1.—The solid line curve shows the results given by an ordinary pre-selector, and the dotted curve the increase in rejection at the second channel frequency brought about by the use of an image rejector.

and which no degree of selectivity in the IF amplifier can remedy. Second-channel, or image interference, as it is sometimes called, necessitates an adequate degree of signal-frequency selectivity for its avoidance.

In ordinary superheterodyne practice, the oscillator always functions at a frequency higher than that of the desired signal by the intermediate frequency, and the rectification of the combination of frequencies gives rise in the frequency-changer to the intermediate frequency, equal in value to the difference between the signal and oscillator frequencies. The same thing happens if the signal frequency be higher than the oscillator frequency. Whatever the oscillator frequency, there-

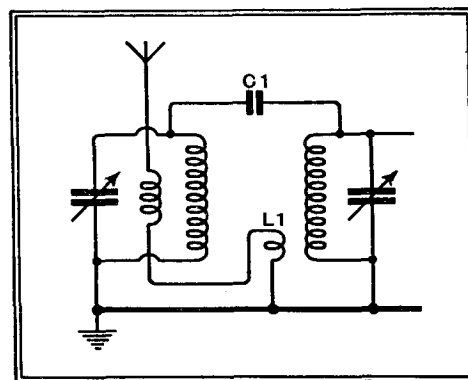


Fig. 2.—A simple image suppressor can be used when two coupled tuned circuits form the pre-selector.

# Interference

Generally speaking, two signal-frequency tuned circuits can provide sufficient protection against second-channel interference when only distant stations are involved and the intermediate frequency is 110 kc/s, but they are inadequate to deal with interference due to a local transmitter. With the higher frequency of 465 kc/s, a single tuned circuit may be sufficient.

The addition of tuned signal-frequency circuits to a receiver is likely to be an expensive business, for more sections are needed in the gang condenser, more coils and more switch contacts, while there are more circuits to line up in the initial ad-

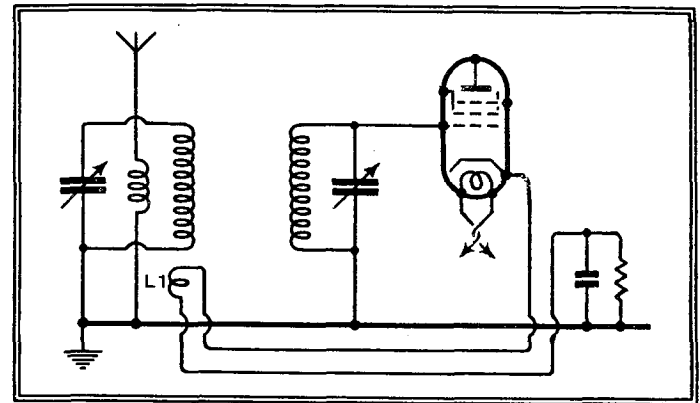


Fig. 3.—In this circuit image rejection is secured through the use of the cathode coil L1.

justments. Great attention has been paid, therefore, to methods of improving the second-channel rejection of the ordinary tuning system, and it is the purpose of this article to describe briefly some of the more widely used systems. In Fig. 1 the solid curve illustrates the response of the conventional signal-frequency tuning system and the dotted curve the result of adding an image rejector. The response at the second-channel frequency is greatly reduced.

### Special Rejectors

Image rejection is usually easiest to apply where an input band-pass filter is used, and one possibility is shown in Fig. 2.<sup>1</sup> The filter coupling proper is provided by mounting the two tuning coils in the correct relative positions following ordinary practice. Two other couplings of opposite phase are provided, however, one due to C1 and the other due to L1 coupled to the filter secondary. If two different opposing couplings be used they will equal one another at some frequency, and at this frequency there will be no transference of energy from one circuit to

<sup>1</sup> The Wireless World, June 9th, 1933.

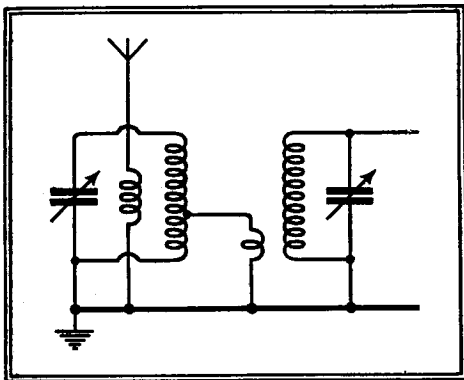


Fig. 4.—A simple rejector depending for its action on the tapping on the first tuned coil.

the other. In practice, however, there is always some coupling existent, for the circuit resistances prevent exact neutralisation of the coupling from one source by coupling from another. By selecting the values of components correctly it is easy to make the frequency of zero coupling higher than one particular signal frequency by twice the intermediate frequency, and so secure a very high degree of second-channel rejection. As the tuning is varied, however, the difference between the frequencies of the signal and maximum rejection vary, so that the degree of second-channel rejection varies greatly over the waveband.

It is in order to reduce this effect that two methods of offsetting the normal coupling are used in the arrangement of Fig. 2. Although either alone will give full rejection for any one frequency, the combination gives better average results throughout the waveband, for two different frequencies of maximum rejection can be secured. In practice  $C_1$  is a very small capacity of the order of  $5 \mu\mu F$ , and

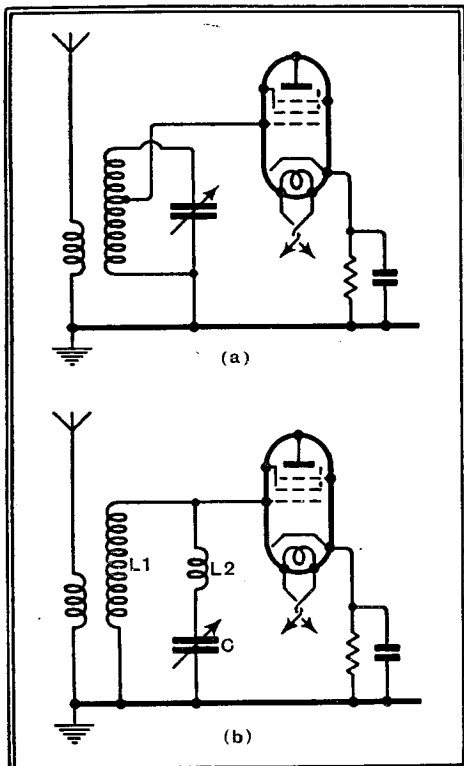


Fig. 5.—The action of the simplest image suppressor (a) is clearly shown by the equivalent circuit (b);  $L_2$  and  $C$  form an acceptor circuit tuned to the image frequency.

it is adjusted to give maximum rejection at the high frequency end of the waveband. The coil  $L_1$  consists of two or three turns loosely coupled to the secondary, and the coupling is adjusted for maximum rejection at the low-frequency end of the waveband. Two frequencies of maximum rejection are thus obtained, but although there are only two points at which the full advantage of the arrangement is secured, the system gives some improvement at all frequencies.

Another system which gives much the same results and is even more widely used<sup>1</sup> is shown in Fig. 3. Here the band-pass filter coupling can be of any type, and image rejection is secured by coupling a coil included in the cathode circuit of the first valve to the first tuned circuit. With this system a voltage at the image

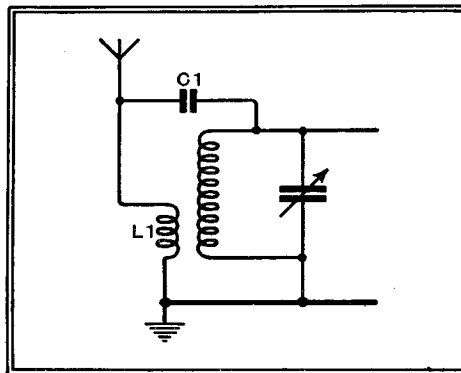


Fig. 6.—Another arrangement applicable to a single circuit is shown here.  $L_1$  and  $C_1$  give opposing couplings at the second channel.

frequency is set up between the cathode of the valve and the earth line by the coupling of  $L_1$  to the first circuit and an equal and opposite voltage between grid and the earth line by the normal filter coupling. These voltages are effectively in series between grid and cathode and so cancel out.

Still another method is shown in Fig. 4. With this system the filter coupling coil is connected to a tapping on the first circuit, and it is this tapping which provides image rejection. This system may also be used with only one tuned circuit as shown in Fig. 5 (a), and its mode of operation is more clearly seen if the circuit be redrawn as in Fig. 5 (b). The circuit  $L_1$   $L_2$   $C$  as a whole is tuned to the signal frequency, and the voltage developed across  $L_2$  and  $C$  in series is applied to the valve. If the tapping point be correctly chosen,  $L_2$  and  $C$  resonate at the second-channel frequency and form an effective short-circuit to  $L_1$  at this frequency only. The circuit thus acts as a combination of a single tuned circuit tuned to the signal and a wave-trap tuned to the image.

Once again, however, perfect rejection can be secured only at one point in the waveband, but an improvement is evident throughout. This arrangement is so simple that it can be applied to each signal frequency circuit, but, of course, the tapings should be differently placed on each coil so that the points of maximum rejection are staggered throughout the wave-

<sup>1</sup> Proceedings of the Institute of Radio Engineers, June, 1935.

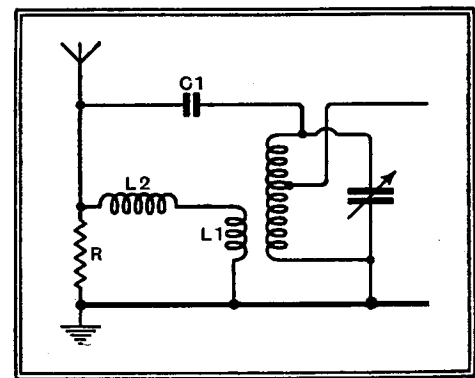


Fig. 7.—A more complex rejection system giving two different points of optimum rejection.

band. Very approximately the number of turns between the tapping point and earth divided by the total turns of the coil should equal  $1 - f^2/fsc^2$  where  $f$  is the signal frequency for which maximum rejection is required and  $fsc = f + \frac{2}{2fi}$  where  $fi$  is the intermediate frequency.

Double coupling systems can also be used with only one tuned circuit. In Fig. 6 the aerial coupling is provided partly by  $C_1$  and partly by the coupling of  $L_1$  with the tuned circuit. If the couplings oppose one another they can be adjusted to be zero at some frequency, and so give full image rejection at one point in the waveband. The grid of the valve can also be connected to a tapping on the tuned circuit and another point of full rejection secured, so that with such simple tuning systems quite a high degree of second-channel rejection can be secured.

#### 465 kc/s Intermediate Frequency

Where the intermediate frequency is of the order of 465 kc/s, signals capable of causing second-channel interference are largely outside the medium waveband. Some further reduction of interference can then be secured, as well as improved sensitivity, by roughly tuning the aerial circuit as in Fig. 7. An additional coil  $L_2$  is inserted in series with the aerial and given such a value that it resonates with the aerial capacity at about the middle of the waveband. The resistance  $R$  is included to damp the circuit to prevent an excessive response at the resonance frequency. Where the aerial is tuned in this way, cathode-coil image rejection can be used with only a single tuned circuit merely by inserting a suitable coil in the cathode lead of the first valve and coupling it to  $L_2$ .

In cases where the second-channel and signal frequency ranges do not overlap it is, of course, possible to do a great deal with fixed filters and resonant coils in the aerial, and in extreme cases, such as the single span system, it is possible to dispense with signal-frequency tuning altogether. With an intermediate frequency of the order of 465 kc/s, however, this is hardly possible, but it should not be difficult to secure an enormous degree of image rejection with only a single tuned circuit by using it in conjunction with image suppressors and aerial filter circuits.

# Current Topics

## On the Trail

AN anti-pirate campaign by the Post Office is now being conducted in the London area. Last year there were 3,000 prosecutions.

## New N.B.C. President

MAYOR LENOX RILEY LOHR has succeeded Mr. M. H. Aylesworth as president of the National Broadcasting Company of America.

## Optimists

"RADIO-LIBERTÉ" is the name of a French organisation just formed "to enable listeners to obtain from the radio authorities the sort of transmissions they really desire."

## High Power from Yugoslavia

YUGOSLAVIA will soon be radiating to the tune of 180 kilowatts. Belgrade is to have a new transmitter of 120 kilowatts, while new stations are also to be erected at Zagreb (50 kW) and Split (10 kW).

## Radio Beacons : New Style

MARSEILLES (according to a correspondent) is rapidly assuming the appearance of a forest of Belisha beacons. More and more roof-tops are adorned with brilliant metal balls which the residents are employing as aerials in place of the wire variety, which, in most cases,

Times of Beginning of Each Note.	O	CAN	A	DA!
	10 h	10 h	10 h	11 h
	59 m	59 m	59 m	00 m
	58 s	59 s	59.75	00 s

**KILLING TWO BIRDS . . . .** The Canadian Radio Commission's identification call is also a time signal, radiated daily from the Commission's Standard Frequency Laboratory at 11 p.m. As the above shows, the call is a "split second" one.

had been condemned by the municipal authorities.

## Marconi's Experiments

MARCHESE MARCONI is resuming his experiments with micro-waves in Italy, his object being to prove their penetrating power in the case of obstacles which defeat ordinary wavelengths.

## Radio Fatality at Toulouse

MICHEL GOURIAUD, a 31-year-old engineer, was accidentally electrocuted last week while testing the new transmitting apparatus at the Toulouse-Pyrenees Regional station.

## More Listeners in Norway

A "CHRISTMAS present" came to the Norwegian Broadcasting Company in the form of a licence rise of 4,200 during December. Norway now has 183,000 licensed listeners—an increase of 30,000 during 1935.

## Catastrophe

A STRAY cat caused a short circuit in the HT transformer filter of *Radio Normandie* a few days ago, and the station closed down for some minutes. "Pussy" went up in smoke.

## Politics "On the Air"

ENTERTAINMENT broadcasting in the U.S. this year will be punctuated by political programmes leading up to the National Election in November. President Roosevelt started the ball rolling on January 8th with his speech at the Jackson Day dinner; on January 25th Governor Alfred E. Smith's speech at the dinner of the American Liberty League in Washington will undoubtedly be broadcast over the networks, and also via the short-wave relay stations.

Thereafter (writes a corre-

## EVENTS OF THE WEEK IN BRIEF REVIEW

### VISITING ENGLAND.

Dr. Vladimir Zworykin, inventor of the "electric eye" and the electron multiplier, arrives in London in February to lecture before the Institution of Electrical Engineers.



500,000 dollars' worth of carrier waves and this year will probably buy considerably more.

### "Electric Eye" Inventor

DR. V. K. ZWORYKIN, inventor of the electron multiplier and television "electric eye," has responded to a cabled invitation of the Institution of Electrical Engineers to lecture before the Wireless Section in London on February 5th. Dr. Zworykin had intended to deal with the applications of electrical and optical systems, but it is hoped that he will be induced to discuss his electron multiplier which was described in *The Wireless World* of November 22nd.

Dr. Zworykin is expected to arrive in London a day or two before the lecture. Very probably he will visit the Alexandra Palace television station, where his advice should prove of great value at the outset of the service.

### Radio as Cold Cure?

ULTRA - SHORT wireless waves are being used by Dr. William Dieffenbach to cure the common cold. "It was discovered," runs the report which has reached us, "that although wireless operators work in close, confined quarters they rarely caught cold. At the same time nearly all wireless operators experience a feeling of congestion in the head when off duty. Investigations showed that this feeling was due to abnormal condition of the blood, caused by the ultra-short waves.

"Consequently it was proved that waves actually act as a warning to the white corpuscles to be ready to attack and keep cold germs at bay."

An ex-operator whom we interviewed regarding the above shook his head and said: "I often had filthy colds."

### D.F. for Aircraft

A WIRELESS beacon will be in operation at Croydon Aerodrome within the next three weeks. Directional wireless is being installed at Newcastle Airport.

### Preparing for Cairo

ESPECIALLY to collect data in support of the amateur cause, the Radio Society of Great Britain has just appointed a committee of four of its leading members to study all amateur radio matters likely to be discussed at the International Telecommunication Conference to be held at Cairo in 1938.

### Town Representatives

IN order still further to stimulate the amateur movement in the larger towns, the Radio Society of Great Britain has organised a new system of town representation. In each town a prominent amateur experimenter is appointed to promote good fellowship among his colleagues within a radius of ten miles. The new scheme comes into force this month.

### An Indian Radio Industry?

A PLEA for the establishment of an Indian radio industry was made by Mr. Lionel Fielden, Controller of Indian Broadcasting, opening the second radio exhibition recently in Bombay.

Referring to the increasing demand for moderately priced radio sets, Mr. Fielden said to his audience of Indian dealers and manufacturers: "Why allow this market to be taken from you by foreign firms? You have everything in your favour—an immense market and a Government pledged to support and develop broadcasting."

The new Controller hopes before long to call a conference of representatives of Indian States and British Provinces.

# The Physical Society Exhibition

## MEASURING INSTRUMENTS AND DEVICES OF WIRELESS INTEREST

AT Olympia each year the finished products of the radio industry are presented with all the arts of salesmanship and window dressing. The Physical Society Exhibition, on the other hand, affords a glimpse into the workshop behind this façade. In the research section the discerning eye may get a hint of future developments, but the practical-minded will be arrested by the fine display of measuring instruments, which are the tools and stock-in-trade of the set designer and research worker.

Direct and alternating current meters form the foundation of most types of measuring apparatus, and ranges of new miniature instruments were shown by Ferranti, Ltd., and Salford Electrical Instruments, Ltd. The former are only 2 in. in diameter and in the latter range there is an extremely sensitive instrument with a full-scale deflection of 25 microamperes.

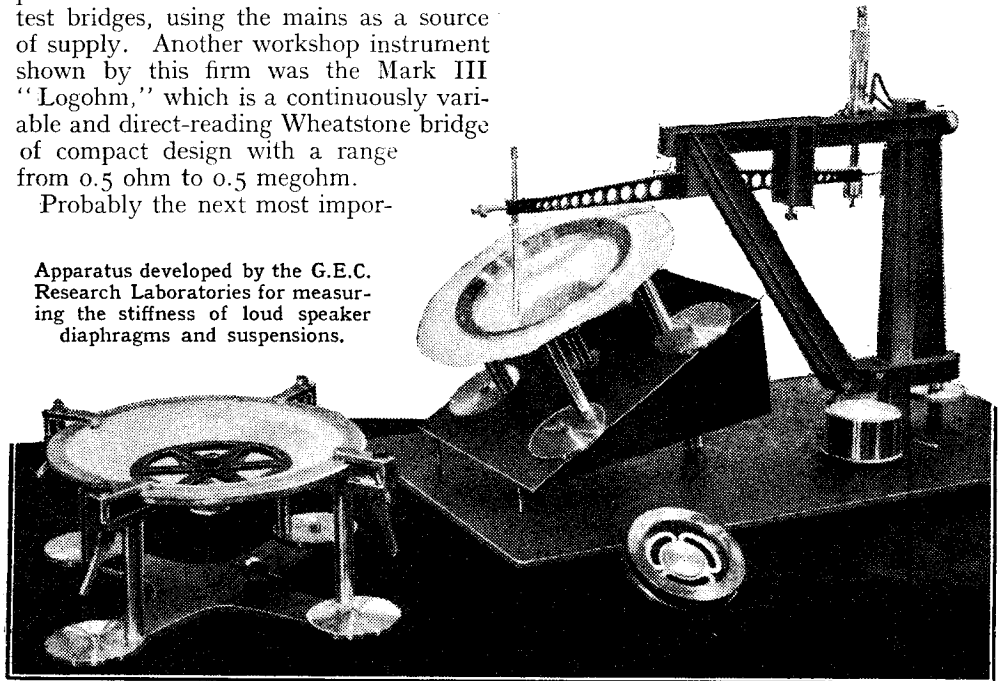
The Westinghouse exhibit this year was devoted mainly to power equipment, but a series of metal rectifiers for AC instruments were also shown. These now give readings up to 100,000 cycles with an accuracy within 1 per cent. of the 50-cycle calibration.

For many purposes a needle-type meter does not afford a sufficiently high sensitivity, and a galvanometer must be employed. The Cambridge Instrument Co., Ltd., were showing a new short-period galvanometer of robust construction with a sensitivity of 300 mm. per microampere at one metre scale distance, which should find many useful applications.

Another interesting exhibit was the 50-cycle vibration galvanometer shown by the Baldwin Instrument Co. This should prove useful as an indicator for works test bridges, using the mains as a source of supply. Another workshop instrument shown by this firm was the Mark III "Logohm," which is a continuously variable and direct-reading Wheatstone bridge of compact design with a range from 0.5 ohm to 0.5 megohm.

Probably the next most impor-

Apparatus developed by the G.E.C. Research Laboratories for measuring the stiffness of loud speaker diaphragms and suspensions.



tant instrument in the wireless laboratory is the valve voltmeter, and Muirhead's were showing a new multi-range instrument employing a diode rectifier and triode DC amplifier with a scale shape approximating to that of an ordinary DC moving-coil instrument. It is well known that the ordinary valve voltmeter is liable to

serious errors at high frequencies, and the General Electric Co. Research Laboratories, Wembley, demonstrated, in the research section, an instrument which is

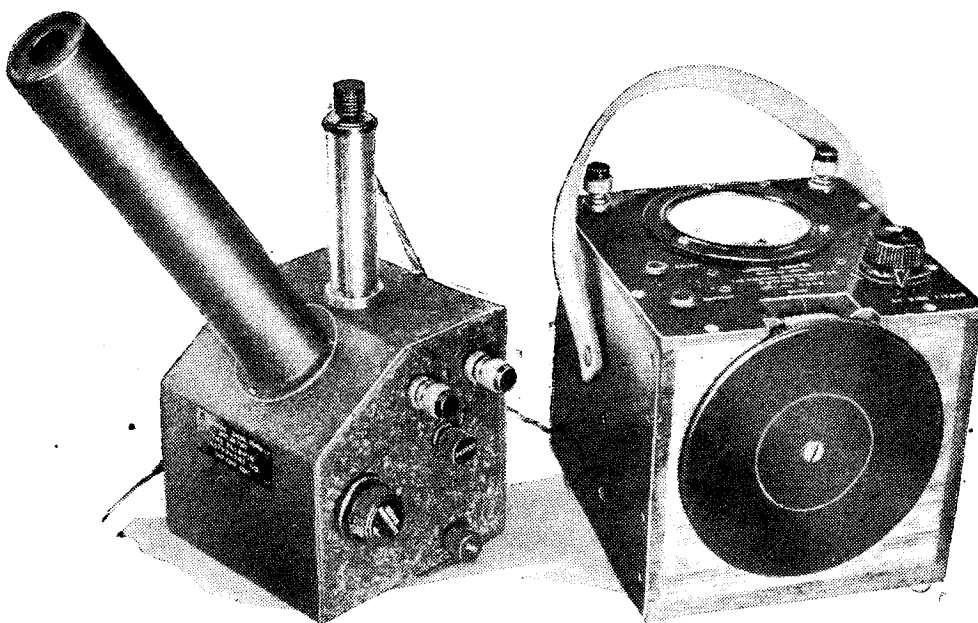
accurate up to 100 megacycles. This instrument uses a special valve with small interelectrode distances, and by applying calculated corrections may be used up to 1,000 megacycles.

The increased importance which the ultra-short wavelengths have recently assumed is reflected in the provision by Marconi's Wireless Telegraph Co., Ltd., of a standard signal generator with a range from 3 to 14.5 metres. The output is calibrated directly in decibels and may be taken from a rod aerial or across an output resistance.

### Test Oscillators

Signal generators for the development of receiving sets for the normal broadcast bands were well represented and new models were shown by E. K. Cole, Ltd., and the Automatic Coil Winder and Electrical Equipment Co., Ltd. An essential part of any signal generator is the output attenuator, and a new design of this component was exhibited by Muirhead & Co., Ltd., which has been checked at frequencies up to 5 megacycles.

Test oscillators for service men, which are essentially simplified versions of laboratory standard signal generators, show a tendency to further refinement in design, and in some cases these have been combined with valve-testing adaptors to



Vibration galvanometer for 50 cycles and (right) the portable Mark III "Logohm" shown by the Baldwin Instrument Co.

**The Physical Society Exhibition—**

form a complete analyser for any of the faults which receiving sets are heir to. The Weston combined Model E665 and 692 was a notable example.

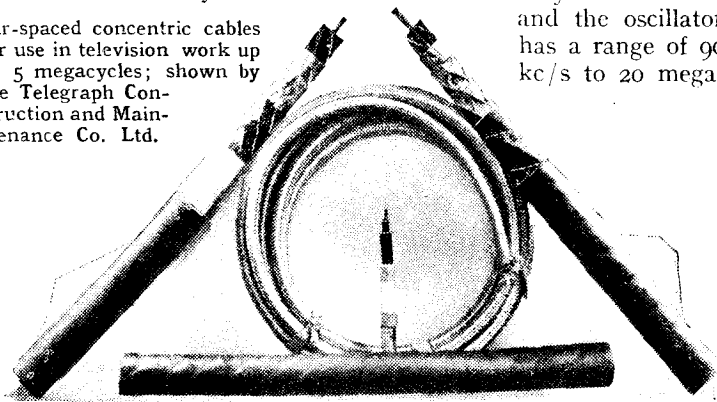
The design of deaf aids has many problems which differ from the acoustic design of ordinary receivers and amplifiers, and in order to obtain data for the design of apparatus for different types of deafness a new type of instrument, known as the "Equalimeter," has been developed by the Multitone Electric Co., Ltd., for examining the patient's reactions to tones of different frequency in the presence of masking effects due to noise. Another instrument for investigating the patient's aural response was the 2B type Audiometer, shown by the Western Electric Co., Ltd., which enables a curve of threshold audibility to be taken over a range from 64 to 8,198 cycles in octave steps.

It was only to be expected that television developments would be well to the fore. Special cathode ray tubes for this purpose were shown by the Edison Swan Electric Co., Ltd., and there was an interesting working model in the research section of the G.E.C. exhibit showing the action of the various electrodes on the electron stream during the process of scanning.

The choice of suitable materials for the fluorescent screen is largely dependent on the degree of "after glow" following the excitation of the screen by the electrons at any given point. The relative proper-

operations with visual indication by means of the new Cossor linear portable oscillograph and ganging oscillator. The response curves of HF, IF circuits and the overall response may be viewed, and the oscillator has a range of 90 kc/s to 20 mega-

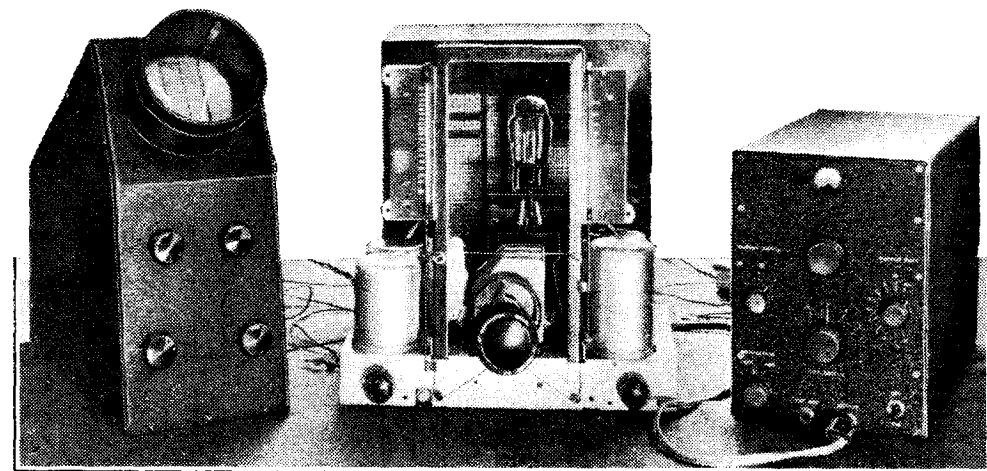
Air-spaced concentric cables for use in television work up to 5 megacycles; shown by the Telegraph Construction and Maintenance Co. Ltd.



cycles. A variation of plus or minus 15 kc/s is superimposed at any frequency in the range by applying a portion of the sweep voltage to a square law valve. The impedance transferred from the anode to the grid circuit through the Miller effect is proportional to the mutual conductance, and hence to the applied voltage, so that the resonance frequency of the oscillator circuit is directly controlled by the time base circuit of the oscillograph without having to resort to rotating condensers.

**Cathode Ray Developments**

In conclusion, the visitor cannot fail to be interested by the many ingenious applications of the cathode ray to other industries. For instance, it is now being used as a high-speed engine indicator, and examples of this application were shown by Standard Telephones and Cables, Ltd., and Cossor. In the research section it was also shown applied to the plotting of instantaneous polar curves showing the



Cossor portable oscillograph and ganging oscillator for viewing HF and IF response curves.

ties of various types of material were very effectively demonstrated by a stroboscopic method in the research exhibit of the General Electric Co., Ltd.

The cathode ray tube has also extended its usefulness in the commercial production of receivers during the past year, and it is now possible to carry out the ganging

distribution of light from an electric lamp. The light collected by a mirror rotating about the centre of the lamp is applied to a photocell, and the resultant current amplified and passed through a potentiometer. Contacts driven by cranks at 90 deg. on the mirror shaft provide the necessary rectangular co-ordinates.

# News from the Clubs

**Modern Components**

"The Trend of Modern Components and Their Design" is the title of a talk to be given by Mr. H. T. Stott, of A. F. Bulgin and Co., Ltd., at a meeting of the Ilford and District Radio Society on Thursday next, January 23rd. The Society meets at 8 p.m. every Thursday in St. Albans Church Room, Albert Road, Ilford. Visitors are cordially invited. Hon. Secretary: Mr. C. E. Lagen, 44, Trelawney Road, Barkingside, Ilford.

**A Big Test**

Shortage of appropriate adjectives handicapped Mr. W. J. Bird, chairman of the Croydon Radio Society, in describing the much-applauded radiogram recital by Mr. Salter at the Society's last meeting. The twenty tunes played revealed the wide range of the instrument, which dealt as happily with the comedy numbers of Elsie and Doris Waters as with the Grieg pianoforte concerto, played by Backhaus. The Society holds its meetings at St. Peter's Hall, Ledbury Road, S. Croydon, and the Hon. Secretary is Mr. E. L. Cumbers, 14, Campden Road, South Croydon.

**Annual Dinner**

Fifty-eight members and friends were present at the fifth annual dinner of Slade Radio (Birmingham). The Society has prepared an ambitious programme for the second half of the session. Hon. Secretary: Mr. C. Game, 40, West Drive, Heathfield Park, Handsworth, Birmingham.

**Television in Yorkshire**

Professor R. Whiddington is president of the Yorkshire Television Association, which has just completed four months of a successful existence. Hon. Secretary: Mr. A. Buckley, 52, Vicarage Avenue, Gildersome, Leeds.

**For Kingston Enthusiasts**

The Kingston and District Amateur Radio Society has made a successful start. Full particulars of forthcoming meetings may be obtained from Mr. R. K. Sheargold, "Reculver," Manor Lane, Sunbury, Middlesex.

**Far-flung Membership**

A "refresher course" is being introduced by the Radio, Physical and Television Society, and many of the "old hands" as well as the novices are attending the lectures. Members come from all parts of London, and an invitation is extended to all interested to apply for particulars of the Society to the Hon. Secretary: Mr. W. G. Licence, 62, Ringmer Avenue, Fulham, S.W.6.

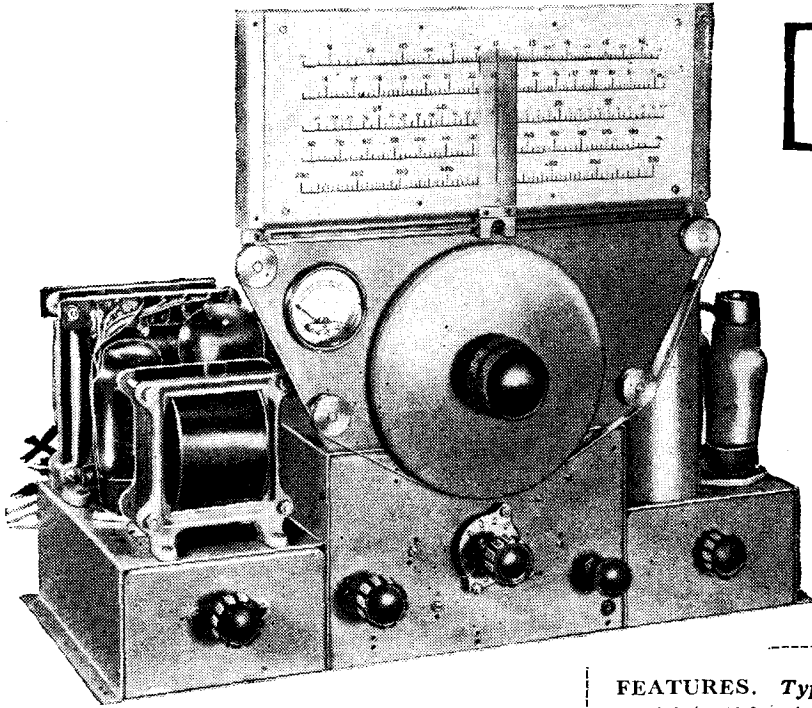
**New Manchester Society**

The North Manchester Radio Society, which was inaugurated in the autumn, has become very popular with an increasing membership. Meetings are held every Friday at the British Legion, Elms Street, Bury New Road, Whitefield, nr. Manchester, commencing at 8 p.m., the room being open for the use of members from 7 p.m. onwards. Morse instruction is given from 7.30 to 8. Meetings are open to all interested in radio. Hon. Secretary: Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, nr. Manchester.

**Amplifiers and Relays**

Amplifier and relay systems will be dealt with by Mr. A. C. Mallinson at a meeting of the Bradford Experimental Radio Society on Wednesday next, January 22nd, at 8 p.m., at Cambridge House, 66, Little Horton Lane, Bradford. Hon. Secretary: Mr. E. P. Burgess, 23, Baslow Grove, Heaton, Bradford.





# Dominion Short-wave Superhet

A SPECIALISED RECEIVER WITH  
UNUSUALLY EFFICIENT AVC

**I**N their general design the majority of short-wave sets show a greater leaning towards ordinary broadcast receiver practice than to the rather special requirements of short-wave reception. That a different technique is required in order to obtain stable results on short waves every experimenter who has worked in this sphere will bear witness. On the other hand, there is no real difficulty in getting results of a sort by merely adding an extra range of coils to a superheterodyne of normal design. The performance given by such an arrangement, however, is hardly likely to satisfy the non-technical listener whose standards of performance are those of the longer wavelengths.

On making his first acquaintance with the short waveranges he is almost certain to be critical of the higher level of background noise, but more particularly of the wide fluctuations of volume due to the inevitable fading effects associated with long-distance transmissions. Even with

a degree of automatic volume control which is more than adequate for the normal broadcast wavebands, the range of fluctuation in volume on the loud speaker will be such that the set is only useful in being able to demonstrate for a few moments the ability of the set to bring in, say, American broadcasting. It is quite a different matter if one wishes to sit down for an hour or more to enjoy the programme.

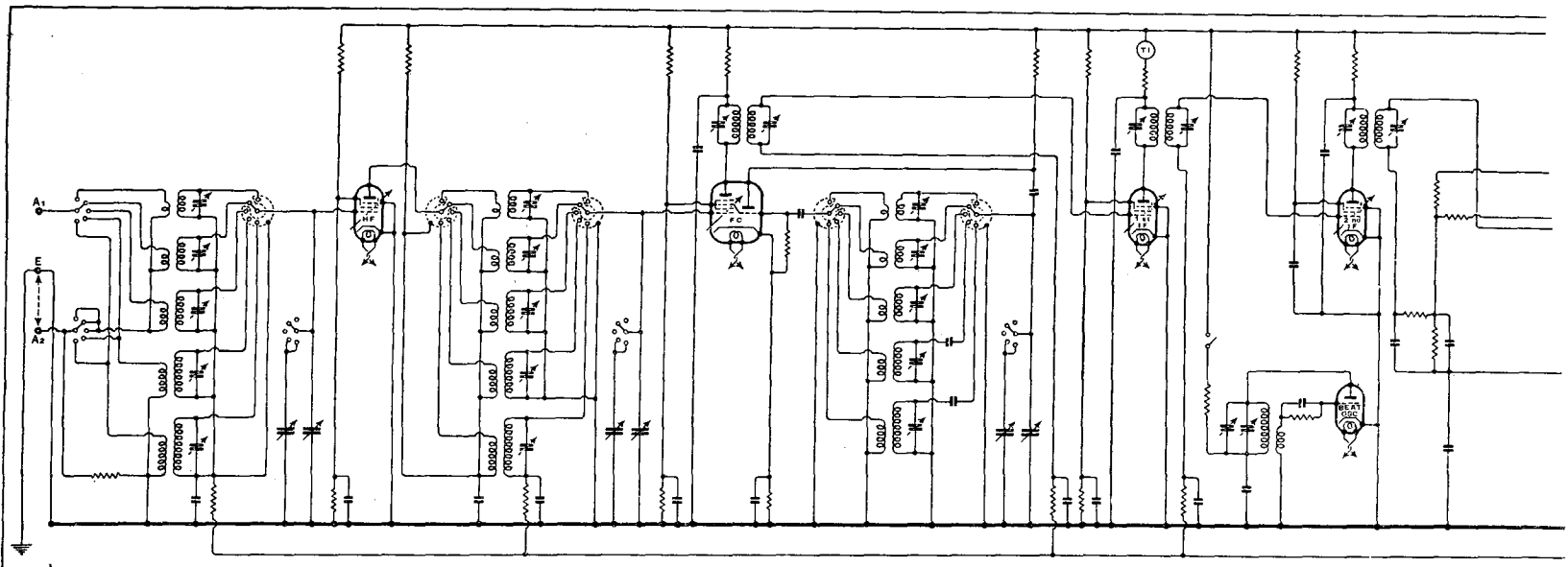
## Volume Stability

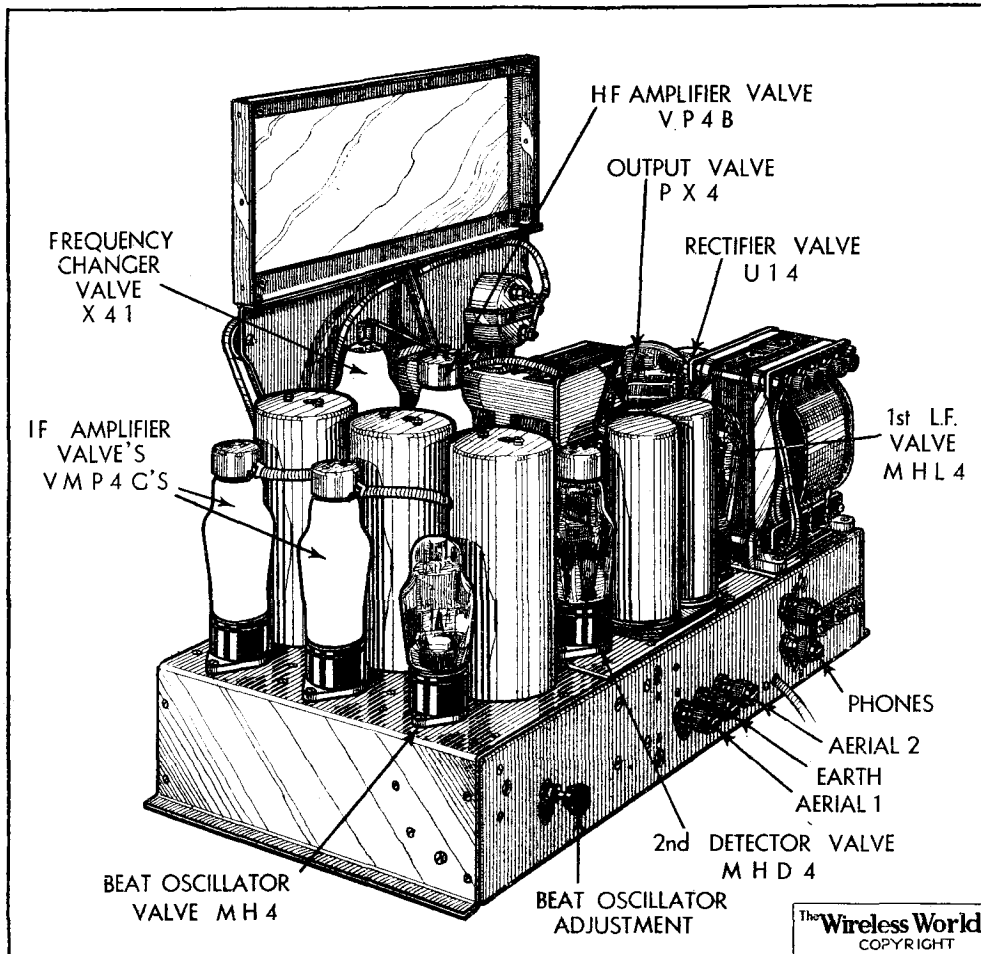
To achieve the necessary stability of volume the designer must forgo ordinary broadcasting standards and start afresh from the short-wave standpoint, if neces-

sary making the performance of the normal broadcast wavebands subsidiary to that of the short waves.

This is precisely what has been done in the case of the Dominion set, and there can be little doubt that for the majority of people its performance will set a new standard, at least as far as the performance of the automatic volume control is concerned. The excellent results obtained in this direction have been achieved by utilising the triode portion of the second detector to amplify the AVC bias instead of using it as the first low-frequency amplifier following the detector stage. This arrangement, together with the introduction of an unusually high delay voltage, results in a

**FEATURES.** *Type.*—Short-wave superheterodyne chassis for A.C. Mains. *Ranges.*—(1) 8.8 to 16.3 metres. (2) 15.5 to 31.1 metres. (3) 30.5 to 59.5 metres. (4) 58.5 to 186 metres. (5) 200 to 550 metres. *Circuit.*—Pentode HF amplifier—triode hexode frequency-changer—two pentode IF amplifiers—double-diode-triode second detector and amplifier AVC valve—triode first LF amplifier—triode output valve. Full-wave valve rectifier. *Controls.*—(1) Tuning. (2) Wave-range. (3) Volume control and on-off switch. (4) Sensitivity. (5) Beat oscillator switch. (6) Beat oscillator adjustment. (7) Loud speaker and 'phone switch. *Price.*—£35. *Makers.*—Dominion Radio





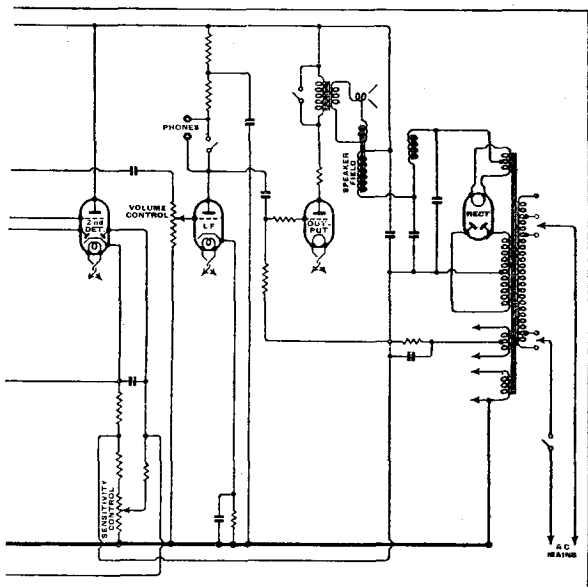
General view of chassis showing arrangement of valves. The aerial and earth terminals may be connected for a single-wire or doublet-type aerial.

steady signal quite free from the sudden bursts of volume which one usually associates with long-distance short-wave transmissions controlled by normal AVC circuits.

Under these conditions the occasional troughs in which the signal strength falls practically to zero are far less noticeable and in no way interfere with the intelligibility of the transmission. Another point which is worthy of note is that the conditions in the AVC circuit have been adjusted so that the maximum output to the loud speaker cannot exceed the power

handling capacity of the output valve. With the wide range of control which is necessary to satisfy this condition it often happens that distortion is experienced earlier in the circuit, but in the Dominion set there is no trace of this defect.

The provision of automatic volume control of this calibre presupposes a high initial sensitivity, and this is



(Left) Complete circuit diagram.

(Right) Interior of coil compartments on underside of chassis.

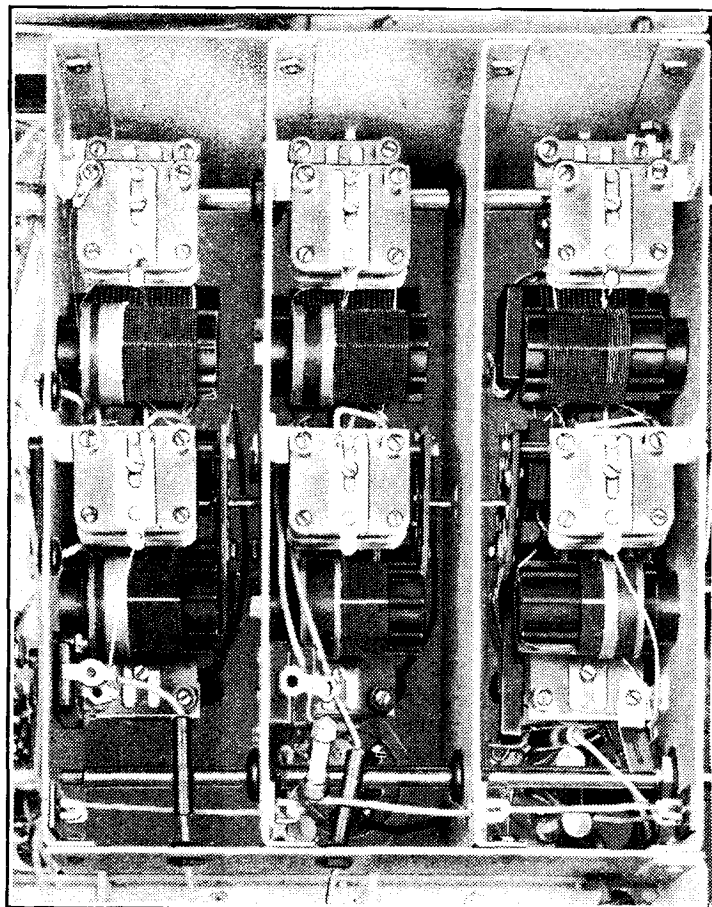
given by an efficient circuit which includes two IF amplifiers in addition to a stage of signal frequency amplification before the frequency-changer. Four separate short-wavebands are pro-

vided, and these are slightly overlapped to give complete coverage from 8.8 to 186 metres. The fifth range is from 200 to 550 metres for the ordinary broadcast transmissions, and to avoid excessive complications the long waveband has been omitted.

The coils are grouped in three sections for the aerial, HF coupling and oscillator tuning circuits. A special type of wave-range switch has been adopted in which all coils, whether above or below the range of those immediately in use, are short circuited. The coils are wound on ribbed bakelite formers with machined threads to ensure accurate spacing of the turns, and each coil has its own trimmer which is of the air-dielectric type in the interests of stability and low loss. A special type of ganged tuning condenser provides, in conjunction with the wave-range switch, a maximum capacity of 150 micro-mfd. on the three lower wave-ranges and 500 micro-mfd. on the remaining two ranges.

### Alternative Aerial Systems

The aerial input circuit is arranged so that a doublet-type aerial may be used on the three lower waveranges if desired, but a single wire aerial may be equally well used throughout the full range of the set. The first stage of HF amplification makes use of a variable- $\mu$  pentode, and the valve in the frequency-changer stage is a triode hexode. The two IF stages both employ variable- $\mu$  pentodes, and a meter-type tuning indicator is connected in the anode circuit of the first stage. Asso-



**Dominion Short-wave Superhet—**

icated with the second stage is a beat oscillator for the purpose of reading CW telegraphy transmissions on the amateur and other wavebands.

The three band-pass filters associated with the IF stages make use of Litz-wound coils and air-dielectric trimmers. In the second detector stage one diode is used for signal rectification and the other for providing the initial AVC bias which is further amplified by the triode portion of the valve before being applied to the earlier stages in the set. On the short waveranges the input HF amplifier and the two IF amplifiers are controlled, the bias to the second IF stage being reduced in order to increase its signal handling capacity. On the broadcast band the AVC is applied also to the frequency-changer stage. A sensitivity control enables the amplification of the receiver to be adjusted to suit conditions when signals are very weak and atmospheric noises abnormally high, but in general the sensitivity of the set is sufficient to bring the AVC into action and so automatically to reduce background noises.

**Provision for Phones**

A separate triode LF amplifier follows the second detector stage, and there is provision in its anode circuit for connecting headphones when using the set at a late sitting. The output stage is a triode capable of delivering 2 watts undistorted to the 9-inch moving-coil loud speaker.

In a receiver specially designed for short-wave reception it is not sound politics to attempt to obtain too wide a frequency response in the LF amplifier and output stage, otherwise the entertainment value of the set may be marred by over-accentuation of the high frequencies which form so large a proportion of atmospheric noise. On the other hand, a carelessly applied cut-off at the top end of the scale may produce equally intolerable results. In the Dominion set the balance between these conflicting factors has been admirably handled, and both the quality of reproduction on distant stations and the suppression of background noise are exceptionally good for a short-wave receiver.

The high sensitivity and the accurate calibration of the tuning scales enable the set to be tuned in to American broadcasting at any time of the afternoon or evening, and the three most important stations—Bound Brook (W3XAL), Pittsburgh (W8XK), and Schenectady (W2XAD)—were always there at the same strength whenever the set was switched on during a test period extending over a full week.

As an indication of the selectivity of which the set is capable it may be mentioned that Pittsburgh and Zeesen on 19.72 and 19.74 metres respectively were easily separated and, moreover, gave precisely the same volume in the loud speaker, although the signal strengths at the aerial were widely divergent. In fact the only indication of the field strength of

a station with this set is that given by the position of the needle of the tuning indicator meter, which, incidentally, also discloses the degree of fading. The AVC has a remarkable levelling effect on the British and foreign stations received on the medium broadcast band, and gives the set an entirely different "feel" from that of the ordinary broadcast superheterodyne. There are a few second-channel whistles on the medium waveband but none on the short waveranges, which are the primary concern of this receiver.

The chassis is built up in sections and the whole structure is unusually rigid. Three groups of tuning coils, together with their trimmers and switches, are con-

tained in adjacent compartments immediately below the ganged tuning condenser. This is driven by a two-speed slow-motion dial of large diameter which is connected through a metal belt to a celluloid hair-line cursor. This traverses a rectangular panel 10in. long with separate horizontal scales for each waveband calibrated in metres.

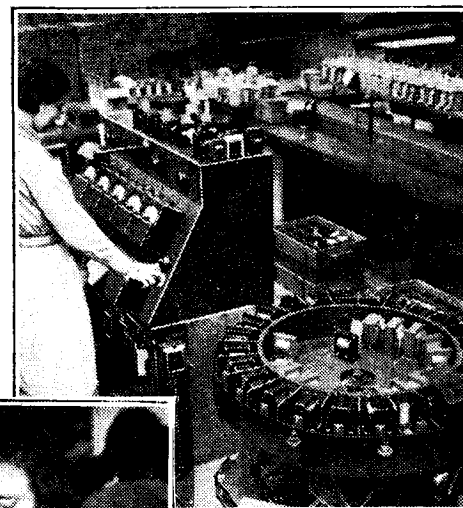
Ceramic valveholders are used throughout the set, and every component is of the highest possible quality. The workmanship throughout is that of a sound engineering job, and the fact that the receiver is sold in chassis form only may be taken as an indication of the direction in which the makers' real interests lie.

## Components for Constructors

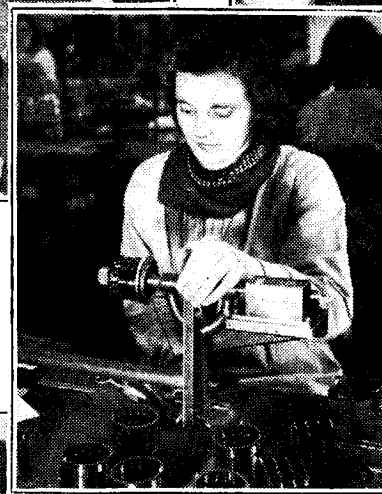
TRANSFORMERS AND VOLUME CONTROLS IN THE MAKING: SOME PHOTOGRAPHS TAKEN IN THE FERRANTI WORKS



(Above) Assembling LF transformers of the AF5 and similar types.



(Above) Finished transformers on a turntable, awaiting their turn to undergo a number of final tests, the results of which are indicated by the meters,



(Right) Winding output transformer bobbins on moulded formers.



(Left) Testing volume controls for continuity, resistance, and contact between brush and element.



(Right) A turbine-driven machine, operated by compressed air, for winding LF transformer bobbins.

# HOW THE SUPER-REGENERATIVE RECEIVER WORKS

## The Most Sensitive of Receiving Circuits

WHEN broadcasting began there were two "Super" receivers in the running—the Super-sonic heterodyne ("superhet" to you and me) and the Super-regenerative. The former enjoyed only moderate popularity until a few years ago, since when it has come right out on top. The latter aroused much interest for a time, and then became almost forgotten. Now the pendulum is swinging the other way once more, and we are having a super-regenerative revival. I see no likelihood at all of this being on anything like the scale of the superhet revival, but there exists some interesting scope.

The merit of the scheme is that it enables the simple reaction-type of receiver to be pressed to a condition in which it gives abnormally high amplification. There are the inevitable shortcomings—loss of selectivity, for instance—that rule it out for most purposes; but sometimes one wants an extremely small portable set. Take policemen; the majesty of the law would not be augmented by sizeable frame aerials wound around the helmet, or conspicuous bulges in the uniform. Any personal police receiver must be discreetly unobtrusive. In general this is difficult, because either (a) a lilliputian frame aerial necessitates a large multi-stage amplifier to yield anything from it, or (b) a receiver with room for only one or two valves, and midget batteries, needs a full-sized aerial for long-distance work.

That is where the super-regenerator steps in. A cigarette-case type of completely self-contained set can be made sensitive enough to provide a useful range. But the main cause for revived interest is the spot light now being directed upon ultra-short waves, largely in the interests of television. Actually the super-regenerator is of no use for television itself; but, whereas vision looks like being the rich man's portion for some time to

come, the accompanying sound, to say nothing of amateur and other efforts, can most simply be groped for with that type of receiver. The loss of selectivity is actually a considerable asset, otherwise it is extraordinarily difficult to tune in a transmission at all; or, when once in, to keep it there.

There still exists a good deal of mystery as to how super-regeneration works. It is not easy to explain it concisely and at the same time, with any justifiable claim to accuracy, but readers who know very little about it indeed may be slightly wiser within the confines of this page.

In non-super regeneration, usually described as reaction, some of the amplified signal is coupled back to the input for the purpose of strengthening it. A moderate amount of this is very effective, and stations can be easily heard with its aid that are quite inaudible without. When the back-coupling is increased beyond a certain point, however, the situation gets out of hand and continuous oscillation is set up quite independently of any stimulation from incoming signals. It is like a machine gun, in which the power released from the firing of one cartridge is applied to send off the next, and so to keep up a continuous action so long as there is any ammunition left. There is no need for anybody to keep on pulling a trigger.

### Restoring Intelligibility

The incoming programme is then usually so much obscured by the local oscillation that it is necessary to reduce reaction below the oscillation point in order to restore useful reception.

Now in the ordinary way the reproduction of sound is produced by the wave sent out from the station varying its strength at an audible frequency—between 30 and 10,000 times a second, one may reckon. Suppose, now, a reaction control is twisted back and forth through the oscillating point 20,000 or 30,000 times a

By "CATHODE RAY"

second. This being a tiresome operation to perform by hand, it is usual to arrange for it to be done electrically by means of a "quenching oscillator." The still higher frequency oscillations of the receiver are chopped into groups at the quenching frequency. If the quenching frequency were lower—below about 15,000—these groups would produce a piercing note. But they are inaudible.

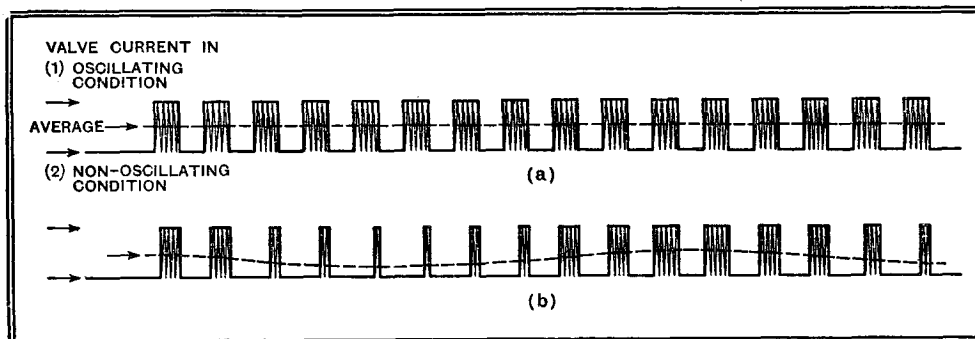
Now this is the interesting thing. When a circuit is suddenly put into the condition of being able to oscillate it does not immediately take advantage of it. A needle, perfectly balanced on end, would remain there for a fraction of a second until some vibration or draught, though extremely small, sent it over. In the same way, an oscillator requires something to set it going; and usually it finds it, within a very minute space of time, in the random circulation of electrons in valves and circuits. These are irregular, and so, when nothing else is being received, the starting-off points in a super-regenerative receiver are irregular, and likewise, therefore, the durations of the separate groups of oscillations.

Suppose (a) in the Fig. shows diagrammatically the effect in the receiver of the groups of oscillations assuming they were to respond instantly to the word "Go!" Each block represents a much larger number of oscillations than can be shown. These being of such high frequency, and all alike, they average out to a dead level, as shown dotted. There is no audible result.

But if the starts are delayed in an irregular manner, groups of these are larger or smaller than others (b), causing ups and downs in the average line, and irregular sounds in the receiver. Actually when a super-regenerator is working one hears a rough hissing sound.

When the carrier wave of a station's programme is tuned in these wholly irregular impulses are swamped by impulses which correspond to intelligible sounds, if one may so flatter the average programme. In view of the fact, which I have just explained, that comparatively large chunks of sound-making power are controlled by the inconceivably minute irregularities of electrons in the circuit, it is perhaps not difficult to realise that such an arrangement is very sensitive to weak signals, and the amplification under favourable conditions is enormous.

Readers who have been successful in following this explanation will see that the action of a super-regenerative receiver is entirely different from that of the ordinary receiver with reaction.

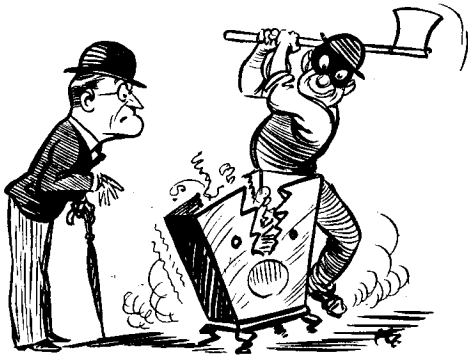


In a super-regenerative receiver the oscillations brought about by tightly-coupled reaction are broken up into groups by the quenching oscillator. The start of oscillation in each group is not instantaneous, as might be indicated at (a), but there is a delay until some other impulse—stray or intentional—starts it off, (b). The dotted line shows the low-frequency "average" in each case.

# UNBIASED

## A New Radio Industry

IT is an ill wind that blows nobody any good, as has been exemplified many times in matters pertaining to wireless. The coming of broadcasting early in the last decade, following as it did so soon after women began to cut off their hair, saved thousands of hairpin manufacturers from ruin, since it enabled them to beat their wares into cores for hedgehog transformers. The great and persistent drought of 1921, followed, as it was, by such a remarkably mild winter, brought thousands



Few swift strokes.

of plumbers to the verge of the bankruptcy court, and had it not been for the wireless boom which enabled them to turn themselves, almost overnight, into fully qualified radio engineers, goodness only knows what would have become of them.

The latest instance of this sort of thing was brought home to me in a striking fashion last week-end, when, in the course of a nocturnal ramble, I encountered a cabinet-maker who was literally (yes, literally) up to his eyes in it. I thought at first that he must have landed a contract from some big wireless manufacturer, more especially when I saw that his workshop was chock-full of the wares of one particular firm.

I was staggered, however, when he seized one of the new sets and with a few swift strokes of an axe bereft it of its cabinet (save the mark) and proceeded to cram it into one of his own make. It appears that practically all his customers are people who had chosen their sets on the very proper ground of technical excellence rather than that of external appearance, but had, nevertheless, failed to see why beauty and goodness should not go hand in hand. They had accordingly decided to scrap the glorified soap-boxes in which the manufacturer sends them out in his praiseworthy endeavour to sell a good set at as low a figure as possible in order to bring it within the reach of the poor and needy.

Manufacturers who put all the value into the set rather than lavish it upon unnecessarily ornate period cabinets have my warmest commendation, since they

bring their sets within the reach of those of us with somewhat meagre purses and at the same time do their bit towards lessening the trade depression by starting an entirely new industry such as my new-found friend was engaged in.

There is only one suggestion I have to offer, and that is that all set makers should sell, in addition to the complete sets, the chassis only, thus enabling a lower price still to be attained—for even these temporary cabinets cost money, even if it be only a shilling or two. Thus, if we did not have to pay the little extra for these unwanted cabinets, more of us would be able to have a cheap but pleasing one built, instead of being compelled to operate the sets in a nude condition.

## Conduct of a Conductor

IT is astounding how backward we are in the matter of applied science, other countries leaving us literally standing in this respect. We have, for instance, harnessed the valve to radio communication, to the recording and reproduction of various sounds, and a handful of other things, but don't seem to have the gumption to use it to ease the strain of life a little farther.

These melancholy reflections were prompted the other day when I was the unwilling witness of what the police usually call an altercation between a bus conductor and a couple of washerwomen.



I was the unwilling witness.

The altercation led, I regret to say, to the fraying of tempers and the use of words which would have called forth a reproving "tut, tut" from the lips of a ship's stoker had one been present. Both parties to the dispute decided to report each other, and both insisted on taking my name and address as a witness, in spite of my warning that I intended to tell the truth.

Eventually, of course, both parties will give evidence that will disagree so profoundly with my own that both they and the tribunal of the transport company concerned will look upon me with suspicion.

Now, in a certain European city in

which I spent a few happy days a short while ago such a state of affairs could never occur. In the buses which ply the city streets secret electrical recording gear is fitted which comes into operation automatically when tempers have risen above a certain predetermined temperature, with the result that a true report is always available.

Since neither the public nor the conductors of these vehicles are as yet aware of the existence of this equipment, the microphones being skilfully disguised as cuspidors, some astounding discrepancies have been noted between the words on

## By FREE GRID

the record and those reported by the disputants; so much so that in the first few cases after the fitting of the equipment it was wrongfully thought that the apparatus had made a regrettable mistake.

As things are in this country, not only am I put to inconvenience by having to answer a letter couched in rather peremptory and none-too-polite terms, but my reputation for honest truthfulness is in danger of being impugned.

## All's Well

I MUST take this opportunity of giving belated thanks to the many kind-hearted well-wishers, friends, and other readers who so gallantly came to my assistance after the recent holocaust which destroyed such a large part of my laboratory gear. I have enough now to come to the aid of the N.P.L. should it find itself running short during the current year, and I trust that the superintendent of that establishment will make a note of it for future reference.

My thanks are also due to the readers who remembered me when sending out their Christmas and New Year's wishes. Last, but by no means least, I must thank the aerial navigation company who so kindly gave me a free passage home from Central Europe after I had lost my return ticket.

I felt quite comfortable in the 'plane until I noticed not only the complete absence of wireless but of any furnishing in the machine at all. The 'plane was, in fact, stripped bare, and enquiry of the pilot elicited the rather disquieting fact that the machine had recently been condemned on the grounds of old age, and, as in the case of the *Mauretania*, had been stripped of all fittings prior to its passing into the hands of the ship-breakers' yard, or perhaps I should say the aeroplane-breakers' yard, whither we were then bound. I must confess that momentarily my opinions of the company's ideas of hospitality underwent a drastic review, but still, all's well that ends well.

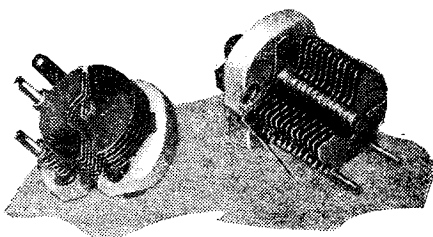


# New Apparatus Reviewed

## Recent Products of the Manufacturers

### POLAR AIR-DIELECTRIC TRIMMERS

THERE are many uses to be found for miniature air-dielectric semi-variable condensers, especially in short-wave receivers, and the new series just introduced by Wingrove & Rogers, Ltd., are ideal for this purpose. They are made in 25-, 50-, 75- and 100-m-mfd. sizes and mounted on a base of ceramic material. A single end-bearing is used with the spindle having a slot at either end for adjustment.



New Polar Air-dielectric Trimmers.

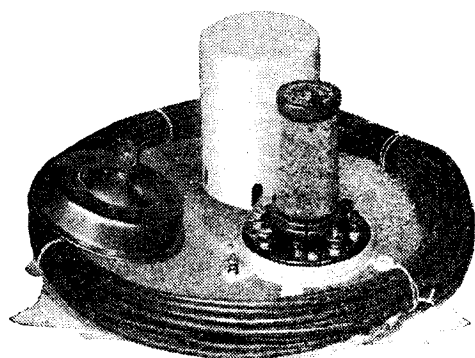
These new Polar models are very compact, the base measuring  $1\frac{1}{4}$  in.  $\times$  1 in. only, while the height varies according to the capacity of the condenser. The largest is, however, only  $1\frac{1}{2}$  in. high.

Two specimens, one of 50 and the other of 100 m-mfds., were sent in for test, which, on measurement, were found to be 49 and 95 m-mfds. maximum respectively. The minimum of the smaller was 3 m-mfds. only, whilst that of the larger was but 5 m-mfds. They are strongly made and cost 3s. each for all sizes.

### GOLTONE STATOFORMER AERIAL SYSTEM

THIS aerial system, which is intended for installation where electrical interference is particularly troublesome, is of the type that employs a low-impedance screened down-lead with matching transformers at each end. In the Goltone system these are termed Statoformers.

The latest pattern receiver Statoformer is claimed to cover the exceptionally wide waveband of 75 to 2,000 metres. Whilst it



Goltone units comprising the Statoformer anti-interference aerial system.

is ostensibly automatic in its operation throughout this range, provision has been made for short-circuiting the long-wave loading section by an external switch, and this does undoubtedly improve the medium and the 100 to 200 metres band's performance.

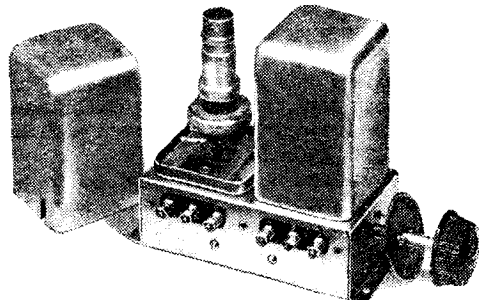
The system is very efficient, and signals do not show any apparent loss in strength over the medium and the bulk of the long wavebands. The efficiency tails off near 2,000 metres and below 100 metres, but these are really outside the useful broadcast bands, so are of little consequence.

The signal-to-noise ratio is vastly improved if care be taken to erect the horizontal portion of the aerial well away from buildings, or high enough to be outside the interference zone. Prices of the units are: Receiver Statoformer as described, 9s. 6d.; aerial type, 5s.; and Stato-lead screened conductor, 3s. 9d. for 50ft.

### TELSEN IRON-CORED COILS

THE twin coil unit illustrated is one of a new series introduced by the Telsen Electric Co. (1935), Ltd., in which iron-cored coils are used. This particular model is known as the Type W478, and comprises two matched dual-range coils individually screened and assembled on a small metal chassis in the base of which are the wave-change switches.

Each coil former has three windings intended for use as primary, secondary, and reaction respectively. Only the secondary is switched, and the others are each arranged in two parts tightly coupled to the medium- and long-wave sections of the secondary. This is quite satisfactory in practice.



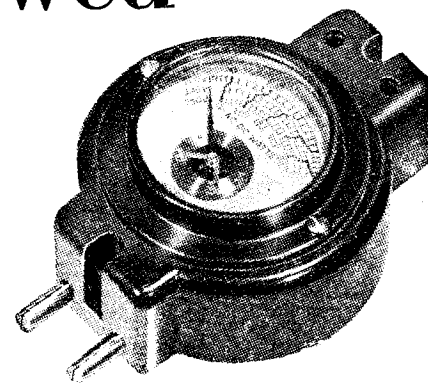
Telsen screened twin coil unit fitted with iron cored coils and waveband switching.

The inductance of the secondary was found to be 159 mH for the medium-wave section and 2,260 mH with the long-wave loading coil in circuit. Both coils are satisfactorily matched in inductance, our measurements showing a 1.2 per cent. discrepancy on the medium waveband and just under 0.5 per cent. on the long waveband.

The twin model costs 12s., and a triple unit 18s. Also, there are superheterodyne units fitted with oscillator coils for 110 kc/s IF amplifiers obtainable at the same price.

### BULGIN WATTMETER

THIS is a very useful addition to the range of measuring instruments made by A. F. Bulgin and Co., Ltd., as it will give the actual consumption in watts of a wireless receiver or radiogramophone on either AC or DC supplies. It is mounted in a moulded bakelite case having a two-pin five-amp. plug at one end and a socket of similar size at the other, so that it can be interposed between the receiver and the mains without the aid of additional adaptors.



Bulgin Universal AC-DC Wattmeter.

The instrument is actually an 0-1 universal-type ammeter with the dial calibrated in watts and for supply voltages of 200, 230, and 250, there being separate scales for each of these voltages. The maximum range of the instrument is 250 watts, and its price is 15s.

We have tested two specimen meters, and find that the measurements made with them are accurate to within about 10 per cent. on the lower readings, but improving towards the higher wattage end of the scale. This holds good both on AC and DC.

It gives an indication of power consumption every bit as accurate as could be obtained by any other means, unless elaborate and expensive instruments are used, but it has the advantage of being simple and easy to handle.

## THE RADIO INDUSTRY

AN extremely attractive series of all-wave receivers is being introduced by Ferranti next week. Both "straight" and superheterodyne models are to be included, and the prices appear to be distinctly low.

Several important installations of public-address equipment have recently been carried out by the Trix Electrical Co., Ltd., 8-9, Clerkenwell Green, London, E.C.1. Trix equipment has been installed at the Ritz Hotel, Piccadilly, for cabaret shows and band amplification; at the Aldwych, Comedy, Phoenix and Savoy theatres, and at the Palace Hotel, Southend-on-Sea.

In future, the only address of W. Andrew Bryce and Co. will be North Road, Burnt Oak, Edgware, Middx.

We have received from Doolittle and Falknor, Inc., Chicago, U.S.A., a leaflet describing the concentric transmission line cable manufactured by this firm. The cable is of the low-loss type and is produced in various diameters; in cases where condensation of moisture inside the line is likely to give rise to trouble the space between conductor and external screen can be filled with dry nitrogen under slight pressure.

**Radio Amateur Call Book.**—The latest edition of the well-known Radio Amateur Call Book is now available in this country. It is a publication which ought to be in the hands of every keen long-distance listener containing, as it does, classified lists of short-wave stations both commercial and amateur, throughout the world, as well as a considerable amount of other information of a type indispensable to the short-wave enthusiast.

Copies can be obtained, price 5s. 6d. post free, from Mr. F. L. Postlethwaite, 41, Kinfauns Road, Goodmayes, Ilford, Essex.

# Readers' Problems

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

## "Stabilised Grid Bias"

REFERRING to the article under the above heading in *The Wireless World* of January 3rd, a correspondent asks whether it is not a fact that, with the arrangement advocated, a difference of potential of some 150-200 V. would exist between the heater and cathode of any indirectly heated valves used in the receiver.

This state of affairs would only arise if the heaters of the receiver valves were fed from the transformer secondary which provides heater current for the bias rectifying valve; it is not intended that this should be done, and, in the absence of a spare secondary (or a spare transformer) it is necessary to use a metal rectifier in the manner shown in Fig. 2 (a) of the article in question. The only part of the anode supply unit that is also common to the bias system is a part of the HT secondary winding of the power transformer.

## Testing the Aerial

FROM some points of view it is rather unfortunate that the aerial-earth system is not so readily susceptible to simple tests as the majority of other accessories and components of a receiver. To a correspondent who asks for information on this subject, we would point out that the only quality of the aerial that can be tested with certainty with simple apparatus is its insulation resistance—not always a matter of supreme importance.

The insulation test is made in the manner illustrated diagrammatically in Fig. 1 (a).

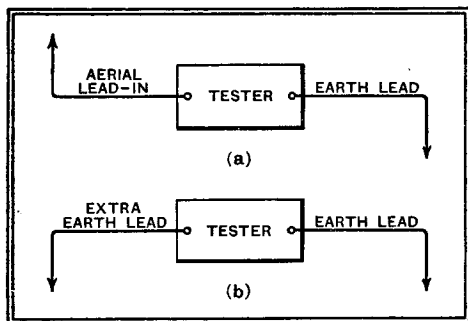


Fig. 1.—Testing the aerial for insulation and the earth lead for continuity.

Any indicator of continuity or resistance can be used as the tester, and, under ideal conditions, an infinitely high resistance should be shown between the aerial and earth leads.

Of course, an aerial that survives this test is not necessarily perfect; for instance, complete discontinuity may exist between the aerial lead-in wire and the aerial proper. A fault of this nature is, however, revealed by any form of tester that indicates the existence of capacity. For instance, a pair of headphones and a dry cell might be used as a tester; on completing the circuit a faint "click" would be heard, due to the charging of the aerial capacity, but, if in-

sulation is good, no "click" should be heard at "break."

Without elaborate apparatus, it is still harder to test the efficiency of the earthing system, but the method suggested in diagram (b) will at least show that continuity exists in the earthing lead. The extra testing connection to earth should preferably be made to some point other than that to which the receiver is earthed.

## Piezo-electric Pick-ups

THE user of a piezo-electric pick-up seems to have misunderstood the manufacturer's instructions to the effect that bias cannot be applied through the pick-up itself. He has attempted—with the inevitable results—to operate the first valve of his amplifier without any bias.

As the pick-up in question is, in itself, an insulator, it is obvious that bias cannot be applied through it, but the volume control resistance connected in shunt provides a path for the application of bias to the grid of the valve in a perfectly normal manner.

## Ganging a Frame Aerial

IT is not always too easy to make the tuning of a frame aerial run "in step" with the tuning of the other circuits in a receiver; this is partly due to the fact that the frame has inevitably a relatively high self-capacity and, further, as its physical dimensions are vastly different from those of the other tuning coils, special precautions must be taken to ensure that its inductance value may be accurately matched.

However, it is possible to align the frame aerial circuit with the others by "trial and error" methods, and we think that a correspondent who asks for information on this subject may tackle the job with some confidence, especially as he does not wish to cover a wide band of wavelengths.

The procedure is to wind the frame to have an estimated inductance as near as possible to that of the receiver tuning coils, and then to tune in a station at the lower end of the waverange, adjusting the trimmer very accurately and noting its setting. The next step is to tune in a station of high wavelength, noting carefully where it is necessary to reduce or to increase the trimmer setting in order to obtain resonance. If a reduction is necessary, we then know that the inductance of the frame is too high and that turns, or part of a turn, must be removed from it. Conversely, if

## The Wireless World

### INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in connection with receivers described in *The Wireless World*, or those of commercial design which from time to time are reviewed in the pages of *The Wireless World*. Every endeavour will be made to deal with queries on all wireless matters, provided that they are of such a nature that they can be dealt with satisfactorily in a letter.

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

the trimmer must be increased, turns must be added to the frame.

It is generally most convenient to make the final adjustments on a small coil connected in series with the frame.

## Grid Bias Batteries

ONE or two readers have pointed out that the system of identifying polarity of the terminals of grid bias batteries described in the "Hints and Tips" section of our issue for January 3rd does not seem to apply to their own particular batteries. It might have been pointed out in the paragraph in question that the connections of sockets as shown related only to batteries constructed on the original and conventional plan, where the mains line of sockets runs along the centre of the battery (see Fig. 2 (a)).

One or two batteries are arranged as in (Fig. 2 (b)), and their polarity always seems to be that indicated. Again, at least

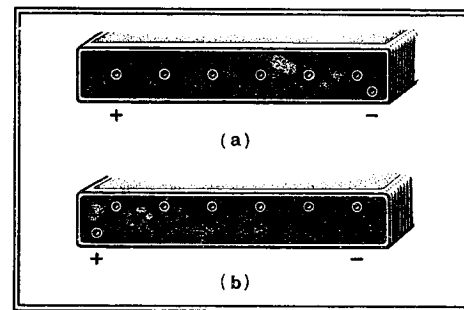


Fig. 2.—Normal mounting and polarity of bias battery sockets, and (dia. b) an arrangement with reversed polarity.

one other make of battery has its sockets arranged in a straight line without an offset end socket; in this case, of course, there is nothing to guide one except the label.

## Much of a Muchness

ALL other things being equal, there is theoretically little to choose between one receiver and another in the matter of susceptibility to electrical interference.

A reader who asks for information on this subject should be reminded, however, that it is rather difficult to lay down a hard and fast rule, as a good deal depends on the nature of the disturbances. For instance, if the LF component of the interference is of a predominant high-toned nature, a set with a good response in the upper register is likely to accentuate the trouble. Even so, that is hardly a valid reason for choosing a receiver with a limited frequency range, because, so far as reception of strong signals is concerned, it is quite likely that the ratio of signal to noise will be sufficiently favourable to permit of good use being made of a set that reproduces high notes well. For weaker signals, of course, drastic use must be made of the tone or selectivity control.

Strictly speaking, the only sets that are less susceptible than others to mains-borne electrical interference are those—particularly universal models—which embody some form of anti-interference filtering in their mains input circuits. A large number of modern sets include this refinement, but, in any case, it is not fundamental to the design, being merely an adjunct which may equally well, if not better, be connected externally in the mains supply leads.

# Novel Accumulator Construction

## THE FULLER "DRY" SECONDARY CELL

By R. W. HALLOWS, M.A.

WHEN Mr. L. W. Fuller, of Block Batteries, produced his "plateless" secondary cell, some time ago, he was not long in realising that here was a design that might well open the way towards the "dry" accumulator. The "plateless" cell is, of course, not really plateless: the negative plate is a hollow cylinder which surrounds the stout central rod that forms the positive. After a long period of research and experiment, Mr. Fuller found that his plateless design could be made up in "dry" form and the cells now to be described are constructed on these lines.

The make-up of the Fuller rechargeable dry cell will be readily followed after an examination of the drawings in Fig. 1, which show it (in sectional form) at various stages of its manufacture.

The foundation of the cell is a solid drawn lead can, the inside of which is pasted with negative material. The next step is to cover the inner surface of the negative paste with the separator, which must be both porous and a good insulator. Several materials have been found suitable for the purpose, but a cement made from powdered pumice was used in the cells I was kindly allowed to examine.

Into the cavity formed by the separator is inserted a lead rod with a fluted stem and a flat base. Into the space between this rod and the separator is rammed positive material in paste form. At this stage the cell is given a top dressing of sand and after the cane vent plug has been inserted it is sealed off with bitumen. A brass cap is then fixed to the end of the central rod and when a wire to form the negative connection has been soldered to the can the cell is ready for use.

The paste used in the dry secondary cell is similar to that pressed into the interstices of the positive and negative plates of an accumulator cell of the familiar type, but there is one very im-

portant difference. In the Fuller cell the paste is actually mixed with the dilute sulphuric acid which forms the electrolyte. Mr. Fuller has long believed that in the wet accumulator cell no use is made of a good deal of the material that should be active. In his dry secondary cell the electrolyte is, he contends, in its proper place; it is *inside* the "plates," so that every particle of active material is surrounded by it. This seems sound reasoning, and there can be no question that he has produced a secondary cell of remarkably compact form. The type designed for filament heating is contained in a moulded case only three inches in dia-

on the plates; the recharging process returns them from the plates to the electrolyte. The secondary cell has two further big advantages from the wireless user's point of view: its EMF remains almost constant once it has settled down to its work, and its internal resistance does not reach a high figure. On the other hand, the dry Leclanché cell suffers from a constantly falling voltage and a constantly rising internal resistance when under load.

### HT Cells in Two Sizes

I have already mentioned the Fuller dry secondary cell intended for filament heating. I was able to examine two other types which have been developed for high tension battery purposes. The first of these is of exactly the same dimensions as the little cells used in standard capacity dry batteries. The second, which interests me most, is of the same size as the cells from which super-capacity batteries are built up; that is to say, it measures one and a quarter inches in diameter by two and a quarter inches in height. Fig. 2 shows the average discharge curve of one of these cells under a load of 250 milliamperes. It will be seen that the initial EMF of 2.2 volts falls fairly rapidly to 2.0, after which it remains steady almost until the ninth hour is reached. The capacity of a cell of this size, even under so heavy a load, is therefore about two and a quarter ampere hours. I was shown the reports of tests made not only at the Block Battery works but also in the National Physical Laboratory. The tests were most exacting, the cells being discharged at 250 milliamperes, then recharged immediately and then discharged again without further delay. After more than 50 complete cycles of discharging and recharging no appreciable deterioration could be found in the cells. A further interesting point is that the cells under test were treated in the way described for 22 weeks without the addition of so much as a drop of water.

No cell or battery can be a commercial success unless it can be produced at a reasonable price. So far as I can ascertain there is no objection to the Fuller cell on this score.

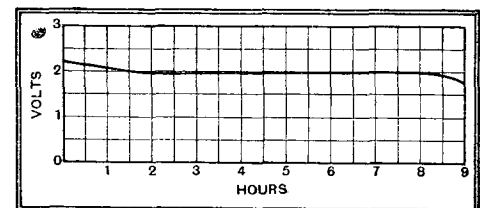


Fig. 2.—Discharge of a high-capacity HT cell under a load of 250 mA.

May I say that the Fuller secondary dry cells and batteries are not yet on the market and will not appear until the manufacturers are completely satisfied with exhaustive tests now being carried out,

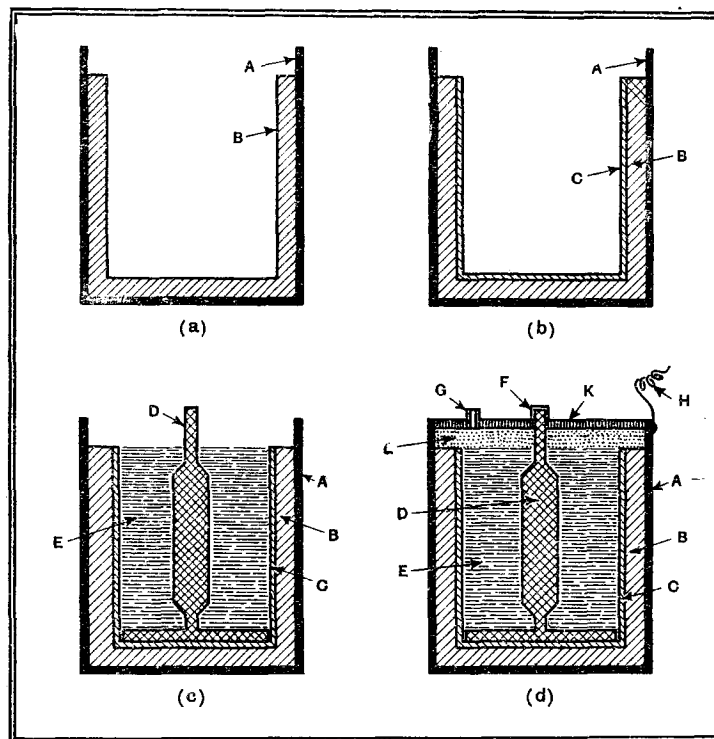


Fig. 1.—Steps in the construction of the new cell. (a) The lead container A is pasted inside with negative material B. (b) The separator C is pasted on to the inner surface of the negative material. (c) The positive electrode, in the form of a flat-based fluted rod D is inserted and the space between it and the separator is filled with positive paste E. (d) Finished cell; the centre rod is fitted with a brass cap F; a vent plug G is inserted; a negative lead H is soldered on, and a bitumen seal K is placed over a layer of sand L.

meter by six inches in height; yet it has a capacity of 45 ampere-hours.

Assuming that the dry secondary cell can put up a good performance when it is called upon to do work (I shall deal with this particular point in a moment), what special advantages can be claimed for it? If it is as good as it seems to be—I have so far had no opportunity of putting it through its paces—I can see no reason why it should not do most of the work at present performed by the dry primary cell—and do it a good deal better in many ways!

As the cell is rechargeable, nothing is wasted, in theory at any rate, except a certain amount of water from the electrolyte, which is easily replaced. During discharge, sulphur and oxygen are taken from the electrolyte to form lead sulphate

# Listeners' Guide



## GEORGE ROBNEY

If one personality may be said to dominate the coming week's programmes it is George Robey's. For a number of hours the carrier waves of the home and Empire transmitters will be modulated by "George's" own life story—"schemed and scribbled" by Robey himself with the aid of Rupert Hazell. Robey started as an engineer, but achieved the position of amateur mandolin player. At one of his performances, when asked to deputise for an absent singer, he gave the only song he knew, and it brought down the house. That was his real start.

"Here's George—a Radio Ramble" will begin with a comic song and finish up with Shakespeare. Elsie Day is to take part; also Mario de Pietro, who, according to George Robey—speaking more or less as an expert—knows how mandolines should be played.

A pleasant sequel is being offered by the B.B.C. Variety Orchestra, which takes part in the main programme; immediately afterwards the orchestra will present a feature, "Following in George's Footsteps," with famous selections associated with the name of the great comedian. (Tuesday, Nat., 8.30; Friday, Reg.)

## THE WEEK'S BEST TALKS

ONE of the professional humorists' stock subjects used to be the talks broadcast by the B.B.C., but only the most

threadbare jokes could now be built up on this topic. To those who have the time to listen the talks are now genuinely interesting, and it needs uncommon will-power to switch them off.

This week there are at least four talks which should keep many a dozing listener awake. At 9 on Sunday evening (Reg.) Rose Macaulay inaugurates a new series, "The Spice of Life," in which people with varying titles to fame will reminisce, giving personal recollections of the incidents which, in their opinion, have made life well worth living.

National listeners at 6.50 on Monday will hear Dr. H. Stafford Hatfield discussing "Many Inventions," and at 10 on Tuesday may learn some home truths in "The Case of the Stolen Motor Car"—another poser in the "Is That the Law?" series.

Lastly, high- and low-brows alike should be intrigued by Edward Clark's talk at 8.15 on Wednesday (Nat.), introducing the symphony concert in which Paul Hindemith, modernist composer, will be the soloist in his own "Der Schwanendreher"—concerto for viola and orchestra, based on old folk songs.

## RADIO MUSIC CHIEF

PROFESSOR OSWALD KABBASTA, the B.B.C.'s guest conductor at the Sunday evening symphony concert (Reg., 9.20), is director of the music department of the

## Outstanding Broadcasts at Home and Abroad

"HERE'S GEORGE," a feature programme next week, will bring George Robey to the microphone to tell his own life experiences, ranging from Shakespearean drama to the humour of "the halls." Supporting "George" will be Elsie Day and Rupert Hazell, with Mario de Pietro (mandoline) and the B.B.C. Variety Orchestra.

Austrian radio company. Sunday's programme will include Schubert's Third Symphony, "The Leonora Overture No. 3," by Beethoven, and "Scenes from Petrouchka" by Stravinsky.

## NO CHOIR OF ANGELS

JAMES WATT, the bicentenary of whose birth is the subject of a feature programme, "The Romance of Steam," at 8.30 on Monday (Nat.), was a realist. Interested in the mechanical side of organs, he built one, but said: "I build according to the laws of science. I see no choir of angels. You may talk about the heavenly tones of flutes. For my part, I measure with this foot-rule and with this caliper, and I draw these things upon this squared paper."

The moment that saw the birth of the modern era of steam was the most dramatic in his career. This was in 1765, when, walking on Glasgow Green, he conceived the idea that if steam were condensed in a vessel distinct

## CIRCUS AND A FARMERS' BALL

TWO promising "O.B.'s" next week are one from Bertram Mills' Circus at Olympia on Monday (Reg., 8.15), and a relay from the Warwickshire Farmers' Ball at 10.20 on Tuesday (Reg.).

## SEVENTY YEARS IN SIXTY MINUTES

CAROL GOODNER will have the task of ageing from nineteen to ninety in one hour in playing the part of Elizabeth Patterson in Norman Edwards' radio play, "The Queen of Baltimore," which will be heard Regionally on Tuesday (8) and on the National wavelengths on Thursday (8). The play reviews the life of Elizabeth Patterson, who married the youngest son of Napoleon.

## A GERMAN CONCERT

GERMANY provides the fourth of the series of European concerts, to be relayed by the B.B.C. this evening at 8 on the National wavelengths. The famous Leipzig Symphony Orchestra, conducted by Hans Weisbach, will be heard in a well-balanced programme of classical and modern works, the former represented by Bach and Handel, and the



IN TOWN TO-MORROW NIGHT will be this Coster Band, directed by Leon Cortez, which is taking part in the Music Hall programme at 8.30. All the players are genuine members of the coster fraternity.

from the cylinder, it would be possible to make the temperature of condensation low and still keep the cylinder hot.

latter by Pfitzner and Graener. Organ lovers will listen eagerly for Günter Ramin's rendering of Bach's "Tocatta

for the

Week



**GERMAN CONCERT.** The fourth in the series of internationally relayed concerts comes to-night (Friday) from Germany, the Leipzig Symphony Orchestra taking part. Dr. Günter Ramin (inset), the celebrated Bach exponent, will play the Toccata and Fugue in D Minor. The Bach statue stands outside the Thomaskirche in Leipzig.

in D Minor." Ramin, who gained his experience of the organ at Bach's own church of St. Thomas, Leipzig, will also be the soloist in Handel's Concerto in D Minor for organ and orchestra.

#### NEWCOMERS

If newcomers to the microphone do not always fulfil expectations, there is always a thrill in observing how they acquit themselves, so next Wednesday's variety hour (Reg., 8.15) should be uncommonly interesting. Ernest Longstaffe has collected, with one notable exception, an entire cast of radio novices.

The exception is Edwin Lawrence, whose funny monologues have already scored a radio success. The newcomers include "The Three Herons," a close-harmony trio described by the B.B.C. as "astonishingly talented"; also there will be "The Busking Broadcasters," who make music with a harp, English concertina, a dulcimer, and a violin. Another microphone debutante will be Marjorie Holmes, a soubrette, and, finally, Beck and Aston, famous on the halls for their broad Lancashire cross-talk.

#### THE BEST RADIO OPERA?

Of all Wagner's operas probably the most easily adapted to broadcasting requirements is "The Flying Dutchman," in which the "Storm Music," the Spinning Chorus and Senta's Ballad tell the story, with marvellous orchestration. The radio version of the opera comes from Hamburg to-night at 7.10.

To-morrow's "star" opera is Massenet's "Don Quixote" from Radio-Paris at 8.45; on the same evening Rome offers Pizzetti's recent opera, "L'Orseolo," conducted by the composer himself. A novelty is promised at 8 on Saturday by Brussels No. 2—"Californian Ballad," composed by Hanns Eisler, with a cast of ten Flemish singers.

#### OPERETTA

TO-NIGHT'S operetta treat will be Mascagni's only effort in this direction, "Si," which Rome gives at 6.35. Later Lecocq's melodious "Fille de Madame Angot" comes from Radio-Paris at 8.45. On the following evening an electrical recording of this is being relayed by Budapest at 6.45.

There is an English interest

#### HIGHLIGHTS OF THE WEEK.

FRIDAY, JANUARY 17th.

Nat., 8, European Concert, contributed by Germany.

Reg., 8, Comic Opera: Offenbach, Edward German, Hermann Finck. 9.15, B.B.C. Orchestra.

Abroad.

Radio-Paris, 8.45, Operetta: "La Fille de Madame Angot" (Lecocq).

SATURDAY, JANUARY 18th.

Nat., 2.35, Wales v. England Rugby Commentary. 8.20, Music Hall.

Reg., Concert by Glasgow Orchestral and Choral Union. 9, Act I "Madame Butterfly" (Puccini) from Sadler's Wells. 11, Henry Hall's Hour.

Abroad.

Brussels I, 8, Symphony Concert. Soloist: Marcelle Meyer (piano-forte).

SUNDAY, JANUARY 19th.

Nat., Mantovani and his Tipica Orchestra. 7, Moisewitsch (piano-forte) in Chopin Ballades. ¶Torquay Municipal Orchestra.

Reg., 5.30, B.B.C. Military Band. 9, Rose Macaulay: "The Spice of Life." ¶Sunday Orchestral Concert.

Abroad.

Strasbourg, 8.15, Sacred Concert from Nancy.

MONDAY, JANUARY 20th.

Nat., Music from the Movies (Louis Levy and his Symphony). 8.30, James Watt Bicentenary Programme.

Reg., 8.15, Relay from Olympia Circus. ¶Viola Recital by Paul Hindemith. ¶Maurice Winnick and his Orchestra.

Abroad.

Munich, 8, Festival Variety.

TUESDAY, JANUARY 21st.

Nat., Moore's Irish Melodies (B.B.C. Singers). 8.30, George Robey in "Here's George." ¶B.B.C. Midland Orchestra.

Reg., 8, Radio Play: "Queen of Baltimore" (Norman Edwards). ¶Leslie Bridgewater's Quintet.

Abroad.

Paris PTT, 8.30, "The Weird and Magical in Music."

WEDNESDAY, JANUARY 22nd.

Nat., B.B.C. Dance Orchestra. 8.30, Paul Hindemith in B.B.C. Symphony Concert. ¶Sydney Kite's Piccadilly Hotel Band.

Reg., 8.15, "Vaudeville in Five Flats." ¶Fred Hartley and his Novelty Quartet.

Abroad.

All German stations, 7.15, Gala of German Youth.

THURSDAY, JANUARY 23rd.

Nat., 8, "Queen of Baltimore." 10.20, Nelson Keys in January Revue. ¶Al Collins and Berkeley Hotel Dance Band.

Reg., 8.25, Music of the Coldstream Guards. ¶Revue: "Standing on a Corner."

Abroad.

Kalundborg, 7.10, Thirteenth Thursday Concert. Soloist: Cassado (cello).

in Suppé's "Donna Juanita," which Berlin (Funkstunde) broadcasts to-morrow evening, for the scene is laid in San Sebastian in 1796, when the fortress town was in the possession of English troops.

Another classical operetta, "Betrothal by Lanternlight" (Offenbach), is being given on Saturday evening by Warsaw at 7 o'clock. Much more modern is Königsberg's radio operetta, "Your Car—My Car," at 8.10.

Ziehrer's very melodious "Die Landstreicher" comes from Frankfurt at 7.10 on Tuesday.

◆ ◆ ◆

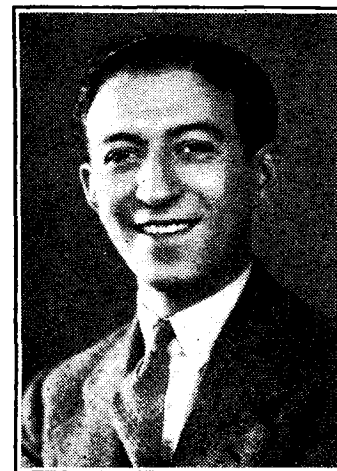
#### A FAMOUS QUARTET

THE famous Dresden Quartet, now touring Europe, lands at Warsaw on Tuesday at 9 o'clock, and will be heard in Schubert's String Quartet in D Minor ("Death and the Maiden").

◆ ◆ ◆

#### MIDNIGHT WEDDING

GERMAN fondness for the play-with-music form is exemplified in Munich's 8 o'clock transmission on Tuesday,



AL COLLINS, who brings the Berkeley Hotel Orchestra to the microphone for the late night dance music on Thursday.

which consists of "The Midnight Wedding," produced in collaboration by Althaus and Kusche, who appear to be the Gilbert and Sullivan of modern Germany.

◆ ◆ ◆

#### SPECIAL ITEMS

MUNICH, Thursday 8: Radio opera, "Jorinde and Joringel" (first performance).

Kalundborg, Tuesday, 6.15: "A Trip to Rosenberg Castle."

Munich, Monday, 8: The Augsburg studio celebrate their birthday.

THE AUDITOR.



# Letters to the Editor

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

## Transients and Bass

THERE have appeared from time to time, in *The Wireless World*, letters dealing with the problem of reproducing transients. The chief difficulty is to connect theoretical arguments with experimental facts.

Theoretically good transient reproduction requires only an adequate frequency range with a minimum of phase distortion, since any waveform can be resolved by Fourier analysis into various sinusoidal components, each with a particular amplitude and phase.

But the practical results that the transient response is improved by increasing the field strength and by using a horn, do not at first seem to be connected with the frequency characteristic, and are explained by saying that both devices increase damping and cause unwanted vibrations to die down more quickly.

In agreement with theory is the statement that the transient response is improved by extending the frequency range upwards to include the higher frequency Fourier components. This is especially marked in the case of such noises as paper rustling. But what of a more musical transient such as a piano note?

In his book "Noise" Dr. McLachlan shows the spectrum of a piano note of frequency 64 c/s. The band spectrum due to the transient part of the sound does not extend above 1,600 c/s and the majority lies below 1,000 c/s. The lower end reaches right down to zero frequency.

Hence for the re-creation of the waveform in the air, all frequencies from zero upwards will be required, though presumably the omission of those below the limit of audibility will not be apparent to the ear. Does not, therefore, the faithful reproduction of transients depend on the extreme bass down to 20 c/s or so, just as much as the extreme top?

W. J. CLUFF, B.A., B.Sc.

Cambridge.

## Home Recording

WE were interested to read Mr. A. Graham's, of Dudley, letter published in the issue of December 27th, further to your reference to "Home Recording" in November 29th issue, particularly as your correspondent is obviously using an ordinary standard "Simpson Electric Turntable" for his work.

We should like to point out that we are in a position to supply a super-power "Simpson Electric Turntable," which would have ample torque for the recording on discs up to 12in. This information may be useful to your correspondent.

G. L. d'OMBAIN,

London, W.C.1. Technical Dept.,  
Kingsway Radio, Ltd.

## Stereophonic Broadcasting

IN reference to the leader in the issue of January 3rd, the following may be of interest.

In the early days of broadcasting, transmissions from certain theatres were sometimes arranged.

At this period the Electrophone service was still available. On several occasions I tried the effect of listening first on one service and then on the other with double headphones and then listening with two

receivers, one of which was connected to the Electrophone service and the other to the Broadcast system. The improvement under the latter condition was extraordinary. Whereas each service individually gave with the headphones a somewhat flat response, the combined arrangement gave the impression of listening from within the theatre.

Electrophone transmitters were always fixed by the footlights and the broadcasting transmitters in the wings. The pronounced stereophonic effect was no doubt due partly to the position of the transmitters and partly, possibly, to difference in phase.

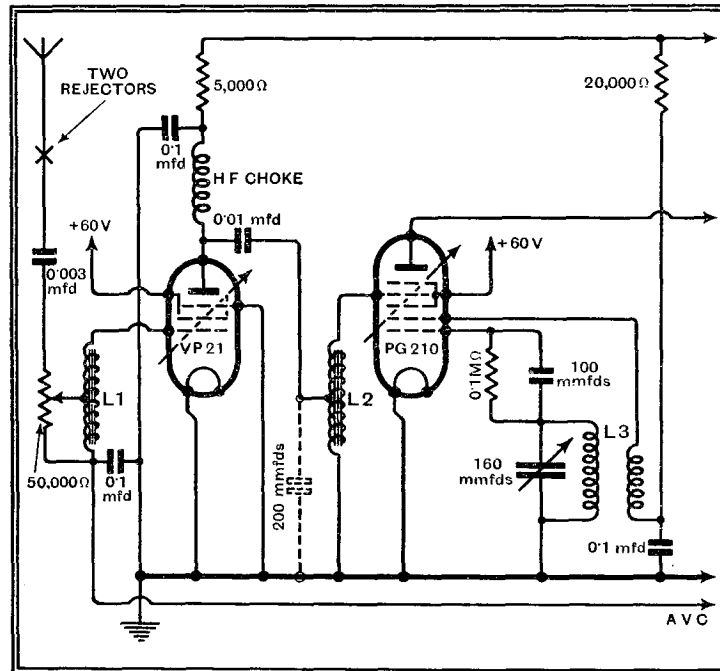
Those early observations of mine justify me in believing that considerable gain in the quality of reception would result from twin transmission as suggested in your leader.

G. G.

London, S.E.21.

## Single Span Tuning

YOU may possibly be interested in some experiments I have made on the Single Span receiver, and in the circuit of my receiver working on this principle. I constructed a receiver on the lines of the original battery Single Span some time ago, and found that if the input voltage from the aerial did not exceed a certain value, about 0.1 volt, the receiver behaved quite well. On a large aerial, however, whistles were present which were due to the sixth harmonic of the beat frequency of the two locals, National and Regional. It was possible to reduce these whistles by operating the frequency changer at zero bias, or by



Reader's modifications to Single Span receiver.

using a rejector tuned to either of the two locals. I am now using two rejectors. A certain amount of second-channel interference from morse stations was present, however. I have now succeeded in eliminating this, and in increasing the signal to noise ratio considerably, by the use of a signal frequency amplifier.

The input volume control, V, can be

turned up to such a point that cross-modulation begins to occur. The actual gain is limited by the field strength of the most powerful station, in this case Daventry, as the local station rejectors reduce these signals considerably. The use of two filters, L1 and L2, has resulted in complete elimination of the morse interference.

The sensitivity is practically uniform over the frequency range covered, as far as I have been able to measure it with the W.W. Modulated Oscillator, via a dummy aerial of 200  $\mu$ F, 25  $\mu$ H, and 25 ohms.

Trusting this will be of interest to you,  
London, N.4. COLIN COATES.

## Need for Cheap Blanks!

IT is a pleasure to see that the belated question of home recording is now being raised in *The Wireless World*.

I have several times attempted recording, latterly with good results, the drawbacks consist of the shortcomings of the aluminium discs, and the insufficient torque of present motors to cut a decent groove. For a long time I have been trying to find a substitute for the aluminium discs, and have tried gelatine coating with no success. A paint manufacturer is letting me have a resinous compound to coat the aluminium blanks with; this has not yet been tried, and to my mind will need very skilled working.

I intend to write for details of the "Simplot" records recently described; but the price will probably discourage the universal use of these.

For tracking, a successful method is to move the turntable and fix the recording head. A drive is taken from the main spindle via meccano gears to four pinions and flanged wheels; the pinions work in meccano rack strips, while the flanged wheels run on rails, ensuring a smooth and straight motion. The recording head is allowed a vertical movement to compensate for unevenness in the turntable and blanks. My recording head consists of an old B.T.H. horseshoe-type pickup, formerly 5 watts output has been used; this is now increased to 12, and a transverse microphone, as described in *The Wireless World*, constructed; thus, in the near future, with better blanks, excellent results are expected.

G. F. W. POWELL.

Bromley, Kent.

**Ionosphere Fauna**

I JUST wish to let "Diallist" know that it is not H. G. Wells to whom must be given the credit for anticipating the Radio Research Board in their references to the lairs of the ionosphere. The story to which he alludes is surely "The Horror of the Heights," by the late Sir A. Conan Doyle.

M. G. SCROGGIE.

Bromley, Kent.

**The Imperial Short-wave Six**

WE would refer to an article entitled "Imperial Short-wave Six" in *The Wireless World* dated January 3rd, where a statement is made on page 3 that the X31 valve was found unsuitable on the shorter wavelengths.

While appreciating that the statement probably refers only to the specific components used in connection with this receiver, we fear that it might be read by some as a general implication that the valve is not satisfactory for the purposes claimed in advertisements for the type.\*

We should like, therefore, to correct this inference by stating that we are satisfied that good conversion gain is maintained with the X31 valve down to the minimum wavelength specified, namely, 5.5 metres, without the addition of the separate oscillator valve, and in this particular case it would seem that the coils used could not have been satisfactory to the X31 type.

If desired, we are prepared to co-operate in suggesting a suitable coil design to accomplish this result.

THE GENERAL ELECTRIC CO., LTD.,

Osram Valve Dept., Magnet House,  
Kingsway, W.C.2.

\* The statement did, of course, apply only to the particular arrangement employed with the components mentioned.—  
ED.

**Sub-harmonics**

TO avoid any misunderstanding in connection with my article on sub-harmonics in *The Wireless World*, December 27th, 1935, the sentence at the foot of column two, page 668, might be modified with advantage. "The cone in the Jensen speaker used by Pedersen is similar to that used by the Telefunken Co." should read "... is similar to the straight-sided cones used formerly by. . . ." This company now used curved-side cones, thereby avoiding sub-harmonics.

Prof. Pedersen claims to have proved that these harmonics are due to non-linearity of the centring device or surround. By means of his integrating machine at the Manchester University, Prof. D. R. Hartree has very kindly solved a number of typical differential equations for me. In no case likely to be encountered in practice did the machine show that a sub-harmonic would occur. It follows, therefore, that the portion of Prof. Pedersen's mathematical analysis which deals with a *non-linear restoring force* is incorrect (Journal Acoustical Society of America, April, 1935). He assumed that the solution of the differential equation of motion of the cone contained a term representing a sub-harmonic, and Prof. Hartree's machine has proved that this assumption is untenable under conditions likely to arise in practice. The correct explanation of sub-harmonics in cones is that given in the article of December 27th.

Acton, W.3. N. W. McLACHLAN.

# Random Radiations

By "DIALLIST"

**Well Done, B.B.C.!**

THOUGH the B.B.C. transmitters were in action for a total of 68,795 hours 38 minutes during 1935, the average time lost owing to breakdowns was only 0.026 per cent. This means, approximately, one-fortieth of an hour, or, say, a minute and a half, for each hundred working hours. As one and a half minutes equal ninety seconds, less than one second was lost, on the average, for each hour of transmission. That is a pretty good record, when you come to think of it, and one of which the Engineering Department may feel justly proud. Another cause for congratulation is the way in which the B.B.C. stations have kept strictly to the wavelengths allotted to them under the Lucerne Plan or the subsequent small revisions that have taken place. Not many other countries could show such a good record in this respect.

**Spotting the Spots**

A NEW use has been discovered for infra-red photography, and it is one that may have very far-reaching results. Ailments such as measles and diphtheria cannot be diagnosed by ordinary methods until the rash or other outward signs appear. The disease, therefore, cannot be tackled until it has run the full course of the "incubation" period. Experiments at the Middlesex Hospital have shown that infra-red photographs will detect the presence of the usual signs long before they become visible to the eye, since a penetration of three or four millimetres in the skin can be obtained.

**The "Queen Mary"**

BROADCASTS from the *Queen Mary*, during her maiden voyage, are to be a feature of the B.B.C. programmes. The Corporation has been given sole control of the arrangements, and several commentators will make the voyage. Their broadcasts should be most interesting, giving, as they will, pictures of the daily life on board the latest and fastest of luxury liners. Permission has also been given to the authorities of the United States, Holland, Austria, and other countries to send commentators and to make broadcasts of their own. These will, of course, not be under the control of the B.B.C., except in so far as the arrangements for them are concerned.

**Sharing Out the Short Waves**

ON February 27th, a conference convened by the International Broadcasting Union will meet in Paris to consider the whole subject of short-wave broadcasting. It is expected that representatives will come from all European countries who are interested, and invitations have been sent as well to the United States, South American countries, and the chief countries of the British Empire. The B.B.C. is sending a delegation under the leadership of Sir Noel Ashbridge, its Chief Engineer. There is a great deal of work to be done, for certain bands of the short waves threaten to become almost as overcrowded as the medium waveband now is. It is hoped that it may be possible for the delegates to reach a general agreement which will result in a fair allotment of the wavelengths below 100

metres and to the elimination of mutual interference. Unfortunately, the delegates will have no authority to pledge their Governments to observe any agreements that may be made.

**France's Empire Station**

THE French Ministry of Posts and Telegraphs, usually known as the P.T.T. for short, has announced its intention of erecting shortly the most complete and most powerful plant in the world for the transmission of short-wave broadcasts. The present Radio-Colonial has been doing good work. Its 10-kilowatt plant transmits at different times on three wavelengths between 19.68 and 25.6 metres, with a total "time on the air" of sixteen hours and thirty-five minutes out of the twenty-four. It is, however, not sufficiently extensive to provide the whole of the French Empire with a satisfactory service. If you care to examine an atlas you may be surprised to find how big the French Empire is and in what distant parts of the world some of the French possessions lie.

**The Longer-wave Americans**

A WEEK or two ago I mentioned in these notes that I could make little or nothing of American stations working on wavelengths much above 379.5 metres. A reader who writes from the most westerly part of the West Country expresses surprise, since he can record loud speaker reception of WOR on 422.3 metres, WLW on 428.3, and other U.S.A. stations on wavelengths well above the limit that I mentioned. He is, of course, just about as well situated for transatlantic reception as any dweller in this country could be. I, on the other hand, live inland, almost as far from the sea as it is possible to be and a good 160 miles from the nearest point on the Atlantic coast. Since I wrote the paragraph referred to I have heard one or two American stations, but only at feeble volume. What is rather surprising is that if U.S.A. stations on wavelengths above 400 metres are coming through well, in certain parts of the country at any rate, there are not more reports of reception from WLW, the 500-kilowatt station at Cincinnati, Ohio. Though I used to receive transmissions from the old WLW plant (50 kilowatts was its rating, if I remember aright), I have never heard the present huge station at all well except in the early mornings rather more than a year ago.

**Are We Growing Bored?**

I HAVE heard it suggested that for many people the programmes provided by the B.B.C. have ceased to have any particular interest. This is a sweeping statement and, like most statements of that kind, not to be accepted without careful scrutiny. It is true that you will find in some houses that on several days during the week no one bothers about anything but the news bulletins. Such homes are exceptional, and even in them full use is made of the receiving set when any particularly important item is broadcast. Those whose attitude towards the programmes is such as I have

described are often suffering from the kind of reaction that is due to a surfeit of wireless in the past. If you make enquiries you may discover that when they first became set owners, and for some little time afterwards, they kept the set switched on morning, noon, and night without bothering to make any particular choice of the items that they tuned in and without much caring what was delivered by the loud speaker so long as it was "entertainment."

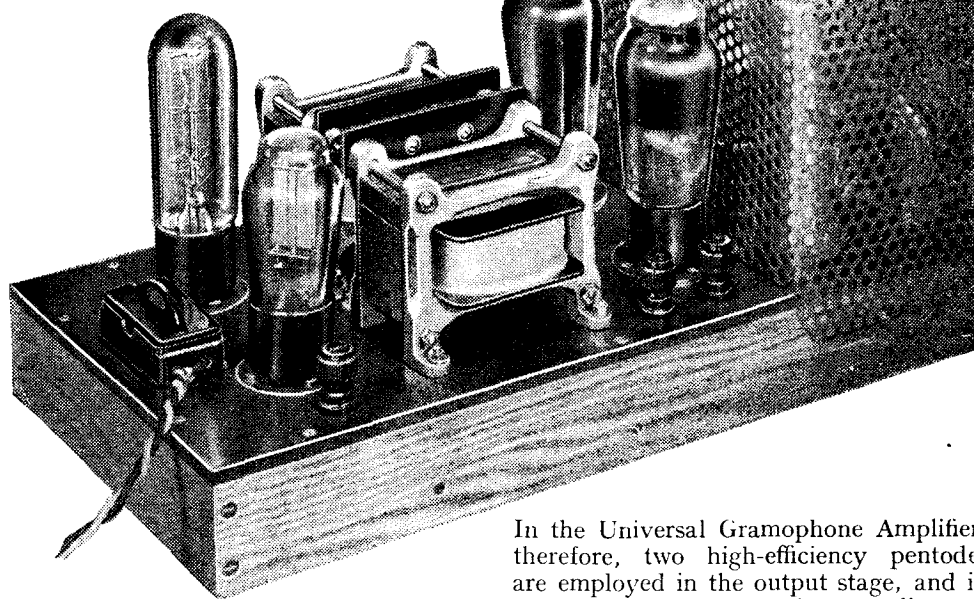
### Overdoing It

You could doubtless put your finger upon half a dozen instances of this kind amongst your friends and acquaintances. Certainly I can. The best things in the world must in time become flat, stale and boring if you overdo them. The home wireless programmes are no exception, particularly if you exercise no selection or discrimination in your tuning in.

One very interesting point about those who assert that they are "bored with wireless" is that in nine cases out of ten they never go beyond the local stations—though they probably possess sets capable of bringing in the majority of European transmissions that are genuinely worth hearing. Should any of your friends have come down to the news bulletin only stage, introduce him to a few of the best-received foreign stations and show him what splendid alternatives are available should neither the National nor the Regional programmes be to his liking. This often works a cure for radio-boredom, but should it fail you have still another shot in your locker.

### The Short-wave Cure

Tell him something of short-wave reception and, if possible, let him hear for himself what the wavelengths below 100 metres have to offer. Unless you are very unlucky, or his is an almost hopeless case, you won't as a rule have much difficulty in firing his enthusiasm anew.



One of the greatest mysteries to me is that our manufacturers have not tried more whole-heartedly during the past few months to bring home to the man-in-the-street the enormous advantages of the all-wave receiver. In the United States there is hardly a set, with the exception of the low-priced "midgets," which does not cover the chief short wavebands as well as the medium and

long waves. Here all-wave sets are still comparatively few and far between, and the average listener hardly yet realises what a difference the addition of a short wave-range can make to his pleasure in using his receiving set.

### Radio Pirates

IT was rather surprising to read the estimate by Post Office officials that hundreds of thousands of non-licensed wireless receiving sets are in use in this country. Every year several thousand pirates are found, but the practice of sneaking entertainment for which other people pay still continues. From the cases one reads it would appear that the offenders are not as a rule people so hard up that they can't afford to pay their share, which, after all, comes to something under 2½d. a week. I suppose that they are people of the same kind as those who think the Railway and Government Institutions fair game and have no scruples about defrauding them when the chance offers. Anyhow, wireless piracy is a pretty mean kind of business,

## In Next Week's Issue

# Universal Gramophone Amplifier

## High-quality Equipment for AC/DC Operation

THE low HT voltage available in apparatus which is designed for operation from DC mains is one of the greatest difficulties in the way of obtaining an adequate undistorted output.

and if the numbers of pirates do run to hundreds of thousands, the B.B.C. is being robbed of a substantial part of the revenue which it so badly needs for improving the programmes and developing its plant.

Now that the majority of receiving sets are bought ready-made instead of being constructed at home, one wonders whether a regulation that no set could be sold without the production by the purchaser of a receiving licence would not have a salutary effect. Alternatively, dealers might be required to report the sale of each receiving set to the Post Office.

### Televisors and Television Receivers

IN my notes a week or two ago I inadvertently used the word "televisors" when speaking of television receivers in general and not of the products of any particular firm. I should not have done so, for the word Televisor is the trade mark of Televisor, Ltd., a company which is owned by Baird Television, Ltd., and should, therefore, be used only of Baird instruments.

operate on any supply voltage from 200 volts to 250 volts, AC or DC, without alteration, and due to the special precautions taken in design it has been found to be entirely free from any trace of mains hum. Provision has been made for the use of two pick-ups, or a pick-up and microphone, with a fade-over from one to the other, and an effective tone-control is included.

#### List of Parts.

- 2 Smoothing chokes, 10 henries (Bryce, Davenset, Ferranti, Healyberd, Partridge.) **Sound Sales 10 DC**
- 2 Valve holders, 5-pin (without terminals) **Glix Chassis Mounting Type V1**
- 3 Valve holders, 7-pin (without terminals) **Glix Chassis Mounting Type V2**
- Fixed Condensers**
  - 1 0.1 mfd., mica **Dubilier B.775**
  - 1 0.02 mfd., tubular **Dubilier 4511**
  - 1 0.1 mfd., 300 volts peak working **Dubilier 9200**
  - 1 0.01 mfd., 300 volts peak working **Dubilier 9200**
  - 1 50 mfd., 12 volts, electrolytic **Dubilier 3013**
  - 2 200 mfd., 10 volts, electrolytic (Ferranti, T.C.C.) **Dubilier EC28**
  - 4 8 mfd., 500 volts peak working, electrolytic (Ferranti) **Bulgin EC2**
- 1 Potentiometer, 500,000 ohms, tapered (Ferranti, Claude Lyons, Reliance, Rothermel.) **Dubilier Type "B"**
- 1 Volume control, 0.25 megohm + 0.25 megohm (Ferranti) **Dubilier "Fadover"**
- Resistances, ½ watt**
  - 1 1,000 ohms **Bulgin HW3**
  - 1 2,000 ohms **Bulgin HW5**
  - 1 50,000 ohms **Bulgin HW23**
  - 1 100,000 ohms **Bulgin HW25**
  - 1 250,000 ohms **Bulgin HW28**
- Resistances, 10 watts:—**
  - 2 100 ohms **Bulgin AR100**
  - 2 165 ohms **Bulgin AR165**
- 1 Twin fuse-holder, complete with 1 amp. fuses **Belling-Lee 1033**
- 2 3-pin plugs and sockets **Belling-Lee 1119**
- 3 Ebonite shrouded terminals, L.S.(2), E. **Belling-Lee "B"**
- 1 Screened connector **Bulgin P64**
- 1 Length screened sleeving **Goltons**
- 1 Sheet paxolin, 15 × 8 × ¼ in. **Wright and Weare**
- Miscellaneous:—** **Scientific Supply Stores**
  - 4 Lengths systoflex, wood, brackets, perforated zinc, etc.
- Screws: 20 6BA ¼ in. S/hd., 10 4BA ¼ in. C/sk., all with nuts and washers.**
- Wood screws: 14 ¼ in. No. 4 C/sk., 8 1 in. No. 4 C/sk., 12 ¼ in. No. 4 R/hd.**
- Valves:—** **Mullard Philips**
  - 2 Pen30C, 1 HL13C, 1 UR1C
  - 1 C1 Barretter, pin-base

\* Special value for this amplifier.

In the Universal Gramophone Amplifier, therefore, two high-efficiency pentodes are employed in the output stage, and in spite of the difficult conditions, deliver an output of the order of 3 watts. A single resistance-coupled LF stage enables them to be fully loaded from all but the most insensitive types of pick-ups and microphones.

Thus three valves are used together with a half-wave rectifier for the HT supply and a barretter for the regulation of the heater current. The amplifier will

# BROADCAST BREVITIES

By Our Special Correspondent



**B.B.C. RESEARCH CHIEF.** Mr. H. L. Kirke is en route for India to advise the Government in the technical development of broadcasting.

## Private Television Party

TELEVISION parties are to supersede cocktail and film parties in Mayfair and other places where they sing.

I hear that one of the first private parties of this nature will be given in April by Lady Selsden, wife of the Chairman of the Television Committee. A very special programme will be staged at the Alexandra Palace.

## Advertising the Atlantic

THE garrulous allegation that by broadcasting from the *Queen Mary* the B.B.C. will be putting out a sponsored programme is too far-fetched to be seriously considered. It reminds me of Max Beerbohm's choice remark at the end of his recent broadcast: "Now I'm off to Paddington—er—I hope I haven't advertised Paddington."

## Cochran "First Night"

If the *Queen Mary* affair is a sponsored broadcast, what of John Watt's running commentary next Friday at the opening of Mr. C. B. Cochran's new show, "Follow the Sun," at the Adelphi Theatre? All the intelligentsia will be there, and word pictures of their arrival will be painted by Mr. Watt *via* a microphone in the foyer.

No power on earth can prevent this being a first-rate boost for the Cochran show, but, in my view, the fact that it will possess strong listener interest is all that matters.

## Following the Sun

Besides the foyer microphone there will be one in the auditorium which will, one hopes, scoop in the *bon mots* and daring quips which besprinkle the more expensive parts of the house; also, there will be a stage "mike" to pick up the first ten minutes of the Show itself with John Watt's descriptive comments.

## Henry Hall's Proviso

Henry Hall will *not* take the B.B.C. Dance Orchestra with him when he sails on the *Queen Mary*. The idea is that Mr. Hall shall conduct the ship's own dance orchestra in the broadcast; and, if I know Mr. Hall aright, he will not conduct on the ship at any time unless the music is being broadcast, either to Britain or America.

It is as a broadcaster that the B.B.C.'s dance band director has won his well-deserved reputation. Not to have a live microphone at his elbow makes him feel cribbed, cabined and confined.

## Off to India

MR. H. L. KIRKE, of "Kirkifier" fame, and now the Head of the B.B.C.'s Research Department, left for India last week to advise the Indian Government on the technical problems which face them in setting up the new broadcasting system.

## Friend of the "Hans"

Very tall and very broad, Mr. Kirke is one of the most reserved of a very reserved band of workers; yet I have always found him very helpful when acting as guide over a new broadcasting station or showing off a new gadget at Clapham.

At one time Mr. Kirke frequently attended the meetings of the Radio Society of Great Britain, and was a great friend of the "hams."

He became famous for his work in developing distortionless diode rectification.

## Haunted House: Official Statement

A B.B.C. official has informed me, with his hand on his heart, that the "Effects" Department will play no part whatever in the projected broadcast from a haunted house.

Ghostly traditions have, of course, to be respected. Thus no attempt will be made to eavesdrop until the witching hour of midnight, or a few minutes before, so that the footless footsteps can be faded into the late dance music *à la ros-signol*.

## Why Locality is Secret

Mr. Harry Price, of the Psychological Research Laboratory, will accompany Mr. de Lotbiniere, B.B.C.'s outside broadcasts director, to the haunted house at about 8 p.m. All the gear will be rigged up and a constant vigil will be kept until the

time is ripe for signalling through to the Control Room.

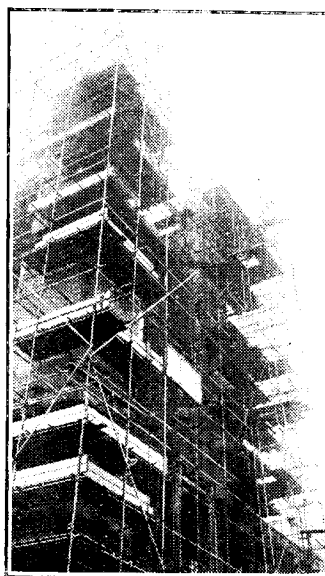
I have been specially asked not to disclose the whereabouts of the haunted house, as it is feared that, were the locality known, scores of motorists would drive up and disturb the "fluence."

## An Opportune Arrival

DR. VLADIMIR ZWORYKIN, whose forthcoming visit to this country is reported on another page, is the inventor of the "electric eye" developed by the Radio Corporation of America, with which the Marconi-E.M.I. concern is associated. He visited England some two years ago, but his arrival this time will be hailed with much more jubilation, for he comes at a critical moment: the start of high-definition television.

## Alexandra Palace Visit?

When Mr. Gerald Cock, the B.B.C. television chief, escorts Dr. Zworykin around the Alexandra Palace, the inventor will



TELEVISION IN SIGHT. This snap, taken last week, shows a new tower nearing completion at the Alexandra Palace in preparation for the high definition broadcasts.

see his scanning device already installed for the "shots" which are to be made in the Palace grounds as well as in the studios.

## Feats of the "Electric Eye"

Mr. I. Shoenberg, the Marconi-E.M.I. television chief, himself told me some months ago that the "electric eye" respects neither the time of day nor the weather. It will seize upon images in semi-darkness and give good pictures in blinding rain.

It should therefore be ideal for television purposes at a typical English race meeting or Sunday school treat.

## Enticement

EFFIE ATHERTON is just another British broadcasting favourite to be enticed over to America. By the time these lines are read she will be touring the United States with Jack Hylton and his Band. Austen Croom-Johnson, of "Soft Lights and Sweet Music" fame, also succumbed to the American lure, though he is now back in England. I hear that he will cross the Atlantic again in March for another spell of broadcasting over the networks.

## B.B.C. and the Money Question

The arrangement is a little one-sided. The B.B.C. might make an effort to capture a few American stars were it not for the money question. As things stand at present, the B.B.C., despite its wealth, is not able to offer artistes a tithe of what they demand—and get—from American advertisers.

## Wavelength Juggling in Scotland

THE Burghead wavelength mystery grows apace. According to the Lucerne Plan, North Scottish Regional is nailed down to 267.4 metres, but Sir Stephen Tallents has just been telling Scottish Press representatives that the engineers are still experimenting with various wavelengths and that none has definitely been fixed.

## Setting Up Whistles

Naturally these tests are on low power, but even a few kilowatts on a wrong wave can set up a powerful whistle. It would not surprise me if a few honest German or Scandinavian listeners were pulling their sets to pieces to find where the whistles come from. Ah well, it's good for trade.

## Blaris

PEOPLE who talk about the new Lisburn transmitter of the B.B.C. in Northern Ireland have got it all wrong. The precise locality of Britain's most modern broadcasting station is Blaris, the inhabitants of which village fully intend to claim the honour which Lisburn is trying to filch from them.

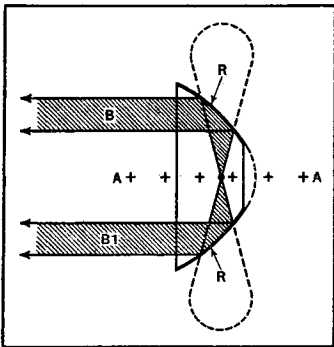
Lisburn is nearly a mile away, and any true-born Blarisian will tell you that His Grace the Governor-General would refuse to open a regional station in such a place.

# Recent Inventions

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

## BEAM AERIALS

FOR ultra-short-wave working, a line of dipole aerials A . . . A is combined with a reflector R in such a way that the normal radiation-field from the aerials (shown by the dotted figure-of-eight curve) is reflected in two stages, so that the two resulting beams B, B<sub>1</sub> come off in the same direction and in phase with each other. Different directional results can be obtained by energising the line of aerials A . . . A with out-of-phase currents, so as to modify the radiation field. The



Beam aerial arrays.

dipoles may be replaced by small frames or loops.

N. V. "Meaf." German Convention date April 13th, 1934. No. 436355. ○ ○ ○ ○

## CATHODE-RAY TUBES

WHEN applying magnetic deflection to the electron stream, difficulties may arise owing to the capacity coupling between the two sets of coils, although these are usually arranged at right-angles to each other. To offset this, one pair of coils, say those which control the line scanning, are fed from a transformer, the secondary of which is connected to earth through a variable tapping. By adjusting the position of this tapping any capacity-coupling can be balanced out, so that no current at line frequency will be transferred to the framing coil, and vice versa.

Telefunken Ges Fur Drahtlose Telegraphie m.b.h. Convention date (Germany) January 30th, 1934. No. 436622. ○ ○ ○ ○

## TELEVISION SYSTEMS

SYNCHRONISING signals are produced independently, or are selected from the picture signals, and are then filtered and applied to a gas-filled tube, which restores them to a form having a steep wave-front. They are then injected in such group-phase and polarity that they do not appear during the fly-back period in the receiver as a black line; though they may be arranged to produce a bright line.

For instance, the synchronising-signals, produced, say, by a photo-

electric cell at the transmitter, are first amplified so that they become "blurred" or sinusoidal in shape. They are then applied to a triggered valve and reappear in "sharpened" or saw-tooth form in the output circuit, where they are combined with the picture signals for transmission.

G. B. Banks and Baird Television, Ltd. Application date March 13th, 1934. No. 436650. ○ ○ ○ ○

## DIRECTIVE AERIALS

FOR directional working a frame aerial is wound as a solenoid about a cylindrical core, the wire being taken "forward" for a number of turns and then "backward" to the starting point.

The pick-up will differ from that on an ordinary frame aerial, since an incoming wave, travelling in the direction of the axis of the coil, strikes adjacent ends of the two windings at the same moment. Any current due to the horizontal component of the wave is, therefore, balanced out. This leaves the aerial subject only to the vertical magnetic field, and free from the disturbing effects normally introduced by the horizontal field.

W. van B. Roberts (Assignor to Radio Corporation of America). No. 199258. ○ ○ ○ ○

## TELEVISION AMPLIFIERS

THE output frequencies from a photo-electric cell as used in television may vary from a very high figure down practically to zero. In order to do justice to the lower frequencies, and at the same time to maintain a good signal-to-noise ratio, the circuit of the cell P comprises a high-resistance R, which discriminates against the higher frequencies by its distributed or shunt capacity. The

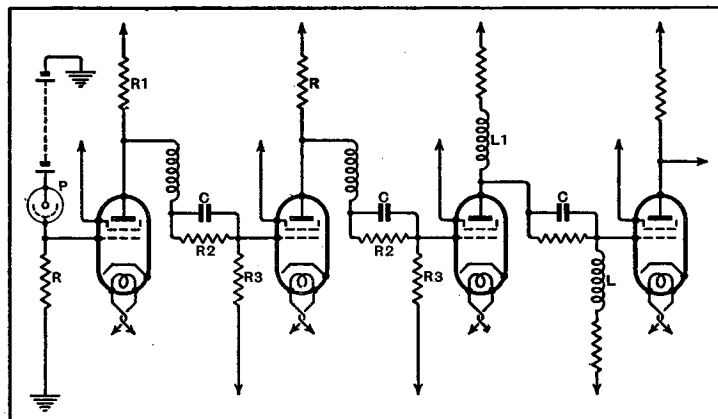


Photo-cell amplifier.

subsequent chain of amplifiers is then designed so as to discriminate against the lower frequencies.

Of the total coupling-resistances R<sub>1</sub> + R<sub>2</sub> + R<sub>3</sub> in each amplifier stage, the intermediate or grid resistance R<sub>2</sub> is in each case shunted by a condenser C of pro-

gressively smaller value, so that each stage will "favour" successively higher bands of frequency. The lowest frequencies pass through without appreciable amplification until they reach the final stage, where the original loss of the higher frequencies in the cell circuit is made good by the action of the inductances L and L<sub>1</sub>. In this way the correct overall balance is restored.

A. D. Blumlein and C. O. Broune. No. 436734. ○ ○ ○ ○

## tone control

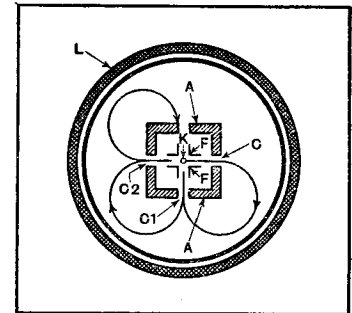
IN a tone-control system, the input is applied to three amplifiers arranged in parallel. Each amplifier has a distinctive frequency-characteristic, and AVC is used to apportion the input between them as the signal strength varies. The gain is first controlled so as to expand the dynamic range or contrast between maximum and minimum loudness, say, in an orchestral performance, and, in addition, the relative gain of the high-frequency over the low-frequency notes is also increased as the input level rises, so as to satisfy the physiological requirements of the human ear.

W. van B. Roberts (Assignor to Radio Corporation of America). No. 1993859. ○ ○ ○ ○

## A "RENODE" VALVE

TO render it more sensitive to control, the electron stream in a valve of given dimensions is deliberately made to traverse a longer path than usual. The emission from the cathode is first concentrated into a narrow stream, and in this way is caused to pass through one or more holes in a perforated anode; thereafter it comes under the influence of an electrode, termed a "Renode," which, together with a magnetic coil, forces the stream to curve back, until it is finally deposited on one of a group of electrodes. The theory of performance is that the longer the path of the stream

directed by a focusing-electrode F through an aperture C in the anode A. It is then bent back through a second aperture C<sub>1</sub> by the magnetic field from the coil L, or by an electrostatic deflecting electrode (not shown), so as to pass through the next aperture C<sub>2</sub>.



Renode valve construction.

It is finally collected on one of the anodes A at the end of its curved path.

C. A. S. Jensen. Convention date (Denmark) April 12th, 1933. No. 436533. ○ ○ ○ ○

## AIRCRAFT WIRELESS

IN the process of making a land landing, the wireless receiver on the aeroplane is used to pick up warning-signals from the radio beams which "mark" the boundaries of the aerodrome, and also other signals which mark the track of the inclined landing beam. In the case of the latter, it is necessary to control the sensitivity of the amplifiers so as to keep the received signals at constant strength, in spite of the fact that the aeroplane is steadily approaching their source.

According to the invention the two sets of signals are separately received on different aerials and pass through individually tuned HF amplifiers, which are, however, coupled to a common low-frequency circuit. Here the boundary-marking signals are separated out by filters, and used, at least in part, as a source of AVC voltage for regulating the sensitivity of the amplifier receiving the landing-beam signals.

C. Lorenz. Convention date (Germany) August 14th, 1934. No. 436839. ○ ○ ○ ○

WHEN landing in a fog, or at night, with the aid of wireless the pilot usually has no way of determining either his altitude or his relative position along the line of the guiding beam. To remove this difficulty the wireless receiver on the aircraft is arranged to indicate the actual field-strengths of each of the two overlapping beams which mark out the course—as well as the median line between the two. In this way the pilot can plot his altitude as well as his horizontal distance from the landing point. He is also given a definite indication when to "flatten out."

R. M. Wilmotte (Assignor to Radio Corporation of America). No. 2012412. ○ ○ ○ ○

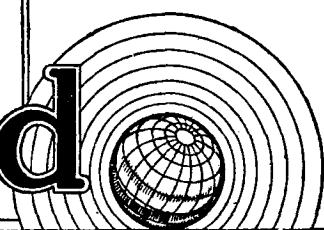
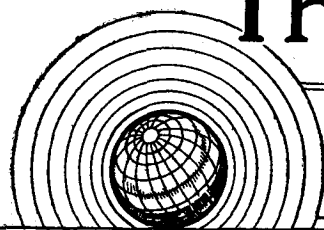
is made the more responsive it becomes to control by an applied signal.

The electrodes may be arranged in various ways to secure this result. In the form of Renode shown in the figure, the electron stream from the cathode K is



# The Wireless World

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

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(Photo: "The Times.")

## George V

### *The Passing of a Beloved King*

**T**O millions of his sorrowing subjects at home and overseas the news of the death of His Majesty King George came, through the medium of broadcasting, shortly after midnight, when anxiety over his illness had increased with each successive bulletin issued during Monday, January 20th.

Through broadcasting, and particularly the Christmas broadcasts, his Majesty's contact with his people became more intimate and personal than would have been possible by other means, and established more firmly than ever both the King and the man in the affection of his subjects. It was well known that His Majesty looked forward with great pleasure to these Christmas addresses, which were inaugurated on Christmas Day 1932.

In particular will be remembered the references made in his late Majesty's address only last month, when he referred to the celebrations on the occasion of the completion of twenty-five years since his accession, and the spontaneous loyalty demonstrated by his subjects.

Even before his accession to the throne, his late Majesty showed a keen interest in the progress in the development of wireless, and, whilst still Prince of Wales, made a personal visit to the wireless station at Poldhu. This interest in scientific matters was maintained throughout his reign, and there can be no doubt that he did much to encourage those wireless pioneers who, under difficult conditions, were striving to perfect an instrument which has since proved so great a boon to civilisation.

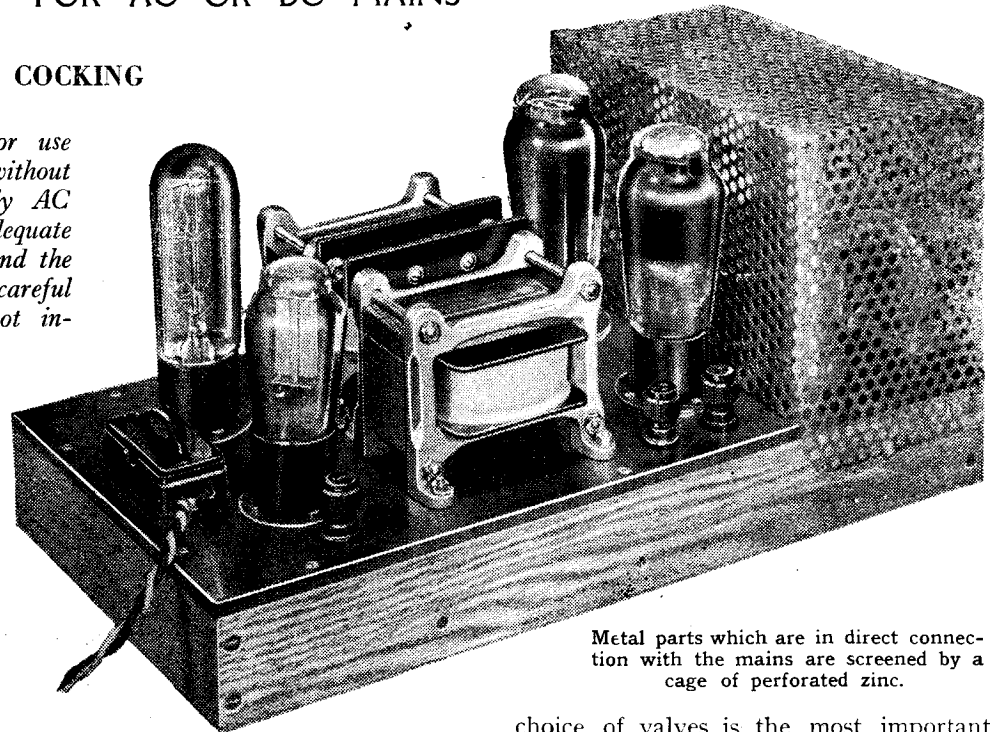
The whole Empire mourns the loss of a beloved Sovereign and extends sympathy to the bereaved Royal Family and, in particular, to our new King, on whom the burden of responsibility now rests.

# Universal Gramophone

HIGH-QUALITY EQUIPMENT FOR AC OR DC MAINS

By W. T. COCKING

*APPARATUS which is intended for use on either DC or AC supply mains without alteration necessarily differs from purely AC equipment. The attainment of an adequate output, the elimination of mains hum, and the isolation of the circuits all demand more careful design. The problems, however, are not insuperable, and through careful attention to detail a very high standard of performance has been secured from the Universal Gramophone Amplifier. Both high quality and freedom from hum are obtained, together with adequate amplification and safety for the operator.*



Metal parts which are in direct connection with the mains are screened by a cage of perforated zinc.

**T**HE attainment of a high standard of reproduction demands two things—a flat frequency response characteristic and an absence of amplitude distortion. The former is by no means difficult to obtain, for the technique of ordinary LF amplifier design is now well understood, and the only limitation placed on the designer is that of cost. This is by no means the case with regard to amplitude distortion, however, for, although the requirements are well known, it is only possible to meet them easily when the equipment is AC-operated. No limitation, apart from cost, is then placed on the current and voltage requirements of the output stage.

The position is vastly different when one considers an amplifier for DC mains, however, for the voltage available is limited to that of the supply mains, and it be-

comes quite difficult to obtain an adequate undistorted output. It is only comparatively recently that any satisfactory solution has been possible at a reasonable cost, since it is only lately that suitable types of valves have become available. There is undoubtedly a demand for an amplifier of this kind, and most prospective users require one which is as suitable for AC operation as for DC, in view of the possibility of their supply being changed over to AC in the near future. A universal amplifier is also convenient to those undertaking public address work.

When considering the design of an output stage for apparatus of this type the

choice of valves is the most important point to be decided. Obviously, the valves must give as large an output as possible for a given, rather low, anode voltage, and they must not require a large grid bias. This last requirement is brought about by the fact that the anode voltage cannot exceed the mains voltage less the grid bias, and consequently the greater the grid bias the less the anode voltage. The requirements are best met by high-efficiency pentodes, for such valves give a large output for their anode circuit dissipation, and require a very small grid bias indeed. Furthermore, on account of their efficiency, quite a modest amount of amplification is required fully

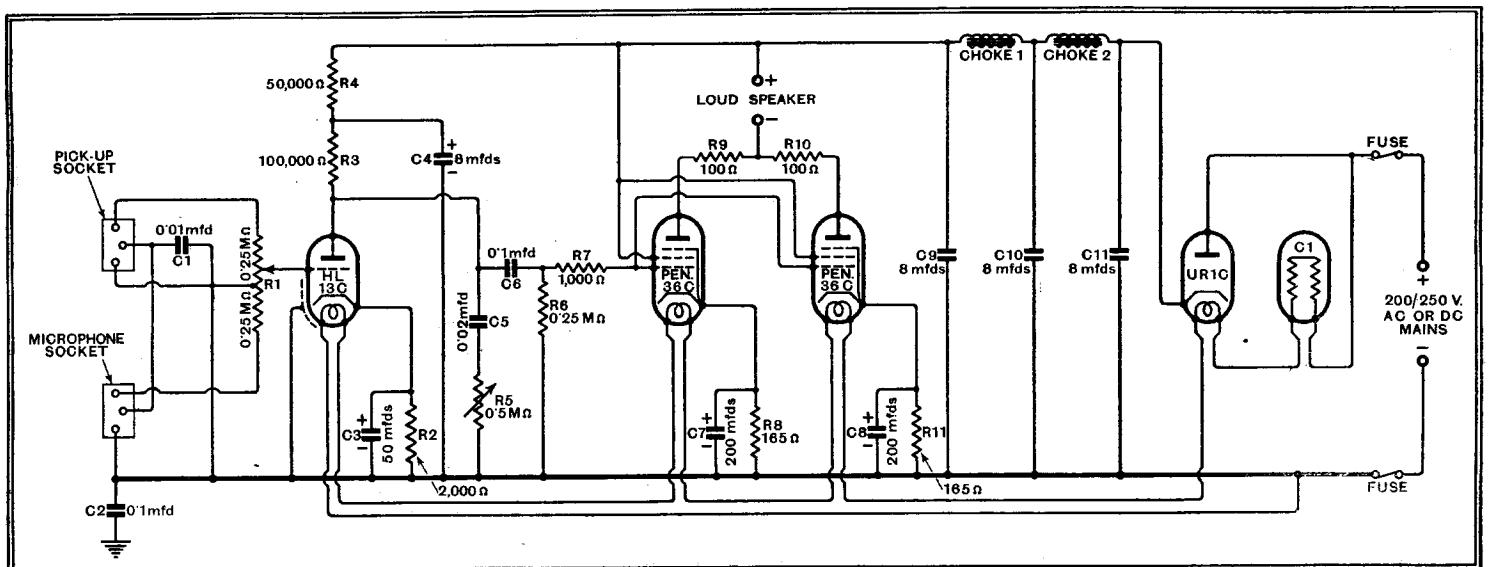


Fig. 1.—The complete circuit diagram of the amplifier. A fader is fitted to permit a gradual change-over from pick-up to microphone, and a barretter is used to regulate the heater current.

# Amplifier

to load them from a pick-up, or even a microphone.

In the Universal Gramophone Amplifier, therefore, the output stage consists of two Pen36C valves in parallel. Referring to Fig 1, it can be seen that each valve is independently biased by the 165 ohms resistances R8 and R11, which are shunted by 200 mfd. electrolytic condensers C7 and C8 in order to preserve the bass response. These large capacities are necessary to provide an adequate shunt to the low-value bias resistances at low frequencies.

The primary of the output transformer is connected directly in the anode circuits of these valves, but separate 100 ohms anti-parasitic resistances R9 and R10 are

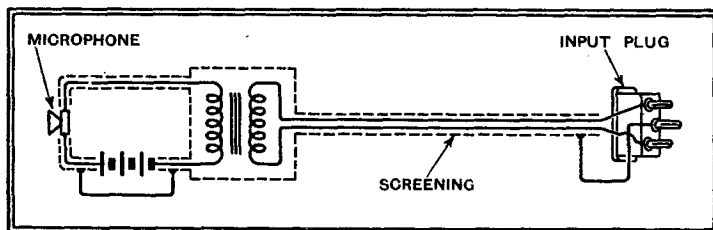


Fig. 2.—When a microphone is used the leads should all be screened.

employed. Each valve consumes a total current of about 50 mA., so that the grid bias is of the order of 8.25 volts. The input must never exceed this figure, and normally cannot approach it without distortion. A single resistance-coupled amplifier preceding the output stage consequently gives adequate amplification. An HL13C valve is employed, and biased by the 2,000 ohms resistance R2 shunted by a 50 mfd. condenser C3. The anode coupling resistance R3 has a value of 100,000 ohms, and the decoupling resistance R4 is 50,000 ohms with a decoupling condenser C4 of 8 mfd.

## The Mains Equipment

The coupling between the two stages is by means of the mica-dielectric condenser C6 of 0.1 mfd. capacity, and the grid leak R6 of the output stage has a value of 250,000 ohms. The 1,000 ohms resistance R7 in the grid lead to the output stage is for the purpose of preventing parasitic oscillation. A tone control, comprising the 0.02 mfd. condenser C5 and the 0.5 megohm variable resistance R5, is connected to this coupling.

The input to this first valve is taken through a volume control, and a fader-type control has been selected. It can be seen that the input terminals are duplicated so that two pick-ups or one pick-up and a microphone can be connected to the amplifier, and the change-over effected by means of the fader. The ability thus to

fade from one programme source to another is often felt in public address work, and it is sometimes convenient also for domestic use, since it is quite possible to connect the output of a receiver to one set of input terminals and a pick-up to the other, and fade from one to the other as required.

Turning now to the mains equipment, two smoothing chokes of low DC resistances are employed in conjunction with two 8 mfd. condensers C9 and C10, and are adequate to reduce the hum to inaudibility under all normal circumstances. The rectifier is a UR1C, and is of the half-wave type. It is always in circuit, but on DC mains it performs no useful function save that it protects the electrolytic condensers should the apparatus be connected to the mains the wrong way round.

The valve heaters are all connected in series, and require a total voltage of 103 volts at 0.2 ampere. The difference between the heater and mains supplies is taken up by the type C1 barretter, which also serves automatically to regulate the heater current and to maintain it at the correct figure for all supplies between 200 and 250 volts.

The reservoir condenser C11 is given the unusually large value of 8 mfd., since

in connection it may be remarked that, although the rectifier is officially rated for a current of 75 mA. only, the current actually taken is of the order of 100 mA. This is, how-

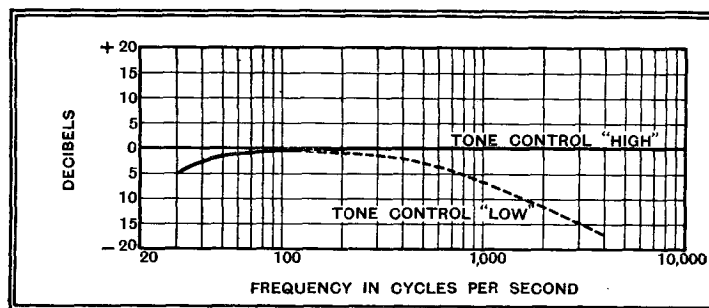
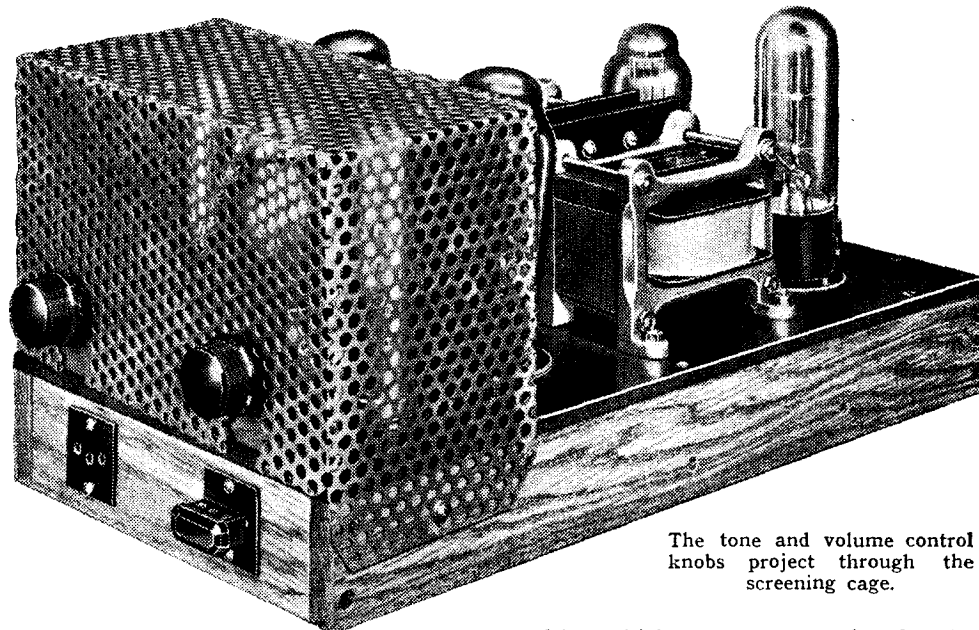


Fig. 3.—The overall frequency response curve of the equipment in the two extreme positions of the tone control.

ever, generally considered to be a safe current for this particular valve.

## Avoiding Mains Hum

One of the greatest difficulties with DC and AC/DC sets is that all the apparatus is in direct connection with the supply mains. This not only necessitates departures from ordinary AC practice in order to avoid mains hum, but it calls for great care in insulation, and all parts which are connected to the mains must be so placed that accidental contact with them cannot be made. With this end in view, it was decided in the experimental stages to employ an earthed metal chassis and to connect all screening, and even the metallising of the LF valve, directly to this so that no unearthed part of the apparatus would be accessible. The result was terrific mains hum! It was eventually found that to avoid hum the screening must *not* be earthed, but must be at mains potential. This created insulation diffi-



The tone and volume control knobs project through the screening cage.

this permits a higher rectified voltage to be secured on AC supplies than if the conventional 4 mfd. were used. This value of 8 mfd. is the largest that can safely be used, however, since it increases the peak current through the rectifier. In this con-

culties, which were overcome by abandoning the metal chassis.

In the final and successful design the chassis is constructed from a sheet of Paxolin supported by wooden battens. Most of the wiring is carried out on the underside of the chassis, and is conse-

**Universal Gramophone Amplifier—**  
 quently protected. The cans of the electrolytic condensers C7 and C8, the metalising of the LF valve and the screened lead to its grid are all on the upper side of the chassis, and are connected directly to negative HT. In order to obtain protection against accidental contact with them, therefore, a cage made of perforated zinc is fitted over these components.

Connections external to the receiver cannot be treated in this way, and it is usually essential to screen pick-up and microphone leads if hum is to be avoided. Tests showed up the impossibility of earthing such screening, for the hum was far worse than with unscreened leads. The difficulty was overcome by connecting the screening to negative HT through a 0.01 mfd.

VOLTAGES AND CURRENTS.					
Valve.	Anode Volts.	Screen Volts.	Cathode Volts.	Anode Current.	Screen Current.
HL13C ...	56	—	1.05	0.5	—
Pen36C (1)	170	195	8.4	41.5	8.8
Pen36C (2)	170	195	8.5	42.5	9.2

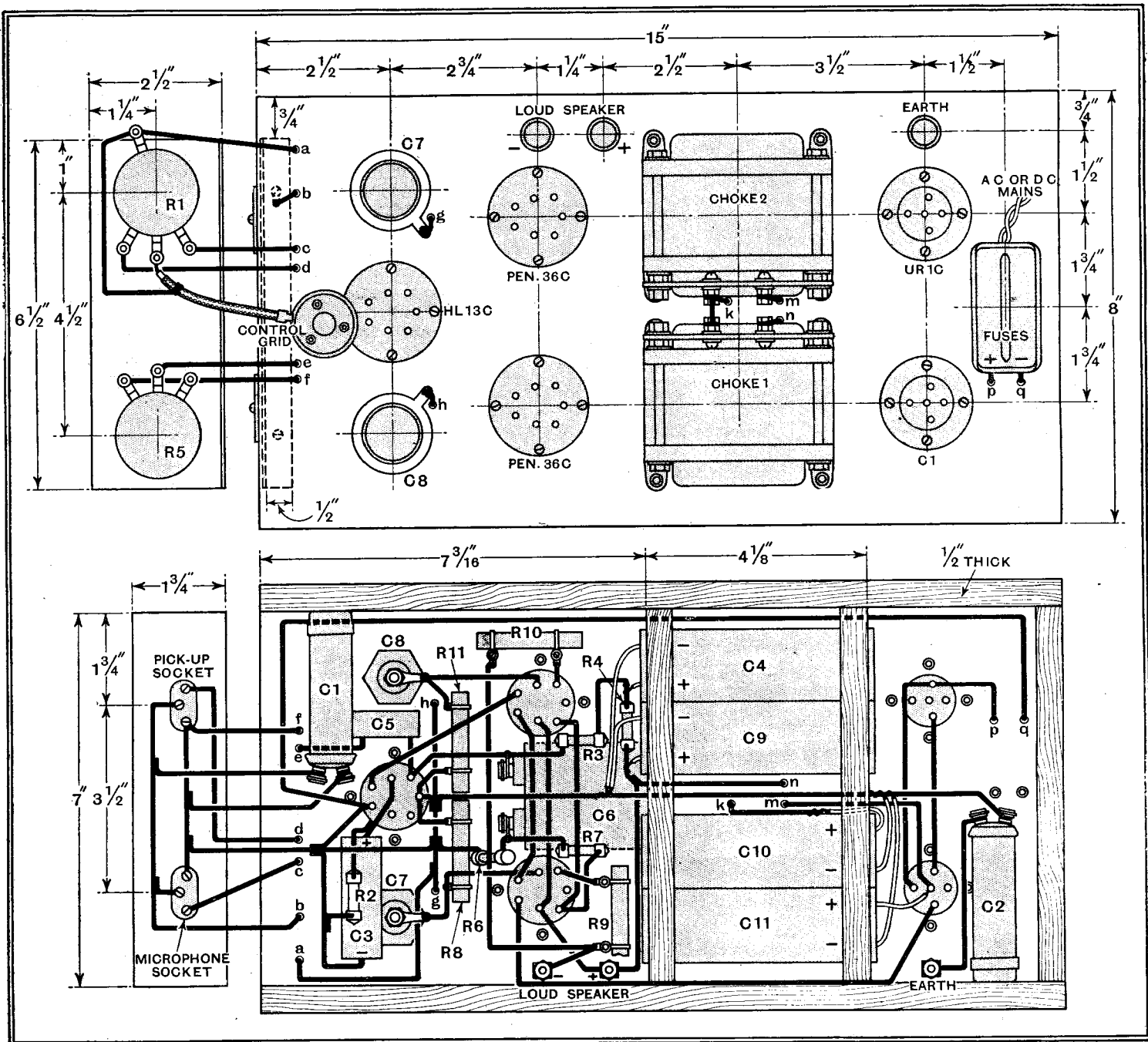
Volts across C 11 = 220, C 10 = 207.5, C 9 = 195.  
 Mains Voltage = 230 AC. Current through Ch2 = 100 mA.

condenser C1. This proves as effective as the direct connection in the elimination of hum, and protects the user against shock if he should touch the screening. On DC supplies the isolation afforded by the condenser is complete; on AC it is sufficient to prevent any risk of shock, but if the screened leads be *lightly* touched a slight

prickling sensation may usually be felt. The capacity and voltage rating of this condenser, and also of the earthing condenser C2, have been selected in accordance with the requirements laid down for interference suppressors, for the conditions as regards the isolation of metal parts from the mains are virtually the same. No change should be made, therefore, in either the capacity or the voltage rating of C1 or C2.

Three-way connectors are used for the input—the two outer pins being for the leads to the pick-up or microphone transformer, while the centre-pin is for connection to the screening. In general, the metal body of a pick-up or the metal casing of a microphone transformer should be connected to the screening of

## PRACTICAL WIRING DIAGRAM

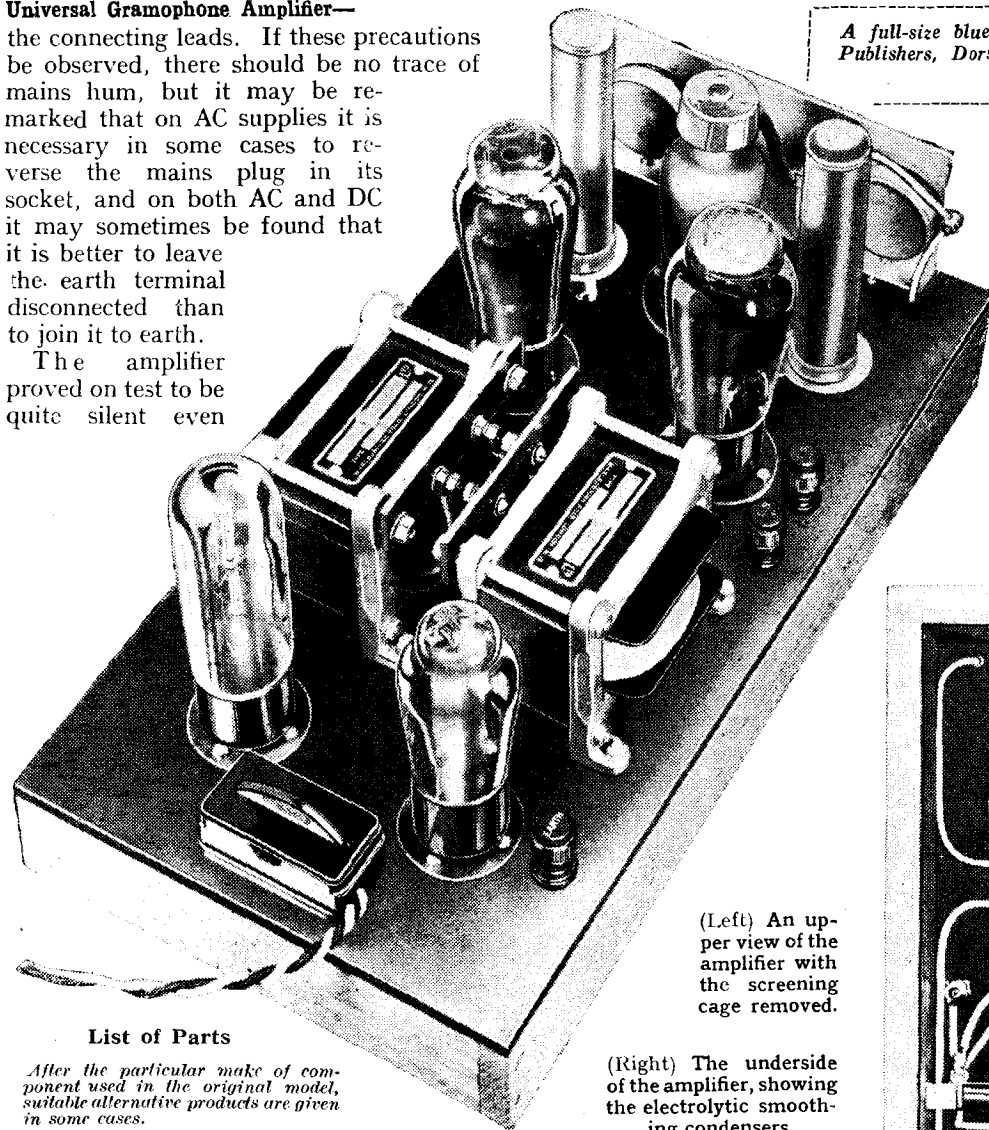


Full details of the construction and wiring are shown in these drawings.

**Universal Gramophone Amplifier—**

the connecting leads. If these precautions be observed, there should be no trace of mains hum, but it may be remarked that on AC supplies it is necessary in some cases to reverse the mains plug in its socket, and on both AC and DC it may sometimes be found that it is better to leave the earth terminal disconnected than to join it to earth.

The amplifier proved on test to be quite silent even



(Left) An upper view of the amplifier with the screening cage removed.

A full-size blue print of the wiring diagram is available from the Publishers, Dorset House, Stamford Street, London, S.E.1. Price 1s. 6d. post free.

account of itself, being quite free from hum and having an output adequate for most purposes. The overall frequency response curves with the tone control at "high" and "low" are shown in Fig. 3. In the former position the response is practically flat, within  $\pm 0.5$  DB., from 100 c/s to 10,000 c/s, and falls off gradually at lower frequencies until there is a loss of 5 DB at 30 c/s. This loss is almost entirely due to the bias circuit of the output stage, and could be avoided, while retaining cathode bias, only by increasing the condensers C7 and C8 very considerably

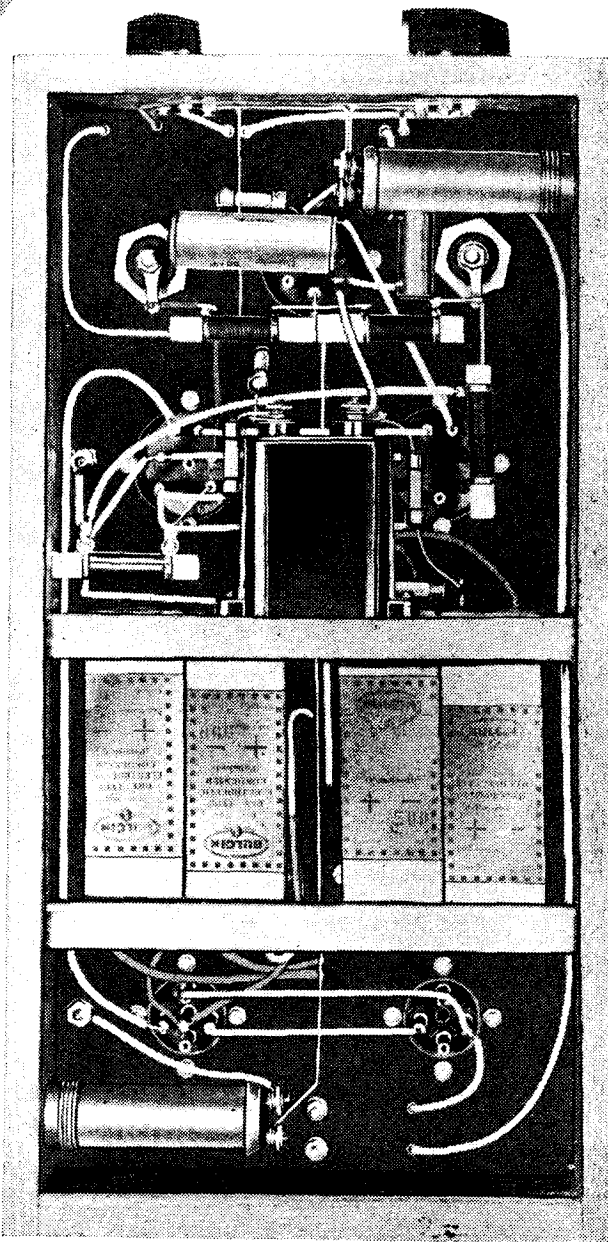
**List of Parts**

After the particular make of component used in the original model, suitable alternative products are given in some cases.

- 2 Smoothing chokes, 10 henries, Ch1, Ch2  
Sound Sales 10 DC  
(Bryce, Davenset, Ferranti, Heayberd, Vortexion, Partridge.)
- 2 Valve holders, 5-pin (without terminals)  
Clix Chassis Mounting Type V1
- 3 Valve holders, 7-pin (without terminals)  
Clix Chassis Mounting Type V2
- Fixed Condensers**
  - 1 0.1 mfd., mica, C6 Dubilier B.775
  - 1 0.02 mfd. tubular, C5 Dubilier 4511
  - 1 0.1 mfd., 300 volts peak working, C2 Dubilier 9200
  - 1 0.01 mfd., 300 volts peak working, C1 Dubilier 9200
  - 1 50 mfd., 12 volts, electrolytic, C3 Dubilier 3013
  - 2 200 mfd., 10 volts, electrolytic, C7, C8 Dubilier 0283
- (Ferranti, T.C.C.)  
4 8 mfd., 500 volts peak working, electrolytic, C4, C9, C10, C11 Bulgain EC2
- (Ferranti)  
1 Potentiometer, 500,000 ohms, tapered, R5 Dubilier Type "B"
- (Ferranti, Claude Lyons, Reliance, Rothermel.)  
1 Volume control, 0.25 megohm  $\pm$  0.25 megohm, R1 Dubilier "Fadover"
- Resistances,  $\frac{1}{2}$  watt**
  - 1 1,000 ohms, R7 Bulgain HW3
  - 1 2,000 ohms, R2 Bulgain HW5
  - 1 50,000 ohms, R4 Bulgain HW23
  - 1 100,000 ohms, R3 Bulgain HW25
  - 1 250,000 ohms, R6 Bulgain HW28
- (Ferranti.)  
**Resistances, 10 watts:—**
  - 2 100 ohms, R9, R10 Bulgain AR100
  - 2 165 ohms, R3, R11 Bulgain AR165
- 1 Twin fuse-holder, complete with 1 amp. fuses, Belling-Lee 1033
- 2 3-pin plugs and sockets, Belling-Lee 1119
- 3 Ebonite shrouded terminals, L.S.(2), E. Belling-Lee "B"
- 1 Screened connector, Bulgain P64
- 1 Length screened sleeving, Goltone
- 1 Sheet paxolin, 15x8x $\frac{1}{8}$ in. Wright and Weairs
- Miscellaneous:—** Scientific Supply Stores
  - 4 Lengths systoflex, wood, brackets, perforated zinc, etc.
  - Screws: 20 6BA  $\frac{1}{4}$ in. S/4d., 10 1B4  $\frac{1}{4}$ in. C/sk., all with nuts and washers.
  - Wood screws: 14  $\frac{1}{4}$ in. No. 4 C/sk., 8 1in. No. 4 C/sk., 12  $\frac{1}{4}$ in. No. 4 R/4d.
- Valves:—**
  - 2 Pen30C, 1 HL13C, 1 URIC Mullard
  - 1 C1 Barretter, pin-base Philips

\*Special value for this amplifier.

(Right) The underside of the amplifier showing the electrolytic smoothing condensers.



with the volume control at maximum, and the amplification proved sufficient even for a needle armature type of pick-up, which has quite a small output. It is also adequate for all but insensitive microphones, and is ample for all carbon types. A microphone transformer is necessary, of course, and the ratio required naturally depends upon the particular microphone selected. The connections for such an accessory are shown in Fig. 2 together with the method of connecting the necessary screening. Should the microphone be at any distance from the amplifier, the extension leads should be to the microphone, and the transformer kept near the amplifier. Although it would be possible to energise the microphone from the mains equipment, this would involve some risk of hum, and would inevitably lower the HT supply to the output stage, and so reduce the available output. It is advised, therefore, that a battery be used for supplying the microphone.

On test the amplifier gave a very good

above their present values of 200 mfd. Since the drop manifests itself only at the very lowest frequencies, however, it is not thought that it is in any way important, and it is improbable that it is detectable aurally under any ordinary conditions of use.

The power output cannot be stated with any degree of certainty, for it varies with



**Universal Gramophone Amplifier—**

the voltage of the supply mains. It will be least with 200 volts DC mains, and greatest with 250 volts AC. For the same reason, the figures in the table of voltages and currents must also be taken only as a guide.

With a supply of 230 volts AC the undistorted output is about 2.5 watts, but an output rather greater than this is obtainable before any serious degree of distortion is noticeable. In spite of the precautions taken against a loss of voltage, it can be seen that the true anode voltage is only  $170 - 8.4 = 161.6$  volts, and it is this fact which is responsible for the output being no more than could be obtained from a single pentode if it were possible to obtain an actual anode potential of 250 volts.

If the full output is to be secured, it is necessary to match the speaker to the output stage properly, and the ratio of the

transformer should be chosen to give a load of 2,000 ohms. The transformer should have a primary of low DC resistance, and an inductance of some 10 H. at 80 mA.

Where the amplifier is to be used off both DC and AC supplies a permanent-magnet loud speaker is the most convenient, but when DC mains only are used an energised type can be employed and its field connected directly to the mains. To use an energised speaker on AC mains would necessitate an additional rectifier and smoothing equipment.

The mechanical details of the construction need not be dealt with here, for the drawings and photographs which accompany this article provide full information. It may be remarked, however, that The Scientific Supply Stores, Ltd., have notified their intention to make up the chassis ready-built with all holes drilled and complete with the screening cage.

## GERMANY'S NEW TELEVISION SERVICE

### Direct Transmissions and News Films

By OUR BERLIN CORRESPONDENT

*THE opening of new television transmitters in Berlin to replace those lost in the radio exhibition fire has been made the occasion for introducing direct transmission as distinct from film. A daily news film is also broadcast.*

**B**EFORE the assembled representatives of the three German Ministries which control television in that country—the Ministries of Air, Posts and Propaganda respectively—Berlin's new television service was officially inaugurated on January 15th. Press representa-

The new television service consists of a daily programme of one hour's duration from 8 to 9 in the evening, repeated from 9 to 10 p.m. Apart from this extension—the old service provided entertainment on only three evenings a week—the broadcasters have now obtained direct television facilities enabling them greatly to vary the programmes which, in the past, had been limited to films.

Sight is broadcast on 6.72 metres and sound on 7.06 metres, definition remains at 180 lines, and the number of frames is still twenty-five. It would not have been possible in so short a time to build suitable transmitters for higher definition.

Inaugurating the programme, the Deputy Director of German Transmissions, Herr Boese, stated that the service was *experimental*. Public televising rooms in various parts of Berlin have been provided to permit the public to follow the service in its experimental stage and to become accustomed to it. The German Broadcasting Company supplies

programmes of light entertainment consisting of direct television by well-known artists, of excerpts from the latest film releases and of a newsreel film specially made for television. The programme is changed each week. The news reel fea-



Three German television executives photographed at a television receiver during a rehearsal. On the right is Diplom-Ingenieur Stumm, technical chief of the service.

ture, provided by the broadcasters themselves, will be issued in a new edition every day. The time lag between the event and the television of the film will ordinarily be about twenty-four hours. The news reel feature is a kind of stop-gap until it becomes technically possible to televise events directly.

The more important phases of the Olympic Games, to be held in Berlin from August 1st to August 16th, will be televised without the use of intermediate film, an "electric eye" being employed.

The service area of the Witzleben transmissions is limited to a radius of roughly thirty miles from the Radio Tower.

Apart from the regular television transmissions from 8 to 10 p.m. local time, the sound transmitter will broadcast an ordinary programme of sound only from 5 to 7.30 p.m. and from 10 p.m. to midnight, local time.

Reception of the opening programme on January 15th showed that the new transmitters give better definition, i.e., an improved picture quality. On the other hand, the direct television apparatus did not produce as steady a picture as one might wish. This, I was assured, was largely due to the local interference from the aerials of the receivers installed for the Press representatives.

All news concerning technical television development in Germany is being kept secret for reasons of national defence. It is therefore, unfortunately, not possible to give details of the present position of work with the "electric eye."

One item regarding new photo-cells which are shortly to be installed for the direct television programmes was made public. These new cells will permit of the extension of direct television to groups of up to three persons. At the present moment it is limited to the head and shoulders of one person or to the heads of two people.



Else Elster, a well-known Berlin actress, in the rôle of television announcer in the direct transmission cabinet. Note the identification panel which appears as a background to the "picture."

tives had been invited to attend the presentation of the programmes in the actual studios situated a few hundred yards away from Broadcasting House. The new Witzleben ultra-short-wave transmitters replacing those destroyed in the radio exhibition fire were completed by December 23rd.

# Why Only One Alternative?

**S**IR JOHN REITH is credited with having said that only when all parties complained with equal volubility could he feel sure that the B.B.C. was doing the right thing. The difficulties of the Corporation are only too well known. Brown likes symphony concerts; they are anathema to Jones, who prefers dance music. Smith likes instructive talks; Robinson prefers radio drama, and so on *ad infinitum*. One could go on through many gradations of taste.

About ten years or so ago the B.B.C. hit on a solution, or at any rate a partial solution. An alternative programme would satisfy two sections of the community at the same time. So Capt. Eckersley's famous Regional scheme was born.

Two points stand out prominently.

(a) It was planned in a crystal, or small set era.

(b) It envisaged the provision of only two programmes for each listener.

Now it seems to me that since condition (a) no longer holds good it is time to revise conception (b). In 1936 Sir John Reith should not rejoice that all opinions are equally offended, but should be able to take comfort in the thought that four or five sections of the public can on any night at any time find something to their liking.

## Seven Stations: Two Programmes

An average modern set in London can pick up four or five British stations with ease. What does the listener find? I dip into the programmes entirely at random for answer, and here is the result, at the most popular hour of the night, 8 o'clock: Droitwich—Vaudeville. London National—same as Droitwich. Regional—Play. Midland, West, North and Scottish stations—same as Regional.

Here are seven stations with just two programmes among them! Try again; another night chosen at random—and a Saturday: Droitwich—Promenade Concert. London National—same as Droitwich. Regional—Debate and dance music. Midland, West, North and Scottish—same as Regional.

Surely the best resolution that the B.B.C. can make in 1936 is to co-ordinate its programmes nationally. I contend emphatically that the two-programme basis is as dated as the crystal set which inspired it.

That there are difficulties is obvious. Programme planning would become a task of far greater magnitude and complexity. It is also obvious that the first duty of a

*ON most nights the B.B.C. provides only two programmes, although the Corporation possesses eleven transmitters of comparatively high power. Pointing out that the present system of distribution was organised some ten years ago to satisfy the owners of low power receivers, our contributor gives cogent reasons for an expansion of programme policy, with an accompanying increase in transmitter power.*

provincial station is to its local audience. Organisation is the answer to the first objection, while as to the second it is possible in this case to serve two masters, as indeed is done with the main Regional programme.

To increase the service area of the provincial stations the B.B.C. should raise their power. This is long overdue. In Europe there are fifteen or sixteen medium-wave stations using 100 kilowatts or more, while the British stations are content with half the power. Such increases would make alternatives available for the smaller set owners. An opportunity exists for the B.B.C. to do a great service to the British set manufacturer. Offered a greater diversity of programme material the listener would have an added inducement to replace an obsolete set with one up to date. By arranging a service which will give a listener the maximum advantage with the minimum apparatus the B.B.C. is, in a sense, encouraging the use of old apparatus.

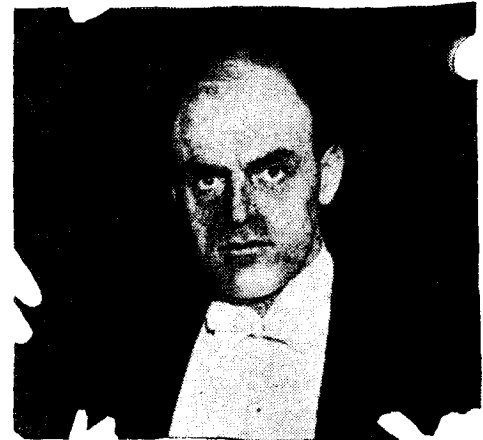
Lately a number of newspapers joined in an attack on the B.B.C.'s policy with regard to the winter Promenade concerts. The burden of their complaint was that on many occasions the second and less important half was broadcast instead of the first half, which generally represents, musically, the real substance of the concert.

This circumstance points the moral that the need for satisfactory alternatives was never greater than now. The B.B.C. has plainly launched on a policy of catering more for the less serious section of its audience. Capt. Cecil Graves, the new Programme Controller, indicated as tactfully as possible the other day that symphony concert broadcasts would, to a great extent, in future be limited to an hour or an hour and a quarter.

Mr. Eric Maschwitz, the Director of Variety, has revealed that in January, 1936, his department was responsible for more than twice as much programme time compared with January, 1933—58 hours instead of 22.

## Influential Minority

The evidence is therefore strong that the B.B.C. is sacrificing music to vaudeville. Whether the spoken word will also suffer we do not know, but there are plentiful signs that talks are being given a more



"Sir John Reith should be able to take comfort in the thought that four or five sections of the public can find something to their liking."

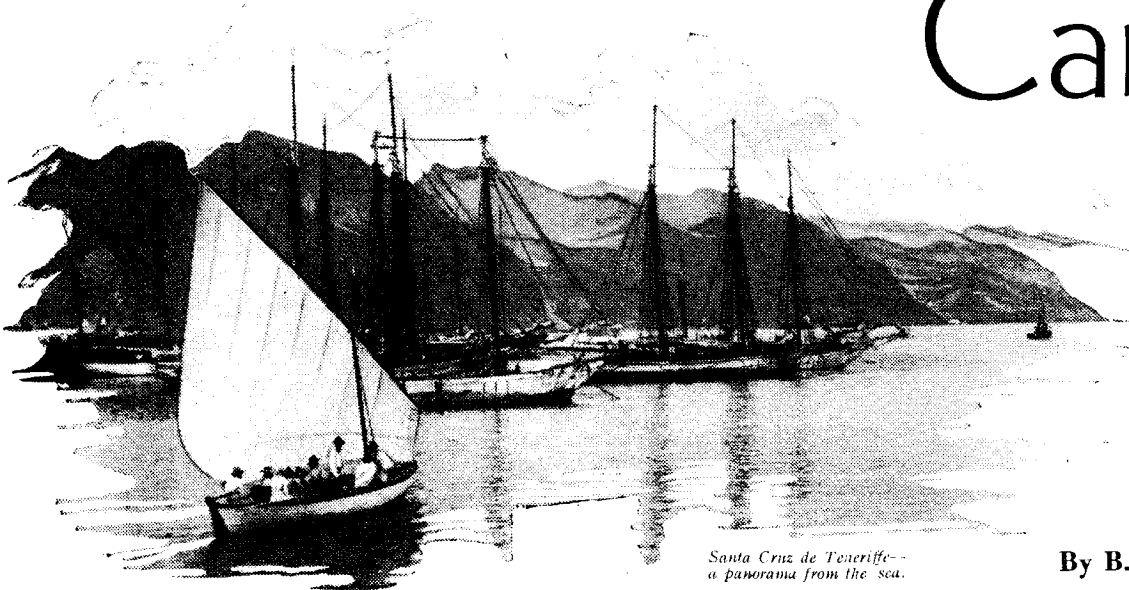
journalistic and topical and less didactic bias. Again, then, the same forces are at work. The B.B.C. is being "popularised," but not quite in the way anticipated by the newspaper sages.

Instead of establishing new contacts with the listener as expected, the B.B.C. is tackling the problem from the programme end. In taking this course I think there can be no doubt that the B.B.C. will meet the wishes of the majority of listeners. But they will displease an influential minority. Ibsen, I think, said that the majority were always wrong. Be that as it may, suitable alternatives from the Regionals offer a reasonable hope of satisfaction for nearly all the B.B.C.'s immense and diverse audience.

This is a big problem, which I respectfully suggest to Sir John Reith and his staff should be tackled in a big way. I am aware that the suggestions I have made involve sweeping changes which cannot be made in a day. But it seems to me that the B.B.C., in its "lower brow" policy, is taking serious steps without fully envisaging the consequences. The B.B.C. has a solemn duty to perform towards all sections of the community.

In conclusion, I am of opinion that the time has come to evolve a radical new plan—a Two-Year Plan—a Five-Year Plan if you like. It is not enough to replace existing transmitters with modern ones, to build a new station here and a new station there. The new plan should have as its basic principles the raising of the power of the British medium-wave stations to the level permitted by the Lucerne Plan, and the continuous provision of four or five alternative programmes for the average listener.

# Eavesdropping in the Canaries



*Santa Cruz de Tenerife—  
a panorama from the sea.*

HOW BRITISH  
AND AMERICAN  
STATIONS ARE  
HEARD AT  
TENERIFFE

By B. W. F. MAINPRISE (G5MP)

LATE in 1934 the writer decided to spend the winter in the Canary Islands. These islands lie roughly 150 miles off the north-west coast of Africa and are under Spanish rule. Teneriffe is the largest, and, apart from its actual size, is conspicuous as a landmark on account of the Peak which rises over 12,000 ft. above the Atlantic.

Once the decision was made, it was seen that there would be an excellent opportunity of comparing radio conditions on the islands with those of England. Accordingly, a letter was sent to the Spanish Consulate in London asking what customs duties or deposits would be required on landing with wireless apparatus, and the reply was received that the ports of the Canary Islands are "free ports" except for articles such as tea, butter, spices, etc. Thus there would be no charge payable on radio apparatus, and on arrival it would merely be necessary to obtain a licence from the appropriate office. This would be based on a progressive scale and would cost less than in England.

The receiver was of the simplest, employing a reacting detector, transformer-coupled to a low-frequency stage. While such a receiver can by no means compare with the modern single-signal superheterodynes as regards amplification and selectivity, it was of a type very suitable for travelling purposes—compact enough to be carried complete with batteries in the corner of a suit-case.

The Canary Islands may be reached by taking a ship either to Las Palmas, in the island of Grand Canary, or to Santa Cruz in the island of Teneriffe. Owing to more convenient sailing dates, the writer travelled to Las Palmas, and transhipped to Santa Cruz by the nightly inter-insular service, crossing Teneriffe by

*THE detached listener, outside the main stream of international broadcasting, has opportunities to compare the world's transmitters in a manner denied to those living within the orbit of perhaps fifty high-power stations. This illuminating article tells of experiences with a reacting detector and transformer-coupled LF set some 1,500 miles from many of the leading transmitters.*

car to Puerto Orotava on the north coast. It was decided to concentrate reception observations on the experimental 1.75 megacycle band, while during hours when there was little activity to be heard on this frequency, attention would be paid to broadcasting and to the experimental 7 megacycle band. As the broadcast band will possibly have the wider appeal, it will be considered first.

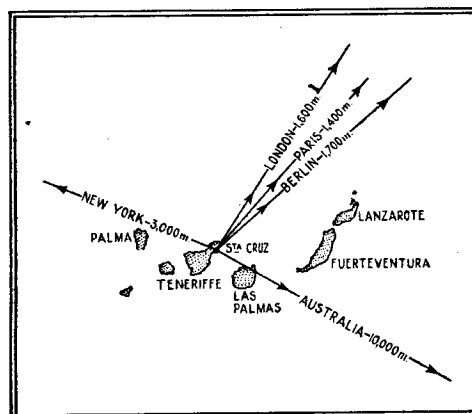
In the Canary Islands many of the leading transmitters are perhaps 1,500 miles away, and consequently receivers of a fairly advanced type are required. The prices are beyond the reach of the peasant or artisan classes, and so one notices the aerials chiefly in the more wealthy districts. In these residential districts

probably the greater part of the villas exhibit aerials attached to eucalyptus, palm or pine trees, or even the more familiar (to English eyes) aerial mast.

It is seldom that fewer than four valves are employed. American sets have a wide sale, and in common with the custom of that country often run to eight or ten valves. Multi-valve receivers are naturally heavy on batteries, and a great proportion of the sets are mains driven. Unfortunately, in Puerto Orotava, as in many other places of similar size abroad, the demand for electricity in the daytime is quite insufficient to cover the fuel and generating costs, with the result that the supply is only switched on at sunset and is switched off at sunrise. Thus, during daylight, the mains-driven sets are useless, but at the same time, owing to the distance from Europe, reception of the majority of the stations is not possible until dark, so that the absence of the supply is not a serious factor.

In practice, the long-wave band is seldom of use in the Canary Islands. While distortion and fading are at a minimum on this band, it is unfortunate that atmospheric and mains disturbances are at their best, with the result that on a great many sets the background noises render reception impossible. In addition, the writer was rather surprised at the weak strength of the long-wave stations in general at this distance.

On the medium waves, atmospheric and



The Canary Islands are beyond the service area of most broadcast transmitters.

other disturbances are less, but one is faced with the bugbear of fading and distortion. The choice of station depends largely on the receiver employed. With many there appears a falling off in sensitivity towards the upper region of the medium waveband, though it is here that reception is the more steady. Towards the lower end of the band many approach instability, with consequent high amplification, but the stations suffer considerably from fading.

### Tuning-in the B.B.C.

Conditions vary from night to night, and the listener in England can get a rough, though not altogether fair, idea of reception by ignoring all stations he can hear within a radius of one thousand miles or so. Lisbon, being comparatively near, is well received. So is Toulouse, though the quality is not always as good as the strength. Of the British stations, the Nationals are of little value, but London Regional is often quite satisfactory, though surpassed by the more distant North Regional.

One point about the British stations is frequently criticised. Papers arrive a week or ten days old, and the exile cannot look up the evening programmes beforehand as he can at home. Thus, he never knows when a broadcast which would especially appeal to his taste is to be transmitted. It would be a great advantage to those abroad if the B.B.C. would devote a few moments, say, after the second news bulletin, to a synopsis of the chief items in the following night's programme. Such information would have to be made fairly late in the evening, for in countries west of Greenwich local time is behind G.M.T., as in the Canary Islands, where the first news at 6 p.m. in England is received at 5 p.m.

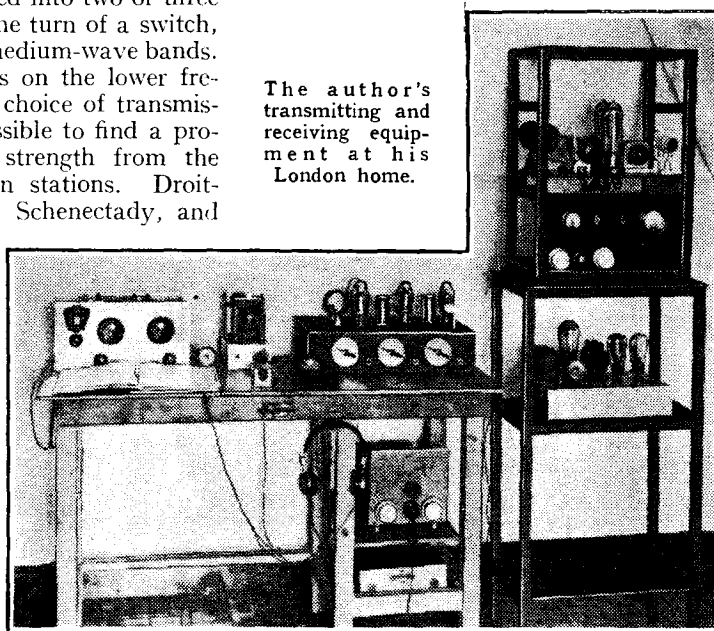
seem excellently situated for reception from the States, and from perhaps eleven at night till sunrise in winter one can pile up a good log of Americans at really praiseworthy strengths giving good entertainment value.

From an entertainment point of view, broadcasts on the short waves from 14 to 60 metres receive far more attention in the Canary Islands than in England. Many of the American sets have the short-wave band divided into two or three portions, selected by the turn of a switch, as with the long- and medium-wave bands. Tuning is as simple as on the lower frequencies, and by due choice of transmissions, it is usually possible to find a programme at excellent strength from the European or American stations. Droitwich, Rome, Moscow, Schenectady, and others, as long as the transmissions are not directed too far from the region of the islands, can often produce signals, which may not be of quite so great field strength as some of the medium-wave transmissions, but actually the programme may be followed with less strain imposed by a background of heavy static, or interference, met with on the lower frequencies.

As regards the 7-megacycle band, winter conditions are roughly as follows: Round mid-day there is little to be heard except for a few stray signals from southwest Europe, or, at week-ends, a certain amount of local telephony between the islands. Towards sunset European signals rapidly increase in strength, until the band is alive with signals up to R.8 or 9.

sibly they were hidden in the intense interference with which a simple reacting detector could not cope. Later in the evening the European signals fade out to some extent, to be replaced by the Americans. Many of these are received at tremendous strength, the chief districts being the first, second, third, eighth and ninth. It appears that the islands are far more favourably situated for the reception of these transatlantic signals than is Eng-

The author's transmitting and receiving equipment at his London home.



land, where often in the latter part of the evening most of the European signals fade out, and the American fail to arrive.

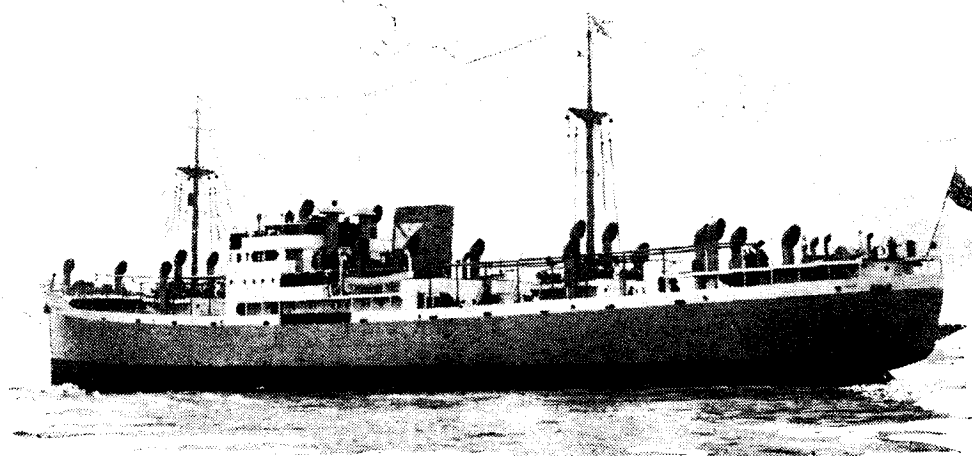
In the Canaries there were very few occasions when American signals were not plentiful throughout the band, surpassing both in number and strength those received at the home station. They do not fade out till towards daybreak, when the New Zealanders and Australians appear. Incidentally, in England the writer has noticed that the former are the better received than the latter, whereas in the Canaries the opposite seemed the case.

### A "Radio Shadow"

Possibly the explanation lies in the fact that the Australian signals would be arriving at a more westerly angle, and would be less in the "radio shadow" cast by the high ground behind the writer's location. The 12,000ft. peak lay rather to the south-west, and it would be interesting to know to what extent this, together with the ridge of the island, rising to some 8,000ft. above sea level, can cast a "shadow" on the various frequencies.

At daybreak, in addition to the Australian signals, a good number of the fifth district of America (comprising the Southern states) are received, together with a few Californians, which at the writer's English station are very seldom heard on this band.

On the 1.75 megacycle band there is again ample evidence that the reception of American signals in the Canaries is superior to that in England. Observations were regularly carried out on this fre-



S.S. Betancuria, 4,000 tons, of the Olsen Line, which is engaged in the Canary Islands fruit export trade. Though carrying only 12 passengers, she is equipped with direction-finding and other radio aids to navigation.

local time, at which time, except in mid-winter, one is still waiting in rural districts for sunset and the local electricity supply!

Apart from European stations, programmes can generally be picked up from America later in the evenings. The islands

As one would expect, signals from the south-west of Europe, such as Spanish, Portuguese, French and British predominate. There seems, however, rather a lack of the Far-Eastern countries, such as India, Hong-Kong, and the Antipodes, though Europeans can be heard calling them. Pos-

**Eavesdropping in the Canaries—**

quency for three months, during which period over 100 transatlantic C.W. stations were identified. As this band is in America devoted far more to telephony than to telegraphy, the numbers of 'phone carriers greatly surpassed the code signals, but on a two-valve receiver were, for the most part, just too weak to be identified. On this frequency the British stations are limited to an input of only ten watts, yet over fifty were heard at strengths up to R.5 or so, and as long as the static level was not unduly high, no difficulty was experienced in copying them.

During February and March the attempts by British and American amateurs to span the Atlantic were listened to and both sides were heard with ease in the Islands. Rather curiously, only a small proportion of the forty or more Americans logged in the Islands were

heard in England, though the British amateurs were using more powerful receivers than was the writer. As a contrast to the above reception from the west, during the Soviet contest many Russian stations were heard from districts as far apart as the southern coast and the northern region of Leningrad.

From 175 to 190 metres there is a considerable quantity of small-boat communication by means of appalling frequency-modulated telephony. Many of the transmissions probably come from off the Spanish and Portuguese coast, but some are of such strength that they would seem to originate from the fishing fleet working between the Islands and the African coast. The band-width of some of the signals would almost suffice for high-definition television, but as it is no worse than that heard round the North Sea and English Channel, one cannot blame the local authorities.

# Below 100 Metres

## Notes from a Listener's Log Book

**R**EVIEWING conditions during the past fortnight, January 1st to 14th, there seems little doubt that they were very good for the winter season until January 7th, then fell off, becoming poor on January 9th, to improve again with the appearance of a new group of sunspots on January 10th-11th.

It has also been the case, as in previous notes this winter, that the range of wavelengths encountered was very large, from the various U.S. police cars on 8.9 metres up to the U.S. Transatlantic 'phone transmitter WCN on 59.08 metres.

### Television

Another outstanding feature has been the amount of ultra-short-wave activity, both local and dx, many stations having been received at good loud-speaker strength. The two Baird transmitters at the Crystal Palace have again been active on 6.8 metres (video channel) and 8.5 metres (sound channel) respectively. Both are very strong signals in South-West London, but the quality of the sound channel is often rather poor, in contrast to the B.B.C. transmissions which have been heard again recently from the 7.75-metre transmitter on the roof of Broadcasting House.

The new E.M.I. transmitters at Hayes, Middlesex, have not been intercepted yet, but the new mast has been completed, and may be seen from the G.W.R. main line.

A strange 8.5-metre station, radiating a tuning note the modulation of which is increased periodically and rhythmically, has also been heard very clearly, and at present remains unidentified. It may be, of course, an experimental landing beacon at Croydon.

The *pièce de résistance*, however, has been the rather astonishing reception of U.S. police cars, touring about the streets of Newark and possibly other American cities—perhaps I ought to say "round the blocks"! Details of the reception was referred to in other columns of the January 3rd and 10th issues.

Finally, some readers may be surprised to hear that on Saturday, January 11th, at 3.30 p.m., the field strength of W2XEN on 9.9 metres (300 watts) was approximately equal to that of W3XAL on 16.87 metres (20 kW). W2XEN may be distinguished by his "metronome" interval signal.

At the present moment the peak period for transatlantic ultra-short wave reception appears to be between 3 and 5 p.m., but on days of very high ionisation the signals remain in until 6 p.m. I should not be surprised if, during the midsummer period this year, 10-metre signals will be audible from the U.S. from morning until well after sunset!

Turning now to a detailed study of conditions, on New Year's day I noted that they were on the up-grade, and W2XAF, 31.48 metres, was very good at 8.30 p.m., when a football running commentary was in progress, a slight heterodyne from LKJ1, Jelöy, being audible about 4,000 cycles on this occasion.

Conditions in the 49-metre band seemed also to be very good later in the evening, and at midnight W3XAL on 49.18 metres was as good as I have heard him this winter, only slightly troubled by interference from the Soviet commercial Morse transmitter RWJ.

Here I must thank the Soviet authorities for moving at least one of their telegraph transmitters out of the broadcasting bands. RKK, so long faithful companion of W8XK on 48.86 metres, has now apparently been moved to approximately 51 metres!

The improvement in conditions during the first week in January may be gauged from the fact that W3XAL on 16.87 metres was still a very good signal at 7 p.m. on January 2nd, a "signal" performance!

At this time W2XAD on 19.56 metres was also very strong, but spoilt by a low-pitched hum, although now the modulation quality is very good. W8XK and W2XE were also there in this band.

Absolutely local station signals were obtained from W2XAF on 31.48 metres at

9.20 p.m., and W1XK on 31.35 metres was also R9, with a single blemish—hum. There must be a shortage of smoothing condensers (or chokes) in the States!

The "amateur" transmitter VP3MR was also a good signal in the 40-metre band at 11 p.m., but QRM was bad. This station does some really excellent O.B.s—at least they appear to be outside broadcasts—the quality being very natural and distinct. It is, however, causing quite a stir in amateur circles, where it is regarded, possibly correctly, as an interloper, in view of its local broadcasting character.

### Broadcast Wavelengths

One understands from the overseas Press that operation on 6,075 kc/s and 11,800 kc/s is contemplated, when the channel in the 40-metre band will be vacated. The power is presumably still 50 watts, to be increased to 300 watts later. From the purely technical angle a very creditable performance, VP3MR! But surely the lower end of the medium-wave band, or slightly lower, is the right place for local broadcasting, not the already overcrowded *international* amateur and broadcasting bands.

Conditions were similar on January 3rd, and W3XAL on 16.87 metres was good again, with deep fades, at 7 p.m., whilst W2XAF on 31.48 metres was listened to for 2½ hours solidly from 8.50 p.m. onwards.

One of the best U.S. 10-metre 'phones on Saturday, January 4th, was W2GFH at 5.12 p.m., and earlier, at 4 p.m. roughly, several U.S. police cars were heard between 8 and 10 metres. One in particular was heard enquiring about the other's low tension battery! Some of the carriers were rough, but some seemed quite crystal controlled.

Excellent signals were intercepted from W2XAD at 5.15 p.m., and a very noticeable echo on GSI was observed a little later.

Conditions after January 4th fell off rather, W3XAL remaining good in the afternoons, and W2XAF fairly good at night, but this latter station dipped to very poor on Thursday, January 9th, and on this day things were very long-wavish.

A marked improvement was noticed on January 10th and W3XAL was really excellent all the afternoon on 16.87 metres. W8XK on 13.93 metres was again good at 10.5 p.m. on Sunday, January 11th, and, while GSL was off the air for about fifteen minutes on Saturday evening, the Canadian transmitter CJHX, Halifax, which uses the same frequency, was heard fairly well at Merit 2-3, R5, and was about the best North American 49-metre transmitter at this time. As mentioned at the beginning of these notes, the U.S. police transmitter W2XEN on 30,100 kc/s was a very good signal at 3.30 p.m.

One of the best signals on Monday evening, January 13th, was PRF5, Rio de Janeiro, on 31.56 metres. At 10 p.m. this station was quite a good loud-speaker signal, with rather jerky fading.

The longer waves were in evidence, too, on Monday evening, and VP3MR was a Merit 3-4 signal again at 10 p.m.

Most of the listening this fortnight was done on the Imperial Short-Wave Six, slightly modified to take two ultra-short wave ranges, 4½-9 metres and 8-16 metres; all the ultra-short wave listening was done on this receiver, with, of course, the advantage of one knob control!

ETHACOMBER.



# CURRENT TOPICS

## B.B.C. PROGRAMME ARRANGEMENTS

*IN consequence of the deeply lamented death of H.M. King George V, broadcasting arrangements during the next few days will necessarily involve many departures from the programmes listed in our "Listeners' Guide." The B.B.C., which has more than once demonstrated its sensitive understanding of the national spirit, may be depended upon once more to interpret the feelings of the country in a fitting manner.*

## Sailors' Broadcasting Station

DENMARK is planning the erection of a short-wave station to broadcast news to Danish sailors all over the world.

## 7½ Million in Sight

AT the end of 1935 British wireless licences numbered 7,415,709.

The German licence figures are once more challenging the British, for at the end of the year the German post-office returned a total of 7,192,952.

## Broadcasting from a Ship

RECENTLY we stated that a lady announcer had been appointed to conduct the broadcast programmes from the Australian liner "Kanimbla," now building at Belfast. She is Miss Eileen M. Foley, an Australian, and the licence under which she will operate is the first of its kind to be granted in the British Empire.

## Gold Medal Winner

MR. R. J. BRADLEY (G2FO), of Stockton-on-Tees, has won a gold medal offered by the Radio Society of Northern Ireland for the highest number of points scored in a DX competition during the last twelve months. The Society's own Leonard Trophy—a silver cup—was won by Mr. J. N. Smith (G15QX), of Belfast, who gained seventy-three points in open competition with amateurs all over Ireland. Over eighty-one stations took part.

## A Sweeping Statement

"IN the world of wireless nothing is impossible," writes a well-known professor. He has evidently overlooked the fruitless efforts in some quarters to uproot the "Foundations of Music" broadcasts.

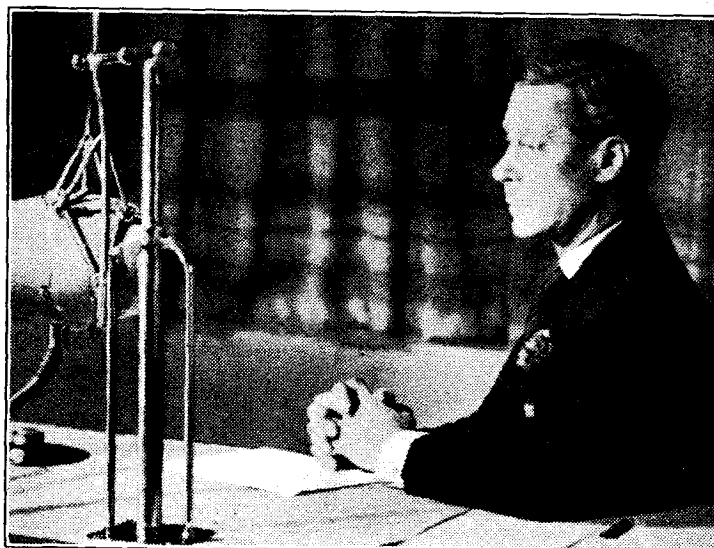
## Not Noisy

ROTHERHAM rural council has decided that local loud speakers are not unduly noisy and that no anti-loud speaker bye-law is necessary.

## No More Reception Reports

AMERICAN broadcasters are following in the wake of the B.B.C. in deciding to discontinue the issue of short-wave reception confirmations. It is announced that the new rule applies to the Westinghouse stations W8XK, Pittsburgh, and W1XK, Boston.

These two stations receive



H.M. KING EDWARD VIII. A recent portrait of the new King, who, as an acknowledged "master of the microphone," has broadcast at frequent intervals ever since the service was opened in 1922.

several hundred letters daily from various parts of the globe, and they both have been described as "local" by listeners in India, Africa, Australia, South America and Britain.

## The Radio Hooter

HOOTERS may disappear from German streets if success is achieved with a new system of wireless warnings which was recently tested in Berlin. Each vehicle in the test was supplied with an ultra-short-wave transmitter and receiver, and drivers, instead of tooting, pressed a key which transmitted a warning to other cars fitted with radio. The main advantage of the system is that warnings are inaudible except to drivers.

## Micro-ray Communication

MR. W. L. MACPHERSON, B.Sc. (Eng.), and Mr. E. H. Ullrich, M.A., are authors of a paper on "Micro-ray Communication" to be read at a meeting of the Institution of Electrical Engineers on Thursday next, January 30th, at 6 p.m.

## Swedish Television Begins

SWEDISH television programmes were opened last week in Stockholm by the Svenska Radioaktiebolaget. Transmissions are made from the suburb of Alstromergartan, television being radiated on 6.97 metres and sound on 7.31 metres. 240-line definition is used. The television transmissions are from 2 to 4 p.m. daily.

Television receivers designed by the firm's own engineers are already on the market at a cost

## Events of the Week in Brief Review

that experience shows that channel widths of at least 20 kilocycles are required for reasonably good reception and reproduction on these short waves. Yet assignments are being made by some nations with separations of only 5 kilocycles.

## Marconi Wireless School

OWING to increased demand on its services the Marconi School of Wireless Communication at Arbour Lane, Chelmsford, is to be transferred to a new and larger building. This centre for advanced instruction in experimental and practical wireless was established in 1901, and has occupied the present premises for the last fifteen years. New apparatus to meet modern requirements is to be installed and the residential accommodation is being extended.

## Index and Binding Case

THE Index for Volume XXXVII of *The Wireless World*, July to December, 1935, is now ready, and may be obtained from the publishers at Dorset House, Stamford Street, London, S.E.1, price 4d. post free, or with binding case 3s. 1d. post free.

## Cathode Rays and Television

MR. T. D. HUMPHREYS, of the Ediswan Co., will lecture on "The Cathode Ray Tube and Television" at a meeting of the National Radio Engineers' Association on Thursday next, January 30th, at 8.15 p.m., at the Star Hotel, 163, City Road, London, E.C.

## England-Ireland 5-metre Test

AN attempt at two-way working on 5 metres between England and Ireland will be made on Sunday next, January 26th, by Mr. W. Johnson (G2INP) operating a transmitter on the summit of Ashurst Beacon, near Ormskirk, Lancs. Both telephony and I.C.W. will be used between 09.30 and 16.00 and it is hoped that listeners hearing the signals will report to G2INP at 6, Denmark Road, Southport, or *via* the R.S.G.B. An effort will also be made to exchange signals with G6IA on Snae Fell, I.O.M.

## The Open-Air Theatre

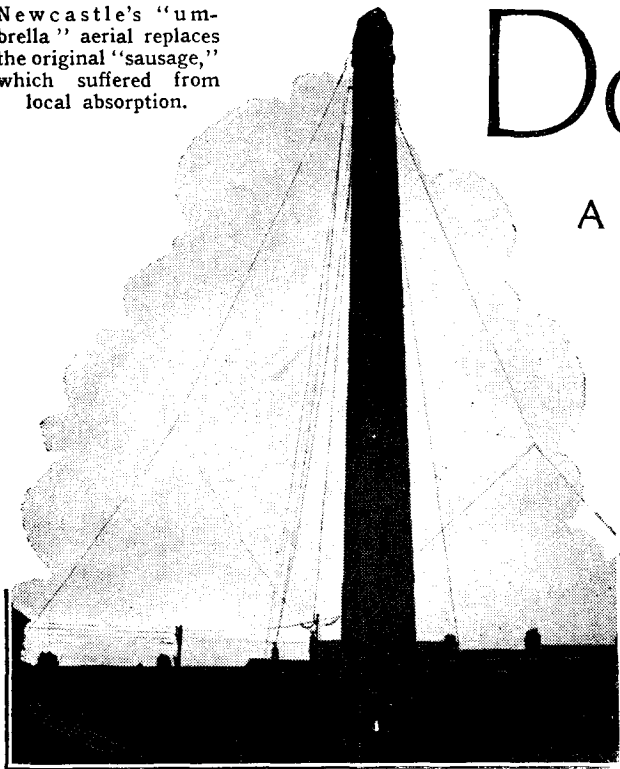
IN our recent reference to the public address system installed at the Regent's Park Open-Air Theatre it should have been made clear that the work was carried out by the Trix Company, on whose staff Mr. Derek Farrer was then engaged.

## U.S. Accuses Us

JUST when the European countries are organising a short-wave conference comes a smashing indictment from the American Federal Communications Commission. In the Commission's annual Report the European nations are accused of unscientific allocation of short wavelengths.

The European nations (runs their report) are disregarding engineering fundamentals and cluttering up the short-wave ether, thus spiting themselves because what otherwise would be good reception is being destroyed. The report adds

Newcastle's "umbrella" aerial replaces the original "sausage," which suffered from local absorption.



# Does Broadcasting

## A REGIONAL TOUR OF INVESTIGATION

*THE most neglected of all the "neglected areas" is the subject of Mr. Baily's article this week. He describes the vicissitudes of the Newcastle station—how, after surrender of part of the station building to the Income Tax authorities, better counsels prevailed, with the result that the whole of the building has been recovered by the B.B.C. and now incorporates three of the most modern type of studios. The article concludes with a plea for a twin-wave transmitter for Newcastle, the National to be synchronised.*

By **LESLIE BAILY**

transmitter which relays the North Regional programme, to which occasional items are contributed from the Newcastle studios and from various local O.B. points—churches, theatres, etc.

There has been a good deal of Tyneside Press agitation for increased activity—the local scribes cynically dub Newcastle a B.B.C. suburb of Manchester, which city, they contend, plays too prom-

## IX.—Over the Border to Newcastle

**O**F all the newly projected B.B.C. transmitters, none is more overdue than North-East Regional.

The population in this district is much greater than in any other of the "neglected areas." The reception is utterly inadequate. In fact, nowhere throughout Northumberland, Durham, and Cumberland can listeners enjoy that reliable high-quality fadeless reception of twin programmes which should be the keystone of the Regional Scheme.

It is true that Newcastle and its satellite towns have enjoyed from earliest B.B.C. days the services of a local transmitter, but the effective range nowadays is only some ten miles around the most obsolete transmitter in the country. Let me briefly recall its history, which aptly illustrates three phases of B.B.C. policy.

First, the opening of autonomous stations in chief centres of population. Of the original 1922 B.B.C. transmitters—2LO, 5IT, 2ZY, and 5NO—only the last remains in service. Captain Eckersley promised transmissions for Tyneside by Christmas, 1922, but when the time arrived the studios were unready, so the inaugural transmission was carried out from a lorry drawn up in the yard of the "Co-op" factory where the transmitter had been installed in a stable! Nobody on the present Newcastle staff remembers that strange inception. Mr. Tom Payne, original Station Director, runs a wireless business in the town.

Second, through the invention of land-line relaying, and through the craze for "centralisation," the provinces lost power; Newcastle, furthermore, was absorbed into the North Region; the local



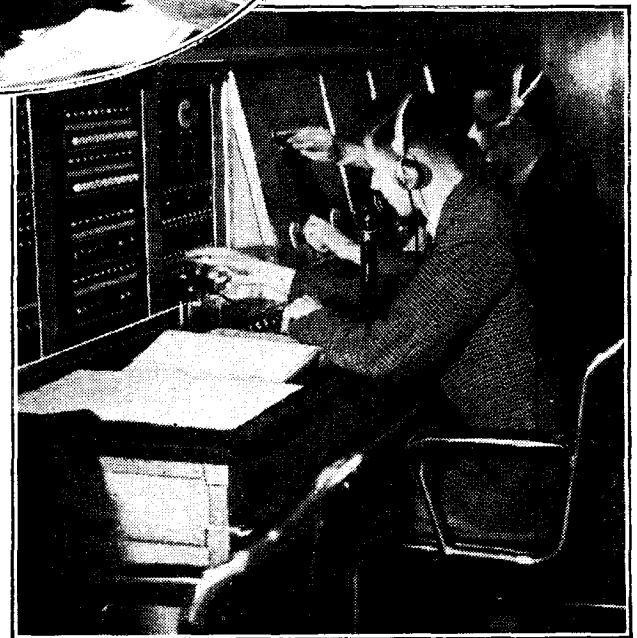
Mr. Guilford "looks after" an area extending from Carlisle and Berwick to Darlington.

orchestra disappeared, the staff dwindled, part of the studio building in New Bridge Street was let to the Income Tax people, and the number of studios was cut from three to one.

The third phase came a year ago, when the lost rooms were recovered from the Income Tax, and the entire building was modernised, with three studios again!

Externally, Newcastle's Broadcasting House has a slightly ecclesiastical appearance (it dates back to the 18th century), so that it is startling when you enter to behold the modernism of Wells Coates, who has designed as pleasing a set of studios as I've seen anywhere. There are now all the facilities for any programmes, except the most elaborate multi-studio shows, to be efficiently presented from Newcastle, but the local programme staff consists merely of a Station Director (Mr. E. L. Guilford). One can hardly count the occasional part-time announcer as "staff."

So, to-day, the position on Tyneside is that we have this modern Broadcasting House, with its single programme-organiser, linked up to an antique one-kilowatt



S.B. and control positions, Newcastle.

inent a part in North Regional affairs. It would be dangerous, however, to deduce from this that a general public demand for more local programmes exists. The B.B.C. answer to the "suburb" allegation is that the placing of Regional headquarters at Manchester is only for technical convenience, and that actually programme producers from Manchester visit Newcastle frequently. The same, I believe, applies to Leeds. In fact, the North Region's producers and music directors seem to spend a lot of time travelling between the studio centres.

# Serve Britain ?

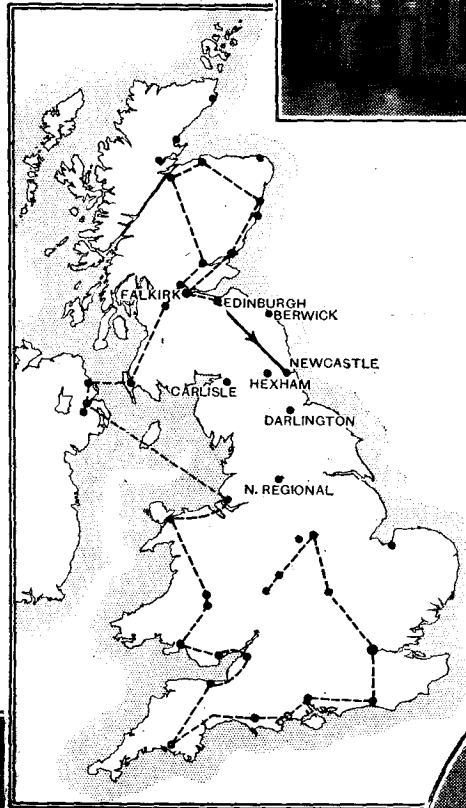
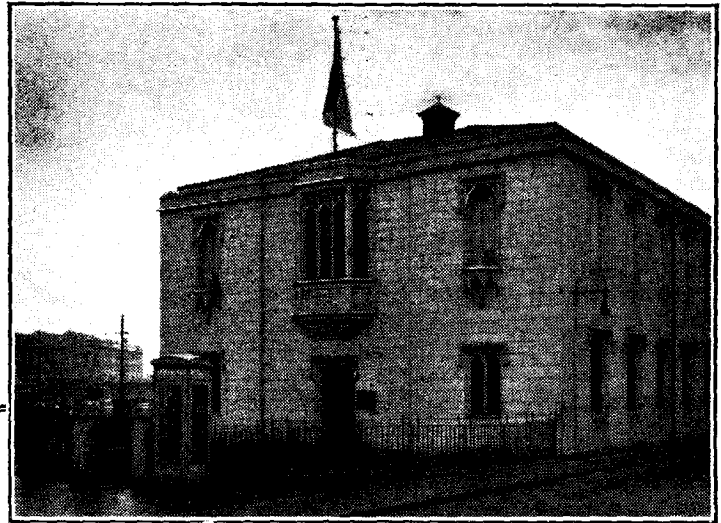
The contention I will make is that this itinerant system is not conducive to the highest efficiency, and that only by the employment of a number of specialists whose permanent residence in the district permits unremitting application to the job is it possible to improve the presentation of local programmes—and in this city, as in fact everywhere, I believe that what the general public really wants in programmes is not more quantity, but better quality.

## A Watching Brief

The country over which Mr. Guilford holds a watching brief on behalf of the North Regional Director stretches from Carlisle and Berwick in the north to Darlington in the south (nearly half of the North Region), and the best part of this area will, it is hoped, come within satisfactory range of the new North-East Regional transmitter.

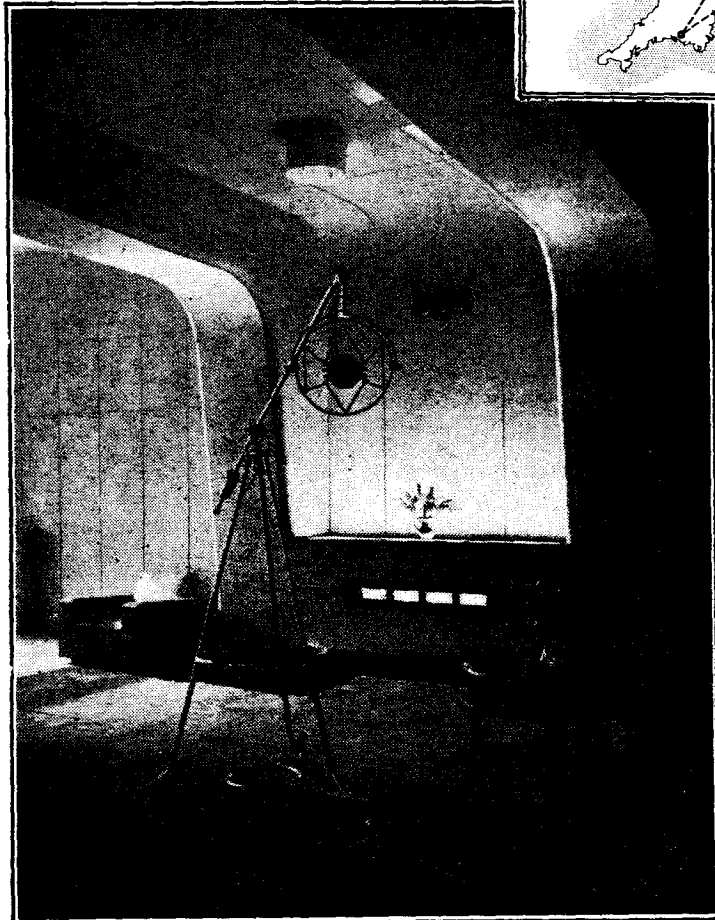
The site of the new station, not far from Hexham, some 16 miles west of Newcastle, is 600 feet above sea level, on an expanse of bleak moorland. The output will be 50 kilowatts. The transmitter, working on power from local mains, will employ high-power "Class B" modulation. Whether a mast-aerial will be used rather depends on the performance of the trial aerial of this type in Northern Ire-

"Newcastle's Broadcasting House has a slightly ecclesiastical appearance."



at the "Co-op" works. The original aerial was a "sausage" slung to the factory chimney, but the coming of modern field-strength measuring vans revealed that the polar diagram was lop-sided, due to absorption by the steel-framework of the factory. An "umbrella" aerial—three wires equidistant around the chimney—has been substituted, with beneficial results in a north-easterly direction—so says Engineer-in-Charge Nicholson.

When 5NO closes down there may be discontent from the crystal-set fraternity—for I learn that any number of Tyneside people—even rich people—still use ten-year-old crystal sets.



A portion of the new main studio, designed in the modern style by Mr. Wells Coates.

Mr. Walter Dierick at the microphone in a Tyneside character study.



land. The builders are about to start work, so it will be a year or more before this transmitter makes its long-delayed début.

Newcastle transmitter will then close down—the last of the original B.B.C. stations. During 5NO's life the circuit has been altered to improve quality, but basically it remains the famous Marconi "Q" job, and it is still in the old stable

"We still sell large quantities of crystals daily," I was told by Mr. Tom Payne, who added these comments on local reception conditions: "All the Regionals fade—North at times very badly, at other times not at all. West, despite its distance, is often better received than either North or Scottish. Droitwich is variable, sometimes its fading is very noticeable, other times very little. Splendid transmitter as Droitwich undoubtedly is, it has, furthermore, to contend with the vast amount of electrical interference prevalent in such districts as ours."

Newcastle-on-Tyne is 90 miles from the North Regional transmitter at Moorside

**Does Broadcasting Serve Britain?**

Edge, but actually in Newcastle itself and for about 10 miles round about, the fading on North Regional does not matter, as listeners get the same programme from 5NO. But beyond that local service area there are important towns like Carlisle, Durham, the Hartlepoons—while even at Darlington, 60 miles from Moorside Edge, I am told that there is fading on that wavelength.

Another comment about Droitwich has reached me by post from an ex-B.B.C. engineer now resident in Newcastle.

"The quality is a great improvement on the old Daventry," he writes, "but the difficulty is fading. Sometimes the distortion during fading is such that last night, for instance, while listening to the news, it was impossible to make out what the announcer was saying!"

How will the new 50-kilowatt affect this deplorable situation? The B.B.C. has not committed itself as to the nature of the programme it will broadcast, but a pretty safe bet would be that the new

transmitter will relay the North Regional programme (including, of course, local items from the Newcastle studios). So the inability of people in these most northern counties to get decent reception of North Regional programmes will be rectified—but what about good reception of National?

There is fading on Droitwich, and the point Mr. Payne makes—that "man-made static" is at its worst on the long waves—is a very practical one. To make a really adequate job of it, the B.B.C. should be building at Hexham a twin-programme station, to relay National as well as Regional. One appreciates that the B.B.C. engineers work under perplexing difficulties, owing to the restricted number of wavelengths available, but would it not be practicable to synchronise a "North-East National" on a common National wavelength, just as the London, West and North Nationals are already synchronised?

(Next Tour: To North Regional Headquarters.)

## Random Radiations

**Reception of U.S.A. Stations**

SEVERAL readers (to whom my best thanks) have written to say that they are now receiving stations on wavelengths above 379.5 metres. One of them, who writes from the Sheffield area, tells me that, though he tries for Americans pretty regularly, he had only once heard anything on a wavelength above 305 metres before the beginning of January. The "oncer" was WGY. During the last week or two he has managed several times to tune in WOR, the 50-kilowatt station at Newark, New Jersey, which works on 422.3 metres. WOR is also reported by several other Transatlantic enthusiasts. A second station fairly high up in the medium waveband that has been pretty widely received is WEA, also of 50 kilowatts, which is situated in New York and works on 454.3 metres.

**Is it WIOD?**

Some time ago I suggested that WIOD, of Miami, Florida, was perhaps the most remarkable long-distance station received in this country. It works on 230.6 metres and, though it is rated at only a single kilowatt, it is probably one of the most-frequently logged of Transatlantic stations. One correspondent contends that WIOD is overlauded and saying he believes that, as often as not, transmissions logged on 230.6 metres come, not from WIOD, but from other stations. He mentions that he has definitely verified the call signs of WBBR (Brooklyn, N.Y.), WEVD (New York) and WFAB (also New York). Even so, the miracle remains, for WBBR, WEVD and WFAB are all 1-kilowatt stations. That no fewer than four such low-powered stations have been logged at good loud speaker strength in this country seems to show that the wavelength of 230.6 metres is, for some unexplained reason, a peculiarly good one for transmissions over the Atlantic. I can't call to mind any other one-kilowatt U.S.A. stations that are receivable, except possibly on odd occasions under freak conditions.

**By "DIALLIST"****The "Prom" Controversy**

I HAVE heard several heated discussions of late on the subject of the Promenade Concerts. The B.B.C. arranged a series of twelve Promenade Concerts at the Queen's Hall, but actually broadcast only just over an hour of music from each on the average. Those who don't care about serious music say that the Corporation should neither organise the concerts nor broadcast them. Others, to whom a first-rate concert is a joy, hold the view that if the listener pays for a concert out of his licence fee he has the right to be able to hear the whole of it by means of his receiving set if he wants to do so.

It is, I think, a pity that so little of some of the concerts was broadcast. In one or two cases the Queen's Hall programme contained most attractive items during the earlier part of the evening, but nothing was broadcast save the last part of the concert, which was not nearly so alluring.

**The Cup Final**

THE fate of the Cup Final broadcast still hangs in the balance, though it will probably be decided a few days after this note appears in print. The position at present is this. The majority of association football clubs object to the broadcasting of a running commentary unless the B.B.C. permits them to reproduce it for the benefit of spectators on their own grounds by means of public address equipment. Were this permission given (and so far it has not been) the match at Wembley on April 25th would have to start at 2 o'clock, a whole hour earlier than usual. The crowds on other grounds could then listen to the broadcast and watch their own teams play after it was over.

At their next meeting on January 27th, the Football Association will have to consider a resolution, already tabled, to the effect that the kick-off shall be at 3 o'clock

and that the Council shall not permit any running commentary to be broadcast before 6 p.m. Were this resolution carried—and I sincerely hope that it will not be—it would torpedo the relay and deprive hundreds of thousands of listeners of what has been to them one of the greatest broadcast thrills during the past few years.

**A Difficult Position**

The B.B.C. could, of course, send a commentator, and "can" his story of the match by means of the Blattnerphone; but it would probably be almost impossible to find room for a whole hour and a half for this commentary on either Regional or National wavelengths after 6 o'clock in the evening. All that could be done would be to edit the Blattnerphone record in such a way that the most stirring incidents of the match could be brought out in a half-hour broadcast.

On the other hand, if the B.B.C. would at once give permission to clubs to reproduce the commentary for their supporters the whole position would be cleared up in a moment. And I don't see why the B.B.C. should not do this. They have nothing to lose, and possibly a great deal to gain. Their consent would be regarded as a very graceful action, and the relays on club grounds might well bring home to thousands of spectators who are not yet owners of wireless sets what a wonderful provider of entertainment and of excitement broadcasting is.

The present position of affairs is unfortunate. Each side fears that its hand is being forced and hesitates to climb down. Both parties might surely remember that if no agreement can be reached the very people whose interests they have most at heart—the football spectator on the one hand and the wireless listener on the other—are going to be the greatest sufferers. To adapt very freely the old Latin tag: When the Bigwigs are on their high horses it's the man in the street who gets it in the neck!

**Americans and Radiograms**

NOT long ago I mentioned that the radiogram was almost unknown in the United States and asked whether anyone who had recently been in that country could explain why this should be, in view of the fact that these instruments are becoming increasingly popular over here. A Derby reader kindly wrote and gave me the reason. There is, he says, such a wide choice of wireless programmes at all times of the day in the United States that the receiving set supplies all the entertainment that anyone could need. Any device for enabling a set to play records is, therefore, a superfluity.

There is probably a great deal in this, for if you look over a list of U.S.A. stations you can't help being struck by their multiplicity. Many large towns have several big transmitters. In New York, for instance, there are eleven rated at 1 kilowatt or more. Four of these are 50-kilowatt stations, one is rated at 5 kilowatts, and the remainder at 1 kilowatt. Philadelphia has three stations of over 1 kilowatt, Chicago eight, Newark three, Boston four, and so on. In such instances three alternative programmes—those of the Columbia Red and Blue Chains—are available from the big broadcasting organisations, whilst other programmes are sent out by independent or semi-independent stations.

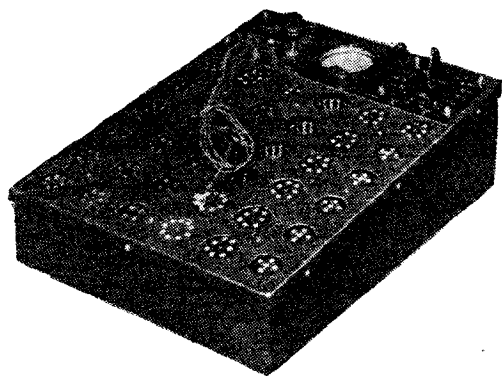
# New Apparatus Reviewed

RECENT PRODUCTS OF THE MANUFACTURERS

## RADIOMETERS ALL-VALVE TESTER

IT is admittedly a difficult matter to design a valve-testing panel having universal application, but one that for all practical purposes fulfils this rôle is made by Radiometers, Ltd.

Described as the Allvalve Tester, it can be used for "vetting" practically every type of valve in general use to-day. In order to simplify the handling of the apparatus and to obviate the need for a multiplicity of adaptors, the panel is fitted with thirty-six valve holders, ranging from the four-pin to the nine-pin types, and for American as well as for British valves.



Radiometers' universal type valve-testing panel, entirely AC mains operated.

Filament supply is obtained from the AC mains, a special transformer being fitted that gives from 2 to 40 volts according to requirements. Likewise HT is derived from the same source, though for this a Westinghouse rectifier is included. The test set is operated entirely from the AC mains.

Valves are tested by noting the anode current passed with two different values of grid bias. Only high-grade components are used, and the price complete is £8 8s. It is an ideal valve-tester for retail dealers and service men, as a check on any valve can be effected in a few minutes. Each tester is accompanied by an instructional book giving in tabulated form the meter readings for average specimens of all modern valves.

## FARREX SHORT-WAVE UNIT

MADE by Farrex Radio, this short-wave unit is of the type that can be employed either as a detector adaptor, in which case it replaces the existing detector circuit, or it may be employed as an autodyne superhet converter. Since most modern broadcast sets are superheterodynes, the performance of the unit as a converter is, perhaps, of greatest interest.

Tests were made with a small AC superhet, and as the unit relies on the broadcast set for its HT and LT, they were obtained from the IF valve-holder with the aid of the cable and seven-pin adaptor supplied, HT being taken from the screen-feed line. The broadcast set was tuned to 2,000 metres.

Being an autodyne unit, every signal can be tuned in at two points, which, in view of the absence of preselection circuits, is inclined to be an advantage than otherwise. Some interference was experienced from

second-channel signals, which is, perhaps, inevitable with this simple circuit and the congested state of the short-wave band, but on the whole very satisfactory results were obtained. Occasional adjustment of the reaction control on the unit is necessary to prevent howling. The only other control is an aerial coupling condenser. On the back of the unit is an on-off switch, which in the "off" position joins the aerial direct to the broadcast set, so there is no need to change it over for short-wave or broadcast reception.

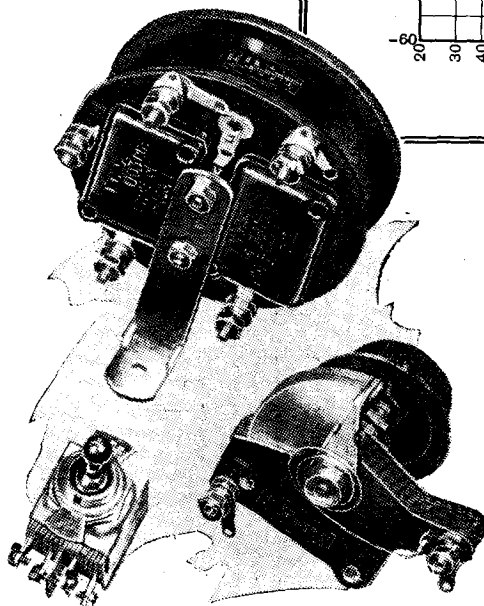
Two plug-in coils are provided, which together have a range of 12.2 to 61.5 metres, or individually 12.2 to 29.5 and 25.4 to 61.5 metres, respectively.

The unit can be used with battery or mains sets, and the price, excluding valve, is £3 3s. A five- and a seven-pin adaptor is included.

## KINVA TUNABLE WHISTLE SUPPRESSOR

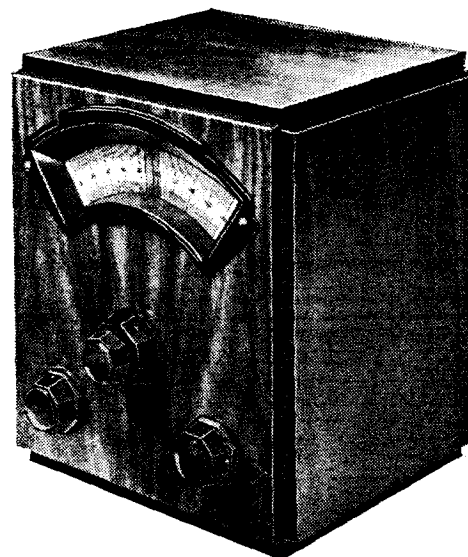
THIS is a dual-purpose device, as it can be used either for removing a heterodyne whistle without materially disturbing the upper register reproduction, or it can be employed to suppress all frequencies above 3,500 c/s, though the cut-off point can be

Kinva whistle suppressor kit, comprising coil unit, switch and condenser. A typical circuit arrangement is shown on the right, together with response curves for whistle suppression (A) and complete cut off (B), the latter with the switch closed.



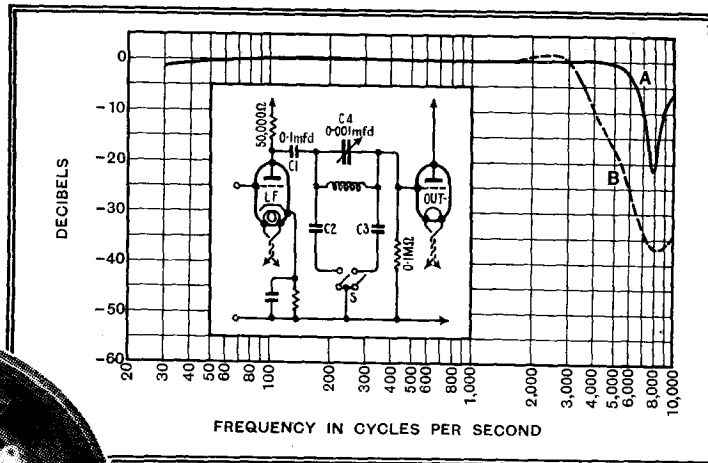
extended to about 5,000 c/s with the adjustment allowed.

The unit can be joined either in the anode circuit of an LF valve—in a modern set this



Farrex short-wave unit for use as detector-adaptor or as a superhet converter.

will be usually the triode section of a duo-diode-triode—or in the grid circuit of the output valve. The latter arrangement is generally best with resistance LF coupling, but the former will have to be adopted with the parallel-fed transformer coupling. A typical arrangement is shown on the graph, and with this circuit the accompanying curves were taken. Curve A is with the device used as a whistle suppressor and with condenser C4 tuned to reject at 8,000 c/s. The switch is open in this arrange-



ment. Closing the switch and thus earthing the by-pass condensers, C2 and C3, gives a complete high note cut-off as shown by the dotted curve B. The unit was left tuned as for the first set of measurements.

When fitted to a set the switch and variable condenser, C4, can be mounted on the panel, or elsewhere if more convenient, but in any case short leads are advised. A whistle filter of this type is virtually an essential fitment in any modern set of the high-fidelity type, and the Kinva model has the added advantage of giving a complete cut-off when required.

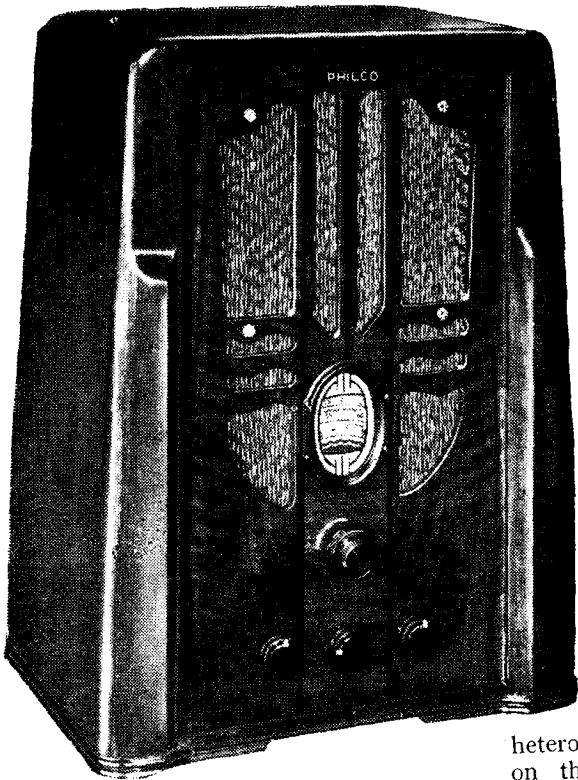
The unit with which our tests were made is known as the Type V2, but there is another model for use in the grid circuit of a duo-diode-triode, and this is described as the V2a.

The makers are Postlethwaite Bros., and the complete kit, including a 0.001 mfd. variable condenser and a double-pole switch, costs 17s. 6d. for either model.



# Philco MODEL 2620

## A Neat Table Model All-wave Receiver



**FEATURES.—Type.**—Table model superheterodyne for AC mains.  
**Ranges.**—(1) 5.7 to 18 mc/s (52.6 to 16.6 metres). (2) 538 to 1720 kc/s (547 to 174 metres). (3) 145 to 350 kc/s (2068 to 857 metres).  
**Circuit.**—Pentode HF amplifier—heptode frequency changer—pentode IF amplifier—double-diode-triode second detector—pentode output valve. Full-wave valve rectifier. **Controls.**—(1) Tuning. (2) Volume and on-off switch. (3) Wave-range. (4) Tone. **Price.**—17 guineas.  
**Makers.**—Philco Radio and Television Corporation of Gt. Britain Ltd.

**E**VEN for a table model this set is unusually neat and compact, the overall dimensions of the cabinet being only 19 × 14 × 9½ in. This fact serves to emphasise the impression of liveliness created by the performance, which, on closer examination, will be found to be attributable to two distinct qualities. One is the crispness and clarity of the response from the loud speaker, and the other the intrinsic range and overall sensitivity of the five-valve circuit.

In common with the majority of successful all-wave receivers, a stage of HF amplification precedes the frequency-changer valve. This not only adds to the

range of the set but also improves the signal-to-noise ratio, and if properly applied, as it is in this instance, can be made to eliminate the double tuning points which in simpler superheterodyne receivers can rise to confusion on the short wave-range. The aerial circuit has been designed for use either with a standard single-wire outdoor aerial or with the Philco all-wave anti-interference type of aerial. A filter tuned to the intermediate frequency is also included in the aerial circuit.

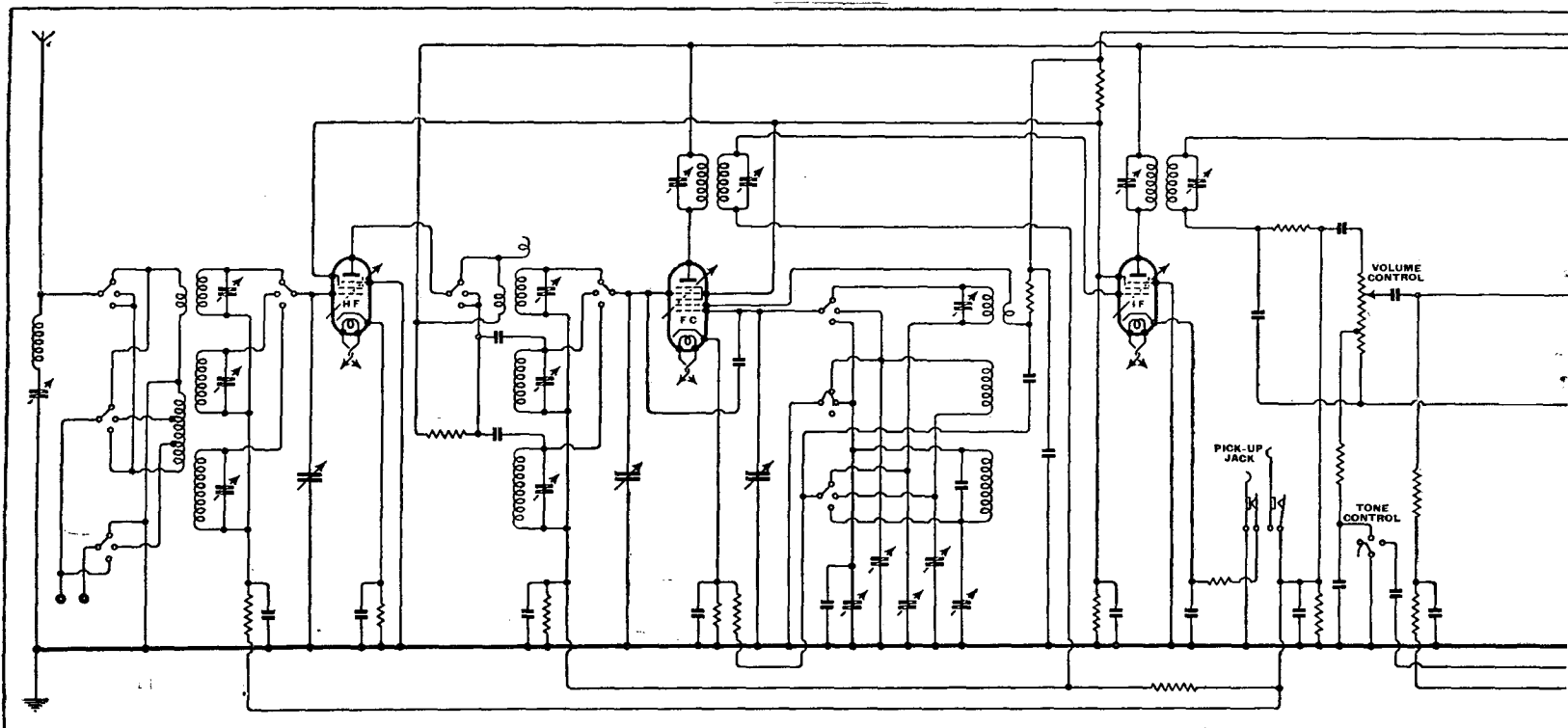
On the medium and long wavebands the coupling between the HF amplifier and the frequency-changer is of the tuned grid type, while on the short waveband a transformer with a combination of magnetic and electrostatic coupling is employed. The frequency-changer valve itself is a heptode, and the provision of a neutralis-

ing condenser between the grids of the oscillator and amplifier sections of the valve is a feature worthy of note.

The single IF amplifier functions at a frequency of 460 kc/s, and its output is applied to a double-diode-triode second detector in which the diodes are connected in parallel. Full AVC is taken from the diode load resistance through suitable filters to the HF amplifier, and to a lesser degree through a potential divider to the frequency-changer and IF valves. The gramophone input is also applied at this point of the circuit, and the pick-up jack has contacts which open the cathode return of the IF stage to silence the radio receiver when playing gramophone records.

The volume control potentiometer forms part of the LF coupling to the triode amplifying portion of the second detector valve, and with it is associated a three-position

Complete circuit diagram. The input coupling is arranged for an ordinary outdoor aerial or an anti-interference aerial connected to the terminals at the bottom left-hand corner of the diagram.



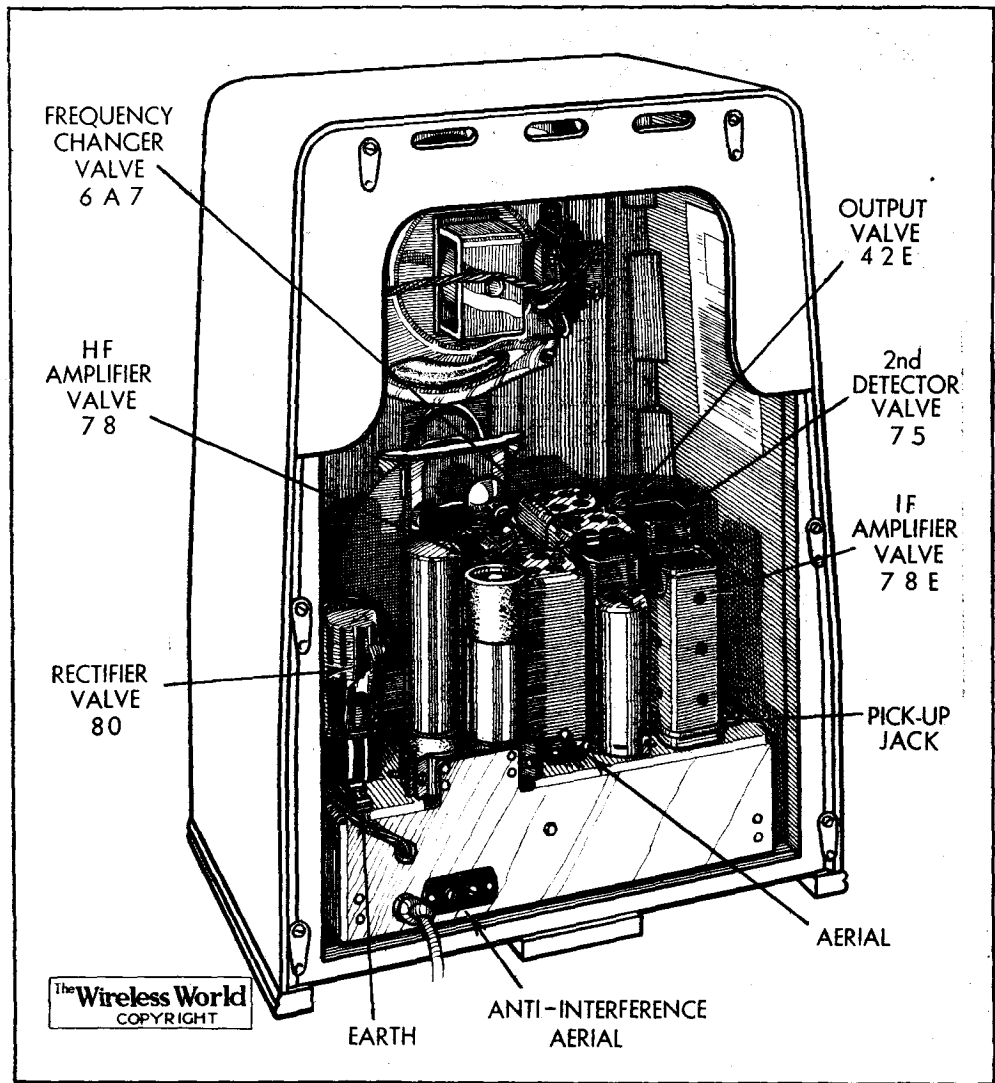
tone control switch designed to give bass compensation at low volumes and to introduce a certain amount of bass boost in one of its three positions.

The output valve, which is resistance-capacity coupled to the second detector, is a pentode designed to give an undistorted output of 3 watts. It feeds an energised moving-coil loud speaker in which the field coil is used as part of the HT smoothing system. A hum-bucking coil is included in series with the speaker coil, and a further contribution to a silent background is to be found in the centre-tapped condenser filter connected across the mains leads.

### Kilocycle Scales

The calibration of the three tuning ranges in kilocycles, and the fact that the highest frequencies are on the right-hand instead of the left-hand side of the scale, as is the usual practice in this country, may at first cause some confusion; but with the aid of *The Wireless World* list of stations familiarity with the kilocycle equivalent of the wavelength settings of each station should soon be acquired. The dial is driven through a two-speed slow-motion gear giving alternative ratios of 9:1 and 72:1. The scales are illuminated from behind, and the indicators take the form of arrowheads projected on to the translucent scale by the dial light.

The daylight performance of the set on the medium waveband gives a certain indication of the high capabilities of the set in the matter of range. Not only is the sensitivity uniform right to the ends of the scale, but there is no apparent difference in the liveliness of the performance on the remaining two wavebands. It is possible to approach within two channels on either side of both the National and the



General view of interior of receiver. The tuning condenser and the chassis as a whole are mounted on rubber suspensions.

Regional Brookmans Park transmitters when using the set in Central London, and on the long waveband the transmission from the Deutschlandsender is free from interference from Droitwich and Radio-Paris when the tone control is in the mellow position.

No difficulty was experienced in tuning-in American transmissions on the short waveband during the afternoon, and the AVC was quite capable of maintaining the programme value of the stations.

There is a wide difference in quality between the "Mellow" and "Normal" positions of the tone-control switch, and those who like to work with plenty of volume from the loud speaker may find themselves forced to use the "Mellow" position by the rather searching quality of the upper middle register when the tone control is in the other two positions. There can be no doubt, however, that this quality gives unusual clarity to speech and the brilliance which is demanded by such transmissions as military bands and dance music. In our opinion the best all-round quality was obtained at moderate volume in the "Full" position of the tone control. Under these conditions the top response assumes its proper proportion, and the bass boost introduced provides just the right balance.

### Imperial Short-wave Six

WE have been advised by Messrs. Stratton and Co., who are supplying the coil formers for this receiver, that in four or five weeks' time they hope to be able to supply complete coil units with switch ready built up. Readers who may hesitate to construct the complete unit themselves will be glad to have this information.

### The Radio Industry

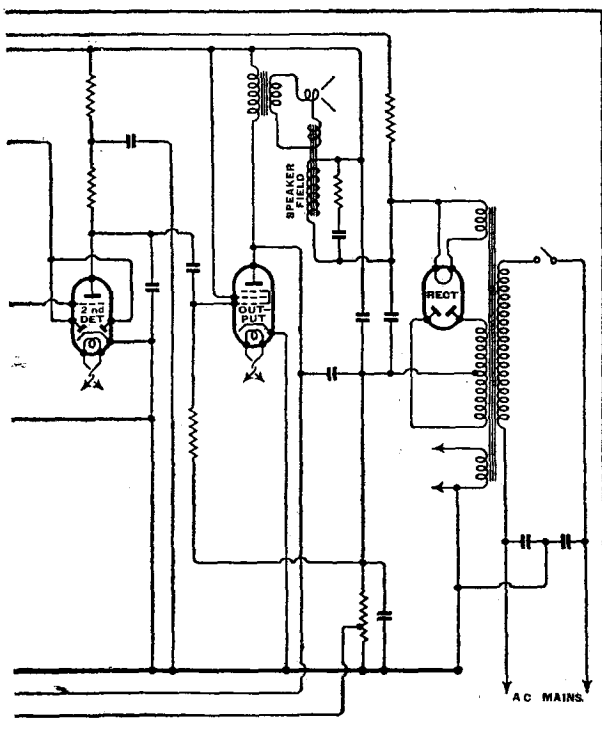
ALL-WAVE testing equipment of an extremely ambitious nature has just been installed in the G.E.C. radio works at Coventry. Technically, the new gear is unusually interesting, and the standard of accuracy is exceptionally high.

"Simplat" sound recording discs, mentioned in our issue of December 13th, 1935, are described at length in a booklet just issued by V. G. Manufacturing Co., Ltd., Gorst Road, Park Royal, N.W.10.

A novel "geographical" tuning system, embodying a dial in the form of a map of Europe, is fitted to the Europa receiver, which is described in a leaflet available from the makers, Radio Industries Development Co., Birch Street, Hanley, Stoke-on-Trent.

The proprietors of Experimental Laboratories of Radio and Television have recommenced business at 23, The Grove, Ealing, W.5.

Change of address: Mr. G. D. Wakeham, Scottish agent for Fuller batteries, to 5, Douglas Lane, off Blythswood Sq., Glasgow.



# Listeners' Guide for

## Outstanding Broadcasts at Home and Abroad



"SCRAPBOOK FOR 1901," on Monday and Tuesday, will bring back such memories as the return of the Volunteers from the Boer War, Marconi's first transatlantic wireless message, "boater" fashions in feminine headgear, and the thrills of early motoring.



"The Autocar" photograph.

### MOMENTOUS YEAR RELIVED

THE year 1901 is in some ways the most momentous of all years dealt with in the "Scrapbook" series, for it marked, with the death of Queen Victoria, the end of an epoch and beginning of the modern age. Leslie Baily and Charles Brewer turn to page 1901 on Monday (Reg., 8) and Tuesday (Nat., 8.30), and personalities who will shine forth, in living presence or records, will include Charles Coborn, the "G.O.M." of the music halls; George Hirst, the Yorkshire cricketer; Emma Calvé, the greatest "Carmen"; Shaw Desmond, the novelist; Ben Davies, recalling the old songs; "Ixion," of *The Motor Cycle*, recalling early motoring experiences; and Marchese Marconi, who first spanned the Atlantic by wireless in the year under review.

Ping pong, now known as table tennis, was the popular craze in those days; the submarine was making its appearance; and M. Santos Dumont circled the Eiffel Tower in an aeroplane.

Life was packed with interest, as the "Scrapbook" will reveal.

### NOTABLE ABSENTEES

FOR the first time since the inauguration of the "Air-do-Wells" Effie Atherton will be absent from the cast in next Thursday's programme (Nat.,

8), as she sailed for Chicago on January 8th to join Jack Hylton's Party. Another absentee is Margery Wyn, now playing principal boy in a Glasgow pantomime. Their places will be taken for these two performances by Doris Nichols, who has achieved a big reputation in broadcast farce and burlesque, and Alma Vane, who is already well known to listeners.

### A BAD MIX

WHAT appears to be an unfortunate juxtaposition of items occurs in the Regional programme on Tuesday evening. At 8 o'clock Steuermann is to play Beethoven's Thirty-three Pianoforte Variations on a Waltz by Diabelli; immediately afterwards comes another pianoforte feature in which those two brilliant Viennese players Rawicz and Landauer will appear in a fifteen-minute recital of their two-pianoforte virtuoso act. Both these programme items should be first-class, but to run them together is like mixing mutton with beef.

### DRAMA

AS the week's most promising talk I should choose Alastair Cooke commencing the first of a series on "Drama of To-day," to be given at 6.45 on Sunday (Nat.). Mr. Cooke, whose sparkling film criticisms have won him a large following among listeners, will

deal with American drama. We may look for vivid excerpts and pungent comments.

Another talk with dramatic interest will be Eric Gillett's third contribution to the series on the plays of John Galsworthy. He will deal with "Justice" at 7.30 on Monday (Nat.).

### "BURNS' NIGHT"

THERE is one birthday the B.B.C. is never allowed to forget, that of Robert Burns; so to-morrow's festivities will be reflected at 8.30 in the Regional programme with a special studio broadcast from Edinburgh. This is the 177th birthday of the Ploughman Poet.

### GRAVEYARD GHOULS

BODY-SNATCHING is a meet subject for melodrama, and the two principal exponents of the art, Burke and Hare, figure in the broadcast which Tod Slaughter and his company of Barnstormers are giving us on Thursday and Friday of next week. The two Irish labourers, Burke and Hare, achieved notoriety in

the 1820's by stealing bodies from Edinburgh churchyards and selling them to the wicked Dr. Knox for dissection purposes. The Doctor will be played by G. M. Slater and Burke and Hare by Tod Slaughter and C. Douglas Carlisle respectively. (Thursday, Reg. 8.40; Friday, Nat. 8.40).

### WOMEN'S ORCHESTRA

THE British Women's Symphony Orchestra comes to the National microphone at 10.20 on Tuesday under the baton of Malcolm Sargent. To prove that a women's orchestra can command as much fire and frenzy as the male variety they are playing the Symphony No. 3 in C by Sibelius.

### BIG FIGHT: AN INNOVATION

BOXING bouts between Jack Petersen and Len Harvey will soon vie with "Music-Hall" or the "Foundations of Music" as regular features in the B.B.C. programmes. These worthy fighters meet again at the Empire Pool Arena, Wembley, at 9.30 on Wednesday, when a running commentary will be given in the Regional programme by Lionel Seccombe, who was himself a University heavyweight champion.

As an innovation Mr. Seccombe will broadcast from a seat at the ringside instead of from a soundproof box. He will have a much better view of what is happening, and to allow him full freedom of movement the microphone will be suspended round his neck. John Snagge will be seated at one side of Mr. Seccombe and a glass shield will be erected at his other side to cut out extraneous noise. In this way listeners will almost be able to imagine that the fight is taking place in their own sitting-rooms.

### SCHUBERT AND JAZZ

THE immortal name is not often linked with negro idioms, but such will be the case at Oslo to-night at 9.15, when Walter Schubert and his Band will give "an earful" of music ranging from the classics to the most blatant of modern jazz strains.

# or the Week

## ENGLISH FROM MOSCOW

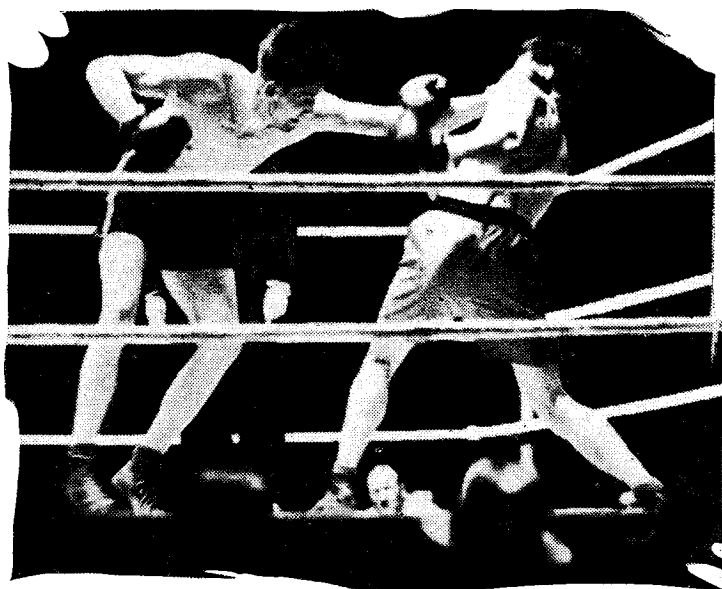
RUSSIAN technical achievements, illustrated by a "visit" to the Polytechnical Museum, are the subject of an English broadcast from Moscow (1,724 m.) on Monday at 9 o'clock. This museum includes a permanent exhibition entitled "Our Achievements," and among the points to be discussed on Monday will be research work in the stratosphere and Arctic exploration.

## SAXOPHONE RECITAL

SIGURD RASCHER, the saxophone virtuoso who recently visited this country, gives a recital at 2.15 to-morrow afternoon (Saturday) from the Swedish stations.

## WASTED FACULTIES

AN erratic genius in 1811 composed "Aurora," the opera which Berlin (Funkstunde) is broadcasting to-night (Friday) at 7.10. He was E. T. A. Hoffmann, of whom Carlyle said that he wasted in liquor and strange company "faculties which might have seasoned the nectar of the gods." To-night also brings us Eugen d'Albert's beautiful opera "Tiefland," relayed from the Vienna Stage Opera at 6.15.



**BRITISH HEAVYWEIGHT CHAMPIONSHIP.** This is the view Mr. Lionel Seccombe will have from his new ringside seat when broadcasting a running commentary on the Petersen-Harvey fight at Wembley on Wednesday next. (Reg. 9.30).

Gounod's "Faust" will be relayed to-morrow by Brussels No. 1 at 8 from the Théâtre

de la Monnaie, and at 9.25 Luxembourg offers Mozart's early opera "Bastien et Bastienne," written when the composer was only twelve.

That perennial favourite, "The Caliph of Bagdad" (Boieldieu), comes from Radio-Paris at 8.45. Two other interesting operas this week are Julius Bittner's "Der Musikant" from Hamburg at 7.45 on Wednesday, and Mozart's "Idomeneo" from Leipzig at 7.10 on Thursday.

## SWEDISH SONG HITS

SWEDEN'S latest song hits are to be featured in the Motala transmission at 7 to-morrow night in a topical revue from the Folkets Hus, Stockholm.

## QUARTET NIGHT

TO-DAY is notable for the number of string quartets in the foreign programmes, and chamber music lovers will be grateful for the fact that the times do not clash. Königsgberg at 3.10 offers the Berlin Steiner Quartet in a Beethoven programme, while Rome at 4 relays the "Napoletano" Quartet from St. Cecilia's Academy. The celebrated Lener Quartet will be heard in a Beethoven and Hadyn pro-

## HIGHLIGHTS OF THE WEEK

### FRIDAY, JANUARY 24th.

Nat., 8, Kentucky Minstrels. ♪Violin Recital by Arthur Catterall.

Reg., 7, George Robey Programme. 7.50, Cochran's "First Night." ♪Soft Lights and Sweet Music.

### Abroad.

Luxembourg, 9.5, Gala Concert from the Casino.

### SATURDAY, JANUARY 25th.

Nat., 8.30, "Dancing Through" (Geraldo and his Orchestra). ♪B.B.C. Orchestra.

Reg., 8.30, Burns Concert (from Edinburgh). ♪Medvedeff's Balalaika Orchestra.

### Abroad.

Brussels II, 9, Bach Festival, from Liège Conservatoire.

### SUNDAY, JANUARY 26th.

Nat., Alfredo Campoli Trio. 7, Recital: Isobel Baillie (soprano). Horszowski (piano). ♪Leslie Jeffries and Orchestra, Grand Hotel, Eastbourne.

Reg., Mantovani and his Tipica Orchestra. 9.20, Sunday Orchestral Concert. Conductor: Sir Henry Wood.

### Abroad.

Berlin, 7, Johann Strauss Concert. Frankfurt, 7, "A New Musical Riddle" (Rosbaud).

### MONDAY, JANUARY 27th.

Nat., 8, Brahms' Quartets by B.B.C. Singers. 8.30, "Romance in Rhythm" (Geraldo and his Orchestra).

Reg., 8, "Scrapbook for 1901." ♪B.B.C. Orchestra: Music by Edward German.

### Abroad.

Deutschlandsender, 7.10, Dohnanyi conducts Hungarian Philharmonic (relayed from Budapest).

Strasbourg, 9, Opera Concert from the Salle de l'Aubette—a "trailer" of forthcoming productions.

### TUESDAY, JANUARY 28th.

Nat., 8.30, "Scrapbook for 1901." ♪British Women's Symphony Orchestra.

Reg., 8, Pianoforte Recital by Steuermann. ♪B.B.C. Northern Orchestra.

### Abroad.

All German Stations, 8.10, Richard Strauss conducts his Symphonic Fantasia: "Aus Italien."

Paris, P.T.T., 8.30, "The Weird and Magical in Music"—2nd of series. French National Orchestra

### WEDNESDAY, JANUARY 29th.

Nat., B.B.C. Dance Orchestra. 8.30, B.B.C. Symphony Concert. Reg., 8, B.B.C. Theatre Orchestra: Old Ballad Concert. 9.30, Petersen v. Harvey Fight.

### Abroad.

Berlin (Funkstunde) Wagner Concert.

Munich, 8.30, Broadcast Dancing Lesson.

### THURSDAY, JANUARY 30th.

Nat., 8, "The Air-do-Wells." 10.20, B.B.C. Orchestral Concert. Reg., 8, B.B.C. Organ Recital by C. H. Trevor. ♪Medvedeff's Balalaika Orchestra.

### Abroad.

All German Stations, 7.10, Mozart's "Idomeneo." Munich, 7.10, "Soldiers and Potsdam"—a musical military sequence.

## GOOSE STEP TO MUSIC

THE "old Prussian soldier spirit" underlies a musical play, "Soldiers and Potsdam," to be relayed by Munich at 7.10 on Thursday, January 30th.

## FIVE HOURS' REQUEST PROGRAMME

A UNIQUE request programme lasting five hours is being given by the Deutschlandsender at 7.10 on Sunday. This is a concert in aid of the German Winter Help Fund.



**MANTOVANI** brings his Tipica Orchestra to the Regional microphone on Sunday at 5.30.

contributors to which have been allowed to choose items for broadcasting. Several orchestras will take part with a number of notable soloists.

## ULTRA MODERN

ULTRA modernists should tune in Willi Stech broadcasting from the Deutschlandsender at 6 p.m. on Wednesday a pianoforte recital of compositions in the very latest manner.

## SPECIAL ITEMS

VIENNA, Sunday, 8.25 a.m.: Opening of Linz Regional transmitter, with relay from Old Cathedral.

Berlin (Funkstunde), Friday, 8.30: Address by Gen. Goering on "Germany's Air Policy."

Warsaw, Tuesday, 9.45: English talk, "Woman in Poland."

THE AUDITOR.

# Letters to the Editor

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

## VK3LR

REFERRING to your issue of September 27th on page 351, "Megacycle" makes mention of reception from VK3LR, but expresses doubt as to times of operation.

VK3LR is on the air each week-day from 6.15 p.m. to 10.30 p.m. (8.15 a.m. to 12.30 p.m. G.M.T.) and relays programmes of our National stations VK3LO and VK3AR. Before transmission there is usually a test period of 15 to 20 minutes. In addition, the station is usually operating on our Saturday afternoons (1 to 5, i.e., G.M.T. 3 a.m. to 7 a.m.) and usually transmits on the occasions of important events, e.g., Melbourne Cup (Tuesday, November 5th).

D. G. MACKIE.

Mount Isa, Queensland.

## Burghead's Wavelength

MAY I put forward the following suggestion regarding Burghead's wavelength, in the hope that it will catch the eye of those concerned.

In the December 27th issue of *The Wireless World*, Lt.-Col. Chetwode Crawley tells us that the last of the coastal spark stations on 600 metres has now been replaced by ICW. As interference from these sources is therefore removed, and having in mind the mountainous nature of the north of Scotland, is it not practicable for the longer of Burghead's waves to be placed in the vacant channel of 510 kc/s (588.2 metres)? The success of this channel would probably depend upon the absence of spark-fitted ships coasting round the north of Scotland.

Midlothian.

J. BARRIE.

## Wireless Operators

NOTICE under "Current Topics" in *The Wireless World* of January 10th a paragraph relating to a pamphlet issued by the Ministry of Labour entitled "Choice of Career." As the paragraph reads, it might lead the public to assume that all the Wireless Commercial Services were being affected by the introduction of the Tele-writer. This, of course, is very far from being the case, as the application of this instrument has so far been confined to fixed stations. No use has been made in the Marine and Commercial Air Services, nor is it likely to be introduced in the future.

In view of the fact that at the present time there is a definite shortage of trained wireless operators for both of these services, we think it of some importance to make these observations and remove any possible misapprehension.

THE LONDON TELEGRAPH

TRAINING COLLEGE, LTD.,

London, S.W.5.

Maurice Child,  
Managing Director.

## Stereophonic Broadcasting

NOW that the old suggestion of Stereophonic Broadcasting has been quite rightly revived, would it not be well to ask why double-channels would have the desired effect?

The advantage of normal two-ear hearing is not much more than that of easy focusing depending on phase differences; however, as in the case of stereoscaphy an illusion is possible for some different reason. Any-

thing which will enable two ears to hear nearly as well as one could under normal conditions is obviously admissible.

If faithful phasing in some wonderful way were preserved both at transmitter and receiver, and a phase shift was contrived on a second receiver, something approaching the original topographic arrangement of the orchestra might be secured by trial and error; but is this what we want?

Light and shade, and preservation of colour are admittedly important, is "Depth" the missing quality?

Ware.

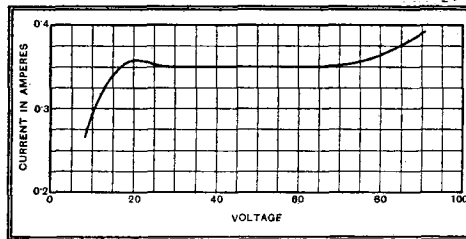
GERALD SAYERS.

## Barretters

IN your issue of January 10th, p. 45, in which an interesting new barretter is described, it is stated, in connection with ordinary barretters, that the current must increase slightly to produce an increase of temperature, so that the current cannot remain absolutely constant.

This is not strictly true for all conditions, in my opinion, since the final temperature is dependent upon the watts dissipation as distinct from the square of the current, the resistance not being constant. Provided that, over a certain range, the resistance is proportional to the watts dissipation, it is evident that the final value of current will remain constant over this range.

Naturally, a sudden change of voltage across a barretter will produce a transient change of current, owing to the thermal capacity of the device retarding the attainment of thermal equilibrium by the filament.



The accompanying curve, which may be of interest to readers, is taken from a leaflet (No. DW 933, date not stated), giving the characteristic curves of a number of Philips barretters. It will be seen that a distinct drop in current is shown as the voltage increases from 20 to 30 volts.

R. J. WEY.

Ealing, W.13.

## Transatlantic Reception

REGARDING the note by "Diallist" on transatlantic reception, in January 3rd issue, he may be interested in my experience.

Being up late Christmas night, or, rather, early Boxing Day morning, I thought I would see whether there were any Americans about before retiring, and switched on about 1.30 a.m. A fraction above Hilversum's wavelength I came on a strong signal—a Christmas party in very pronounced "Yankee" voices. Tuning lower, I picked up the same programme exactly on the wavelength of the Scottish National. Tuning higher, I came on a station slightly above London Regional's wavelength giving what was apparently a talk on child welfare, and tuning further up, I was extremely surprised again to hear the Christmas party

on a wavelength slightly below the Scottish Regional. The first two stations faded in at times at our local station strength (London Regional) but static was very bad. The stations giving the Christmas party had a three-note signal.

I have heard American transmissions several times, but only weakly, so I think conditions must have been very favourable. It was, I think, a very wet and misty night.

My receiver is a Philips six-valve AC "Superinductance," and, from the very accurate marking on the dial, I should say the stations heard were Pittsburgh KDKA, Los Angeles KNX, Chicago WENR and Chicago WBBM respectively.

I have also heard on several occasions in the early hours of the morning very slightly below the wavelength of Breslau a very distant station definitely not American with a curious shaky effect, and from the little I have managed to hear of the announcements I think it may be Radio Nacional Buenos Aires.

Have any of your readers heard this latter station?

S. J. GOODING.

Felixstowe.

## High Notes without Heterodynes

IT is not possible to listen in aural comfort to a receiver with a level response extending as high as 10,000 c/s unless the level of interference caused by man-made static and adjacent carrier-waves is extremely low compared with the desired programme. Nevertheless, all authorities are agreed that a response at least as high as this is essential for the life-like reproduction of music.

Most town-dwellers do not think it worth the extra cost to purchase a high-fidelity receiver as the tone control or selectivity control will nearly always have to be made use of to cut down interference. It is even more annoying to listen to music with heterodynes or "frying-bacon" noises superimposed than to listen to music with attenuated treble. The lost portion of the gamut contains the harmonics which alone give beauty to the strings and crispness to the percussion instruments.

If a receiver is made with a response which falls linearly by 20-30 decibels between 2,000 and 10,000 c/s, a background level which would normally be intolerable is reduced to a level almost below audibility. Under these conditions reproduction is objectionably "woofy" and mellow. To counterbalance this a filter giving an exactly reversed action could be incorporated in the transmitter. A transmission containing a preponderance of treble, when received on a set as described, would be reproduced with a normal high-note content and would sound as though nothing had modified it. The beauty of this scheme is that the interference is now below audibility and a full treble response can be enjoyed even in the worst localities. These high notes having only a small energy content, the transmitter would not have to increase its power to any extent.

In order to test this theory the writer constructed a small transmitter modulated from a gramophone pick-up by an amplifier incorporating a filter giving a response curve rising as indicated. The signals were re-



**Letters to the Editor—**

ceived on a nearby set with a filter adjusted to give a linear overall response.

A small electric motor was started which had been wired in series with a frame aerial. This frame was moved until it brought the interference level up to the point of maximum tolerability. Both the transmitter and receiver were then adjusted each to give a level response. Under these conditions the interference was too loud for any programme to be enjoyed and it nearly swamped quiet passages of music.

The motor was then stopped and another transmitter made to heterodyne the programme at approximately 5,000 c/s at an intensity sufficient to render listening un-



"FLOOR SHOW"—a picture taken at St. George's Hall during the actual broadcast criticised in "At the Transmitting End." Note the chest microphone used by John Watt (extreme right) and, in another part of the photograph, the probable origin of the "pops" referred to.

comfortable. The amplifiers were now made to operate with compensated treble uplift and the heterodyne dropped to an almost inaudible level.

It might be argued that this would render all existing receivers useless, but a filter for wiring in the loud speaker circuit or intervalve coupling circuit could be commercially produced for a few shillings. The device could easily be switched out of circuit if listening to a normal broadcast.

After hearing the realism, coupled with freedom from background, available on a good receiver incorporating this system, the majority of listeners would be only too willing to fit such a filter and request the B.B.C. to broadcast at least a few experimental transmissions with an increased treble output.

Thanking *The Wireless World* for all the help and information it has given me during the last seven years,

ANTHONY FEARNLEY.  
Bromley, Kent.

**Transmissions Criticised**

I THINK it is high time the B.B.C. turned their attention to the subject of balance and control, which has been referred to recently in your columns. Henry Hall's Band is generally weak below 100 cycles—all because they don't give the double-bass fiddle a little more microphone intimacy. Doubtless it is accidental, but Ambrose and Hylton always give us even bass, with no losses in the bottom octave. It seems to me Henry Hall would do better if he added a Sousaphone, as this brass bass instrument has better attack than the double bass. Anyway, his combination has

a pretty good-sized hole to fill up, and is described by all my listening friends as distinctly "tinny." This loss of extreme bass is not confined to the B.B.C. Dance Band, and one can safely say that the Theatre Orchestra would benefit by some intelligent rearrangement of instruments. In my opinion the orchestra directed by Charles Manning from Walthamstow is unexcelled as regards microphone pick-up, and should be used as a basis of comparison when the B.B.C. decide to do something.

In conclusion, I should like a word or two on the Compton Organ in the Concert Hall, Broadcasting House. Do any of your readers remember the demonstration of the instrument shortly after it was opened? When the organist played a few bars, first on the softest stop and then on the loudest, they issued from the loud speaker at almost the same volume, the only difference being that the "Gedact" was accompanied by a

roar of background noise calculated to make even Niagara Falls look to its laurels, whilst the tuba rang out on a dead silent background. The organ cannot possibly have been constructed especially for broadcasting; it is either too big or can be reduced too much in the pianissimo direction involving drastic control at the hands of the earphone man.

To sum up, I am convinced that receiver and loud speaker technique has now progressed beyond transmission quality, and though I hold in the highest esteem the efforts of *The Wireless World* staff in encouraging quality receiving equipment, we shall have to wait for the next move to come from another quarter.

Aylesbury. C. R. MOSCROP.

**At the Transmitting End**

*Technical Criticism of Recent Programmes*

**A "Pop"-ular Programme**

THE B.B.C.'s effort at cabaret—Floor Show, London Regional, January 10th—seemed a little laboured and artificial compared with the easy-flowing continuity of the St. George's Hall varieties, a matter which is rather puzzling because, if the pudding was a trifle hard on the digestion, the ingredients were above suspicion. And John Watt can stir up almost anything—even enthusiasm—in artistes and audiences alike.

My chief worry, however, was caused by the "pops" which occurred intermittently throughout the programme, coinciding with sudden variations in strength, and which

were more in evidence during an artiste's performance.

As the National programme was quite free of these noises and there was no question of electrical interference at the receiving end, it must be assumed that Clapham and Dwyer did not provide the only spot of bother at Portland Place that evening but, unlike theirs, it was a spot which did not improve the entertainment.

**The Good Old Days**

What a craze we are developing for the doings of yesterday!

Historical films, old songs, revivals of this and that, combine in a galaxy of retrospection to show us, sometimes with conviction, that those were the Good Old Days.

1935 has not yet had time to recede far enough into the dim and distant past to qualify for this category, but it was certainly a momentous year, full of the most enthralling and surprising events if one may judge of its dramatisation by the B.B.C. in "Twelve Months Back," London National, January 12th.

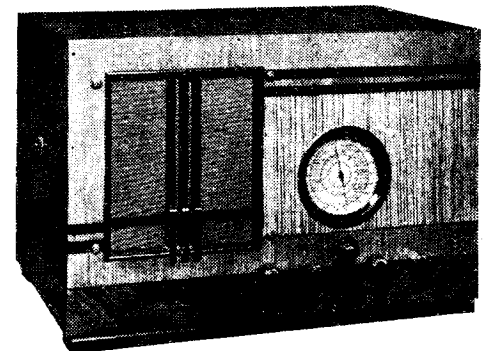
At any rate, it made most interesting listening, and goes to show how quite a large-scale production can be successfully planned chiefly with gramophone records.

Most of them were good and a few particularly so, and rose much above the poor quality we seem to get from the steel tape machine, which I judge was used occasionally in this programme. H. C. H.

**MARCONIPHONE MODEL 345**

*A New All-wave AC Mains Receiver*

THERE are two short-wave ranges (16.5 to 50, and 47 to 140 metres) in addition to the usual medium- and long-wave bands in this new superheterodyne receiver, and special attention has been given in the design to the requirements of the additional wavebands. Sectionalised screened switches and non-microphonic wiring are examples of the precautions which have been taken to ensure the same efficiency and stability on short waves as demanded as a matter of course in the normal broadcast bands.



The circular illuminated dial in the Marconiphone Model 345 is fitted with a dual pointer and carries station names in the medium- and long-wave bands.

The circuit consists of an HF amplifier, frequency changer specially chosen for its efficiency on short waves, a single IF amplifier, double-diode-triode second detector and pentode output valve. It is designed to operate from an orthodox aerial, and to avoid the possibility of HF pick-up from the mains, a separate on-off switch is provided.

The price of the new receiver, which measures 20½ by 14¼ by 12¾ in., is 17½ guineas.

# UNBIASED

## My All-Electric House

AFTER my exertions at Christmas-time I was led astray into taking a few days' holiday at a well-known seaside resort, deceived by the ineffable blue of the sea and sky in a railway poster and the alluring sunshine figures which accompanied it.

Finding myself eventually on a completely deserted and storm-swept sea-front, I was compelled to seek amusement, as my special period ticket did not permit of my returning home on the same day as I had arrived. Thus was I drawn towards a local building exhibition in which one of the chief attractions was an all-electric and all-radio house.

## By FREE GRID

The thing was, or so it seemed to me, a complete fraud. The all-electric part of it was represented by the usual poor lighting installation with lights fixed in all the wrong places, accompanied by a few conventional gadgets such as electric toast-racks and coffee pots connected to a wall plug in the skirting board in exactly the correct positions for people to trip over the flex, as I pointed out to a demonstrator. As for the all-radio part of the house, all I could see was a wireless set of very ancient vintage, no provision whatever being made for short waves and other necessities. No points were provided in other rooms for remote control of tuning or for additional loud speakers, while television was ignored altogether.

Needless to say, I did not waste time over this miserable "exhibition," but speedily made my way to the station to wait patiently in the rain for the first morning train home, where my first act was to draw up my own specifications for the all-electric and all-radio house.

In the first place, I have decided that both lighting and heating shall be automatically controlled. I have decided on the exact amount of light which I require in each room, and the constancy of this will be assured by a battery of photocells which will turn on more and more artificial light as the twilight deepens. In the case of excessively sunny days, of course, the scheme will still function as the photo-cells will cause the blinds to be drawn.

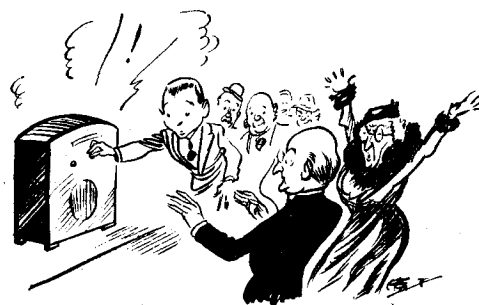
I have, in addition, decided on the exact temperature I require in each room, this to be thermostatically controlled, use being made of electric fires or refrigerating machinery as the outside temperature dictates. Needless to say, all the windows

will be opened or closed electrically, the present cumbersome manual system being taboo. The windows will open or close themselves automatically according to the air consumption inside the house, this being regulated by the number of persons in it at any one time. It will be fairly simple to arrange, by means of photocells, for doors to open automatically when you approach them.

With regard to the radio arrangements, I have as yet not gone very far, and am relying on you to help me with suggestions. The waveband covered by my set will range from an Angstrom unit to a light-year, while such details as tuning control from any room in the house will not be forgotten. It will also be possible to obtain any number of programmes simultaneously on the set, although I must confess that this is no novelty, some of our own manufacturers having included it in their models for years past.

## Is ALC Necessary?

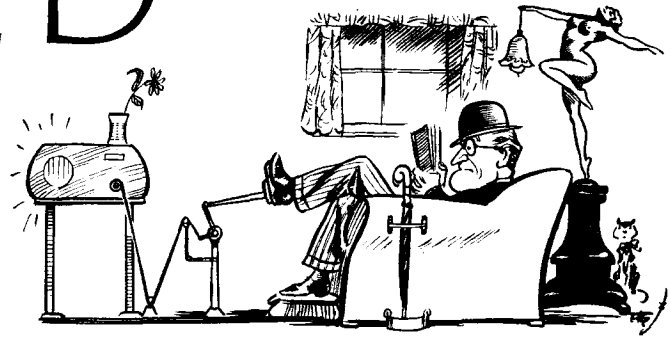
AMID the welter of automatic wireless devices masquerading under such occult hieroglyphics such as ASC, AVC, and QAVC, nobody seems to have thought of the vital necessity of fitting ALC to those of our sets which are equipped for short-wave work and are used in coastal areas.



They had never heard anything like it.

I mention this because of a flying visit I paid in answer to an S O S from a friend who has recently removed into a remote and lonely part of our native shores where wireless is not as popular as it might be, sets being very few and far between, and short-wave sets being practically non-existent.

In order to popularise the all-wave sport we had given a house-warming party to which all the local celebrities for miles round, including the vicar, had been bidden. His guests duly assembled, he had proceeded to demonstrate his latest treasure, a very imposing all-wave receiver. He had, as a matter of fact, never



Tuning control will not be forgotten.

done any listening in the neighbourhood prior to this particular occasion, as the set had been lost by the furniture removers and had only just turned up.

It appeared that the local yokels had never previously seen a modern receiver complete with short waves, their own sets being very primitive pieces of apparatus barely capable of dealing with ordinary wavelengths, and so they were all agog with excitement. After a few well-chosen words by the vicar, my friend rose to start the ball rolling, and after a few remarks *re* the marvel of short waves and what a lot people missed by not going in for this form of listening, he switched on and proceeded to twiddle the tuning dial.

To say that he was astonished at the volume of unparliamentary language that burst forth from the loud speaker would be to put it mildly. Unfortunately, the guests were not only astonished but suspicious, since they had never heard anything like it on their own sets and were not at all sure that it was not being done deliberately with a gramophone record by way of a practical joke.

## Nautical Metaphors

Not knowing what to think my friend had hastily sent for me, and I am glad to say that I was just in time to avert unjust suspicions being levelled against the B.B.C. It took me a great deal of trouble to find out the origin of this language, and even now I am not at all sure. It varies in intensity during the evening, but the curve seems to rise steadily as the night goes on. From sundry nautical metaphors which I have disentangled from the remainder of the language, I am inclined to think that it comes from trawlers fitted with 'phone sets.

My opinion in this respect is made firmer by the fact that the strength (of signals, not language) shows a marked increase in certain coastal areas, where it can be brought in on very insensitive apparatus (speaking, of course, in a radio sense). I am waiting, however, for my opinion to be confirmed before going to the expense of fitting Automatic Language Control, so if any of you who are living in the neighbourhood of our great fishing ports would care to send me a report, I will, of course, treat it as private and confidential.

# BROADCAST BREVITIES

By Our Special Correspondent

## Problems for Mr. Cock

PICTURE a man placed in charge of a beautiful new gun; he is tremendously enthusiastic but is a little doubtful as to whether it fires backwards or forwards, and his job is to find out. This, I think, sums up the situation in which Mr. Gerald Cock, Chief of B.B.C. Television, finds himself.

## Probing Deeply

In a dozen witty speeches at a Press interview last week Mr. Cock revealed that he has been probing more deeply into the terrific possibilities of television than the blithe scribes who think it all boils down to whether television prefers blondes or "people of colour."

## Concentration

Take a few of the problems involved.

"It is preposterous," said Mr. Cock, "even to think of televising long feature films," and in support of this he advanced not only the familiar reason that the production of feature films is beyond the resources of the B.B.C., but the equally cogent one that such films would put an intolerable strain on the looker's powers of concentration, remembering that the average received picture would rarely be as much as 12 inches wide.

## What is this Television?

Another problem is that of getting the public interested. With receivers costing at least £60 apiece, most people will form hearsay judgments on the value of the service unless there are ample facilities for free looking-in. How can this be managed?

## A Typical Viewing Hall

Mr. Cock hopes and thinks that the big stores, radio firms, and others will invite the public to looking-in rooms. "I picture," said Mr. Cock, "a viewing hall with perhaps only a dozen chairs but floor space for fifty or more people passing through. They would not be there for entertainment but simply to gain an idea of what television is like."

## Extension of Hours Necessary?

In my view they certainly would be there for entertainment, for nothing is more dear to the British public than a free show, whether a dog fight or a hole in the road. The trouble with these demonstration rooms

will always be to keep the people moving.

For this reason it seems to me that it may be necessary to extend the hours of television very considerably soon after the start. The projected periods—3 to 4 p.m., 6.15 to 7.15 p.m., and 9.30 to 10.30 p.m.—will seem all too short.

## What the Public Wants

As to the programme material, Mr. Cock seems definitely persuaded that the public wants information as much as entertainment. Thus, although one hour will be devoted each day to variety, the other two will be given up to news flashes and instructional "shorts." Well, it is all very experimental and, no doubt, public reaction will quickly determine whether this is the right policy.

## A Hint from Sir Noel

Sir Noel Ashbridge told me last week that the Marconi-E.M.I. and Baird systems will

and medium waves—certainly in the case of direct television transmissions. When the sound comes from the film strip the inherent defects of this system will not be overcome by even the best of transmissions.

## Secret Apparatus

I asked Sir Noel when the Press would have an opportunity to tell the world what is going on at the Alexandra Palace, but he gave an indefinite answer. Probably towards the end of February the studios will be thrown open to the Press, but the television apparatus is to remain secret throughout the experiments in fairness to the two competing companies.

## The First Tests

Actually no television gear has yet been installed at the Palace. The first tests may be expected towards the end of March. A public service will almost certainly begin in the first week in June.

consideration at Portland Place, to test "listener reaction" throughout the country.

## Tuesday is a Bad Night

University professors apparently have no difficulty in producing statistics to show that the bulk of the population wear pyjamas as opposed to night shirts, or prefer bloaters to caviare; it is a much more difficult matter to gauge the popular taste in broadcast programmes, which have a shifting and varying appeal from day to day.

Why, for instance, is Tuesday considered a poor night for broadcast listening? Why is Monday's listening audience very much larger?

## House-to-House Canvass

A postcard ballot, even on the c.o.d. system, is regarded as utterly useless by the B.B.C. pundits, who remember a humiliating experiment of the kind in the old Savoy Hill days. A house-to-house canvass would offer the most reliable data, but, however splendid the idea of B.B.C. emissaries knocking at every door—castle and cottage



DOORSTEP TO THE ETHER. The imposing—almost awe-inspiring—entrance hall to the N.B.C. headquarters in New York. On the mezzanine floor, which is also shown, an exhibition of radio relics is staged, and there are photo murals illustrating all phases of American broadcasting.

be tested alternately a week at a time. Lookers will be provided with a switch to adapt their sets accordingly, full announcements being made in advance as to which system is in operation.

The Chief Engineer reminded me of another interesting point. The sound transmissions will also, of course, be on an ultra-short wave, and the quality will probably be better than anything dreamed of on the long

## Scheme to Test "Listener Reaction"

THE B.B.C. has been displaying rare interest in programme ballots which have just been conducted by two newspapers in the North of England, although the results were very inconclusive.

The Corporation would have its work cut out if it decided to launch a scheme, which I believe has recently been under

like—it is not practical politics. And yet—the doorstep method may be resorted to.

## Kick Circumspectly

But here is a hint: if you have a gentle caller within the next few months asking whether you prefer the Children's Hour to the Monthly Revues, don't kick him down the steps, because he may not come from the B.B.C. He may be a student from a school of economics.

# Recent Inventions

The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London. W.C.2, price 1/- each

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

## AERIALS

IN order to secure a favourable distribution of the radiated energy, and particularly to reduce the so-called space-wave, it is becoming standard practice in broadcasting to use a single metal pylon, insulated from the earth, as a transmitting-aerial, and to provide it with a capacity "top."

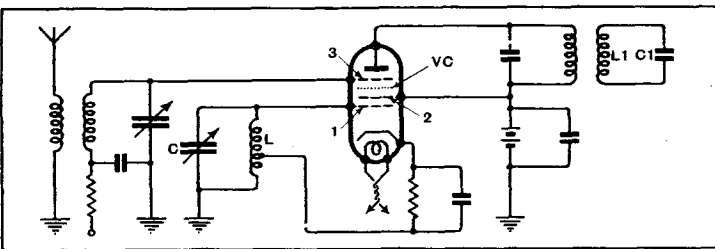
According to the invention the "top" capacity takes the form of one or more metal surfaces which can be expanded or contracted, or otherwise varied, to produce the desired distribution of current along the length of the aerial. The capacity surfaces are latticed or made of openwork in order to reduce their resistance to wind-pressure.

*Cie Generale de T.S.F. Convention date (France) 9th June, 1934. No. 437099.*

## SUPERHET RECEIVERS

THE cloud of electrons produced between two of the grids in a multi-grid valve, by applying suitable biasing-potentials, is made to serve as a "virtual" cathode. When used as a mixer valve in a superhet circuit, local-oscillations are applied to one of the grids so as to vary the density of the virtual cathode, thus modulating the received signals by what is known as electron coupling. There is no interaction between the external signal and local-oscillation circuits.

As shown in the figure, the cathode and the two nearest grids 1, 2 are used to generate sustained oscillations in the circuit L, C. The incoming signals are applied to the grid 3, which is separated from the grid 2 by a layer of electrons forming the so-called virtual cathode VC. The grid 3 is wound so as to have a variable-mu characteristic. The resulting beat or intermediate frequency appears in the circuit L<sub>1</sub>, C<sub>1</sub>. A separate



Superheterodyne circuit.

back-coupling coil may be inserted in series with the cathode, or combined inductive and capacity feedback may be used.

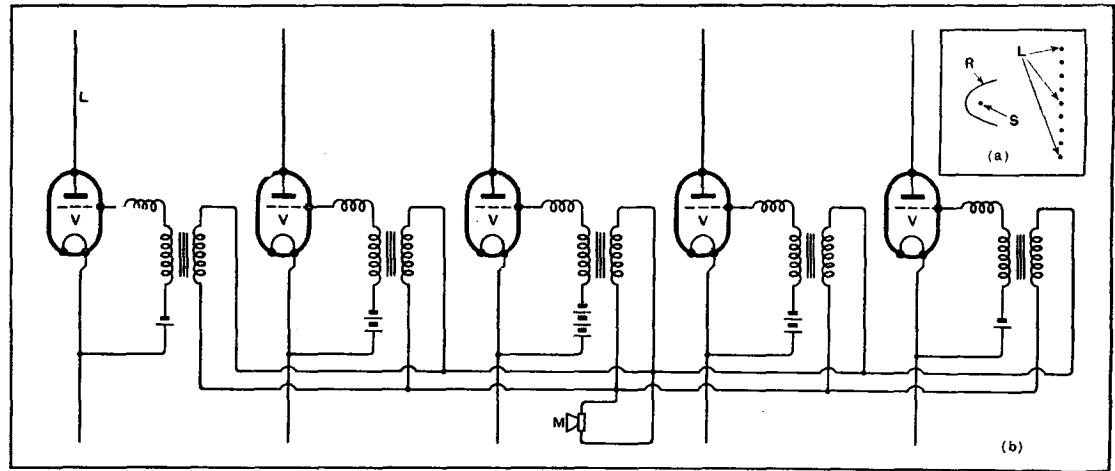
*Hazeltine Corporation (assignees of H. A. Wheeler. Convention date (U.S.A.) 30th January, 1933. No. 436940.*

## SHORT-WAVE SIGNALLING

AN ultra-short carrier wave is modulated by interposing in its path a line of conductors whose effective conductivity is varied by

the applied signal, so that more or less of the incident wave is absorbed. The broad idea is illustrated in Fig. (a), where a dipole aerial, or other source of ultra-short radiation, located at the focus of a reflector R sends out a beam of waves towards a line of conductors L--L.

Fig. (b) shows the individual conductors L in detail. Each of the dipoles is in series with a valve V, the internal impedance of which is varied by a microphone M. The microphone is connected in parallel across the input circuit of each



Systems of modulation for short waves.

valve, so that the varying absorption of the incoming wave by the line of dipoles L---L serves to modulate it. Alternatively the incident wave may be given any desired degree of convergence or divergence.

*Marconi's Wireless Telegraph Co., Ltd., and A. A. Linsell. Application date 28th April, 1934. No. 437040.*

the drying-current, but when tuned by capacity bridges act as blocking-circuits to isolate the HF supply.

*E. J. Steyba (Assignor to Bell Telephone Laboratories). No. 2008266. (U.S.A.)*

## POWER-SUPPLY UNITS

SMALL receivers, particularly universal AC-DC sets, are usually limited to a low anode voltage, owing to the fact that no power transformer is used. According to the invention, the supply is divided more advantageously between the anodes of the valves and the field-windings of a moving-coil speaker, by using a double-anode type of rectifier valve. One anode is devoted to the HT supply to the valves, and the other takes care of the current required for the loud speaker.

*F. H. Engel (assignor to Radio Corporation of America). No. 2002343. (U.S.A.)*

## TUNING UNITS

IN certain circumstances changes of temperature will seriously affect the constancy of the tuning-elements used in short-wave working, particularly in the case of ultra short-wave transmitters or receivers used on aircraft, where temperature variation may be rapid, or in high-precision wave-meters.

In order to overcome this drawback, the condenser takes the form of two interfitting "pots" of ceramic material thinly coated with metal, whilst the inductance consists of helical deposits of metal laid on an earthenware former. The control spindle for the condenser is made of "Invar," and the two tuning-elements are mounted on supports of the same metal.

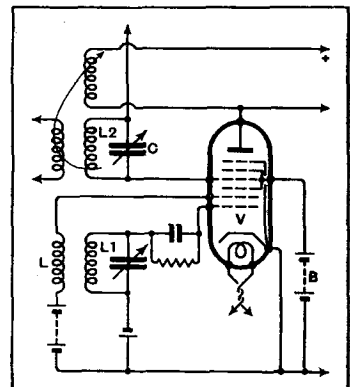
*Telefunken Co. Convention date 21st April, 1933. No. 437201.*

## SUPER-REGENERATIVE RECEIVERS

THE first two grids of an octode valve V are back-coupled at L, L<sub>1</sub> to generate a "quenching"

frequency, which makes itself felt as a fluctuation in the virtual cathode or mass of electrons crowding through the third grid. The third and fifth grids are bonded together and connected to a common HT source B. Incoming signals are fed to the fourth grid, which is earthed through a tuned circuit L<sub>2</sub>, C, and back-coupled as shown to the output or anode coil. The sixth, or suppressor, grid is connected to the cathode. The circuit is designed for the reception of sound or television signals.

*D. W. Pugh and Baird Television, Ltd. Application dates 9th May and 31st August, 1934. No. 437460.*



Super-regenerative circuit.

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

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## Editorial Comment

### Programme Distribution

#### *The Question of Alternatives*

**I**N an article contributed last week a writer drew attention to the present position in regard to the distribution of programmes and deplored the fact that there does not appear to be an organised plan to provide alternatives for the listener in the distribution of B.B.C. programmes.

Our contributor mentioned that in the early days the B.B.C. looked upon every listener in terms of a crystal set or, at the best, a small valve set, but now that every station in the British scheme can be received on present-day sets, there is a great opportunity for the B.B.C. to provide listeners with a much wider choice, if only they will plan their programmes keeping in view that their stations are all within reach of the majority of receivers.

Our contributor went on to recommend that the power of all our transmitters should now be increased to bring them more into line with the Continental transmitters and to increase their efficiency as alternatives.

We should ourselves consider that the B.B.C. would be serving the public admirably in the matter of programme material if they gave every station a new programme every day, and circulated amongst their seven transmitters these programmes on successive days. But in order to make this successful it would be essential that there should be much more contrast between one programme and another than there is at present. Hardly anyone would complain of the average fare which the B.B.C. provides, but when, day after day, stations are transmitting programmes of similar character, then complaints are bound to arise.

## Educational Broadcasts

Some time ago a rumour was current that educational broadcasting was likely to be transferred to an exclusive wavelength, and in our issue of September 27th we said that we should be the first to welcome such a proposal. We have repeatedly expressed the view that what may be termed "educational broadcasting," as distinct from entertainment, ought not to be sandwiched in amongst a programme of a popular character. If a separate station were allotted to talks and educational matter, then the B.B.C. could disregard any urge to be "popular" on that station. This idea could possibly be extended, if the power of the transmitters were increased, so that stations came to be associated with programme matter of a particular type.

In America certain stations have adopted the idea of transmitting programmes of distinctive character so that listeners know what to expect when they tune to those stations. The scheme seems to work out very well and, with an increase in the power of our transmitters here, some similar plan might be found an effective way of meeting the criticisms at present being levelled against the B.B.C. that their programmes are "scrappy" and that there is never any certainty that a second station will provide an alternative programme to the local.



# Selectivity of Tuned Circuits

## THE PREDOMINATING INFLUENCE OF HF RESISTANCE

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

*THEORY and practice must agree; if they appear to be in conflict, one or other must be wrong. For instance, theory would at first sight seem to tell us that the selectivity of a receiver should deteriorate progressively as wavelength is increased. But every observant user of a receiver knows that the opposite appears to happen: a clear and detailed explanation of this apparent disagreement is given.*

CONSIDERING that valves figure so prominently in modern radio circuits, the oft-repeated statement that receivers are designed and built round the valves contains a large measure of truth, although the valves themselves were really primarily designed to fulfil definite functions in the circuits. Nevertheless, the nucleus of every receiver is the resonant circuit, or combination of tuned circuits formed by the judicious use of inductance, capacity, and resistance.

The keen amateur soon grasps the fundamental principle of the ordinary tuned circuit, consisting of a closed loop formed by connecting a condenser across an inductance coil in the manner indicated by Fig. 1 (a). He learns that such a circuit gives greatest response to alternating current or voltage at one particular frequency, given by the well-known formula  $f = \frac{1}{2\pi\sqrt{LC}}$  cycles per second (c/s), where L is the coil inductance in henrys and C the capacity of the condenser in farads, and that this effect gives the circuit its selective property. He also knows that the amount of equivalent series resistance present is the main factor determining the degree of selectivity obtained from any tuned circuit.

In spite of this common knowledge, there occasionally arise doubts and difficulties, especially when theory and practice are compared, and many are somewhat puzzled by the apparent disagreement between theory and practice in some circumstances. In reality, theory and practice agree entirely, but very frequently, in developing a theory, some variable factors which are present in practice are assumed to remain constant, and this usually accounts for apparent discrepancies. But when all factors are taken into consideration, theory and practice are never found to be at variance.

It is intended here to consider a particular case of apparent inconsistency between theory and practice in connection with a normal tuned circuit, one which has often been responsible for doubts of the kind referred to. It refers to the variation of selectivity over the tuning range.

We know, from the formula already cited, that for a definite resonant frequency the product LC must have a certain fixed value, and, as will be seen, theory tells us that the greater we make the ratio L/C the more selective will be the circuit. But in practice we invariably find, where tuning is effected by a variable condenser, that the highest selectivity occurs at the longer wavelength end of the scale, where the ratio L/C is least! Here, then, is what appears to be definite disagreement. But in reality there is no inconsistency. The explanation is that the selectivity of the tuned circuit depends not only on the relative values of inductance and capacity, but also on the effective high-frequency resistance of the tuning coil. The effective resistance is itself a variable factor, increasing as the frequency is raised, that is, as the wavelength is reduced. In practice, the variation of resistance over the tuning range usually has a greater effect on the selectivity than the change in the ratio of inductance to capacity, and in the reverse direction.

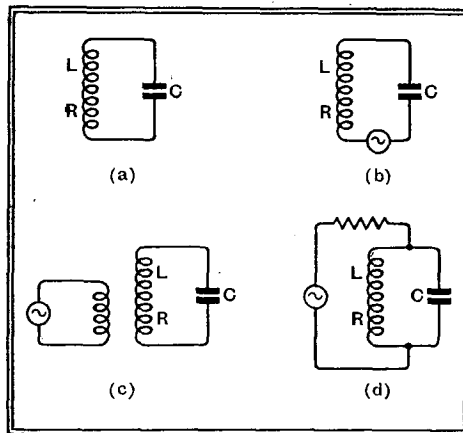


Fig. 1.—A simple tuned circuit (dia. a) and three methods of exciting oscillations in it.

When it is desired to estimate the selectivity of a tuned circuit at any one frequency, it is necessary to know the manner in which it depends on the inductance, capacity, and resistance, and also to know the values of these three "constants" at the particular frequency.

Accordingly, it will be helpful to review briefly the general behaviour of a single tuned circuit like that of Fig. 1 (a). The treatment depends on whether the impressed signal voltage is injected in series with the coil and condenser as at (b) and (c) or applied across the circuit as illustrated in Fig. 1 (d), which represents parallel tuning as used in tuned anode intervalve coupling. Although the theoretical considerations for the two cases of series and parallel tuning are somewhat different, the ultimate results are the same, and so, for clearness, only the series type will be considered.

### Total Impedance

Considering Fig. 1 (b), the applied alternating voltage E drives a current I amperes (RMS values) round the loop. The circuit itself opposes or impedes the flow of current, and this opposition is known as *impedance*. Now the circuit under consideration comprises the three quantities resistance (R ohms), inductance (L henrys), and capacity (C farads), and the total opposition or impedance is due to all three. That part of the impedance due to the coil inductance is referred to as inductive *reactance* and is given in ohms by the expression  $2\pi fL$ , where f is the frequency. Similarly, the condenser possesses a reactance of  $\frac{1}{2\pi fC}$  ohms (capacitive reactance). It is well known that the alternating voltage required to drive a current through an inductive reactance is a quarter of a cycle in advance of the current, whereas for a condenser the applied voltage lags by a quarter of a cycle behind the resulting current. Consequently, in the closed loop, where the same current flows throughout, the component voltages absorbed in overcoming the inductive and capacitive reactances are in phase opposition—when one is positive the other is negative at all times. Thus the voltage absorbed by the two reactances in series is the *difference* of the individual voltages. From this it follows that the inductive and capacitive reactances tend to neutralise each other's effects, and the resultant reactance of the circuit is given by  $2\pi fL - \frac{1}{2\pi fC}$  ohms.

It requires no effort to see from the last expression that inductive reactance increases as the frequency is raised, whereas the capacitive reactance decreases. Thus there must be one particular frequency at which the two reactances become equal and neutralise each other completely, as far as their influence on the current in the loop is concerned. When this happens

**Selectivity of Tuned Circuits—**

the circuit is tuned to resonance with the applied frequency, and the formula for the resonant frequency is derived by equating the inductive and capacitive reactances, namely,  $2\pi fL = \frac{I}{2\pi fC}$ , from which  $f =$

$$\frac{I}{2\pi\sqrt{LC}} \text{ cycles per second.}$$

We see that, at the resonant frequency, the resultant reactance of the circuit is zero, so that only the resistance remains to oppose the flow of current, and we may apply Ohm's law,  $I = E/R$  amperes. At any frequency different from the resonant value the inductive and capacitive reactances become unequal and their resultant is no longer zero, so that the current now experiences an additional opposition, which increases as the frequency departs from the resonant value in either direction, the current being reduced in consequence. Obviously, then, the current is greatest at the resonant frequency, its value being  $E/R$  amperes. The formula for the current at any frequency is  $I = \frac{E}{\sqrt{R^2 + \left(2\pi fL - \frac{I}{2\pi fC}\right)^2}}$

amperes.

If we plot a curve of current against frequency we obtain the familiar resonance curve depicted in Fig. 2, the maximum height being  $E/R$  amperes. Now,

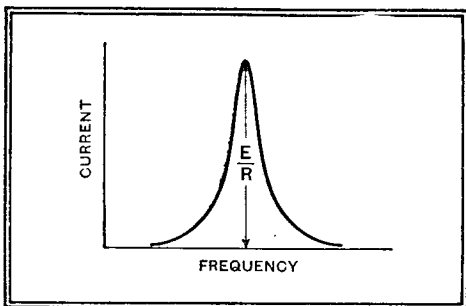


Fig. 2.—Typical resonance curve of a tuned circuit.

in receiving circuits we are not so much concerned with the *current* in the tuned circuit as with the resulting *voltage* built up across it. The voltage across the condenser is  $I \times \frac{I}{2\pi fC}$ , and since, at resonance,

$$\frac{I}{2\pi fC} = 2\pi fL \text{ it follows that the voltage}$$

developed across the tuned circuit is  $I \times 2\pi fL$  volts. From Ohm's law, the applied voltage is  $I \times R$  and so the ratio of the developed voltage to the applied voltage is  $\frac{2\pi fL}{R}$ . This is a very important number and is known as the *voltage magnification* of the tuned circuit. At resonance  $2\pi f =$

$$\frac{I}{\sqrt{LC}}, \text{ and so we may rewrite the previous expression for voltage magnification in}$$

$$\text{the form } m = \frac{I}{R\sqrt{LC}}.$$

It now remains to show that the selectivity of the tuned circuit is directly proportional to the voltage magnification.

This can be done mathematically, but to avoid complication it will be better in the present instance to use a graphical illustration. Let us, in the first place, consider a circuit with fixed inductance and capacity and suppose that we plot a number of resonance curves each for a different value of resistance. The peaks of the curves, which all occur at the same frequency, have various heights *inversely proportional to the respective resistance values*, the effect being clearly shown in Fig. 3, where representative values of resistance are indicated on the curves. It is important to note that all the resonance curves are of approximately the same width near the base, so that by decreasing

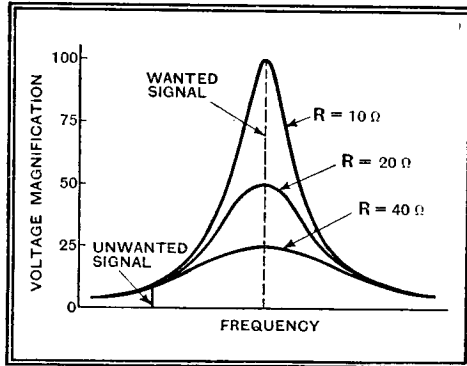


Fig. 3.—Voltage resonance curves showing effect of varying the effective resistance.

the resistance we increase the strength of the wanted signal at the resonant frequency without appreciably strengthening any signals whose frequencies differ moderately from the resonant value. Thus the degree of selectivity is approximately proportional to the height of the resonance curve, and so *inversely proportional* to the resistance, like the magnification factor.

In a similar manner the effect on the selectivity of varying the ratio  $L/C$  can be determined. Let us take two cases by way of illustration. In the first suppose that the coil has an inductance of  $200 \mu H$  and the condenser a capacity of  $200 \mu F$ , the combination tuning to about  $796 \text{ kc/s}$ . In the second let the inductance be  $100 \mu H$  and the capacity  $400 \mu F$ , this also tuning to  $796 \text{ kc/s}$ , since the product  $LC$  is the same in each case. The respective values of  $\sqrt{L/C}$  are then  $1,000$  and  $500$ . Suppose, further, that the effective HF resistance of each tuned circuit is  $10$  ohms.

**Magnification "On Tune" and "Off Tune"**

With the first combination the voltage magnification at the resonant frequency works out to  $100$ , and with the second to  $50$ , each proportional to the respective values of  $\sqrt{L/C}$ . Now, at a frequency of  $766 \text{ kc/s}$ , which is  $30 \text{ kc/s}$  below resonance, the voltages developed across the condensers are  $10$  times and  $9.9$  times the EMF injected into the circuits for the two respective cases. (These figures are found by multiplying the calculated current by the condenser reactance and dividing by the input voltage.) Thus an unwanted signal at  $766 \text{ kc/s}$  appears with

almost equal intensity in the two cases, but the *wanted* signal at the resonant frequency is twice as strong in the first case, where  $\sqrt{L/C} = 500$ . From this it will be seen quite clearly that the degree of selectivity is proportional to  $\sqrt{L/C}$ . The actual voltage resonance curves are given for the two circuits considered in Fig. 4.

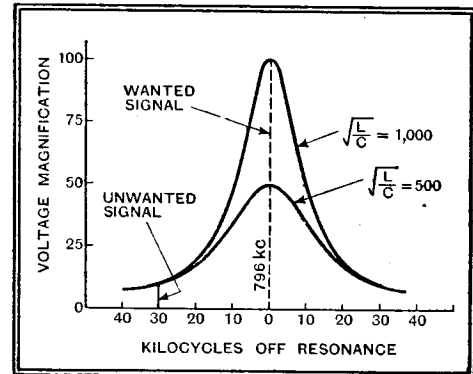


Fig. 4.—Resonance curves showing how selectivity depends on the value of  $\sqrt{L/C}$ .

We see, then, that the selectivity of a single tuned circuit is proportional to  $1/R$  and to  $\sqrt{L/C}$ , that is, to the voltage magnification  $1/R\sqrt{L/C}$ .

In the normal way, tuning to different wavelengths is effected by varying the capacity of the tuning condenser, the inductance remaining constant. This involves changing the ratio  $L/C$ , its value being greatest at the lowest wavelength of the scale, that is, at the highest frequency, and vice versa. As the inductance coil is in no way interfered with the beginner is apt to assume that the resistance remains constant, and that the variation of selectivity is entirely due to the changing values of  $\sqrt{L/C}$ , the fact that the effective resistance also changes being easily overlooked.

**Under Working Conditions**

In order to show clearly exactly how selectivity varies over the tuning range an actual circuit tried out in practice is taken as an example. The coil was

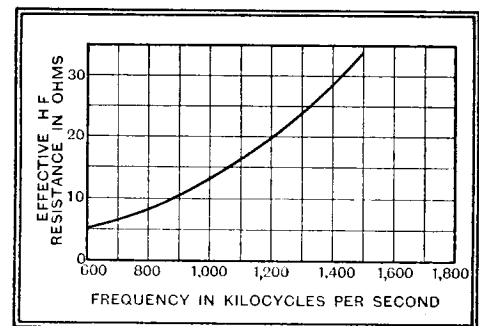


Fig. 5.—Measured HF resistance of a tuned circuit at various frequencies.

wound with Litz wire and the measured inductance was  $211 \mu H$ . The tuning condenser had a maximum capacity of  $0.0003 \mu F$ , and connected across the tuned circuit was a valve holder and valve, the latter being included to give normal operating

**Selectivity of Tuned Circuits—**

conditions. The effective high-frequency resistance was then measured at various frequencies between 1,500 and 600 kc/s (200 to 500 metres wavelength), the results being given in Fig. 5. It will be noted that the HF resistance at 1,500 kc/s is more than six times as great as at 600 kc/s, in spite of the fact that the coil was wound with Litz wire, of which the conductor resistance does not vary to any great extent with frequency. The increase of resistance is mainly due to increased dielectric losses in the coil former and valve holder.

From the formula  $f = \frac{1}{2\pi\sqrt{LC}}$  we can calculate the value of C at any frequency, the inductance being known and constant, and from the curve of Fig. 5 we can read off the value of the HF resistance at the corresponding frequency. We are thus able to calculate the magnification factor  $m = I/R\sqrt{L/C}$  at various frequencies. Calculations have been made in this manner over the range between 600 and 1,500 kc/s and the voltage magnification is given by the full line curve A of Fig. 6. This curve gives a direct indication of the selectivity over the tuning range and it will be seen that the highest selectivity occurs at the longest wavelength (or lowest frequency) end of the scale for the actual tuned circuit under consideration, even though the ratio L/C is least at this end.

If the effective resistance R had been assumed to remain constant at, say, 10 ohms at all frequencies the conditions would have been reversed, the highest selectivity occurring at the other end of the scale, as indicated by the dotted line curve B of Fig. 6. The fact that the variation of resistance with frequency reverses the slope of the selectivity curve shows that the changing value of  $\sqrt{L/C}$  plays a much less important part than the resistance in altering the selectivity over the tuning range for the particular circuit chosen. At longer wavelengths the HF

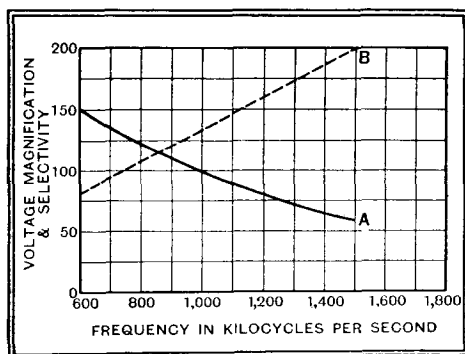
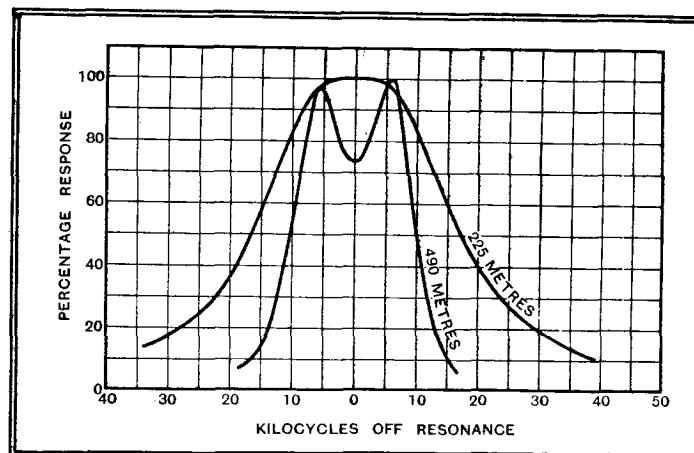


Fig. 6.—Curve A shows the variation of selectivity with all factors taken into account. Curve B represents the imaginary selectivity which would be obtained if the HF resistance remained constant at 10 ohms.

resistance does not vary to the same extent, and it is possible to obtain a tuned circuit in which the selectivity remains nearly constant over the whole tuning range.

The same rules apply in a large measure to band-pass tuning with coupled circuits, but here the resistance also determines the depth of the dip between the two peaks of the double-hump resonance curve, and it also determines to a small extent the peak separation in kilocycles. Two resonance curves for an actual band-pass tuner are given in Fig. 7 and show clearly how the selectivity is reduced at the lower wavelength end of the scale and also how the central dip is influenced. These resonance curves were obtained from actual measurement, not by calculation as for the single tuned circuit pre-

Fig. 7.—Two response curves of a band-pass tuner. These were obtained by actual measurement at the wavelengths indicated, and show clearly the reduced selectivity at the lower wavelength.



viously considered. It is worth noting that at the longest wavelength end of the scale, where the selectivity is greatest, the dip in the curve is most pronounced, and this indicates that the lowest audio-frequencies will be somewhat suppressed in comparison with the highest notes.

In superheterodyne receivers band-pass tuning is normally employed in the intermediate-frequency circuits, where there is no variation of frequency. Consequently in this type of receiver the band-pass units can be adjusted to give the desired degree of selectivity, this setting being left undisturbed. In a modern *Wireless World* receiver the intermediate frequency circuits are designed so that the selectivity can be varied at will to suit the transmission being received. The various settings are obtained by altering the degree of coupling between the pairs of coils forming the band-pass units, not by changing the resistance.

## At the Transmitting End

### Technical Criticisms of Recent Programmes

IT is well, perhaps, that we do not have to judge the ability of foreign orchestras by the relays of them which the B.B.C. please to give us, for in no way are they flattering to the performers.

A case in point is the concert by the Leipzig Symphony Orchestra, which was broadcast in the National programme on January 17th. Quality was distinctly poor, but, so far as could be judged, the players are a very understanding and skilful body, and—above all during the rendering of the Handel Concerto—I wished that it had been

my privilege to hear them in better circumstances.

Some light may be thrown on this attitude towards "Fidelity" by a few remarks printed in the *Radio Times* concerning the "Young Ideas" programme which immediately preceded the relay and in which the writer states: "... it is difficult to write down a list of figures announced over the air, and to get them accurately, they are printed here ..." (the italics are mine).

This, surely, is a very peculiar statement; and one possible construction to be placed on it is that the "standard" of fidelity—if there is such a thing—of the average set is held to be much lower than one would reasonably suppose.

In which case, of course, there is no need at all to worry about the frequency correction of land-lines, and such-like, because however perfect these things are made, listeners will still have the greatest difficulty in distinguishing between Handel's "Water Music" and the Weather Forecast.

H. C. H.

## The Radio Industry

A THREE-VALVE "straight" Philco battery set has just been introduced at the price of £6 19s. 6d. The receiver has an interesting specification, including three-circuit tuning and an 8-inch permanent magnet speaker with aluminium-alloy magnet.

Drydex "Textet" batteries are now enclosed in cartons of the type formerly used only for the Red Triangle series. Drydex batteries of special sizes now bear a label indicating the type of receiver for which they are designed.

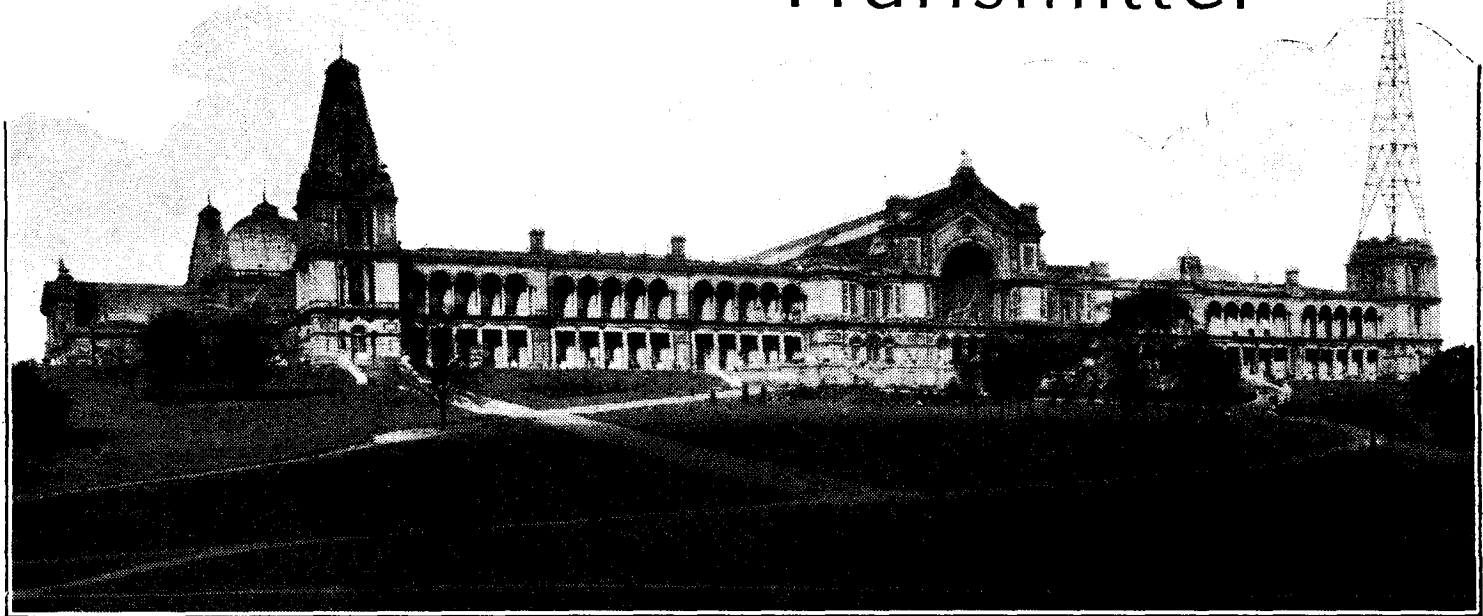
Eddystone short-wave apparatus has been ordered for the forthcoming Mount Everest Expedition to be led by Mr. Hugh Rutledge. Contact will be maintained between the base camp and the outside world by means of two short-wave CW transmitters, while six Eddystone 5-metre Transceivers will provide means of intercommunication between advance parties.

Holiday and Hemmerdinger, of Holmer Works, Dolefield, Bridge Street, Manchester, 3, are now supplying a new series of rectifying units which permit the operation of D.C. sets from A.C. mains supplies. The units, which employ valve rectification, are made for any load and the output is thoroughly smoothed.

A well-prepared and informative booklet just issued by the Copper Development Association, Thames House, Millbank, London, S.W.1, is entitled "Brass Wire Products" and in its pages the main industrial uses of this material and of kindred copper alloys are described.

# The London Television Transmitter

*An artist's impression of the aerial system as it will appear at Alexandra Palace.*



## FIRST DESCRIPTION OF THE MARCONI-E.M.I. INSTALLATION

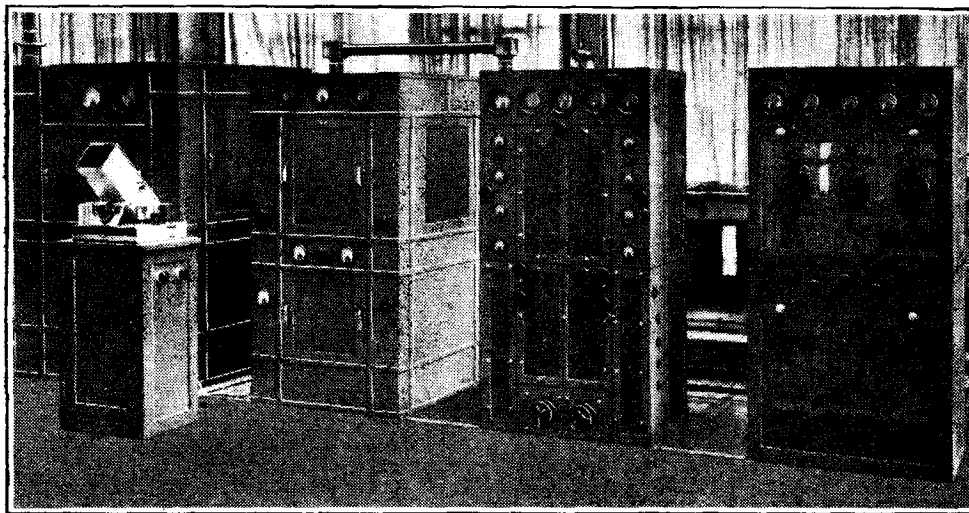
*EQUIPMENT at Alexandra Palace for television broadcasting is now rapidly nearing completion, and in this article appears the first description of the apparatus installed by the Marconi-E.M.I. Television Co. The system employed is entirely electrical and mechanical methods find no place in the installation.*

**T**HE time is fast approaching when television transmissions will start as a regular broadcasting service instead of being merely of an experimental nature. It will be remembered that a full description of the nature of the modulated waveform to be employed appeared in *The Wireless World* for October 4th, 1935, but until the present no information about the actual apparatus has been released. Details of the Marconi-E.M.I. equipment installed at the Alexandra Palace have now been given us.

Four "Emitron" instantaneous scanning cameras, and two specially arranged with film projectors for use with cinematograph film, are provided. They are fitted with 6.5in. F/3 lenses, and enable the scenes which it is desired to transmit to be converted into the appropriate electrical impulses without the necessity for using an intermediate film.

Their sensitivity is sufficient to permit their being used outdoors under normal daylight conditions.

Specially designed multi-way cables are used for the connections between the cameras and the control equipment. This last consists of several sections, of which the more important are the voltage supply units, the scanning circuits, and the amplifiers. A single unit generates the voltages necessary for focusing the cathode-ray tubes employed in the cameras. The voltages from this unit, however, are fed to the cameras through



Part of the ultra-short wave transmitter which will be used for the transmissions from Alexandra Palace.

six sub-units containing the controls necessary for the exact adjustments of the voltages for each tube. A similar

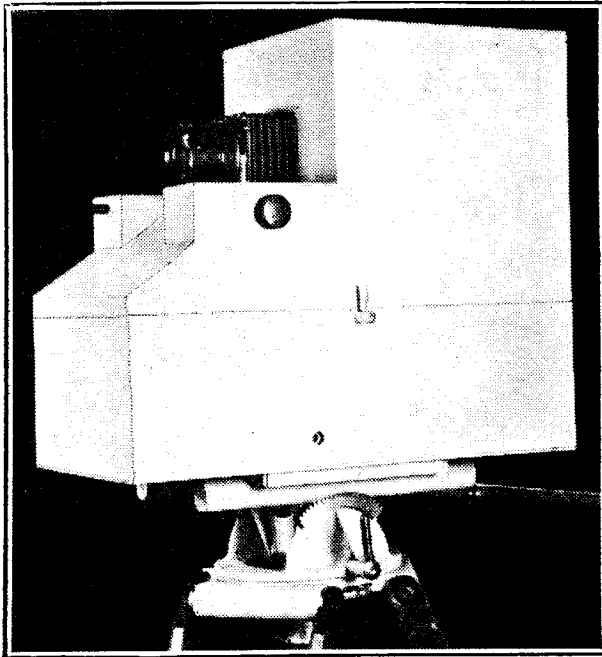
arrangement is employed in the case of the scanning circuits. One unit generates the saw-tooth potentials, and six other units distribute them to the cameras.

Each camera is provided with an amplifier for its picture signal, and the outputs are taken to a mixing and fading unit fitted with controls to enable a change to be made from one camera to another, or the outputs of two or more to be superimposed. The signal then passes through

further amplifiers and units which enable both picture detail and picture contrast to be controlled. To the output of this equipment a cathode-ray tube is connected so that the picture can be seen for monitoring purposes.

The next step is to inject the synchronising impulses into the signal, and when this has been done further amplification follows. No less than six output channels are provided, and of these four are fitted for connection to monitors and two (one being a spare) for feeding the signal to the

provided, and of these four are fitted for connection to monitors and two (one being a spare) for feeding the signal to the



The Marconi-E.M.I. scanning camera.

modulator of the transmitter.

Before turning to the transmitting equipment proper, the remaining apparatus in this section deserves a brief description. It consists of master oscillators for maintaining the line and picture synchronising impulses at their correct frequencies. Actually, a single mains controlled oscillator is used, and other units divide its frequency by suitable factors for the line and picture pulses so that these always have exactly the same relationship to one another. The outputs of these generators are taken to a number of other units for distribution to the proper points in the system.

In the transmitter itself a master oscillator is used and followed by a frequency-doubler, five stages of amplification at the carrier frequency, and then a single modulator stage. In most stages of the amplifier two valves are employed and connected

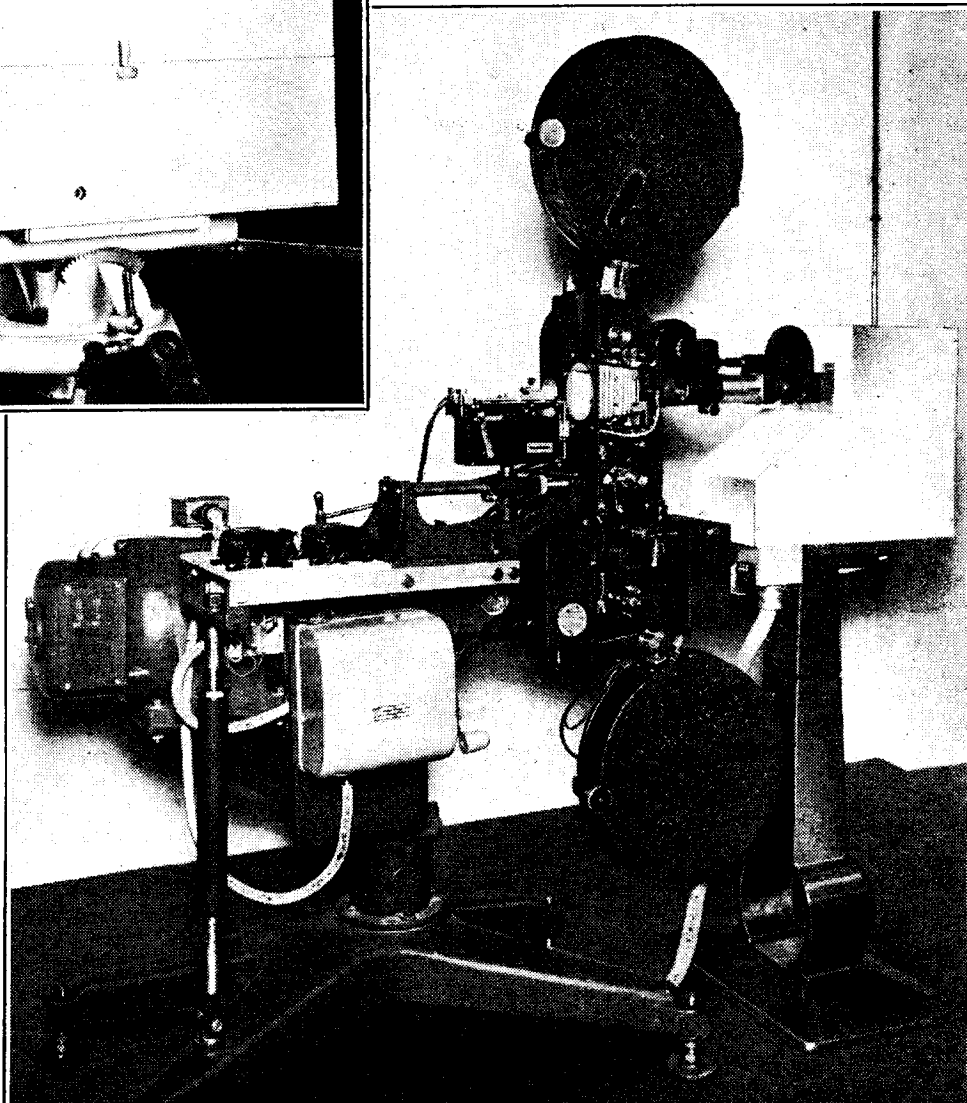
in a balanced bridge circuit. The later stages are mounted in separate units connected together by means of concentric tube feeders.

The arrangements for cooling the valves are particularly interesting in view of

led out at the electrical centre of the circuit by rubber tubing arranged in spiral form.

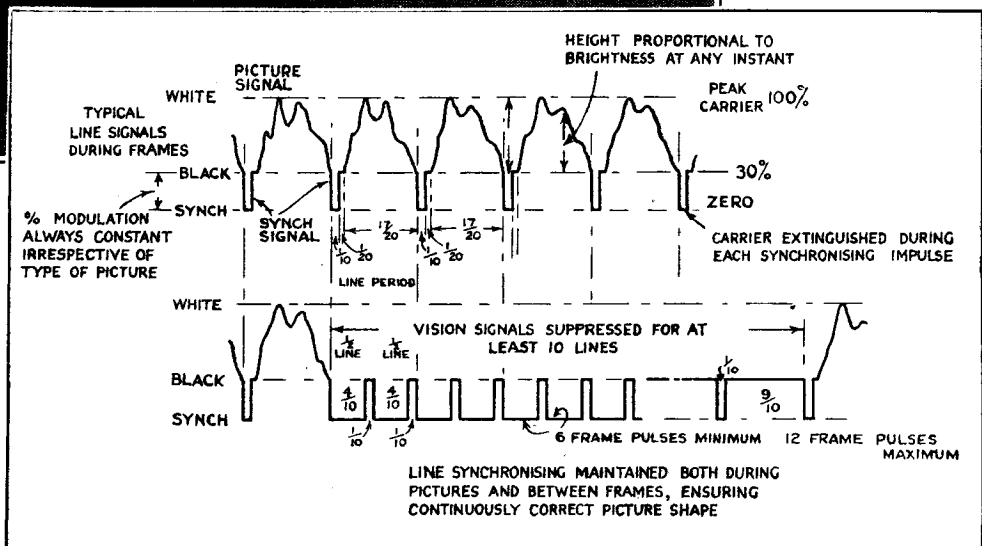
Modulation occurs in the last stage, the picture signal being previously amplified by a six-stage amplifier having a flat characteristic over the enormous range of zero to 3 mc/s. The modulated high-frequency output is coupled to a concentric tube feeder having an impedance of 75 ohms which carries the currents to the aerial system erected on one of the towers of Alexandra Palace. This aerial system is designed to give maximum radiation in an horizontal plane and consists of a number of aerial units suspended around the periphery of an octagon.

From this brief survey of the apparatus employed for the vision-transmissions, some idea of the complexity of the system can be gauged. There is, of course, a host of essential equipment which cannot be touched upon here—the voltage and current supplies, the control panels, and the studios—but which are all very necessary links in the chain. It should be remem-



(Above) The scanning camera with a film projector.

(Right) The waveform of the modulation of the signal is shown here. Modulation depths between 30 per cent. and 100 per cent. convey the picture, while the synchronising signals are transmitted with a lower depth in the intervals of the picture signals.



the precautions taken to avoid losses due to the water used for cooling. The water actually circulates through the tubing which forms the tuning inductance and is

bered also that this equipment is to be employed for the vision signals only. Entirely separate transmitting apparatus is needed for the sound accompaniment.



# SECOND-HAND BARGAINS

## Points for the Wary Buyer

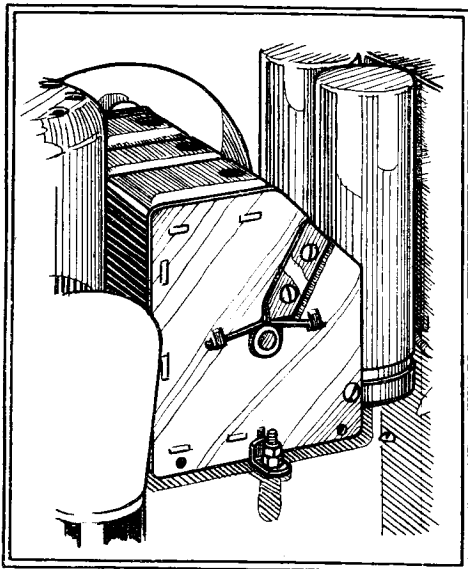
By W. MACLANACHAN

*THE would-be buyer of a second-hand set seldom has facilities for carrying out searching and conclusive tests of the conditions of his prospective purchase. But, by taking reasonable precautions and paying attention to the points described in this article, the risks of getting a bad bargain are greatly reduced.*

**I**N choosing a second-hand wireless set the dangers of making a bad bargain are not so great as with, say, a motor car or certain other commodities, but there are a few points which call for watchfulness.

The majority of second-hand sets that have drifted on to the market through the wireless trade following in the footsteps of the motor trade, and adopting the "part-exchange" principle, are out-of-date three-valve sets of the "straight" HF-det.-LF type. But many of them are superhets which were designed before AVC was regarded as essential. Although the straight set has been ousted by its more selective brother the present popular "short" superhet, its days of usefulness in providing enjoyable listening from the local and one or two Continental stations are not over, and if a discreet selection is made there is no reason why, with suitable precautions, a second-hand bargain should not continue to dispense entertainment.

With both types of set there are one or two elementary precautions one should take to ensure that the bargain really merits the name, and that it is in good working order, or at any rate, that any defects that may exist are easily remediable. The first step is to switch on the set. If it is worth anything it should receive the local station without reaction and the quality and power should be adequate for all ordinary purposes. While listening, careful notice should be taken of crackling, buzzing, or "frying" sounds. If these are present, a later test as to whether or not they are being picked up by the aerial or earth leads should be carried out. By disconnecting both the aerial and earth an almost infallible verdict can be given on this point.



Instability, whether incipient or actual, is often caused by poor contacts between the chassis and the condenser lugs.

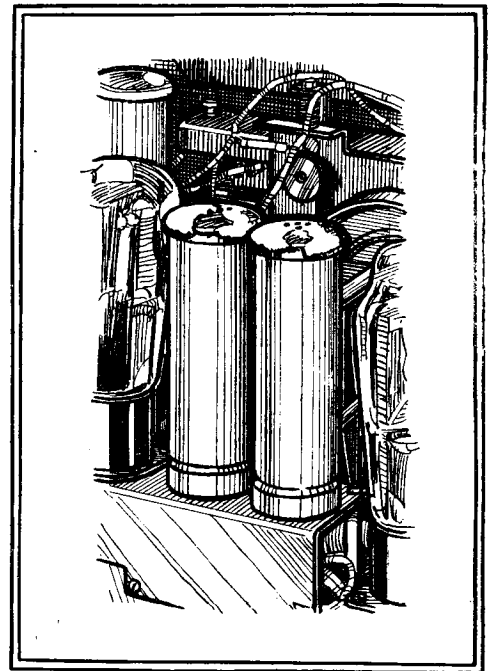
The efficiency and condition of the detector and LF stages can be estimated by the power delivered by the speaker before audible distortion begins. Any signs of "dither" in the speaker at low volume should immediately cause the latter to be suspected, but if a fair volume is obtained before the speaker "rattles," the most probable cause will be loss of emission in either the detector or LF valves. It is often possible to tell which is causing the defect by listening for a particular note and observing whether or not the noise is purely mechanical. With a second-hand set it is not likely that the valves will have their full emissions, and due allowance must be made for this.

On the HF side, apart from the definite evidence of efficiency produced by the reception of a medium-wave Continental station, possibly with the help of reaction, particular attention should be paid to signs of incipient instability. These may only show up when the set is adjusted for extreme selectivity and sensitivity (combined with a certain amount of modulation hum in mains sets). As a rule this is a minor defect which is easily remedied by tightening all the earthing contacts of the ganged condensers and tuning coils. The cadmium plating with which the majority of chassis were coated often causes a slight slackening of the tension on holding-down nuts and screws.

When trying for a Continental station, the switch contacts may be tested by giving the switch knob a tap with the finger and noticing whether or not the switch is "making" at all the contacts. If the switch has to be turned to one or other side to make contact properly, either the cams are badly worn or the springs are weak, and, unless the contacts are readily

accessible for readjustment, or the set is required for medium-wave reception only, such a set should be avoided. To ensure proper reception of the one waveband, the leads from the long-waveband coils to the switch may be permanently short-circuited.

Next in importance is the volume control. After considerable use one may expect that the control will be slightly un-



Formation of a crust round the vent-holes of electrolytic condensers suggests that renewal will probably be desirable.

even, but as replacements of almost all the volume controls used in commercial sets are obtainable, this should not be an insuperable objection, so far as readers of *The Wireless World* are concerned.

### Evidence of Shortcomings

Having checked the performance of the set, the final examination should be of the chassis itself. The condition of the leads to the speaker will soon reveal by fraying of the ends whether or not the set has required servicing frequently. An accumulation of dust, on the other hand, shows the converse. Signs of scorching round the speaker field or mains transformer will show whether these have been overheated, and, although they may be working at the time, any evidence of scorching outside is a warning against the likelihood of an early breakdown of the insulation within.

In many of the mains sets of two and three years ago the smoothing condensers were 4-mfd. and 8-mfd. electrolytic

**Second-hand Bargains—** models. With both the wet and dry types, after several years' use, and possibly abuse, it is probably advisable to fit replacements. With the wet type, any suspicion of a white "crust" round the vents certainly demands a replacement.

The above remarks apply equally well to superhets, but for these there are several further tests. The first is for selectivity. Any wandering of alignment of the intermediate frequency transformers will ruin selectivity, causing the local station to spread over several channels, and perhaps bringing in other stations simultaneously.

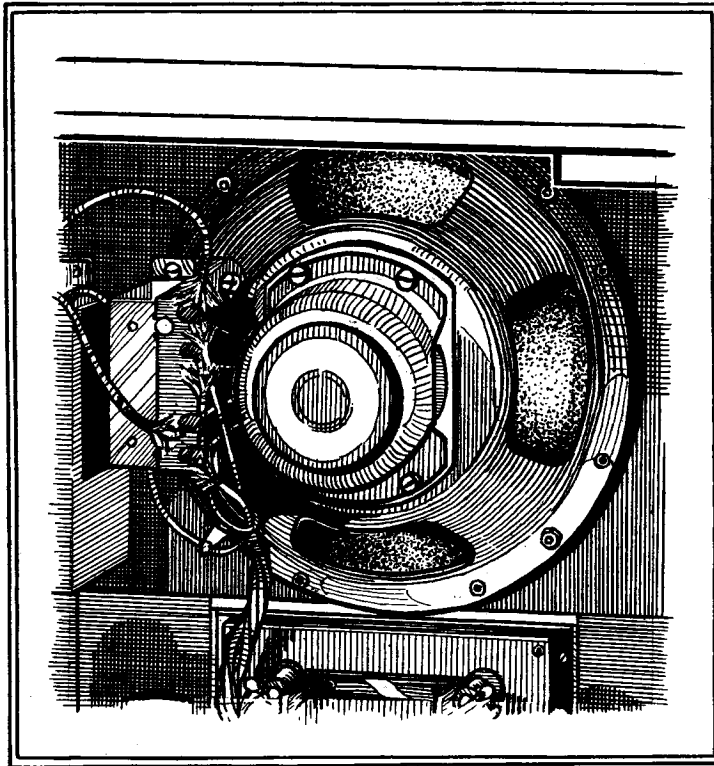
If a number of

**Circumstantial evidence:** if the speaker leads show signs of having been frequently disconnected, it is reasonable to assume that the receiver has given trouble.

second-channel whistles can be heard during daylight, it is certain that the trouble will be aggravated after dark, when the relative strength of foreign-station reception increases. As some traces of second-channel interference are

always evident on superhets with intermediate frequencies below the 450-kc/s band, it is well to make sure that it does not coincide with the tuning position of a favourite Continental station.

Another symptom of ageing in a superhet is cessation of the local oscillation at



the top end of one of the wavelength ranges. When the oscillator valve emission has begun to decline, or even if a by-pass condenser has developed poor insulation, the set may become "dead" above certain wavelengths.

## Distant Reception Notes

**V**ERY soon now the old 15-kilowatt Rosenhügel transmitter should be heard from Linz on 231.8 metres. For some time it was used as a stand-by in case of breakdown for the 100-kilowatt Bisamberg station near Vienna, but a new 5-kilowatt plant has been erected there for emergency duties. This having been done the 15-kilowatt equipment was dismantled and transferred to Linz. Linz actually shares the wavelength with three other Austrian stations, Dornbirn, Klagenfurt and Vorarlberg; but these will conduct synchronised working, and it is quite possible that Linz will so far over-ride the others that it will be as well received as Frankfurt, which has no fewer than five synchronised partners on 251 metres.

No set of mine will cover the intermediate band between 683 and 845.1 metres. I can't, therefore, report that I have received the new Czechoslovakian station, Banska Bystrica, on 765 metres. It is, however, conducting regular tests and several friends report having heard it. Lahti is said to be making tests at the moment with a new high power transmitter, and Brasov, with 150 kilowatts, may be found at work between mid-

night and one o'clock in the morning on 1,875 metres. It was officially stated that the Brasov station had come into full operation on New Year's Eve. This may be so, but I find it rather difficult to believe, since Hilversum, on the same wavelength, does not appear to suffer from interference. At any rate, the only time at which you are likely to hear Brasov is when the Dutch station has closed down for the night.

You should certainly try now for Toulouse P.T.T., which is testing nightly after 11 o'clock with 60 kilowatts on 386.6 metres. The intention of the Ministry of Posts and Telegraphs is to increase the power gradually to 120 kilowatts, once the tests have proved completely satisfactory. Ultimately the station may be rated at as much as 200 kW.

Stuttgart, which used to be a pretty good daylight station, is now to be found, as a rule, only after dark. The reason is that during alterations the old 2-kilowatt transmitter operates daily until 3 p.m.

It was stated in one of the lay papers recently that the German broadcasting authorities would present a strong case for the allocation of additional channels to their country on the ground that they had now

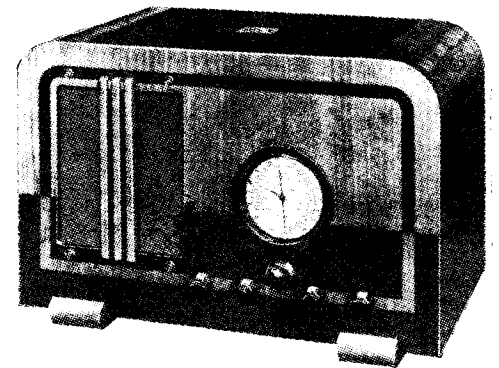
only seven, whilst the B.B.C. possessed no fewer than eleven. It is possible that Germany may feel the need of a greater number of channels, but the figures given are hopelessly incorrect. Germany has actually one exclusive channel (the Deutschlandsender) on the long waves, and nine (Stuttgart, Cologne, Munich, Leipzig, Berlin, Hamburg, Breslau, Gleiwitz and Nürnberg) on the medium band. In addition, Heilsberg on 291 metres has, as a wavelength partner, only the 5-kilowatt Parede, which causes no interference in the service area. This may, therefore, also be regarded as an exclusive wavelength. Beyond this, Germany has two exclusive channels (251 and 225.6 metres) for the use of relay stations. The total number of channels is, therefore, thirteen, which seems, after all, a pretty good allowance. In comparison, this country has twelve channels, but only six of these (North Regional, Scottish Regional, West Regional, London Regional, Belfast and Scottish National) are exclusive to individual stations. A Russian station shares with Droitwich, another Russian with the Midland, a Hungarian and an Egyptian station with Newcastle, and a German station with Aberdeen. The 261.1 metre wavelength has to be used for synchronised working by the London, North and West Nationals, whilst Bournemouth and Plymouth share that of 203.5 metres.

D. EXER.

### H.M.V. Model 480

*A New Superheterodyne with Two Short Wave Ranges.*

**T**HE introduction of short wave ranges in a receiver of moderate price is a new departure for H.M.V., who have hitherto provided this feature only in their largest high fidelity radio-gramophone. The new set is a five-stage superheterodyne with a signal-frequency HF amplifier preceding the frequency changer. Special attention to the requirements of short-wave reception has been given in choosing the X41 valve used in the latter stage, and throughout the circuit equal efficiency on all wavelengths has been the aim of the designers. A new type of "aeroplane" dial with wavelength markings, and a subsidiary vernier pointer calibrated in degrees has been introduced for this set, while the AVC control is of a more efficient type than is required for normal broadcast reception.



H.M.V. Model 480 AC superheterodyne for short, medium and long wavelengths.

The quality of reproduction has also been given careful consideration, and separate tone controls are included for the bass and treble frequency ranges.

A figured walnut cabinet of the horizontal type has been adopted and the price of the set is 17½ guineas.

# Current Topics

## Radio Call to Parliament

ON the morning following the deeply lamented death of King George V, broadcasting was employed to summon the Peers and M.P.s to attend the Houses of Parliament at 6 o'clock that evening.

According to ancient tradition the Peers and Commons are summoned after the death of the Monarch by a flag flown at half-mast over the Houses of Parliament. Wireless has set another new precedent.

## Broadcasts by the Late King

KING GEORGE V broadcast speeches and addresses on twenty-two occasions, the first being on the occasion of the opening of the British Empire Exhibition at Wembley in 1924. The complete list is as follows:—

- April 23rd, 1924.—Opening of the British Empire Exhibition at Wembley.
- May 9th, 1925.—Re-opening of Wembley.
- April 21st, 1927.—Opening of National Museum of Wales at Cardiff.
- July 19th, 1927.—Opening of Gladstone Dock, Liverpool.
- July 10th, 1928.—Opening of Nottingham University College and Buildings.
- October 10th, 1928.—Opening of Heaton Secondary School and New Tyne Bridge.
- January 21st, 1930.—Opening of the London Naval Conference.
- July 8th, 1930.—Opening of India House, London.
- November 12th, 1930.—Opening of India Round Table Conference.
- July 10th, 1931.—Opening of the New Dock at Shieldhall, Glasgow, and naming by H.M. Queen Mary: "King George V Dock."
- July 18th, 1931.—Opening of the King George Hospital, Ilford.
- December 25th, 1932.—Christmas Message to the Empire.
- June 12th, 1933.—Opening of the World Monetary and Economic Conference, London.
- June 22nd, 1933.—Opening of South Africa House, London.
- July 26th, 1933.—Opening of New Graving Dock at Southampton.
- December 25th, 1933.—Christmas Message to the Empire.
- July 18th, 1934.—Opening of the Mersey Tunnel, Liverpool.
- September 26th, 1934.—Launching of "Queen Mary" by H.M. Queen Mary.
- December 25th, 1934.—Christmas Message to the Empire.
- May 6th, 1935.—Jubilee Message to the Empire.
- May 9th, 1935.—Replies to Addresses presented on behalf of the House of Lords and House of Commons in Westminster Hall, London.
- December 25th, 1935.—Christmas Message to the Empire.

## The News on the Continent

VIENNA was apparently the first Continental station to broadcast the 9.25 p.m. bulletin on January 20th announcing that the King's life was drawing to a close. The Vienna reference was heard at 10.30.

Budapest relayed the bulletin at 11.5 (G.M.T.). A few minutes after the B.B.C.'s final broadcast at 12.15 a.m. Radio

Normandie interrupted its programme of sacred music to inform listeners of the sad news; immediately afterwards the French National Anthem was played and the station closed down.

Frankfurt and Stuttgart announced the King's death shortly before 1 a.m., closing down for a few minutes as a mark of sympathy and respect.

At 6 a.m. all German stations broadcast the news before the opening of the daily programme, following it with a few minutes' silence.

## Empire Broadcast from Palestine?

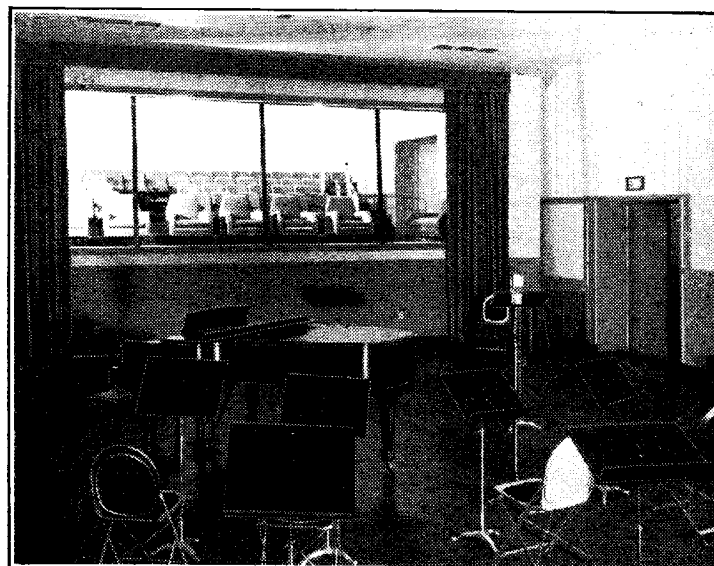
"RADIO - JERUSALEM," which is now being built for the Palestine Broadcasting Co., may broadcast for the first time on Empire Day in a "Round the Empire" programme.

## Irish Morse Tests

IRISH Free State readers who wish to improve their morse can now do so on slow morse tests organised by the Irish Radio Transmitters' Society. They are radiated on 3,522 kc/s from station E19D, situated at Westport, Co. Mayo, and take place at 7 p.m. every Saturday. Transmissions are made at 5, 10 and then 15 words per minute.

## For West Country Enthusiasts

THE Plymouth Radio and Television Society held its first meeting last week at the Co-operative Chambers, Drake Circus, Plymouth.



PIPERS CALL THE TUNE. This new studio of the N.B.C. at Hollywood is so designed that programme sponsors can see and hear the broadcasts from a glass-screened auditorium. Note the stage curtains.

## EVENTS OF THE WEEK IN BRIEF REVIEW

### At Marconi's Birthplace

BOLOGNA, the birthplace of Marconi, is to have a 50-kilowatt broadcasting station to replace the existing 15-kilowatt plant.

### Bod is Testing

ROUMANIA'S 150-kilowatt station at Bod is now testing on 1,875 metres, with announcements in Roumanian and English.

### Higher Power

THE Czechoslovakian Parliament has voted large sums for the building this year of four powerful new broadcasting transmitters. Those of Bratislava and Brno are to be increased in power to 100 kW. and 40 kW. respectively.

### Kisses by Numbers

A SPECIAL code has been instituted by the Italian Postal Administration for radio messages exchanged between troops in Abyssinia and their relations at home. For 4 lire it is possible to send quite a comprehensive message, selecting numbers in a series running from 1 to 40.

No. 3 signifies "All is well; Kisses"; 13, "Have sent money order"; 21, "Boy born, Mother well"; and 22, "It's a girl."



NEW N.B.C. PRESIDENT. Major Lenox R. Lohr, who has succeeded Mr. M. H. Aylesworth as President of the National Broadcasting Company of America.

## Telling the World

"A LITTLE modesty, please!" exclaims our Paris contemporary, *Antenne*, in recalling a remark made by an announcer last week at the private station, Radio Cité. In introducing an artist, Marie Dubas, he was heard to say: "Mademoiselle, the whole world is listening to you." Radio Cité has a power of 0.8 kilowatt.

## Voigt Speaker Demonstrations

THE demonstrations of Voigt loud speakers which were to have been given at the company's works, The Courts, Silverdale, London, S.E.26, at 7 p.m., on January 21st and 28th, were postponed. The new dates are February 4th and 11th. As accommodation is limited, *Wireless World* readers wishing to attend are requested to book seats by phone: Sydenham 4114.

## One in Ten

ONE in every ten automobiles in the United States now carries a car radio receiver, according to statistics recently issued. During 1935 no fewer than 1,100,000 car sets were sold, at an average retail price of £12, compared with 780,000 in 1934.

## Newport, Mon

A RADIO society with no subscription fees has been opened at Newport, Mon. This is the Newport and District Short-Wave Society, which is to hold monthly meetings at the Queen's Hotel.

# Olympic Winter Games

## TWENTY COMMENTATORS IN A WORLD BROADCAST

ONE of the most important series of outside broadcasts yet staged begins on Thursday next, February 6th, with the opening of the Olympic Winter Games at Garmisch-Partenkirchen in the Bavarian Alps, and will continue for seven days. A score of broadcast commentators from at least fourteen countries, including Great Britain, are already assembling at the little village which, already known as a health resort, will soon be world-famous as the scene of a great struggle. Some countries, such as Switzerland, have sent three commentators to broadcast in different languages.

During the Games Garmisch-Partenkirchen will become a vast transmitting station. Thousands of yards of cable are being ran to the various sports grounds, and a large number of telephone cabins, amplifying stations and central exchange offices are being erected.

At the ski-ing stadium fourteen telephone cabins have been erected, two at each of the umpire's towers and ten at the starting point. Commentators, completely protected from the weather, will be able to watch the whole course. Each cabin has a microphone connected by line to the input amplifying station immediately

below the cabins and connected by cables to the central broadcasting office close to the railway station. This building contains a complete telephone exchange, which will radiate to the whole world.

As the diagram shows, the cable channels serve countries as far apart as France and China, Poland and Japan. In addition to the ski-ing stadium there is the ice rink, bobsleigh run, and other centres of activity, to say nothing of the congress hall.

As a number of German broadcasting

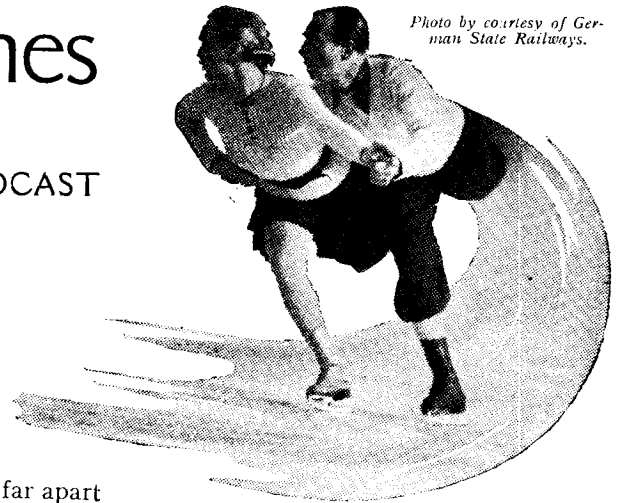


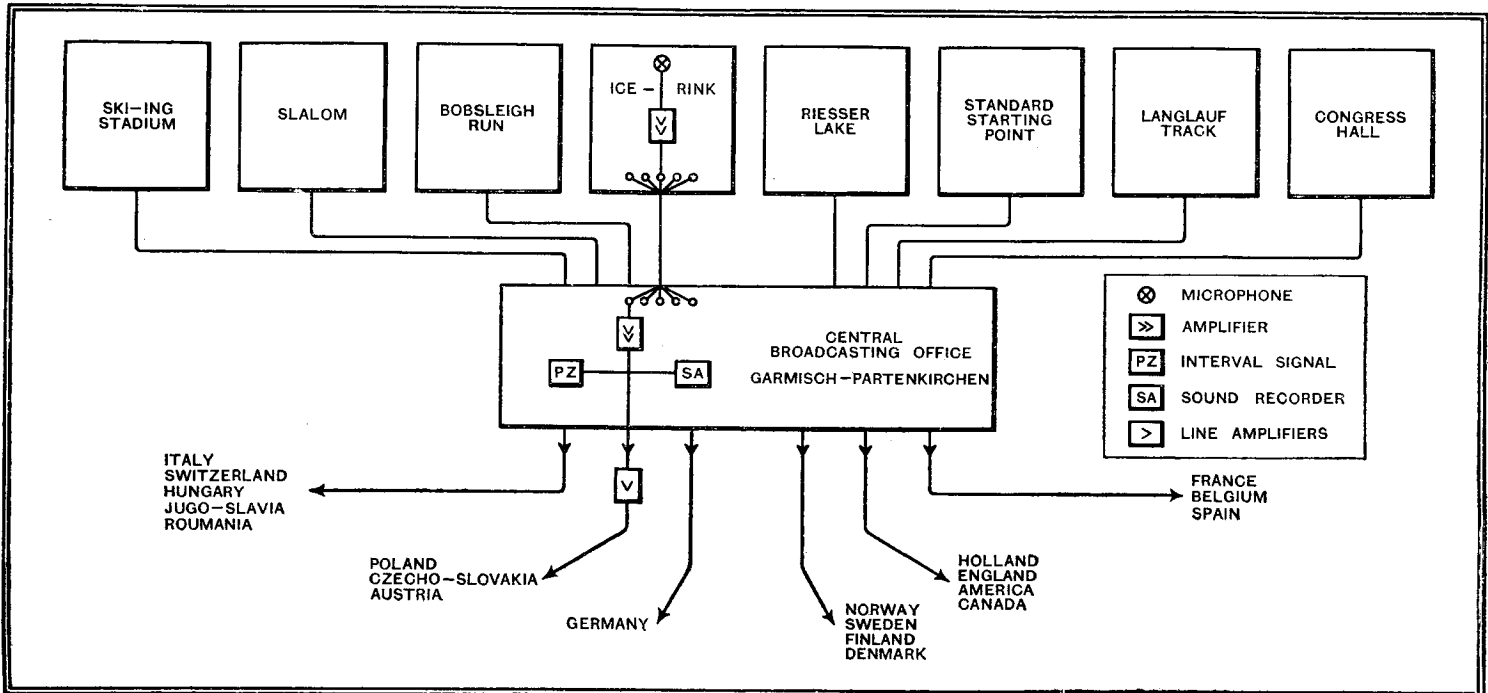
Photo by courtesy of German State Railways.

Maxie Huber and Ernst Baier, the European skating champions, training for the Olympic Winter Games.

stations will only be taking excerpts each evening special record-editing rooms have had to be installed, where skilled sound editors will pick out the best parts of the records and have them re-cut before broadcasting.

Short-wave transmitters and receiving stations will be used for broadcasting reports from commentators on skis and on bob-sleighs who will either be able to follow competitors or to record their impressions. Formidable transport problems face the engineers who are now engaged in wiring up the microphones installed on the mountain peaks.

The opening ceremony will be held in the ski-ing stadium, which constitutes the start and finish of the long-distance races. Several events will be relayed by the B.B.C.



The world's biggest "O.B." at a glance. Six cable outlets from the central broadcasting office will convey commentators' stories all over the world. (Above) Sound proof cabins specially constructed for commentators at the Ice Rink.

# Wavelength Vagaries

## Getting Best Results from an All-wave Set

By "PRESELECTOR"

*SO far as medium and long broadcasting wavelengths are concerned, all the average listener really needs to know is that their range is almost always greater after dark, and that fading is then apt to occur. But short waves are subject to more complex influences, and some knowledge of their apparently erratic behaviour is invaluable to every user of an all-wave set.*

**T**HE recent Radio Exhibition has undoubtedly given an extra stimulus to a very interesting type of receiver which is already well established in America.

The name "all-wave" is, perhaps, a little sweeping because, at the very best, a wave coverage from 6 to 2,000 metres is the widest at present available in this type of instrument. Nevertheless, the title does imply a receiver which will embrace the whole of the wave-bands occupied by the world's broadcast stations. Since the listener for whom the receiver is designed is only interested in broadcasting, the title is really quite suitable and will probably remain as it stands.

An "all-wave" receiver is, fundamentally, a normal superhet, but is distinguished from it by possessing additional short-wave coverage. The amount of coverage varies in different receivers, but usually embraces from 15 to 80 metres.

Although we have standardised our medium and long-wave coverage in all British receivers, we have yet to follow suit with regard to the short waves. Actually there is broadcasting below 15 metres and above 80 metres, but very little of this may be heard in these islands. In addition, the extension of the range usually involves technical complications and an extra range on the wave-change switch. The short-wave range quoted can usually be covered in two steps, making four ranges in all when the medium and long waves are added. The number of valve stages required, the design of AVC necessary, and the inclusion of certain additional controls, cannot be discussed without some knowledge of the peculiarities associated with short-wave broadcasting and communication in general. It is, indeed, most important that the listener should understand a little of the general principles involved, because it is a big step towards obtaining the most from the receiver and becoming a very enthusiastic short-wave listener. It cannot be too highly stressed that, however good the receiver may be, there are certain periods of the day when a particular short-wave broadcasting station may not be audible in this country although its programme is being heard and enjoyed in some other part of the world, located, perhaps, at a

greater distance from the station than our own islands. Similarly, the reverse will hold, and we may be listening to an Argentine programme which is inaudible in Africa.

Unlike the medium- and long-wave transmissions, whose waves travel to our aerials chiefly along the earth's surface, and gradually diminish in strength as the distance increases, the short waves are

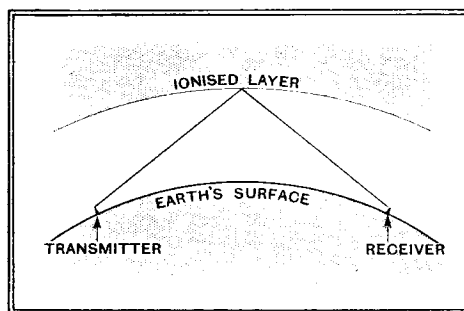
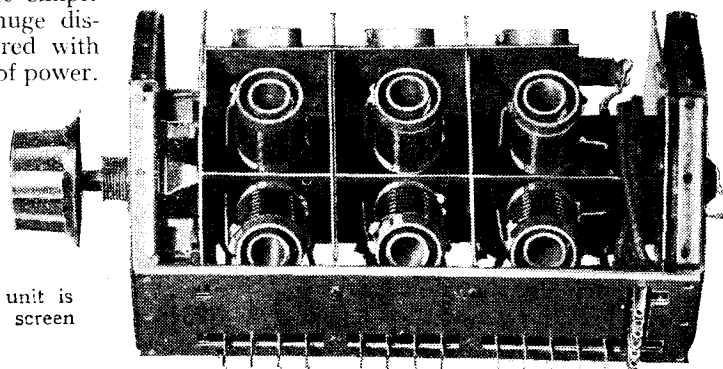


Fig. 1.—The Heaviside Layer is more often than not the listener's friend; this applies to all signals, but the reflecting properties of the layer depend on wavelength.

sent skywards on their journey. Some of the waves do travel over the earth's surface, but they are very quickly absorbed or attenuated, and only travel a few miles at the most.

The waves which travel skywards do not lose a great deal of their intensity, and if they could be reflected back to earth in the manner shown by the simple sketch in Fig. 1 a huge distance might be covered with quite a small amount of power.

Ingenious multiple-coil assemblies have been devised by French designers. This Gamma unit is shown with external screen removed.



Nature has already provided this means of reflection as if by some remarkable foresight. High above the earth's atmosphere there exists a region known to scientists as the "Ionosphere," which we

must visualise as a deep layer of gas in an electrified state, and which, under certain conditions, is capable of reflecting the short waves back to earth again.

This electrification is mainly due to the sun, and must exist in the correct degree for any particular wavelength before maximum reflection can occur.

For example: a broadcast transmission on 16 metres from any great distance (4,000 miles or more) requires an intense degree of electrification of the reflecting layer, which in turn implies the existence of bright daylight over the whole route. In other words, the chances are against obtaining good signals from the 16-metre American stations at midnight in the summer or at 7 p.m. on a winter evening. But at the same time these stations may be putting over a very good programme into Japan, since the western route between the U.S.A. and Japan would then be in bright daylight.

### After Dark

Now on 40 metres it is found that the route between the transmitting and receiving stations should lie in complete darkness for successful communication to be maintained—quite the reverse to the 16-metre wave. This is because the amount of electrification required by the reflecting layer is not nearly so great and the presence of direct sunlight is no longer necessary.

One of the first and most important rules of short-wave listening may thus be derived from the foregoing and stated as follows: Listen on the shortest wavelengths during the daytime, particularly in the summer, and gradually work up the band in the early evening, leaving the higher end until complete darkness has set

in. In the winter, when shorter periods of daylight exist, the shortest wavebands will not usually prove to be very fruitful, while in the summer the same may be said of the upper end of the short-wave band.



**Wavelength Vagaries—**

This first listening rule is by no means hard and fast. The necessary conditions are supplied by Nature, most fickle of all mistresses, and it is not surprising to find all sorts of freak conditions and effects occurring over an extended listening period. The hourly and seasonal variations in "conditions" as they are termed are mainly responsible for the fascination which short-wave listening never fails to provide to a growing army of enthusiasts.

**Morse Signals**

Turning to telegraphy for a moment, it is always rather confusing to the listener, who has just become interested in short-wave reception, to hear so much morse transmission while searching for broadcast programmes. It might conceivably be a source of annoyance until fully understood. This telegraphy is part of the major communication network of the world; a system which is now indispensable to a civilised community. Although much of it is carried out at high speed by automatic senders, a great deal of hand-sent traffic is carried out. To those who would take the trouble to master the morse code such transmission may add to the enjoyment of short-wave listening, but it must be remembered that any messages thus received must on no account be divulged.

Most all-wave receivers clearly show the small portions of the short-wave band allocated to broadcast transmissions, and any telephony or telegraphy received at other settings usually emanates from some licensed commercial or amateur source. Some of the commercial telephony is quite unintelligible, but this is no fault of the receiver. The transmission is said to be "scrambled," and this is purposely introduced to prevent eavesdropping. Most of the transatlantic telephone service is carried out on this scheme.

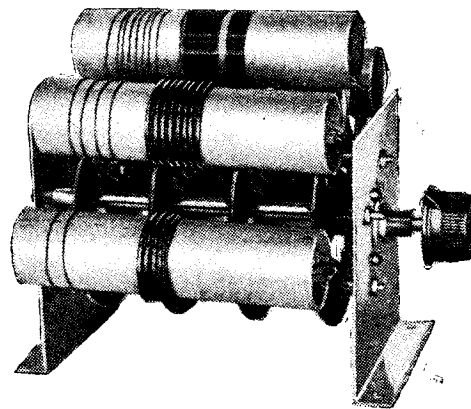
Even though a slow-motion dial is fitted to most all-wave receivers, stations should be searched for with careful deliberation. This may be better understood by making a comparison with the well-known medium-wave range which covers about 950 kc/s over the full scale coverage. Over the same degree of coverage on a typical short-wave range 15,000 kc/s are included, so that the receiver would require at least fifteen times more care to tune to a given station. The second rule might well be formulated as follows:—tune slowly and deliberately through the desired band in which the station is located.

Because the short waves rely upon the electrified layer for the ability to return to earth one would rightly conclude that momentary variations of the layer would affect the amount of signal reflected. This is manifested by erratic variations in signal strength which sometimes accompany transmission. Obviously, a high degree of AVC is essential, and this type of receiver should be equipped with a very efficient control of this nature. Some of the "fades" are very deep, and for this reason the sensi-

tivity of the receiver must be as high as possible, in order to enable a fairly consistent performance to be obtained under adverse conditions.

The foregoing remarks immediately provide a clue to the major requirements of an efficient short-wave receiver. Although a simple two-valve set is readily capable of receiving short-wave broadcasting during periods of excellent reception conditions, a deep fade or a poor reception period will render it of little use.

A sensitive superhet always scores in this respect, and with properly designed AVC is capable of holding distant short-wave broadcasting at full programme value under really adverse reception conditions. The limit to the sensitivity which may be usefully employed is always set by the internal noise of the receiver itself,



The interchanging of inductances is an important matter in all-wave receivers; this Bulgin unit covers five wavebands and includes the necessary change-over switches.

and with careful design the ratio of signal to noise may remain quite high, even with a maximum sensitivity of only a few microvolts. A high degree of available sensitivity together with an efficient AVC system are thus major requirements for the all-wave receiver.

High sensitivity will naturally result in a considerable amount of noise as one tunes from station to station. Unfortunately, QAVC or inter-station noise suppression is not to be recommended for short-wave reception since it would be very easy to miss a station of good programme value which had momentarily faded below the level necessary to release the inter-station suppression. For this very reason an adjustable sensitivity control is a very desirable addition, and when conditions are good the receiver sensitivity may be lowered accordingly with an accompanying reduction in inter-station noise.

**Use of Tone Control**

When operating an all-wave receiver at maximum sensitivity the noise level may often be very considerably reduced by the judicious use of tone control. By cutting out some of the high-note response it is often possible to reduce the noise more rapidly than the programme intelligibility. It must not be thought that short-wave listening is always accompanied by

noise, for this is only true during periods of adverse reception which occur very infrequently and during which time the receiver must be adjusted for maximum sensitivity. Actually, the noise level, for a given sensitivity, is generally much less on short-waves than on medium or long. This is due to the fact that the noise produced by atmospheric electricity is invariably less on the short-waves, particularly in the case of local thundery weather. During such periods when listening is quite impossible on medium and long waves, distant short-wave stations may be received with negligible background noise.

**CLUB NEWS****Home Recording Lecture**

In view of the interest aroused in home recording by correspondence and the leader in *The Wireless World* of January 17th, a lecture and demonstration on the subject is to be given before the Radio, Physical and Television Society at 8 p.m. on Friday, February 7th, by Dr. C. G. Lemon. The meeting will be held at 72a, North End Road, West Kensington, London, W.14. All *Wireless World* readers interested are cordially invited to attend. Assist. Hon. Secretary: Mr. W. Licence, 62, Ringmer Avenue, Fulham, S.W.6.

**Invitation to North Manchester Readers**

The North Manchester Radio Society is now meeting every Friday at the British Legion, Elms Street, Bury New Road, Whitefield, near Manchester, at 8 p.m. The Society's first dance will be held on February 19th next, and all *Wireless World* readers in the district are invited to attend. Full particulars can be obtained from the Hon. Secretary, Mr. R. Lawton, 10, Dalton Avenue, Thatch Leach Lane, Whitefield, near Manchester.

**Response Curves**

A demonstration with a frequency record provided an acid test of loud speakers at a recent meeting of the Croydon Radio Society. Starting at 6,000 cycles, various frequencies down to 50 cycles were reproduced. At the lower figures the response was sufficiently pronounced to make members feel the chairs vibrating.

Mr. Michael, who was lecturing, expressed the opinion that loud speaker firms should not issue their own response curves. It was more satisfactory, he thought, to leave such tests to the National Physical Laboratory, *The Wireless World*, or the Post Office.

Hon. Secretary: Mr. E. L. Cumbers, 14, Campden Road, S. Croydon.

**Southend-on-Sea**

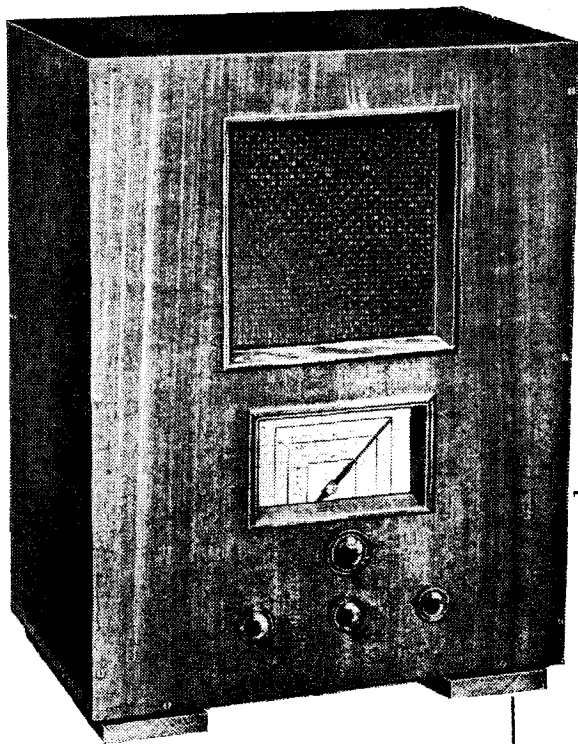
The Southend-on-Sea District Radio and Scientific Society held its annual meeting at Cotgrove's Restaurant, High Street, Southend-on-Sea, on Friday, January 17th. Hon. Secretary: Mr. F. S. Adams, Chippenham, Eastern Avenue, Southend-on-Sea.

**Questions and Answers**

A "Questions Night" is being held by the Ilford and District Radio Society on Thursday next, February 6th. The Society meets at the St. Albans Church Rooms, Albert Road, Ilford. Hon. Secretary: Mr. C. E. Largen, 44, Trelawney Road, Barkingside, Ilford.

**For Short Wave Enthusiasts**

The London Chapter of the International Short Wave Club is enjoying an active session with meetings every Friday, except the second in the month, at the R.A.C.S. Hall, Cavendish Grove, Wandsworth Road, S.W.8. All London amateurs interested in short-wave working are eligible for membership. Full particulars can be obtained from the European representative, Mr. A. E. Bear, 10, St. Mary's Place, Rotherhithe, S.E.16.



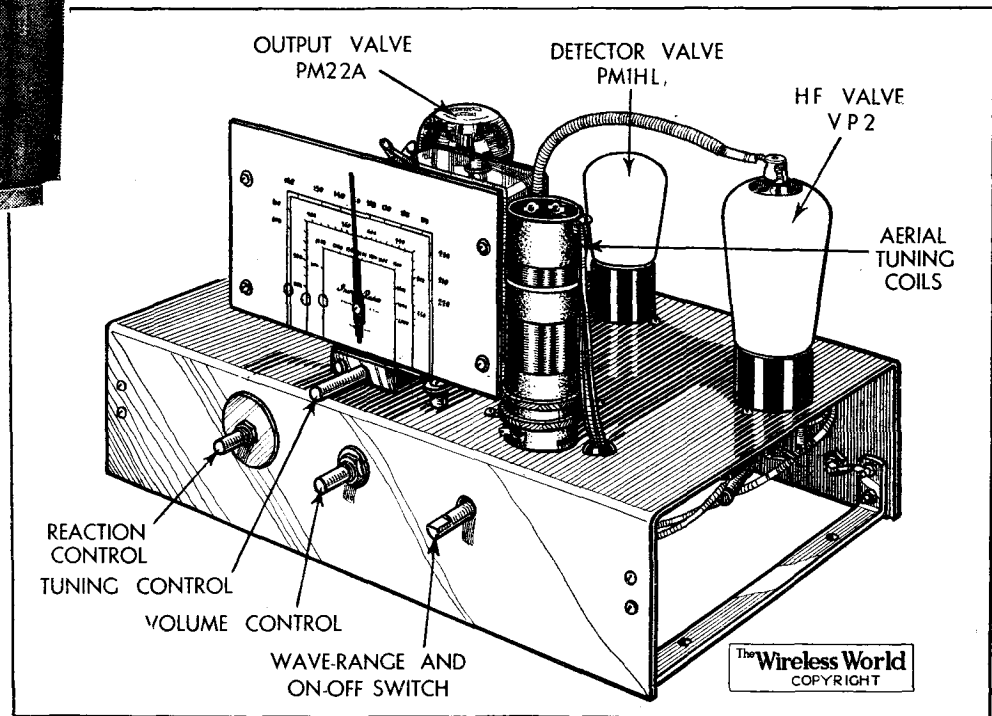
# Invicta MODEL FS36

An Efficient "Straight" Receiver for Service Afloat

**FEATURES.—Type.**—"Straight" battery receiver for broadcasting and shore-to-ship services. **Waveranges.**—(1) 90-220 metres; (2) 220-550 metres; (3) 1,000-2,000 metres. **Circuit.**—Var.-mu pentode HF amplifier—triode grid detector with reaction—pentode output valve. **Controls.**—(1) Tuning, with illuminated wavelength scales. (2) Volume. (3) Reaction. (4) Waverange and on-off switch. **Price.**—(Exclusive of batteries) £9/19/6. **Distributors.**—United Radio Manufacturers, Ltd.

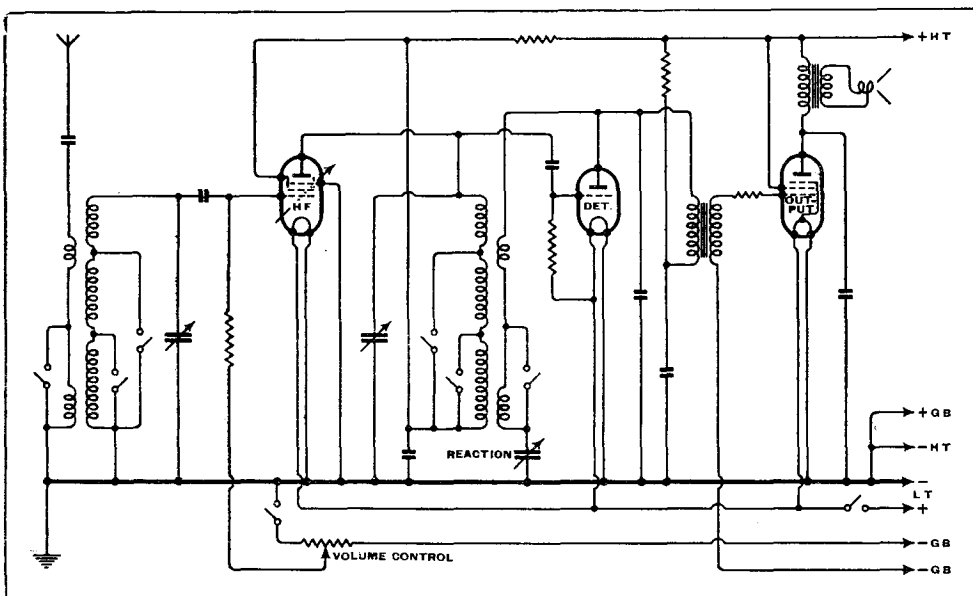
**P**RODUCED originally for use on North Sea trawlers, this receiver is now available for yachtsmen and fishermen who may wish to receive ordinary broadcasting while afloat, and for whom regular weather reports are of vital importance. It follows domestic receiver practice in general design and layout, but a yachting flavour is imparted by the use of Bermuda teak in the finish of the cabinet-work. The introduction of a third waverange, however, should make a far stronger claim to the serious attention of those who go down to the sea in ships. This range, which covers the band from 90 to 220 metres, includes the recently introduced telegram service to yachts on 160 metres and many ship-to-ship and ship-to-shore telephony transmissions.

The simple three-valve circuit, consisting of a variable-mu HF amplifier, grid



detector and pentode output valve, is remarkably efficient on a normal outdoor aerial such as is used inland for ordinary broadcast reception, and after dark there is no necessity to use reaction to bring in fif-

The components under the chassis as well as above are well spaced, and any necessary overhauls could be quite easily carried out at sea.



Complete circuit diagram. Although straightforward in design, the three-valve circuit is remarkably efficient.

teen or twenty of the more important Continental stations on the medium waveband. The long waves and the special short waveband are equally lively, and during the period of the test a number of distant stations were received on the 150-175-metre amateur band at good strength. Although the aerial which would be available on a yacht would not be so long as the one with which the tests were made, the well-known general improvement in wireless reception on the water should afford ample compensation, and we have no hesitation in saying that as far as range is concerned this receiver should provide a generous margin above all the demands that are likely to be made on it. The Droitwich shipping forecasts should certainly be available all round our coasts, and the aviation forecasts from Heston will be easily within reach of all the important yachting centres on the south and east coasts.

Our customary tests for selectivity showed that the London National transmitter could be approached within six

**Invicta Model FS36—**

channels and the Regional transmitter within seven channels on either side of their normal setting. This is not, of course, superheterodyne selectivity, but it must be remembered that at sea, away from the centres of broadcasting, the requirements as regards selectivity are not so stringent.

Although the set takes only 6 or 7 mA of HT current the volume and quality are surprisingly good, and unless there is half a gale blowing it should be possible to listen to weather reports and programmes from the cockpit when the set is installed in the cabin of a small yacht.

The makers have rightly adhered to a policy of simplicity in the design of the circuit and chassis. A two-element ganged condenser simultaneously tunes the aerial input and tuned anode HF coupling circuits. Volume is controlled by varying the bias of the HF amplifier through a potentiometer connected across the grid bias battery. Contacts on the on-off switch disconnect this potentiometer when the set is not in use. Capacity-

controlled reaction is applied to the tuned anode circuit, and by a judicious manipulation of the reaction and volume controls the range and selectivity can be adapted to varying conditions of reception. The output valve is coupled to the grid detector through a small intervalve transformer, and the moving-coil loud speaker is of an efficient type employing the modern nickel aluminium alloy in the magnet system.

The back of the set has openings to prevent box resonance, and the set is, therefore, not protected against the ingress of salt-laden atmosphere which finds its way eventually into the interior of the majority of boats. But if reasonable care is taken of the set during the time when it is not in use, say, by making a painted canvas cover to slip over it, we see no reason why it should not give many years of useful service. If it is to be installed in a small boat in which the motion may be lively the purchaser will have to provide means for wedging the HT and LT batteries and also for screwing the set to a shelf or bulkhead.

# Hints and Tips

## Practical Aids to Better Reception

**D**UE to the fact that it needs no rectifier, a DC set is inherently rather simpler than an AC model, though it is admitted that complications may have to be introduced in order to obtain something like a comparable performance. The difference in complexity

### Simplest Mains Set

is especially marked when we come to deal with the less ambitious type of receiver, and is most noticeable of all in a single-valve circuit such as that depicted in Fig. 1.

"Stand-by" DC mains receivers of this type were built long before the days of economical DC or universal valves, and, notwithstanding a certain amount of background hum, were found to be reasonably satisfactory even when directly heated battery-type valves were employed. The circuit now given represents an adaptation of the original arrangement and is designed to work with modern valves of, say, the 13-volt, 0.2 amp. type.

It will be obvious that the set is essentially for headphone listening; also, if a mains aerial is used as suggested, its

range will be clearly confined to the local station, and an external aerial will be necessary for reception at greater distances.

The circuit shown is probably the simplest and the cheapest that can be devised, and is obviously susceptible to elaboration at several points. Resistance smoothing, for example, though effective enough in this particular case, would hardly be suitable with 100-volt supplies (due to excessive voltage drop), and the same can be said of the resistance-con-

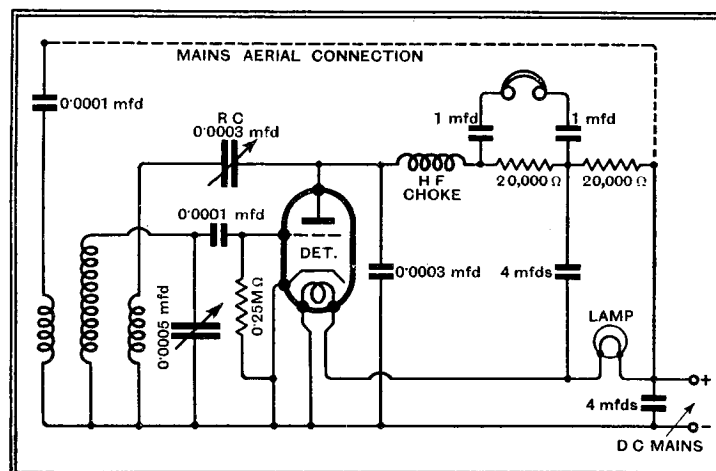


Fig. 1. The simplest possible DC set; if the lamp resistance is used for illumination, upkeep cost is almost nil.

denser filter by means of which the phones are isolated from the mains. Incidentally, in the interest of safety, these filter condensers should be of the highest class and with an ample margin in the matter of

rated working voltage. As an extra precaution, a pair of condensers may be used in each 'phone lead.

Any suitable type of resistance can be employed for absorbing excess voltage in the heater circuit: a lamp is suggested for the reason that it is inexpensive, and by providing illumination tends to reduce waste of energy. It will not always be possible to obtain a single lamp which passes the right value of current, and sometimes it will be necessary to employ two lamps in parallel, or, alternatively, a lamp in conjunction with a fixed wire-wound resistance. In most cases it will be considered preferable to overcome this minor difficulty, when it is encountered, by using a high-voltage valve with a heater rated at full mains voltage, and which accordingly will need no resistance.

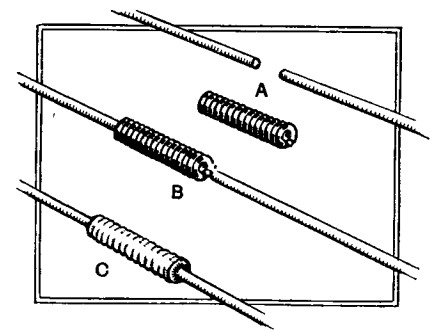


Fig. 2. Stages in the making of a joint in a severed wire connection.

**D**URING testing operations it is often necessary to sever a connecting wire in order that a milliammeter or other instrument may be inserted in series with the circuit under suspicion. Having finished the job, it becomes necessary to rejoin

### A Strong Joint

the wires; the usual method of doing so, by butting them together and running a little solder on to the joint, is far from satisfactory, especially if the set is likely to be subjected to vibration.

A better method of making the joint is illustrated in Fig. 2, which is almost self-explanatory. The first step (A) is to make a closely wound spiral of tinned copper wire just large enough to slip over the ends of the wires, as at (B). Finally, solder is flooded into the joint (C), and the connection is as strong or stronger than before.

**I**T has often been said that a test can be made to determine whether crackling noises come from an outside source, or from within the receiver, by removing the aerial. Whilst this is true in a general sense, there are one or two cases where the rule does not hold good.

### Testing for Crackle

When a dry joint or other faulty contact is located in such a position that radio-frequency currents are flowing through it from the aerial, crackling will take place with the aerial

in position and there will be no crackling when the aerial is removed; yet the fault is actually in the receiver. The grid circuit of the detector valve is particularly liable to this trouble, as any defect will only be shown up when radio-frequency currents are passing through the faulty joint.

WHEN a radio-gramophone is assembled as a self-contained unit, complete with speaker and turntable in the same cabinet, it sometimes happens that an effect apparently akin to "motor boating" becomes troublesome on the "gramophone" side, but is entirely absent when the set is used for radio reception.

**Acoustic  
Reaction**

In several cases this has been traced to acoustic feed back, via the motor-board and turntable, between loud speaker and pick up. The effect may be noticeable even if the pick up is placed on a stationary record.

In most cases a cure can be effected by mounting the motor-board on a non-grid absorbent mounting.

VARIABLE selectivity is largely responsible for a growing use in superheterodynes of an intermediate frequency in the region of 465 kc/s, and it seems that in a few cases users of sets operating at this frequency are troubled

**Intermediate  
Frequency  
Interference**

by interference from nearby telegraphic transmitters which affect the IF amplifier by direct breakthrough. In almost every case interference of this kind is easily overcome by insertion of a simple form of wave trap in the aerial lead. The trap is, of course, tuned to the frequency of the interfering station, which may very possibly be working on 500 kc/s—sufficiently close to the IF to cause interference.

The only obstacle to fitting such a wave trap is that coils suitable for resonating at this frequency with the standard maximum capacity of 0.0005 mfd. are not

# A "Super-super" Circuit

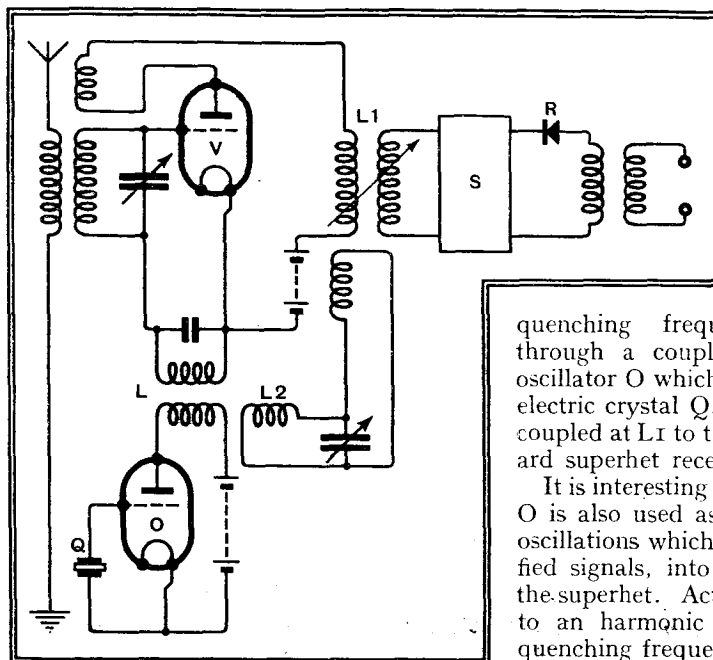
THERE is much to be said in favour of our old-time friend the super-regenerator—particularly for short-wave working—though it has now been

in an arrangement which harnesses the two circuits together to a common task. The underlying idea is to make use of the known merits of the super-heterodyne, as a short-wave receiver, in order to sharpen-up the selectivity of the super-regenerator.

The arrangement is illustrated in the diagram where the first valve V is arranged as a super-regenerative amplifier, the necessary

quenching frequency being supplied through a coupling L from a separate oscillator O which is stabilised by a piezoelectric crystal Q. The output from V is coupled at L1 to the input stage of a standard superhet receiver indicated at S.

It is interesting to note that the oscillator O is also used as the source of the local oscillations which are fed, with the amplified signals, into the "mixer" valve of the superhet. Actually the coil L2 is tuned to an harmonic of the fundamental or quenching frequency produced by O, and this is combined with the signal in the first stage of the superhet to produce the required beat frequency. The audible signals are subsequently separated out in a second detector which is shown diagrammatically at R.



Combining the principles of the super-heterodyne and the super-regenerator.

rather pointedly pushed on one side by the superhet. In the circumstances one may perhaps detect a touch of poetic justice

*In Next Week's Issue:—*

## The "By Request" Crystal Set

OUR correspondence columns have lately borne witness to the fact that a considerable amount of interest is still displayed in the humble crystal set. Such interest is perhaps not altogether surprising, as this simple type of receiver has a fascination of its own, and is of real usefulness either for headphone listening

many special requests, and is planned to have ample selectivity for the exacting conditions of to-day.

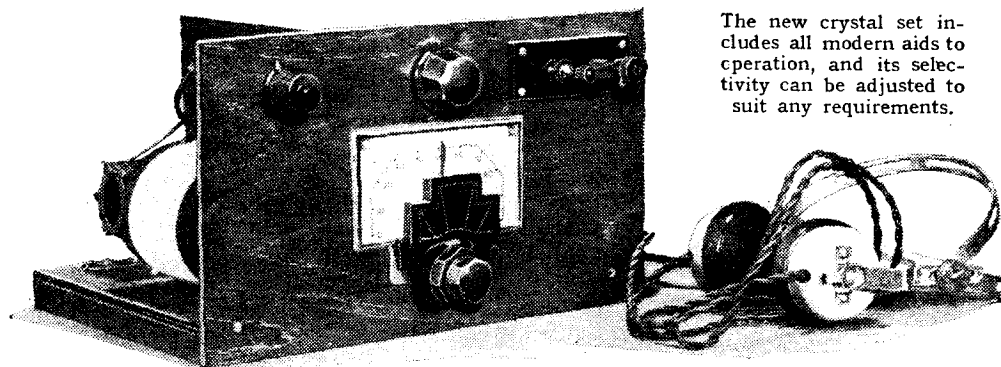
**List of Parts.**

- 1 2-gang condenser, 0.0005 mfd. with air-dielectric trimmer and drive **Formo DU5a** (J.B.)
- 1 Variable condenser, 0.000025 mfd. **Ormond R/149** (Eddystone, Polar.)
- 1 Fixed condenser, 0.001 mfd. **Graham Farish Tubular** (Dubilier, Ferranti, T.C.C.)
- 1 Change-over switch, 6-point, with knob **Magnum WW6**
- 1 Crystal detector **Hinderlich (Zincite-Tellurium)** (Goltone)
- 2 Double terminal strips **Bulgin T10** (Belling-Lee, Clix.)

**Miscellaneous:— Scientific Supply Stores**

- 4 ozs. No. 22 DCC wire; 2 ozs. No. 34 DSC wire; small quantity No. 22 tinned copper wire; 3 lengths sleeving; 2 ebonite formers, 3in. dia. x 3in. long; 2 6-ribbed formers, 2in. dia. x 1½in. long; mountings for coils; wood panel, 12 x 7 x ½in.; wood base-board, 12 x 7½ x ½in.; 2 wood battens, 7½ x 1½ x ½in.; aluminium for screen. Screws: 6 ½in. No. 4 R/hd, 7 ½in. No. 4 R/hd, 4 ½in. No. 2 R/hd.

- 1 Pair headphones 2,000 ohms **Ericsson**



The new crystal set includes all modern aids to operation, and its selectivity can be adjusted to suit any requirements.

standard articles of commerce. However, this difficulty should be easily overcome by using an ordinary medium-waveband coil shunted by a fixed condenser of, say, 0.0003 mfd. and a variable 0.0005 mfd.

in normal circumstances or as a "stand-by" receiver that is quite independent of batteries or any electrical supply.

The set to be described in next week's issue has been designed in compliance with



THE sorrowful events of the past ten days necessitated sweeping changes in the broadcasting arrangements, but the B.B.C., by universal consent, handled an unprecedented situation with the tact, dignity and sense of public responsibility which we have all come to expect.

Now that the veil of national mourning is partially lifted, the Corporation does right to resume its normal programmes, with certain exceptions, and the fare for the coming week promises a range of entertainment which should satisfy—if such a thing were possible—nearly all tastes.

The most notable omission is Darius Milhaud's vivid opera "Christopher Columbus," which was to have been broadcast on Wednesday next. Lack of rehearsal for the B.B.C. Chorus during the past few days is given as the reason for the postponement of the work.

#### FOG

THE B.B.C. "Flying Squad" has been busy recording for Robin Whitworth's actuality programme, "Fog," which is to be given in the Regional programme on Monday at 8.45. No one has found a good use for fog; at sea it is dreaded more than a storm. The object of the programme is to show how the public services on land, sea and air attempt to fight the monster, in many cases with the aid of wireless.

We shall hear an actual recording, made at the Automobile Association's headquarters, of the authorities coping with reports from their

**WINTER OLYMPIC GAMES.** The Ice Rink at Garmisch-Partenkirchen, on which the ears of the sporting world will be centred during the next ten days. The opening ceremony will be relayed by all German stations and many others at 10 a.m. on Thursday. A B.B.C. eye-witness account of the Ski running, skating and toboggan contests comes from Garmisch at 6.30 on Saturday, February 8th.

scouts, requests for assistance from members, and all the other emergency calls which result through fog on the roads.

Another record gives an actual conversation on the bridge of a cross-Channel steamer in fog; the sounds when an air liner makes a safe landing in fog at Croydon aerodrome will also be heard. Congestion and confusion on the railways will be depicted, as well as the efforts of the Post Office to ensure punctual deliveries.

By the way, fog is one of the few phenomena which defeat the resources of the B.B.C. Effects Department.

#### BLACKMAIL AND DOUBLE WEDDING

It has taken six months, I am told, to write the music and lyrics of "Rogues and Rhythm," a story with music which Gladys and Clay Keyes have devised for broadcasting on Tuesday (Reg., 7.30) and Thursday (Nat., 8.30). The scene is a dance hall where we meet characters from the underworld, wasters, dance hostesses, and other sophisticated frequenters.

Blackmail and a double wedding are among the incidents in this world of rhythm, where life becomes so hectic that the hero wishes he were back in the comparatively peaceful jungle.

Besides Teddy Joyce and his

band, a large cast includes Billie Sinclair, Nita Harvey, Gladys Keyes, Cyril Nash and Clifford Bean.

#### HARRY HEMSLEY

NOR even the most sensitive microphone can unmask the amazing child mimicry of Harry Hemsley, who has a thirty-minute entertainment to himself on Wednesday (Nat., 7.30). He sounds like a walking crèche.

#### "WAR CALLS THE TUNE"

THAT politicians are the pipers and humanity the unwilling dancers is the theme of C. K. Munro's play to be broadcast on Thursday (Reg., 8.30) and Friday (Nat.). The play was first produced at the Embassy Theatre in 1934, under the title of "Dirig and Co." The plot concerns an English girl who becomes engaged to a German. War breaks out between the two nations and the girl is persuaded by her guardian, a Cabinet Minister, to marry an English V.C. Two years after the war is over the German is back in England in an important commercial position while the Englishman is a hopeless cripple. There is an ironical *dénouement*.

THE HUNGARIAN GIPSY BAND will be relayed from the Hungaria Restaurant, Regent's Street, at 4 on Monday (Reg.).

# Listeners

## Outstanding Broadcast

D. A. Clarke-Smith plays the part of Ding, and others in the cast are Stanley Lathbury, Ann Twigg and Herbert Gregg.

#### TO-NIGHT'S SPECIAL

LESLIE HENSON in "Seeing Stars"—a relay of Scene I, Act II of the Gaiety success, to be given at 10.20 in the Regional programme. John Watt will compe.

#### ROMANTIC MUSIC

"LIEBESTRAUM" is the title which has been chosen for Julius Buerger's *pot pourri* which is to be heard on Sunday evening at 6.45 (Reg.) and on Tuesday at 8.30 (Nat.). It comprises an hour of romantic music by composers of all shades from Mendelssohn and Brahms, Oscar Strauss, Leo Fall and Franz Lehár. All the twenty-six selections have been orchestrated to take full advantage of the many tonal contrasts that the B.B.C. Theatre Orchestra can command.

#### A BANNED OPERA

VERDI's opera, "The Masked Ball," which Rome broadcasts at 7.35 to-morrow, was banned by the authorities in Naples in 1858 because its plot is based on the assassination of King Gustave III of Sweden at a masked ball in Stockholm in 1792. Just at that time, 1858, the Italians had tried to assassinate Napoleon III, so the production of Verdi's opera might have been somewhat





# ' Guide for the Week

## as at Home and Abroad

tactless. A very different opera is "Rolande et le mauvais garçon," by the modern composer, Henri Rabaud, which Radio-Paris gives at 8.45 to-morrow under the conductorship of Bigot.

A good opportunity to hear the new 150-kW. Radio-Romania comes at 6.30 on Sunday with the relay of the Roumanian opera, "Red Roses," by Bobesco, from the Royal Opera House.

Two Weber operas clash on Tuesday at 7.10 when Frankfurt offers "Euryanthe" and Leipzig "Oberon."

A humorous opera is a rarity, but Mussorgsky's "The Fair at Sorotchinsk" is based on a laughable Gogol tale. Konigsberg broadcasts the opera at 7.45.

### DOLLARS AND GONDOLAS

ITALY appears to be boycotting foreign music, but this is no reason why British listeners should not extract all the entertainment they can from the home-grown product, which is now generally featured. To-morrow night a new Italian opera, "Dollars and Gondolas," by De Nigris, comes from Milan at 7.35. On the same evening at 9, Radio Toulouse offers a concert version of "Lilac Time" (Schubert-Berte).

Two Delibes operettas, "Le Serpent à plumes" and "Le Roi l'a Dit" are in the Paris P.T.T. programme at 8.30 on Tuesday.



### HIGHLIGHTS OF THE WEEK

#### FRIDAY, JANUARY 31st.

Nat., 7.30, Young Ideas. 8.10, Savoy Hotel Orpheans. 10, Raymond Swing: "Transatlantic Bulletin."  
Reg., 8.25, Operatic Concert. 9.25, "Variety in Miniature."

#### Abroad.

Radio Paris, 8.30, Opera: "Thais" (Massenet).

#### SATURDAY, FEBRUARY 1st.

Nat., 2.35, Scotland v. Wales Rugger Match. 8.30, "Music Hall." "Henry Hall's Hour."  
Reg., 8, Topics in the Air. "String Orchestral Concert."

#### Abroad.

Berlin (Funkstunde), 7.10, Concert from Berlin Academy.

#### SUNDAY, FEBRUARY 2nd.

Nat., 1.30, Watson Forbes (viola); Myers Foggin (pianoforte). 5.30, Stratton String Quartet. 9, Albert Sandler and Park Lane Hotel Orchestra.

Reg., 4.30, Commodore Grand Orchestra. "Liebestraum," musical pot-pourri. 9.20, Mahler's "Song of the Earth" (B.B.C. Sunday Concert).

#### Abroad.

Paris P.T.T., 8.30, Musical Comedy: "Riquet à la Houpe" (Hüe).

#### MONDAY, FEBRUARY 3rd.

Nat., B.B.C. Orchestra, 8.45, "Come Round After Dinner" (Stanelli programme). "Chamber Music."

Reg., B.B.C. Dance Orchestra, 8.45, "Fog," an actuality programme.

#### Abroad.

Strasbourg, 8.45, Band Concert from the Salle de l'Aubette.

#### TUESDAY, FEBRUARY 4th.

Nat., 8.30, "Liebestraum." "Leslie Bridgewater Quintet."

Reg., The Cellini Trio. 9.5, Part II, Liverpool Philharmonic Concert.

#### Abroad.

Paris P.T.T., 8.30, Delibes Festival, with French National Orchestra.

#### WEDNESDAY, FEBRUARY 5th.

Nat., 7.30, Harry Hemsley in Juvenile Humour. 10.30, "The Little Show."

Reg., 8, "Floor Show": Carroll Gibbons and Savoy Hotel Orpheans. "B.B.C. Theatre Orchestra."

#### Abroad.

Cologne, 9.30, Station Orchestra and Dance Band.

#### THURSDAY, FEBRUARY 6th.

Nat., 8, Russian Songs by Vladimir Rosing. "B.B.C. Orchestra."

Reg., 8, Yiddish Variety programme. 8.30, "Ding and Co."

#### Abroad.

Kalundborg, 7.10, Thursday Concert. Conductor: Fritz Busch. Soloist: Holst (violin).

### MUSICAL GEMS

THE musically-minded ether tourist has a wide choice of programmes this week. Perhaps the "star" events are a concert from Rome to-night at 8.45 by the St. Cecilia's Academy Choir; Scarlatti and Liszt music by Czarniawski (pft) from Vienna at 9.10 to-morrow; Dvorak's Quartet in A flat by the Weissgärber Quartet at 2.40 p.m. on Sunday; and a concert by the

Continent. At the moment they are touring Scandinavia, and will be heard in the Motala programme at 8 p.m. to-morrow (Saturday) in a concert relayed from the Academy of music.

### MOZART CYCLE

SAARBRUCKEN, the new German regional programme centre, has the honour on Thursday, at 7.15, of contributing its first pro-



PROF. NICOLAI MALKO, the well-known conductor, who directs the broadcast concert by the Liverpool Philharmonic Orchestra on Tuesday at 9.5. (Reg.).

Bucharest Philharmonic relayed from the Athenæum by Brasov at 7.15 on Thursday next.

### ENGLISH DRAMA FROM MOSCOW

HERBERT MARSHALL, the only foreigner ever to be granted a scholarship by the Soviet Institute of Cinematography, is producing an English version of Maxim Gorky's play, "Mother," which Moscow No. 1 is broadcasting to-night (Friday) at 9.5. The fact that the play is in English affords a rare opportunity to study radio presentation methods abroad.

### MUSICAL BRIDGE

A MUSICAL novelty specially composed for the microphone will be featured in the Oslo programme at 7 to-night (Friday). This is a "Musical Bridge Evening" by the young Norwegian composer, Trygve Torjussen, and is written for two violins, viola and 'cello. The movements are: "Peculiar Bidding," "Dance Intermezzo," "Two Leading Colours," "Partner's Joy," and "Hearts are Trumps."

### JAZZ FROM MUSIC ACADEMY

THE Comedian Harmonists are recognised as one of the finest vocal jazz teams on the

programme to all stations of the Fatherland. This will be a Mozart Cycle entitled: "In Salzburg, the beggars' town." Mozart himself gave the town this description, probably because musicians at the Archbishop's court there were badly paid. Of special interest should be selections from Mozart's two uncompleted operas, "Zaide" and "King Thamos."

### FAMOUS GERMAN DANCE BAND

BRUNO AULICH joined the staff of the Munich station some time ago to specialise in music recording. One day he had the chance to prove that he had rhythm in his blood. He conducted a dance orchestra, and very soon was the guiding star of the Munich station's own dance orchestra.

Reorganised under Aulich's direction, it will be heard on the Munich and Stuttgart wavelengths from 9.30 onwards on Sunday.

### SHAKESPEARE ABROAD

"MUCH ADO ABOUT NOTHING" comes in a Danish version from Copenhagen to-night (Friday), at 7. Munich offers "Romeo and Juliet," with incidental music, at 7.10 on Tuesday.

THE AUDITOR.

# INTELLIGENCE (If Any)

## Handicaps that Fetter the Designer

By "CATHODE RAY"

THE above title will awaken pleasant memories in readers who have been fortunate enough to come across that delicious book that appeared a few months ago: "Tuning-in Without Tears" (no, unfortunately, I am not the author). Departing from the highly technical sense in which the term is used in that treatise, I wish to discuss the part played by public intelligence in the design of broadcast receivers. Note, *public* intelligence—not designers' intelligence. It is natural, of course, for one to connect "intelligence" with "design" whenever the two words occur in the same sentence; but just now it is the intelligence of those for whom the designing is carried out that is in question.

Among those members of the general public who pass the matter through their minds at all, the less thoughtful probably imagine that the object of the designer of a radio set is to cram as much of his cleverness and ingenuity into it as possible. More mature consideration might lead them to realise that some forms of ingenuity are withheld from the cheaper articles in order to leave enough over to provide a more attractive specification for the *de luxe* models. In other words, the designer is constantly being obliged to compromise between his purely technical considerations and those of cost. But it may never have occurred to the customer or potential customer that one of the most perplexing problems of compromise that the designer has to face concerns his (the c. or p.c.'s) own intelligence.

### Not Complimentary

It is true that the advertiser of radio receivers and other modern conveniences is at pains to emphasise—rather tactlessly—that they are "foolproof." But perhaps people think of the foolproofness as an item in the specification that can be added to order, like the chromium plating. That is not so. The intelligence of the presumed user must be held in mind throughout the design of a receiver yet unborn. The difficulty is that intelligence is far from being a standardised quantity. And the average varies from year to year, always (curiously enough) becoming smaller with the passage of time. It is one of the paradoxes of modern civilisation that people know more and more about less and less (specialisation) and at the same time less and less about more and more (education).

Compare the motorist of to-day with his ancestor of 1903. In those days he knew all about the works of the car. He had to, in order to stand any chance of completing his journey. Now the car more or

less drives itself, so far as the mechanical side is concerned; which is fortunate, as it allows the occupant-in-charge to concentrate on lights, signs, beacons, policemen, and other external hazards. Similarly, a considerable degree of technical skill was necessary in order to establish wireless communication in the year 1911, when *The Wireless World* was founded, whereas now the tendency is to make it impossible for the listener to fail.

There are still a few possibilities, of course, particularly with battery-driven sets. It is still possible for the purchaser of a set, through inadequate intelligence, to plug the HT lead into the GB socket, and then ring up the shop to tell them that the thing won't work. And after that it is possible for him to ring up the shop a few weeks later, to tell them it has gone wrong, when the accumulator has run down for the first time.

The mains set user is more restricted. He is confined to such things as stuffing a piece of rag in the loud speaker to reduce the sound because he doesn't know about the volume control.

It might be thought that the designer has only to aim as hard as he can at making the operation of the set independent of intelligence during its lifetime. But although public intelligence in these matters is usually considered to be low, it is not quite zero; and it is quite possible to insult what residue there may be.

To revert to the motor illustration; very few drivers display indignation now because synchromesh gears are fitted, but even the bearer of an "L" plate might revolt at the sight of the words "WAY IN" prominently painted on each door.

Then there is the expense. It is galling for a manufacturer, who has had sad experience of service troubles due to unskilled operation, to provide his sets with elaborate foolproof devices only to find his trade being transferred to a rival who is getting away with a cheaper design that is just within the operative skill of the general public.

And there is reliability. A set is made simple to work by introducing complications. Ganged tuning condensers; ganged switches, with simultaneous waveband illumination; tuning indicators; automatic volume control; automatic selectivity control; automatic tuning compensation—all these are for the purpose of making it difficult for the user to arrive at an unfavourable combination of adjustments. As he is assumed to exercise no intelligent and watchful care to maintain an elaborate set, further complications are introduced to keep the others from going wrong. And so on, *ad absurdum*.

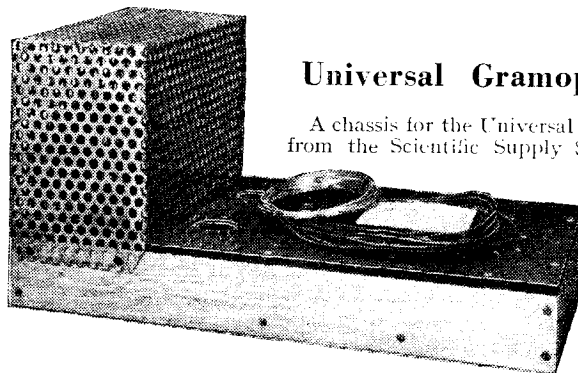
So the designer has to aim, not at something quite definite, but at a shifting target having the disconcerting property of being in more than one place at one time.

### Capable of Misuse

Take a specific example. Variable selectivity is a really good thing. It enables the listener to adjust his receiver to give the best reproduction possible within the prevailing condition of interference. The ordinary unintelligent listener, however, is not at all likely to read or digest the instructions, and is therefore fairly certain to tune in a station with the selectivity control at the inselective setting, then find out that there is interference, and (using his modicum of intelligence) turn the control into the selective position. As exact tuning in these circumstances is a sheer matter of luck, the chances are that the station he wants will disappear (for an explanation of this see works on the subject. I wrote one myself some time ago<sup>1</sup>). The designer, seeing this misuse of his ingenuity, devises a clutch to make it impossible to tune unless the selectivity is at its maximum. The listener who gets hold of this (being unintelligent) forces it and does in the whole mechanism, and the last state is worse than the first. Nothing short of automatic tuning correction, with two or three extra valves, can cope with this situation; and before we know where we are the set is several pounds dearer and several steps farther from the ideal of sweet simplicity.

That is the sort of thing the poor designer has to work out. Fortunately there is no dictatorship in this sphere; intelligences vary and so do designers.

<sup>1</sup> "Variable Selectivity," *The Wireless World*, October 11th, 1935.



### Universal Gramophone Amplifier Chassis

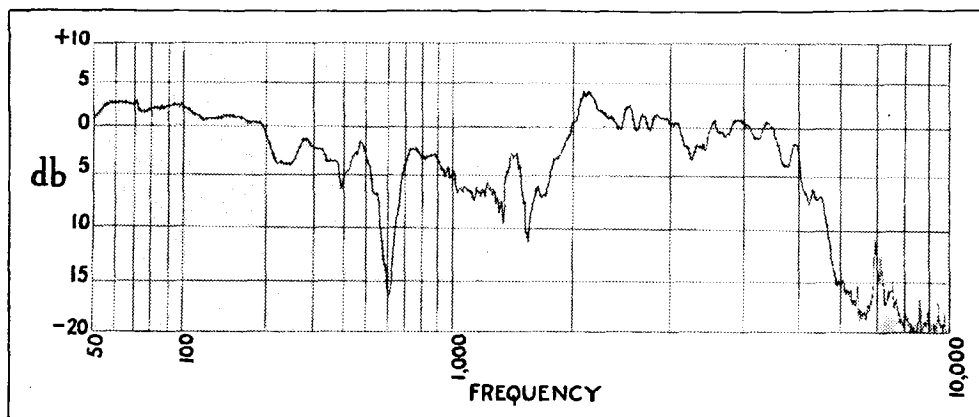
A chassis for the Universal Gramophone Amplifier has been received from the Scientific Supply Stores, Ltd., of 126, Newington Causeway, Elephant and Castle, London, S.E.1. It is constructed to specification and is provided with a bracket for the volume and tone controls, and also a perforated zinc cover. All holes are drilled, and it is priced at 16s. complete, including screws, wire, and systoflex sleeving.

# New Apparatus Reviewed

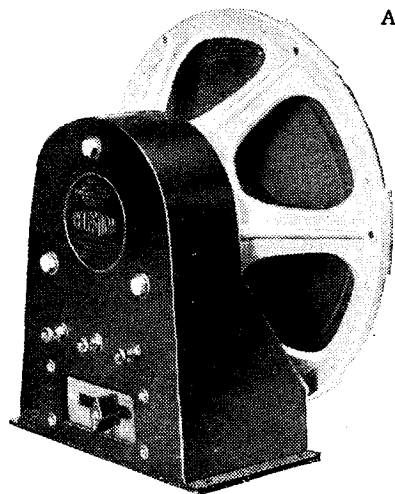
## CELESTION JUNIOR AUDITORIUM SPEAKER

THIS is the leading unit in the range of high-grade extension speakers which were made available to the public at the Show. It is notable not only for its powerful alloy magnet and massive cast framework, but also for the efficient matching system which makes it adaptable to any existing type of output stage. High and low impedance circuits are equally well matched by a sliding "volume control" incorporating a change-over switch. The slider is provided with an off position; a useful feature in an extension loud speaker.

The accompanying curve shows the output on the axis at a distance of 4ft. with an input of 1 watt. The diaphragm movement is free, which accounts for the absence of audible harmonic distortion at all normal volumes. In the upper register the response is well maintained up to 5,500 cycles, and



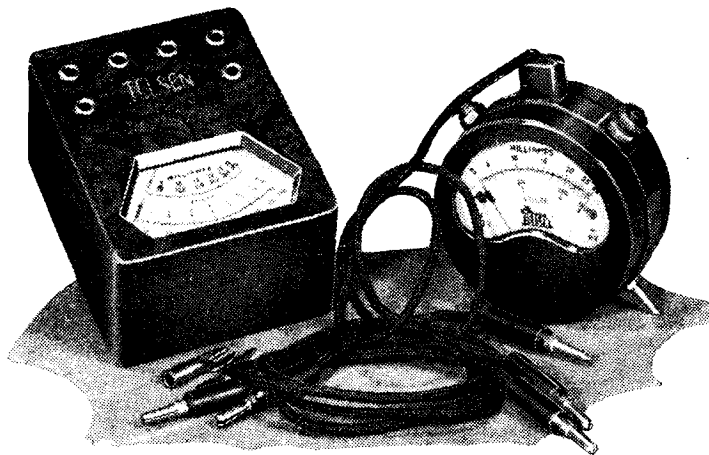
Axial response curve of Celestion Junior Auditorium speaker.  
Microphone distance 4ft., power input 1 watt.



this results in freedom from woolliness while cutting off those frequencies which constitute the foundation of background noise—a wise precaution in a speaker designed for universal application. The dip at 600 cycles is the only serious-looking deviation from an otherwise well filled out response curve, but in actual fact it has little or no influence on the general effect. The main trend of the curve is the thing to look for, and this bears out the impression gained by listening,

## Recent Products of the Manufacturers

Telsen AC-DC Multi-meter and three-range watch-type volt-milliammeter.



which is of a full-bodied response with excellent bass and sufficient top for most present-day receivers.

The price of the chassis is £6, and of the cabinet model £7 15s. Distribution and service is in the hands of Cyril French.

## TELSEN MEASURING INSTRUMENTS

THREE very useful multi-range meters are included in the current range of components made by Telsen Electric Co. (1935), Ltd. One is a universal pattern having five ranges, while the remaining two are watch-

type meters. They are inexpensive yet quite reliable instruments.

The universal meter has three voltage ranges, viz., 0.8, 0.16 and 0.240, and two current ranges, 0.30 and 0.300 mA respectively. A non-polarised moving-iron movement is embodied, so that it can be used either for AC or for DC measurements. Tests made show a quite high standard of accuracy on all ranges. The scales are clearly marked with black figures for voltage and red for current, while a knife-edge type pointer is fitted. Measurements made with this instrument were correct to about two per cent. at full scale, the error increasing slightly towards the low end, but nowhere was the discrepancy greater than five per cent. On the voltage ranges the meter resistance is 33 ohms per volt.

The Multimeter is housed in a brown bakelite case measuring 3½ in. x 2½ in. x 1½ in., and the price is 12s. 6d.

Of the watch-type meters only the three-range model was available for test. This provides facilities for measuring DC volts in two ranges, viz., 0.9 and 0.180, and currents up to 30 mA in one range. Its accuracy is quite good, being of the same order as the larger instrument, though the

spade-end pointer used does not lend itself to such close reading of the scale as does the knife-edge style. Nevertheless, this is a most handy instrument and costs 6s. 6d. The two-range meter of this pattern for voltage measurements only costs 4s. 6d.

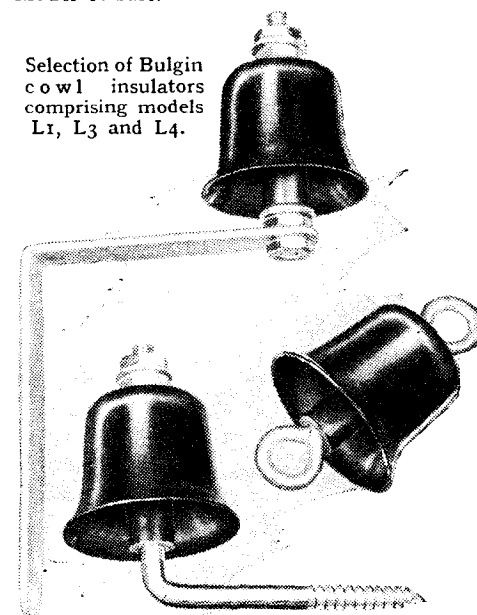
## BULGIN AERIAL EQUIPMENT

AMONG the aerial equipment made by A. F. Bulgin & Co., Ltd., is a new range of cowl insulators now available in seven different types. In one model, the Type L1, there is a small enclosed spark-gap incorporated in the centre limb to act as a lightning arrester, while still further protection can be obtained with the Model L2, in which a safety-gap as well as a fused down-lead connection is incorporated.

The moulded cowl that figures in all these new models, while possessing great tensile strength, is comparatively light and measures approximately 2in. long and 2½ in. across, and the surface path from one contact to the other is not less than 6½ in., while two-thirds of this is virtually protected from the weather.

Other models comprise a vertical stand-off insulator for screwing into woodwork, right-angle supports, also with wood screw fitting, and bracket models for lead-in wires and aerial stay-wires. No matter what the requirements may be, there is a Bulgin model to suit.

Selection of Bulgin cowl insulators comprising models L1, L3 and L4.



The safety-gap Type L1 costs 2s., the arrester model with down-lead fuse 3s. 6d.—incidentally, this embodies two cowls—while the stand-off and bracket models range in price from 1s. 6d. to 2s. each.

# Does Broadcasting

## A REGIONAL TOUR OF INVESTIGATION

*“REORGANISATION from top to bottom”—to quote the words of Mr. Edward Liveing, North Regional Director—sums up the situation at the Manchester headquarters of the B.B.C. In this article Mr. Baily gives vivid impressions of the changes which have taken place in the last two years and describes how the North Region has won the goodwill of listeners from Trent to Tweed.*

The horn section of the Northern Orchestra.



### X.—North Regional Headquarters

**G**OING to North Regional headquarters was like going back home. (I was personally associated with the B.B.C. here until 1932: here my first “Scrapbooks” were produced). . . . But how changed the old

home! Where are those musty old studios? Where are the boys of the old brigade? Of the fifteen principal officials eight are new since my time. But Edward Liveing is still Regional Director. He gave me a right hearty north-country welcome, and as we sat talking in his office



Mr. Edward Liveing, North Regional Director.

overlooking Manchester’s noisy Piccadilly he said:

“We have completely reorganised from top to bottom in the past two years.” He went on to speak enthusiastically of his new young men, and of the fresh ground he hopes to break with them, while I sat

stroking my silvery beard and feeling just like Rip van Winkle, especially when my old friend Lionel Harvey (engineer-in-charge) toured me round the building; there was hardly an inch of it I recognised.

It has been gutted and rebuilt. Modernisation and expansion have been the key-notes of recent policy, so that this is now the finest broadcasting unit outside of London.

The too-brilliant acoustic of the big

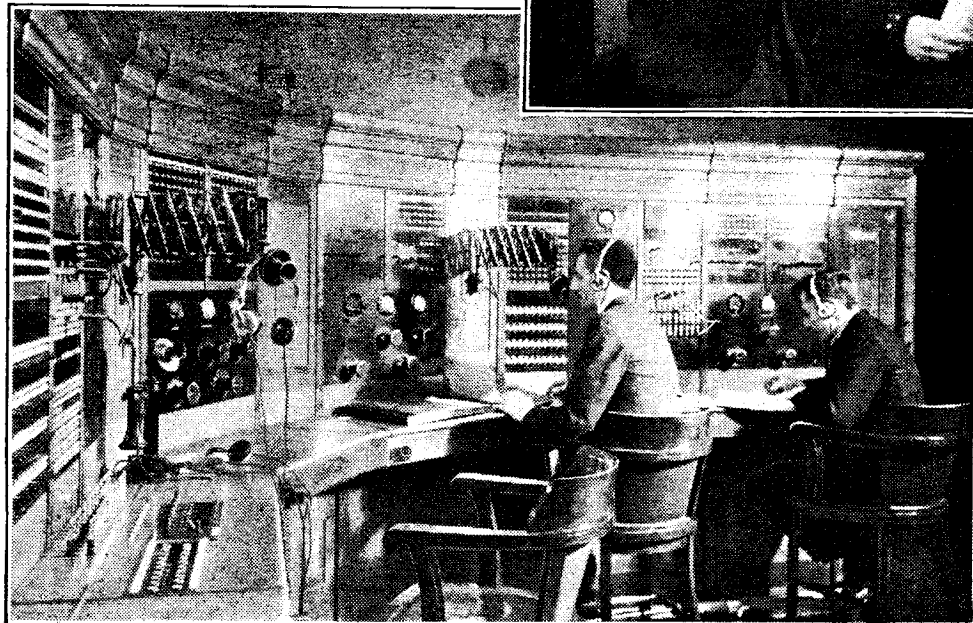
double-decker studio has been rectified by covering the walls with building board (previously they were covered with felt, plastered in turn with wallpaper); and all the smaller studios have similarly been brought up to date in acoustics and equipment, and redecorated to the startling “modernistic” designs of Raymond McGrath. There are now five studios altogether. No longer must producers make shift as we did in the old days when



The North Regional Children’s Hour has an individuality of its own.

(for instance) there were no echo rooms, so that when I prescribed a “trumpet fanfare with echo” in one of my shows the producer had to improvise a nearby corridor as an echo room, barring all traffic therein during rehearsals and transmission. Now there are two echo rooms.

Manchester’s Broadcasting House is a handsome six-storey building, the bottom floor occupied by a bank; until recently four storeys were used by the B.B.C., but



The Manchester Control Room is unique in possessing the original automatic control type of switchboard, which utilises both dialling and press-button operation.

# Serve Britain?

By LESLIE BAILY

the reorganisation has swallowed the fifth, and still more room is needed, so the new echo rooms are remote-control operated, three-quarters of a mile away, in the basement of another bank. The engineers of the O.B. Flying Squad, a unique Northern feature, also demanded storage room for



An assistant awaits his "cue" in the Effects studio.

their gear, so the basement of yet a third bank has been hired! Thus in Manchester, as in London, the B.B.C. is overflowing, and any future development (such as television) might necessitate a new building entirely, as the limit of extension would almost certainly be reached in Piccadilly.

When the B.B.C. originally went into this building in 1929 it was "super-modern"; within five years it was obsolete. How long will the new "super" finish, just acquired, take to tarnish?

Expansion of staff has been equally remarkable; the total is now 125 (61 programme and administrative, 29 engineers, 35 orchestra).

So equipped, the North Region sets out upon its work for 1936. There is a slight tendency to increase the amount of material on the Northern wavelength, but the main objective will be to improve the quality and range of programmes. Mr. Liveing is so keen for more "topicalities" (eye-witness accounts, commentaries, recordings of events) that he has appointed James Tovey to concentrate on this new angle; while I found that Archie Harding, Northern Programme Director (and one

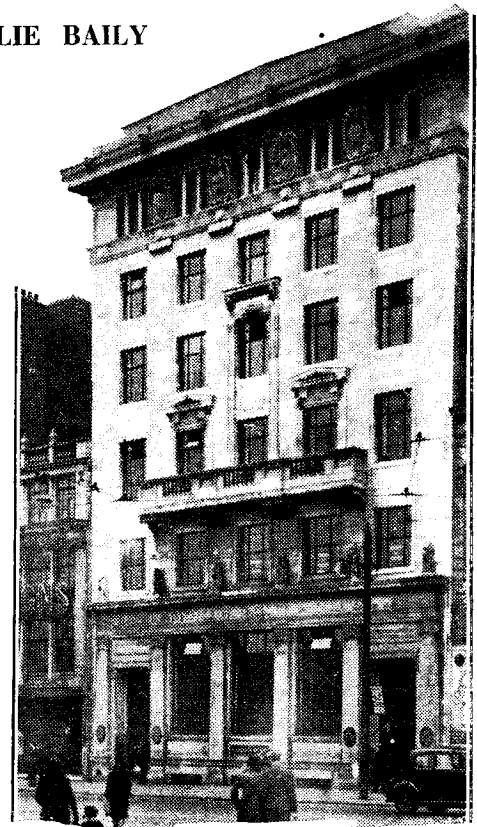
of the most brilliant originators in radio) wants to make a drive on the variety side—in March, for instance, he is sponsoring a "Music Hall" bill in the big studio.

Of all the provincial areas the North Region certainly offers the greatest opportunity for effective programme building, not only on account of its strongly characteristic yet infinitely varied life (from the Pleasure Beaches of Blackpool to the industrialism of Sheffield; from the Lancashire millgirl to the Lakeland shepherd), but because these characteristics are shared by such an enormous and "North-proud" family of people—over fourteen millions of them. The Scottish Region has strong local characteristics but a small population. The Midland Region is heavily populated, yet has a lukewarm individuality. The average Midlander looks upon London as the natural Metropolis, whereas the Northerner's hub of life is the North.

## Northern Prejudice

Northern "local" programmes, therefore, start off with the advantage of listeners' goodwill (and programmes relayed from London are often up against the North's hearty prejudice toward the facile smartness of the South!). Working under these propitious conditions, Mr. Liveing's men have achieved results in certain directions which are noteworthy.

The "Harry Hopeful" series, for in-



The Manchester headquarters in Piccadilly are situated over a bank.

stance, invented by D. G. Bridson, who has been appointed to organise features programmes, are unique in British broadcasting—and enormously popular.

And then there is the Flying Squad. So extensive are the North's outside broadcasting activities that two vans, manned by eleven engineers, are kept permanently on this job, while Victor Smythe (O.B.



The Northern Orchestra, under the direction of Mr. T. H. Morrison, viewed from an unusual angle in No. 1 studio.

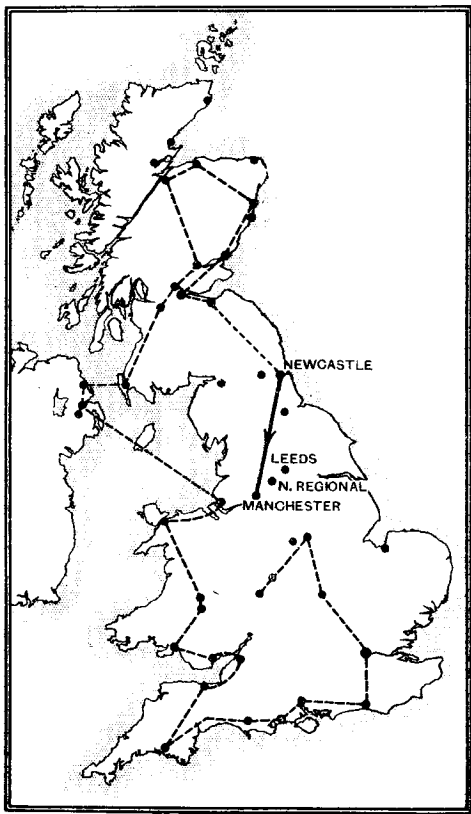


**Does Broadcasting Serve Britain?—**

organiser) travels 24,000 miles a year in his own car.

In the summer, the peak period, the Flying Squad averages eighty-five O.B.s a month, with concert parties, seaside orchestras, music halls, and sporting events. In the winter some of these are replaced by symphony concerts from Liverpool, Manchester, Leeds, and other towns.

Theatre relays, for which the North is famous, continue all the year round at the rate of about one a week. Fifteen theatres are permanently wired. In this particular sphere the North sets an example not only to other Regions but to London. Its success is due partly to the technical experience of Harvey and his colleagues and partly to the genial relationship established by Smythe with theatre managers, who hold special rehearsals and even rearrange their programmes for the B.B.C.'s



The route already covered by Mr. Baily in his tour of investigation.

benefit. They have no objection to microphones showing on the stage (as have some London theatres), and often they allocate a stage box for the control engineer (who thus sits in full view of the stage) and for Smythe, who broadcasts his commentary from this advantageous position.

One could, on the other hand, quote directions in which the B.B.C.'s achievement has fallen short of the North country listener's anticipations. In the past the reasons for failure have been mainly shortage of staff and finance. In the present it may still be shortage of staff, despite recent expansions. If Manchester's Broadcasting House were a self-contained unit I might consider it now to be just adequately staffed, but these men are supposed to cover the entire North of

England. Smythe is not the only traveller. Harding, Bussell (drama), Morrison (music) and the others are often to be seen dashing off to the satellite studios at Leeds and Newcastle.

Incidentally, among the Manchester staff I found only two who were with the original 2ZY at Old Trafford in 1922—Smythe and Vernon (Harvey's assistant, formerly engineer-in-charge of the old Liverpool station).

The control room at Manchester is particularly interesting because it was here that, six years ago, the B.B.C. first tried out an automatic control switchboard, instead of the old-time manual plug-and-jack system. The original automatic board at Manchester utilised both dialling and press-button operation; the latter proved most efficient, and has since been adopted at every other station, but the original switchboard is still in use at Manchester, with modern improvements.

Landline connection with London can be made alternatively *via* Birmingham or *via* Leeds. The National and North Regional programmes both pass through the Manchester control room, then over eighteen miles of underground cable up into the Pennines, to Moorside Edge, where stand the transmitters which serve this vast and sturdy province, the North of England.

(Next Tour: Moorside Edge and Leeds).

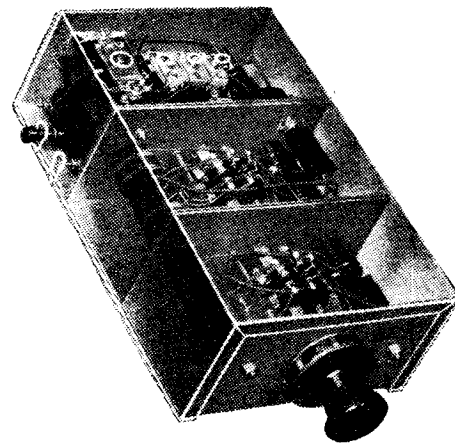
## B.T.S. COIL UNIT

for

### Imperial Short-wave Six

A COMPLETE coil unit for *The Wireless World* Imperial Short-wave Six has been submitted for test by British Television Supplies, Ltd. It complies with the specification in every detail and due regard has been given to all the points mentioned in the description relative to it.

It is a well-made coil assembly and can be confidently recommended; the price is £3.



Coil unit for Imperial Short-wave Six made by B.T.S.

# Random Radiations

By "DIALLIST"

## A Sad Evening

ALL who were listening to the evening programme on the Nationals on Monday, January 20th, must have felt a foreboding that sad news was to come. The Pageant of Steam, commemorating James Watt, came to a rather hurried end at 9.25 and we were told that there would be an interval of five minutes. The half-hour struck, but still stations remained silent. Minutes passed and we realised that this was no ordinary delay. At 9.35 we heard that all stations, including those of the Empire services, were joining London for an announcement to be made at 9.38. Anxiously we waited, knowing and dreading what it must be. Then came the sad words, "The King's life is moving peacefully towards its close." After that, nothing more but the quarters from Big Ben and repetitions of the announcement until 12.15 a.m., when we learnt that the King had passed peacefully away at a few minutes before midnight.

## The King to His People

The death of King George the Fifth affected his people more deeply and more intimately than that of any previous monarch has ever done. Much as they were loved, Queen Victoria and King Edward the Seventh had no means of personal contact with the great body of their subjects. Though hundreds of thousands of people saw them, very few ever heard their voices. But King George spoke to us in our homes in his Christmas messages and at other times. His great wish was to be the Father of the Great Family of Empire. He saw in wireless a sure means of helping him to attain this end, and he made full use of it.

He spoke to us as "his friends," and by his simple direct words, spoken straight from his heart, he made us his friends. The strain of giving those Christmas messages must have been terrible—think what it must mean to speak to an audience of millions in every corner of the world—yet it was a duty that he undertook gladly, even when he was tired and worn after the twelve strenuous months of his Jubilee year. The utter sincerity of his last message makes it a memory to be treasured by all who heard it.

## Interest in Wireless

The late King took a great interest in wireless, and the best receiving set that could then be made was installed at Buckingham Palace in the very early days of broadcasting. This was a rather remarkable set, made to special designs. It must have been one of the earliest examples of the "transportable," requiring, as it did, no outside aerial. It did not work from a frame, as might have been expected. Instead, the collector system was formed by two large metal plates which were fixed one near the top and the other near the bottom of the cabinet. Naturally its range was not great, but this was not necessary since it was intended entirely for the reception of the old 2 LO, whose aerial was at first on the roof of Marconi House, and later on top of Selfridge's building in Oxford Street. That set served its day, and as broadcasting conditions changed it was replaced from time to time by the most up-to-date receiving equipment.

**Random Radiations—****Are Short Waves Worth While ?**

A LONDON reader takes me to task for having suggested recently in these notes that those who were becoming bored with medium- and long-wave broadcasting might be cured by a judicious dose of short-wave reception. He tells me that he has lately had his set "brought up to date" by the addition of an extra tuning band covering wavelengths from 17 to 50 metres. After several days' trial he has formed the opinion that the short waves are not worth listening to. Noisy background, the necessity for patient and critical tuning, distortion, heterodynes and high-speed fading are amongst his objections.

Well, I cannot agree that "several days" are sufficient for sampling the short waves or to come to such definite conclusions. One may strike a bad patch, lasting quite a while, when conditions are like those described. But every short-wave enthusiast knows that, uncertain though the short waves may be, there are many occasions when transmissions from very great distances come through with real entertainment value. I am rather at a loss to understand why my correspondent should have to indulge in tuning of the hairsbreadth type. In the modern superhet, equipped with band-spreading devices, the tuning is not as a rule very critical unless one is trying to get hold of some faint whisper of a signal. My own opinion remains unchanged that short-wave listening is very well worth while, and I still firmly believe that the all-wave receiver is the set of the future. The views of other readers on the subject will be welcome.

**The I.D.A.**

A KIND Bradford reader sends me a copy of the January issue of the "Globe Circler," the official organ of the International D-Xers' Alliance, known for short as the I.D.A. It is an interesting little publication, hailing from the United States. It is not printed from ordinary type, but from blocks made from type-written sheets. The information it contains is most useful, for it covers not only short-wave, but medium-wave reception at great distances and gives one all the latest news about the most important stations of the world and their doings.

**European Reception in America**

Everyone knows that medium-wave stations both in the United States and in South America are regularly received in Europe; but are European stations heard in America? And, if so, which of them? Off hand, one might have been inclined to say that the odds were heavily against such reception. Owing to the difference in time between the two continents the great majority of European stations close down before 8 p.m. Eastern Standard Time—the local time of the States nearest the Atlantic seaboard. Further, there are so many stations at work in America that it would not seem possible for Europeans to be received within broadcasting hours. The "Globe Circler" devotes a special section to this subject, and I was interested to find that Rome, Radio-Toulouse, the Poste Parisien, Rennes, Bordeaux, Fécamp and Nice P.T.T. were all shown as "star" transmissions in the United States. In addition, Lyons, Paris P.T.T., Marseilles P.T.T., Milan, Turin, Trieste, Leipzig and Frankfort appear as stations frequently heard. The curious point is that just as we have to sit up for medium-wave U.S.A. stations, so the American en-

thusiast must sit up for Europeans. He gets them between 1 o'clock and about 3 o'clock in the morning, which means that he hears the programmes transmitted from 6 a.m. by Europe's early-bird stations. At first I was surprised and a little disappointed to see no British stations in the list; but the fact that they don't start up until 10.15 a.m. (which is 5.15 a.m. in the Eastern States) explains at once why this should be.

**A Triumph for Wireless**

THE rescue of Ellsworth and Hollick-Kenyon, the airmen who had been missing in the Antarctic since last November, may be placed entirely to the credit of wireless. The research ship *Discovery II* was directed by the radio link to look for the lost airmen. *Discovery II* made as straight as she could for Little America, where the two castaways were soon located. It is interesting to note that though *Discovery II* has only a half-kilowatt transmitting plant her messages were mostly picked up direct by the Portishead station at a range of 9,000 miles. Only a few had to be relayed from New Zealand.

But though wireless was responsible for

their rescue, a breakdown in their own wireless set was the reason why Ellsworth and Hollick-Kenyon lost touch with the rest of the world. It seems that a defective switch put their transmitting apparatus right out of action.

**Still Not Solved**

Switches, particularly those of the wave-change type, are still too prone to give out in wireless sets of all kinds. The curious thing about switches is that though something like perfection has been reached in types intended to deal with large and comparatively large currents, those designed for very small currents still leave much to be desired in the matter of reliability. At many wireless factories switches are the subject of constant research and experiment—but they still share with the volume control the doubtful honour of being amongst the most vulnerable of components. One of the curious points is that a particular type of switch which has come through a machine-administered ordeal of a million "flicks" with flying colours may break down in a matter of weeks when fitted to a broadcast receiving set.

# Standard Signal Generator

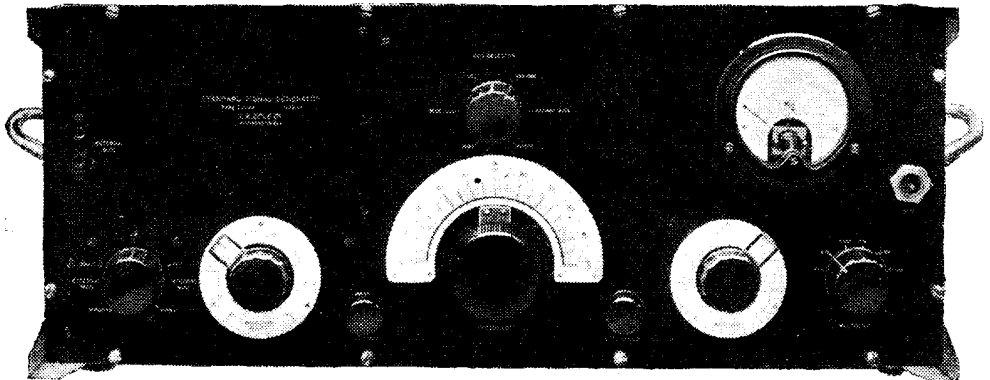
## An AC-operated All-wave Test Set

A NEW standard signal generator, type TF144/A, covering a frequency range of 90 kc/s to 20 mc/s, and thus providing a short waveband, has been introduced by E. K. Cole, Ltd., for operation from the 50 c/s supply mains. It is entirely self-contained, being fitted with coils for all ranges, selected by a panel switch, and 400 c/s modulating equipment.

The accurate determination of the modulation depth has been effected by the adoption of a method of measurement which is independent of the HF swing on the oscillator anode, and also of the frequency characteristic of the modulating system.

volt, the attenuator comprising a step control, or multiplier, and a constant-impedance slide wire. Its output impedance is low at all settings of the attenuator, and the indicated HF voltage may be relied on to within plus or minus 10 per cent. throughout the entire frequency range up to 15 mc/s.

Direct and indirect radiation *via* the power supply leads is effectively suppressed, even at the highest radio frequencies, by triple screening, and a receiver with a sensitivity of one microvolt may be operated alongside the generator and from the same power supply without affecting the accuracy of the measurements.



New all-wave signal generator introduced by E. K. Cole, Ltd.

The depth of modulation is read directly from a calibrated scale giving continuous variation from 5 to 80 per cent.

Frequency modulation is less than 50 c/s over the greater part of the range, so that errors introduced from this source when testing broadcast receivers are negligible.

The radio-frequency output is continuously variable from one microvolt to one

The generator is supplied with dummy aerials for broadcast and for the short waveband respectively, screened cable, calibration charts, and mains lead.

The overall dimensions are 29½ in. by 10½ in. by 10½ in. The price is £95, and the instrument is finished in black crackle lacquer and grey cellulose enamel standardised by E. K. Cole, Ltd., for their precision test apparatus.

# Letters to the Editor

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

## Ultra S.W. Broadcasting

I WAS recently privileged to attend a meeting at which Sir Noel Ashbridge, Chief Engineer to the B.B.C., opened a discussion upon the suitability of ultra short wavelengths for broadcasting purposes.

I was both amazed and disappointed to hear that Sir Noel placed little or no importance on the possibility of utilising the additional benefits which the ultra short waves confer for the development of high fidelity broadcasting, particularly with regard to the lengthening of the useful frequency band, and to the extension of volume contrast.

It would seem that while the B.B.C. have shown excessive zeal in forcing upon the public items of modern music and literature in an effort to raise the level of the public mind, little effort has been made to train the listening public to cultivate an ear which demands reproduction bearing as close a resemblance as possible to the items broadcast.

If Sir Noel's opinion is an indication of the future trend of the B.B.C. policy, it is unfortunate that broadcasting in this country should be in the hands of a monopolist body whose complacent self-satisfaction provides an effective bar to further progress.

I would add that I am fully aware of the difficulties involved, such as the limited service area, inconsistency of reception, limitation imposed by land lines and interference both from motor cars and medical apparatus.

London, S.W.20. H. KINGHAM.

## Recording

AS the subject of control of broadcast transmissions has been discussed to some length in your columns, I venture to draw attention to a matter concerning recordings of B.B.C. broadcasts, which are sent to this and other British Dominions, for transmission by local broadcasting concerns.

It appears that the different modulation levels on the recording are the result of the control of the original broadcast transmission. The amplitude range of a broadcast transmitting channel is much wider than the average disc recording. As a consequence, the modulation on the recording often descends near to, and even below, the background level. Speech, in particular, could be recorded at a level at least 15 db. above the usual. These remarks apply to commercial recordings as well. Much as I admire the artistic and frequently unexpected methods by which the various recording companies' technicians succeed in squashing the 60 db. range of a large orchestra into the meagre 25 db. or so of the recording, the lower amplitude levels do not appear to be raised sufficiently in modulation. Consequently, the background is frequently painfully close to the modulation, especially if the frequency characteristic of the reproducing equipment suffers from high-frequency peaks tending to produce an accentuation of the noise level.

It would appear that, in an attempt to produce as much contrast as possible between the high amplitude level of the full orchestra, and the comparatively low levels of individual string or woodwind sections of

the orchestra playing alone, the recording is modulated at too shallow a level in the latter cases. On the other hand, "attack" is frequently taken out by rapid attenuation of peaks on the part of the control engineer. With a little care it should be possible to record these peaks in their natural state, though with sacrifice of what is known popularly as sufficient "contrast" in the music. In the absence of a suitable method of lowering the noise level of disc recordings, this appears to be justified.

Another plea is for a wider frequency characteristic. As at least one firm now markets a type of reproducing point suitable for wide-range reproduction, a raising of the present high-frequency cut-off, which does not seem to be above 6,000 cycles, would be welcomed by all users of high-quality reproducing equipment. Even so, it appears that the present system of disc recording suffers from inherent faults that make it unsuitable for wide-range purposes, and that some radically different system, such as the hill-and-dale or contour system developed by the Western Electric and Bell Telephone Companies, and used for sound-film purposes, should be adopted by the gramophone companies, at least for recording of the more important musical works.

Otherwise a film recording system em-

ploying the Klangfilm-Tobis Kerr-Cell system of light modulation, and with reproducing equipment as described in the issue of *The Wireless World* dated November 29th, would be suitable. L. F. FRY.

Cape Town, South Africa.

## Contrast Expansion

I CANNOT plead guilty to having missed Mr. Hartley's point; to suggest this might cast some reflection on his perfectly straightforward letter.

One does feel, however, that a much better contrast could be devised within the limits imposed by neighbourly consideration (if no other). The intensity at the listener's ear in any part of a large hall might, or not, approach the level we desire in a living room, but a more successful illusion than at present is an ideal to aim at. We are in the hands of the B.B.C., nothing much can be done until it gives some definite rule for us to work on, which implies automatic control from the start.

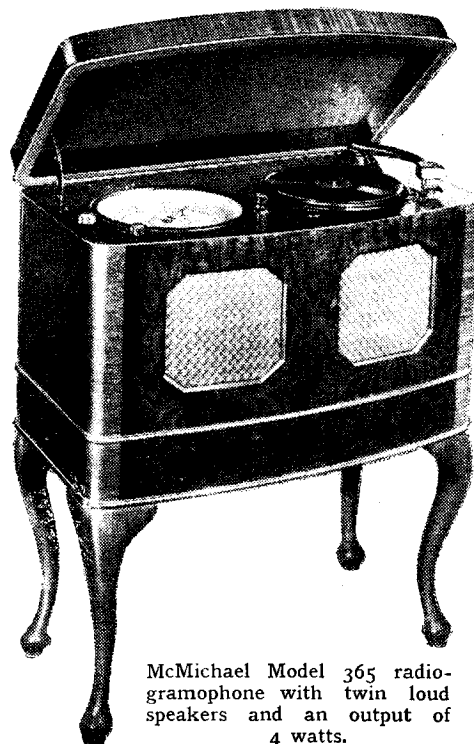
I might add that the use of moving-coil earphones does, in a measure, narrow the question so far as it makes possible undistorted reception at a maximum intensity bearable to the listener, and the lowest level is only limited by background noise.

Ware, Herts. GERALD SAYERS.

## McMICHAEL MODELS 365 AND 135 AC-DC

### A New Radiogramophone and a Universal Version of the Twin-Speaker Superhet

THE "stereophonic" arrangement of twin loud speakers is again employed in the Model 365 radiogramophone just



McMichael Model 365 radiogramophone with twin loud speakers and an output of 4 watts.

released by McMichael Radio, Ltd. Larger loud speakers than usual are used, however, in this new instrument, and the output stage of the set is designed to deliver an undistorted output of 4 watts.

The superheterodyne circuit comprises a triode-pentode frequency changer, IF amplifier, double-diode-triode second detector and a pentode output valve. In the design of the HF coupling uniformity of gain over the tuning range has been made a special feature.

A bow-fronted walnut cabinet on curved legs houses the chassis and loud speakers. It is given a piano-finish by a new process and may be subsequently treated with ordinary wax polish if desired. The gramophone turntable is housed under the lid and is flood-lit. It is balanced by a 10-inch diameter tuning dial which is recessed below the surface of the panel and is illuminated in red and green according to the waveband in use. The set is for AC mains only and the price is 28 guineas.

The McMichael Model 135 twin-speaker superhet. is now available as a universal receiver for AC-DC mains. It is similar in specification to the AC model and incorporates the same giant dial tuning, but includes an interlocked safety back, double-pole fuses and dual mains filters in conformity with the requirements of universal mains operation. The price of the new model is 15 guineas, and a stand to match the cabinet is available at 2 guineas extra.

# BROADCAST

By Our Special  
Correspondent

## BREVITIES

### As the Clock Ticked

NOT the least impressive feature of the broadcasts on that night when millions of listeners were sorrowfully awaiting the last sad news from Sandringham was the sound of the clock tick interval signal. The effect was inexpressibly melancholy.

Quite rightly the officials considered that the sound of Bow Bells at such a time would have had a jarring effect, hence the reversion to the original signal. The sound was not, as one paper put it, "the solemn heavy 'tick-tock' of Big Ben."

### Vigil at Broadcasting House

Sir John Reith and his immediate assistants had not left Broadcasting House or its precincts for three days. Stuart Hibbard and Harman Grisewood shared the announcing, and with them on constant duty were Mr. Cecil Graves, the Programme Director; Mr. Wellington, Presentation Director; and his assistants, Mr. King-Bull and Mr. Godfrey Adams.

### Sir John Reith as Announcer

Some listeners considered that it was the duty of the Head of the broadcasting service to read the last bulletin. The chiefs of the Programme Department held this view, and this was why Sir John Reith came to the microphone for the final sad announcement.

### "Mr. Hall King"

THE Prime Minister's memorable broadcast address on January 21st was widely disseminated over the American networks and was even relayed by short wave. I picked it up clearly on 2XAF, Schenectady, and afterwards heard the announcer introduce "Mr. Stephen Hall King" broadcasting from a studio in London to the people of the United States.

### Continental Interest

Mr. Baldwin's address was also picked up and recorded by Poste Parisien, Heilsberg, and other Continental stations, and subsequently relayed following their late night news bulletins. The circumstances were, of course, exceptional, but the practice raises the question of copyright.

If the B.B.C. had paid the Prime Minister for the broadcast, the Corporation would have been strictly within its rights in claiming copyright fees from the foreign broadcasting organisations.

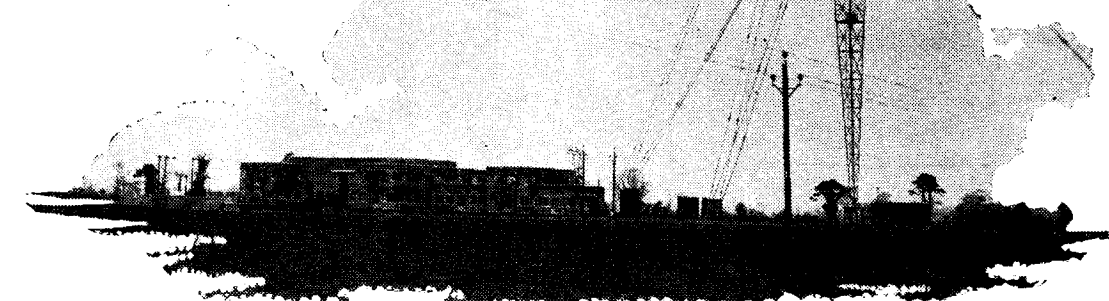
### A Super Receiving Station

The time may come, with continued improvements in transmission and reception, when stations may be able to utilise each other's programmes without any difficulty whatever, and it might then be necessary to institute some kind of international programme clearing house for assessing copyright dues.

The equipment would have

*[Photo: "Northern Wireless"]*

**BLARIS.**—The latest view of the new Northern Ireland station, which is to be opened by His Grace the Governor on March 20th.



to include an elaborately fitted receiving station—a dozen Tatsfields rolled into one—combing the ether day and night in search of a new kind of "pirate."

### B.B.C. to Make Amends

IT is well known that theatre managers, actors, and others are able to take out insurance policies to guard against possible financial loss due to a national calamity such as the death of the Monarch. Broadcasting artistes, however, have not availed themselves of these opportunities, and quite a number have suffered through the recent cancellation of programmes. But the loss is only temporary, for I understand that the B.B.C. is taking all possible steps to engage these artistes for subsequent programmes.

### B.B.C. Programmes in Morocco

A TOURIST has written to the B.B.C. telling of an experience when he recently visited one of the Lords of the Atlas Mountains in North Africa.

While the great chief, wrapped in his silk *burnous*, invited him to take a seat at a low table where tea perfumed with mint was served, a retainer switched on a beauti-

fully made wireless receiving set in a corner of the apartment, and a concert from London was heard.

The chief, with a sudden rapturous smile, exclaimed: "Radio is the best ambassador of Occidental civilisation to this country."

Critics of the B.B.C. please note.

### The Empire Orchestra

BRITISH listeners have had few opportunities to hear Eric Fogg and the B.B.C. Empire Orchestra—one of the most versatile of all broadcasting orchestras, for they play symphony concerts at one hour and accompany a variety programme the next.

Now, however, they are broadcasting regularly on Wednesdays at 12.15 p.m. in the National programme. The concerts also go out on Empire Transmission 2, which is intended for Western Australia, Malaya, China, and part of India.

### Double-Piano Feature

THOSE Viennese musical magicians, Rawicz and Landauer, who play two pianos with the unanimity of a four-handed giant, have already won a large following among British listeners, so it is good to learn that they are to return to the

microphone on February 10th in a special feature programme.

Rawicz and Landauer play jazz and classics with equal brilliance; their double-piano arrangements of well-known pieces are compositions in themselves.

### The Orchestra on Tour

WE shall miss the B.B.C. Symphony Orchestra and Dr. Adrian Boult while they are on their forthcoming Continental tour to Paris, Zurich, Vienna, and Budapest.

Before setting off for Europe the Orchestra will appear twice in the provinces. The first visit will be to Leicester on March 11th.

### Should it be Stagshaw?

THE B.B.C. engineers are incurable romantics. North Regional is situated at Slaithwaite (or Slowit), but the engineers preferred the high-sounding "Moorside Edge." Scottish Regional, near Slamannan, they call "Westerglen." And now North East Regional, as near as no matter to Hexham, is to be dubbed Stagshaw.

I am not surprised that Mr. Stanelli is annoyed. Nice-minded people at Broadcasting House changed his "Stag Parties" to "Bachelor Parties"; they may do the same with Stagshaw.

# Recent Inventions

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

## PUSH-PULL AMPLIFIERS

**A**N automatic balance is maintained between the direct currents flowing in each of a pair of push-pull valves, in spite of any initial mis-matching. A resistance is included in each anode-cathode circuit, and the resultant voltage-drop created by the excess current in one or other of the valves is used to apply a compensating negative voltage to the grid of that valve. The filament supply to each valve is separately regulated.

R. O. Wise (Assignor to Bell Telephone Laboratories). No. 1998479.

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## WIRED WIRELESS

**A**LTHOUGH proposals have previously been made to utilize existing telephone lines for distributing carrier-wave signals, the practical frequency limit in the case of overhead lines has been taken to be roughly 30,000 cycles, whilst for ordinary cables it is roughly 8,000 cycles per second, before the attenuation losses become too high.

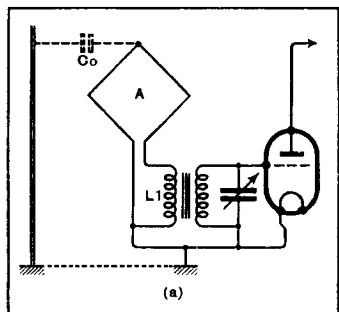
The inventor points out that in the case of a balanced line, as now used for trunk telephony, although attenuation losses increase with frequency, the level of "interference" falls at the same time. Since the effective amplification is limited, in practice, by the level of interference present, it follows that a greater degree of amplification can be applied to high-frequency waves than is possible with low frequencies.

This principle is applied in carrier-wave working, both for television and speech, over telephone cables, to give an effective range of from 14 kilometres on a wavelength of 600 metres to 55 kilometres on a wavelength of 4.500 metres, the signals being transmitted at a low energy level, and being received free from interference and fading.

J. J. Laub. Convention date (Germany) February 18th, 1933. No. 437263.

## ELIMINATING INTERFERENCE

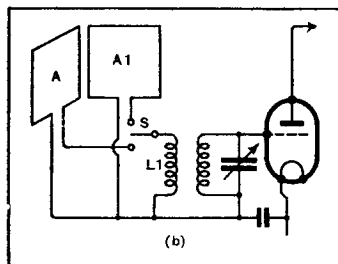
**W**HEN a frame aerial is used in order to minimise local interference, there is usually present some capacity-coupling



Pick-up of interference.

(indicating at  $C_0$  in Fig. a), it may be with an electric supply-line  $L$  or some gas or water pipe which is the seat of inductive disturbance. The invention relates to means for getting rid of this residual effect.

Usually the value of the pick-up coupling  $C_0$  will be of the order 20 cm., and the remedy lies in using a low-impedance coupling between the frame aerial and the receiver. For instance, if the coil  $L_1$  has an inductance of 1,500 cm., then for a signal wavelength of 500 metres the impedance of  $C_0$  will be some 2,400 times greater than that of the



Non-directional frame aerial system.

coil  $L_1$ , so that most of the voltage drop due to the undesired pick-up occurs across the capacity  $C_0$  leaving only a very small fraction to affect the receiver.

Since the directional effect of a single frame aerial may handicap broadcast reception, two frames  $A, A_1$  (Fig. b), set at right-angles, will generally be used in combination. If both are left constantly in circuit, one is provided with a phase-changer (not shown). Alternatively, a switch  $S$  enables that particular frame which gives the best reception to be used alone.

Telefunken Co. and P. Hermannspann. Application date April 13th, 1934. No. 436948.

## PHOTO-ELECTRIC CELLS

**T**HE direct response of a P.E. cell to incident light is increased by feeding the initial output to a valve amplifier, which is back-coupled to a third or control electrode inserted between the cold cathode and anode of the P.E. cell. The amplified voltage is fed back in phase with the original photo-electric emission, and by accelerating the electrons serves to increase the number which reach the anode. The process is cumulative, and serves to improve the signal-to-noise ratio.

A. J. McMaster (assignor to G.M. Laboratories). No. 1984312.

## EXPANDER FOR VOLUME-RANGE

**I**N order to restore the original contrast in volume, particularly when reproducing from a gramophone disc where the sound intensities are contracted in the

process of recording, part of the pick-up voltage is rectified to produce a biasing potential, which is then applied to the amplifying valves so as to intensify strong signals more than weak. This expands the dynamic range of the reproduction in the direction of the loudest signals.

J. Hays Hammond. No. 2008704.

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## ULTRA SHORT-WAVE VALVES

**F**OR short-wave working it is desirable not only to reduce the length of all valve-connecting leads to a minimum, but also to connect the lead to the centre-point of a comparatively long electrode, such as the spiral grid of the valve, so that the natural wave will be as short as possible.

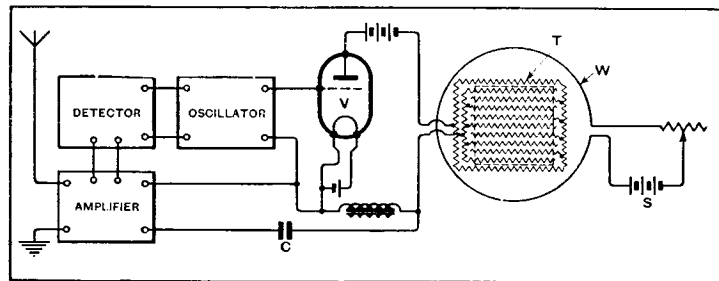
According to the invention, the leads to the grid, anode, and filament are arranged mutually at right-angles in three dimensions and the grid lead is taken directly to the centre of that electrode through an opening formed in the cylindrical anode.

Radio-Akt. D. S. Loewe. Convention date (Germany) March 13th, 1934. No. 437924.

## SCANNING SYSTEM

**S**CANNING for television is effected by setting up a spark-discharge between two parallel rail-electrodes, and then forcing the spark to travel rapidly along the length of the rails, which are folded into a zigzag track so as to cover the whole area of the picture.

In the receiver shown, the detector controls a synchronising oscillator coupled to a valve  $V$ , which feeds into the zigzag electrodes  $T$  the voltage required to set up a spark-discharge from one electrode to its neighbour. As soon as the spark is formed it is swept rapidly over the full length of the zigzag track, from one end to the other, by a magnetic field applied from an outside winding  $W$ , which is



Scanning system in which a zig-zag path between parallel electrodes is traversed by a spark discharge.

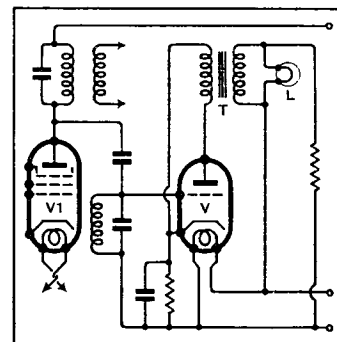
energised from a source  $S$ . The moving spark thus traverses the whole of the viewing screen  $T$ .

Meanwhile the full carrier-frequency output from the amplifier is also fed through a condenser  $C$  and the valve  $V$  to the rail electrodes or viewing-screen, where it is used to modulate the intensity of the spark-gap so as to reproduce the light-and-shade effects of the transmitted picture.

Communication Patents Inc. Convention date (U.S.A.) 21st June, 1933. No. 437602.

## TUNING INDICATOR

**T**HE critical point of resonance is indicated by the flashing of a pilot lamp, which is fed from the AC mains supply and is controlled by the varying impedance of a valve shunted across its input transformer.



Valve-controlled tuning lamp.

As shown, the filament of the flash lamp  $L$  is shunted by a transformer  $T$ , one coil of which is in the plate circuit of the control valve  $V$ . Before a station is tuned in, the control valve  $V$  takes sufficient current to keep the lamp dimmed. But as the signal grows in strength, the bias applied to the valve  $V$  from one of the IF amplifiers  $V_1$  of the superhet increases its impedance to the point where the plate current sinks practically to zero, and the reactance of the transformer-winding falls off accordingly. The lamp  $L$  then takes the full supply, and glows brightly.

Murphy Radio, Ltd. and I. Davies. Application date October 5th, 1934. No. 437481.

## AERIAL COUPLING

**I**T is often desirable to feed a wide range of frequencies to a single aerial, or conversely to supply energy of constant frequency to different aerials having different impedance characteristics. An

aerial coupling unit is accordingly made up of variable tuning-elements, which are designed so as to allow the transmitting valve to work at all times into a pure resistance load, although the aerial may not be in tune with the transmitted frequency. In addition the value of the resistance load can be adjusted so as to balance the internal impedance of the output valve at the transmitter.

I. J. Kaar (Assignor to General Electric Co.). No. 1998322.