

The Wireless World

THE PRACTICAL RADIO JOURNAL
26th Year of Publication

No. 875.

FRIDAY, JUNE 5TH, 1936.

VOL. XXXVIII.

No. 23.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Waterloo 3333 (50 lines).
Telegrams: "Ethaworld, Sedist, London."

COVENTRY: Hertford Street.

Telegrams: "Autocar, Coventry."
Telephone: 5210 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham."
Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Iliffe, Manchester."
Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.

Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates :

Home, £1 1s. 8d. ; Canada, £1 1s. 8d. ; other
countries, £1 3s. 10d. per annum.

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

U.S. Television

Facing Problems Unknown Here

NOT to be left too far behind in the introduction of television, an enquiry into the future of a television service is now being started in the United States of America. The Communications Commission will hear evidence from all parties concerned, very much on the same lines as was done in the case of our own Television Committee, which was appointed by the Postmaster General.

Although America seems in no hurry to introduce a television service for listeners, this does not mean that that country is neglecting technical development, and it may be expected that when a decision is reached America will show herself as progressive as any other country on the technical side. It is the economic aspect of the television service which frightens America much more than the technical problems, and Americans' estimates of the cost of television broadcasts are somewhat staggering. An official of the Communications Commission said recently that if they tried to make their own motion pictures exclusively for television transmission it would cost at least \$200,000 for each production, and that on top of that the broadcasting time and leasing of telephone lines for a two-hour national hook-up might run into another \$100,000.

Altogether America seems to have no illusions about the cost of successful television programmes and it is realised that to launch a service in America necessitates doing it on a very much bigger scale than is necessary initially here. American broadcasting is almost entirely supported by advertisers, yet no advertiser is likely to pay for a television programme until he is satisfied that he has a visual audience already equipped with television re-

ceivers. It would seem that the outstanding contrast between this country and America in the matter of starting a television service is that there they will not be able to find the money for programmes until the receivers are distributed, whereas here the programmes will be produced first and the audience will be built up gradually.

Refinements in PA

Uses for AVC

AUTOMATIC volume control for speech amplifiers is one of those refinements which is far too slow in finding its way into general use. Its value in maintaining quality, especially with the smaller equipments where overloading can easily occur, cannot be overestimated.

Speakers unfamiliar with the natural shortcomings of speech amplifiers do not realise that when they raise their voices in emphasis they will, as likely as not, make themselves unintelligible to their audiences as a result of overloading and consequent distortion.

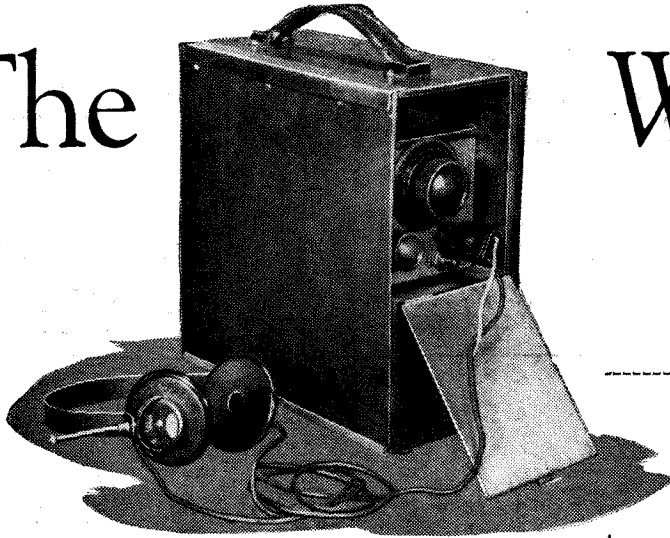
So much for that aspect of automatic volume control, but now another use of the principle is being applied where the effect is practically the opposite, since an increase in input to a microphone is made to increase the output from the PA amplifier and loud speakers. The arrangement depends upon the use of a control microphone, placed, for instance, in the back of a cinema so that the noise of hand clapping or other sounds which might interrupt and make the speech from the loud speakers inaudible, will have the effect of producing a voltage which can be applied to the amplifier to increase its output automatically.

We would suggest that the idea offers great possibilities for political speakers where the efforts of opponents to drown the speaker's voice could be applied to amplifying it instead.

The Wireless World

SELF-CONTAINED, SENSITIVE

By W. T. COCKING



EVERYONE must at some time have felt the need for a receiver which is small and light enough to be truly portable. The *Holiday Portable* is of this type and, in addition to being sensitive, it operates entirely from dry batteries, which are readily obtainable.

THERE are many occasions upon which the need for an inexpensive and truly portable receiver is felt, not to form the only set, but as an adjunct to the main equipment. At holiday times in particular, many wish to be able to listen to running commentaries or to the news bulletin. The size and weight of the ordinary set make it useless for such cases, and the difficulty of erecting a suitable aerial is often prohibitive.

By far the greatest difficulty in designing a portable receiver lies in the batteries, for they are likely to prove the largest and heaviest items in the entire apparatus. Their life must be reasonably long, and they must be readily obtainable. These two considerations at once rule out many types, for although extraordinarily small HT batteries are available, they are relatively expensive and short-lived; furthermore, and this point is perhaps the most important, they are stocked by comparatively few retailers. In designing this receiver, therefore, it was decided to use standard batteries, which are readily obtainable anywhere; the odds are that even the cycle-repairer-cum-grocer-cum-post office at Little Puddleton on the Marsh keeps a supply.

For the same reason it was decided

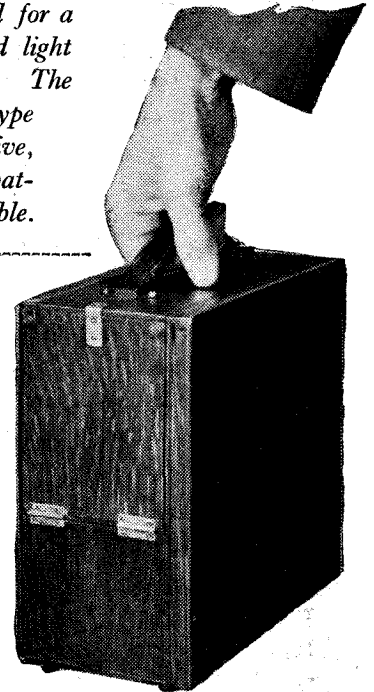
The receiver with the 'phones plugged in ready for operation.

to use a dry battery instead of an accumulator for the LT supply. A new battery can be purchased anywhere, but it is not always so easy to get an accumulator recharged; in any case it cannot be recharged at a moment's notice. The dry battery is, moreover, lighter.

No attempt was made to design the set for loud-speaker operation, for this would have necessarily resulted in an increase in both the dimensions and the weight, while the current drain on the batteries would have been much greater. For headphone use no more than 60 volts HT is needed, and as the total current consumption is only 2.5 mA., a standard type of battery costing 3s. 9d. will give many months' service. The LT battery requires more frequent renewal, but is likely to last at least several weeks with the intermittent operation which will usually be its fate. The current drain on it is about 150 mA. and a 4.5-volts battery is used—the type specified being listed at 1s. 3d.

Since a frame aerial is necessary to ob-

When closed for carrying, the phones fit into a special compartment



tain portability, and its dimensions must be quite small, a high degree of amplification is necessary if a satisfactory performance is to be secured. The number of valves and tuned circuits which can be employed is limited by the space available and by the permissible current consumption. It is consequently necessary to use a fairly high degree of low-frequency ampli-

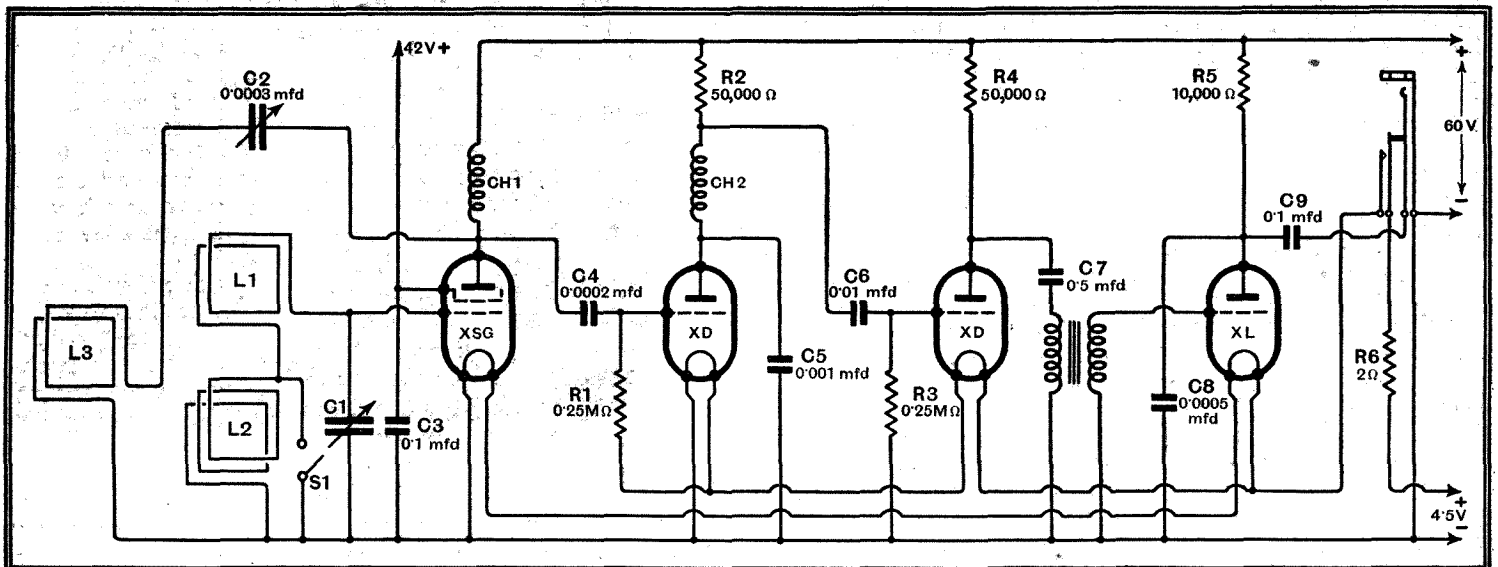


Fig. 1.—The complete circuit diagram shows that the four valves have their filaments wired in series-parallel.

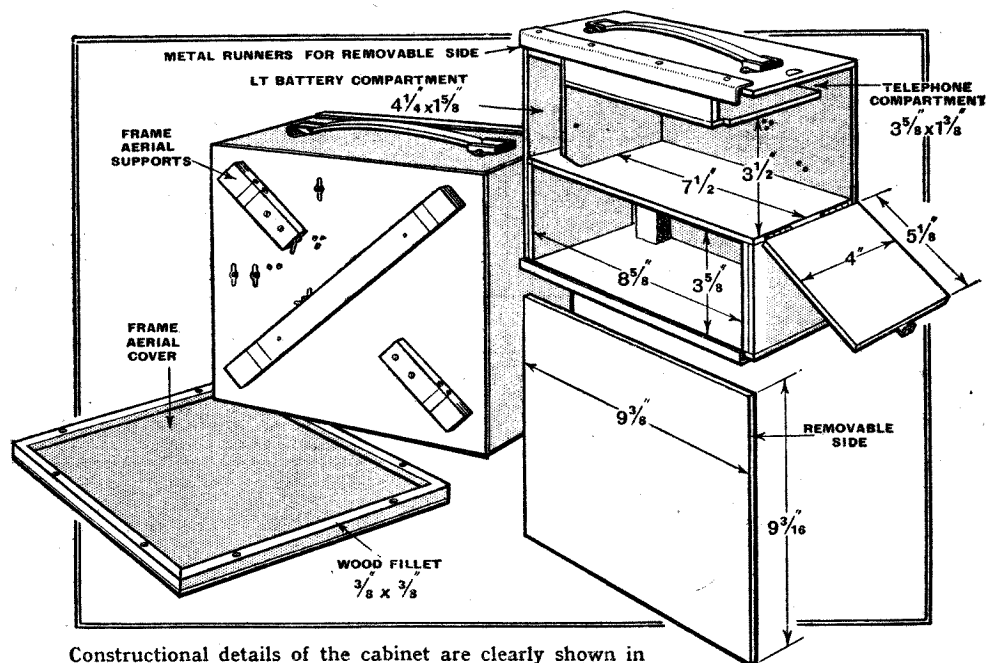
Holiday Portable

AND COMPACT

fication, and to make full use of the properties of reaction. HF amplification is not, of course, impossible, but it is quite difficult to make good use of tuned couplings, partly because of the space which they occupy, but chiefly because of the difficulty of obtaining adequate screening and maintaining stability. The position is made harder by the absence of any earth.

The Circuit Adopted

In this receiver, an aperiodic HF stage is accordingly employed. The amplification obtainable on the medium waveband is, of course, considerably lower than would be the case if a tuned coupling were used, but the gain is still worth while, and as reaction is more effective without an extra circuit, a higher degree of sensitivity can be obtained than one would at first expect. Much higher amplification is obtainable on the long waveband owing to the higher impedance of the coupling,



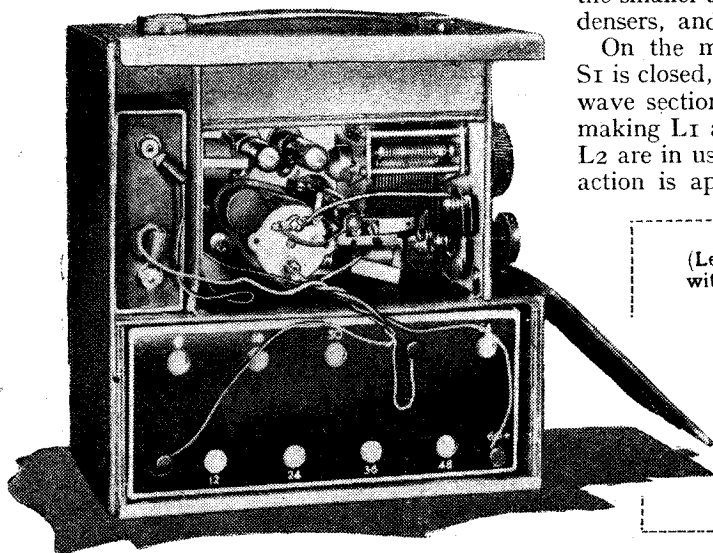
Constructional details of the cabinet are clearly shown in this drawing.

with a slow-motion drive. It can consequently be set much more precisely than the smaller and lighter solid dielectric condensers, and so renders tuning easier.

On the medium waveband the switch S_1 is closed, thus short-circuiting the long-wave section L_2 of the frame aerial, and making L_1 alone operative. Both L_1 and L_2 are in use on the long waveband. Reaction is applied to the frame from the

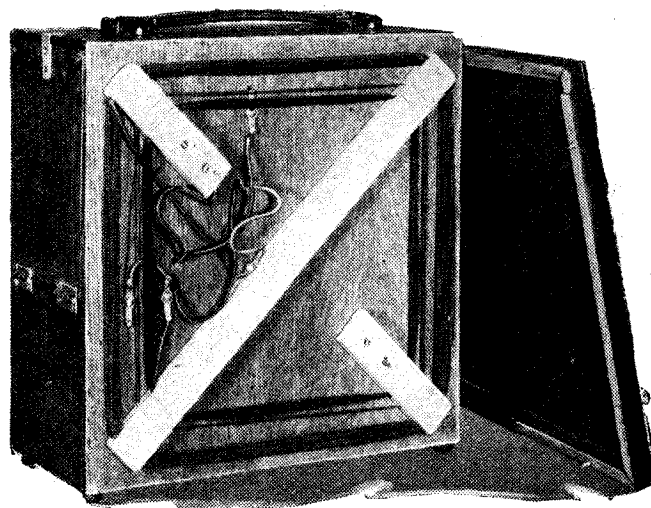
condenser C_6 and a 0.25-megohm grid leak R_3 .

Transformer coupling is used to the second and last LF stage, the transformer primary being resistance-capacity fed by R_4 and C_7 , having values of 50,000 ohms and 0.5 mfd. respectively. The telephones, which are connected in the anode circuit of the second LF valve, are also resistance-capacity fed, the resistance R_5 having a value of 10,000 ohms and the condenser C_9 a capacity of 0.1 mfd. This is done largely in order to make insulation of the 'phone jack unnecessary, but it also leads to some reduction in the anode



(Left) A view of the receiver with the side removed showing the chassis and batteries.

(Right) The frame aerial is wound on the side of the case and covered by a false lid.



and this is advantageous, for it is just at these wavelengths that the frame aerial is least efficient.

The complete circuit diagram of the receiver is shown in Fig. 1, and it will be seen that the four valves are arranged as an HF stage, a grid detector and two LF stages. The valves employed are the Hivac midget class, and each consumes about 75 mA. at 2 volts for the filament. The HF valve is of the screen-grid type, and is operated with 60-volts anode and 40-volts screen potentials; zero grid bias is used. The frame aerial is tuned by the variable condenser C_1 and, contrary to usual portable practice, this component is a good quality air-dielectric condenser

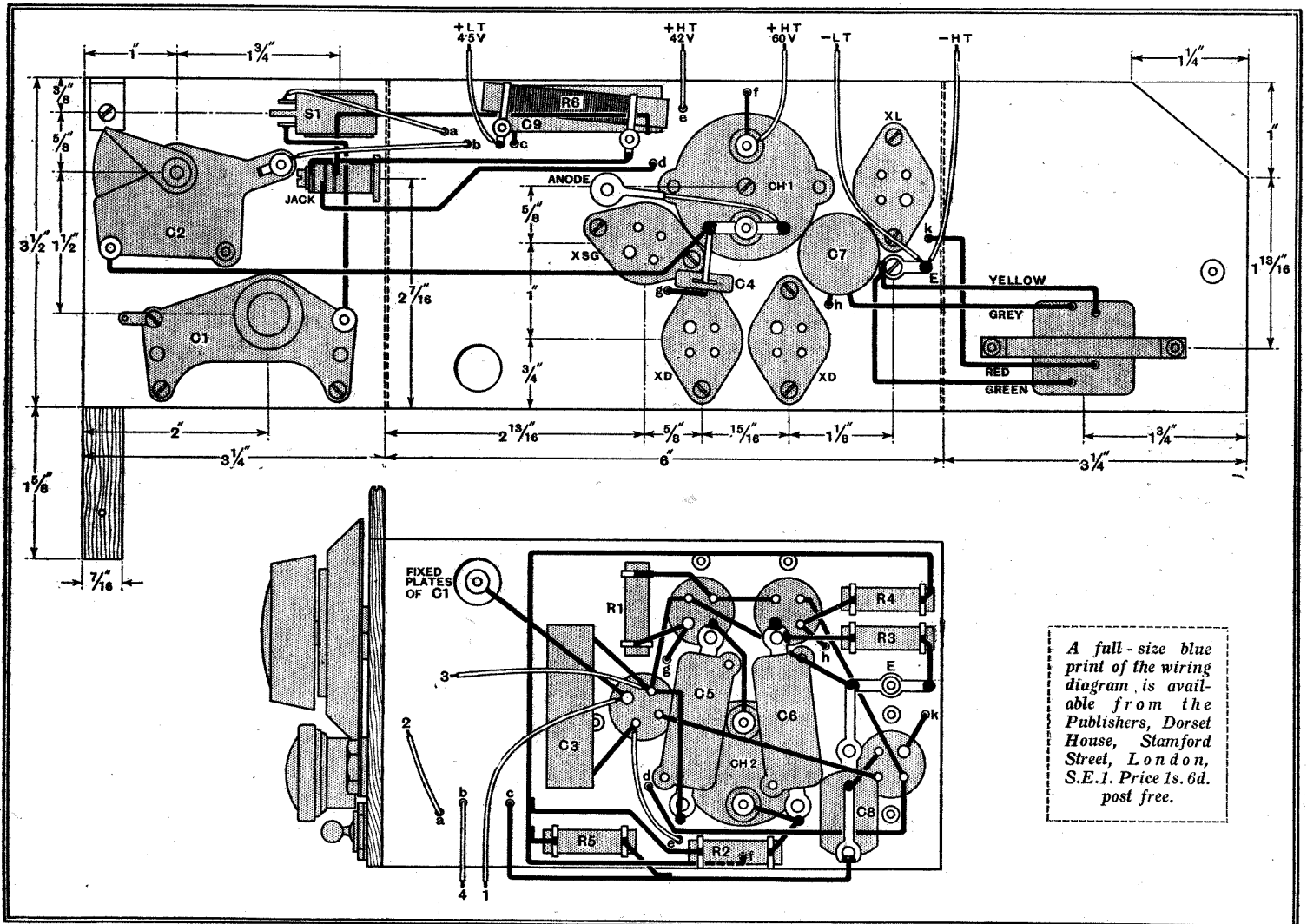
anode circuit of the HF valve by means of the coil L_3 , which is wound between the medium- and long-wave sections. Control is afforded by the 0.0003 mfd. condenser C_2 , which is of the solid dielectric type.

An HF choke Ch_1 forms the principal element in the coupling between the HF and detector valves. The detector is a triode, having a 0.0002 mfd. grid condenser C_4 with a 0.25 megohm grid leak R_1 returned to the positive leg of its filament. In its anode circuit another HF

current consumption of the last valve.

The filament and grid-bias connections are unusual and lead to considerable simplification. The detector and first LF valves have their filaments connected in

RECEIVER ASSEMBLY AND WIRING



The layout of components and the wiring are shown here. A light metal chassis is used.

series, and the detector is connected to negative LT. The grid leak R3 of the LF valve is also joined to this point, and this valve consequently receives the filament supply of the detector—2 volts—as grid bias. A similar course is adopted for the second LF valve, for the filament of this valve is wired in series with that of the HF valve. The HF stage receives no bias, but this is unimportant in view of the small signal amplitudes at this point, and the second LF valve has 2 volts applied to it.

By adopting this series-parallel connection of the valves not only is the need for a bias battery avoided, but the total LT requirements are brought to a more reasonable figure for operation from a dry battery. Instead of the valves requiring 2 volts at 0.3 ampere, they need 4 volts at 0.15 ampere. A 4.5-volts battery can con-

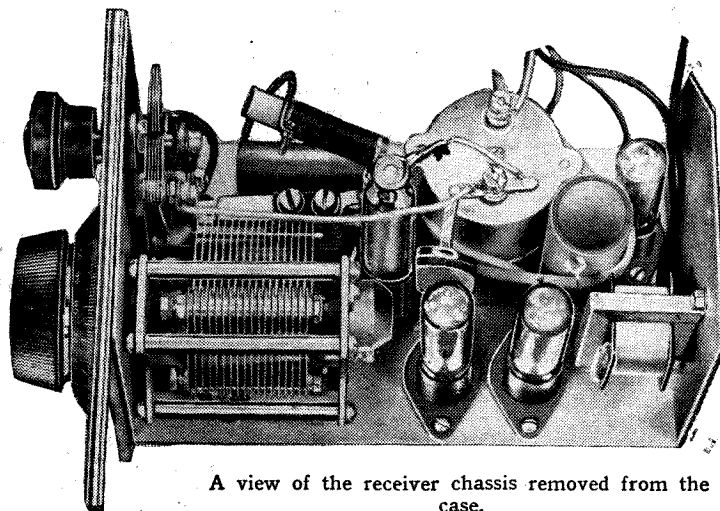
sequently be used with a 2-ohms series resistance R6 to prevent the filaments being overrun when the battery is new.

The controls are four in number and comprise the tuning condenser C1, the reaction condenser C2, the wavechange switch S1, and the telephone jack. This

set on, while its withdrawal automatically breaks the filament circuit.

A metal chassis is used for the receiver, and as there is little room to spare, alternatives to the specified components can be recommended in few instances. The two HF chokes are mounted one above the other, and should be bolted together before mounting on the chassis. These components also serve to support the coupling condenser C7 which is tied to them by thread. The condenser C2 must be insulated from the chassis by an insulating washer. Most of the wiring is carried out on the under side of the chassis where many small components are also accommodated. There is but $\frac{3}{4}$ in. in depth available here, so that care must be taken to follow the plans exactly. No difficulty should arise, but it is important to make sure that the resistances do not come into contact with the metal chassis. For safety it might be wise to wrap the ends of such components with rubber tape.

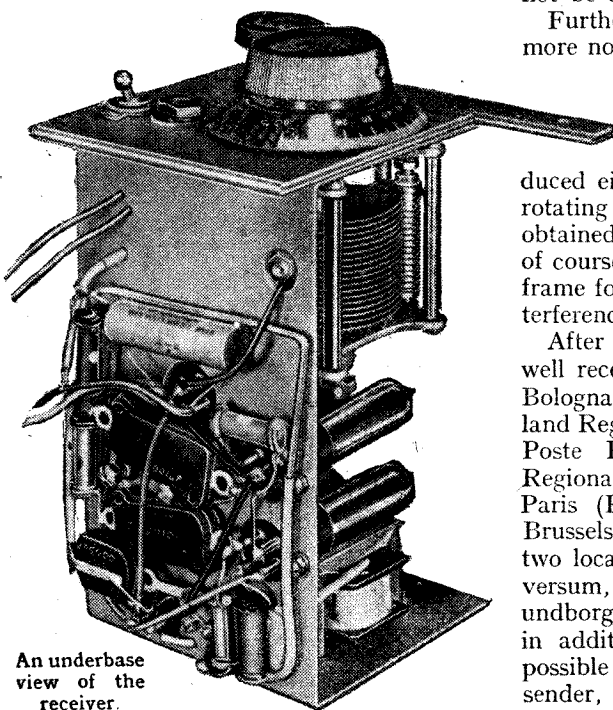
The cabinet is constructed with a false side in which the frame aerial is concealed. The dimensions and winding data are given in the drawings, and all three coils must be wound in the same direction. Long leads should be attached to the set and passed through the appropriate holes in the back of the set compartment; the



A view of the receiver chassis removed from the case.

last is only a control in the sense that it has incorporated with it the on-off switch. The insertion of the 'phone plug not only connects the 'phones but also switches the

The "Wireless World" Holiday Portable—chassis can then be slid in place and secured, and the leads joined to the ends of the frame windings. Compartments are



An underbase view of the receiver.

also provided in the cabinet for the two batteries, and above the chassis for the 'phones. Strips of rubber sponge should be placed at the bottom of the battery compartments so that the batteries are spaced as far as possible from the aerial.

In operation tuning is carried out by C1, but reaction will also require fairly frequent adjustment, particularly if signals are weak. The loudest signals will be obtained when the frame aerial is pointing towards the desired station, but the maximum is not very critical, and good results can generally be obtained from all stations but those which lie in a direction nearly at right angles to the frame. This can often be made use of to eliminate interference from a near-by transmitter, for if the frame be turned to the critical position giving minimum signal from the unwanted station many stations on near-by wavelengths can be received.

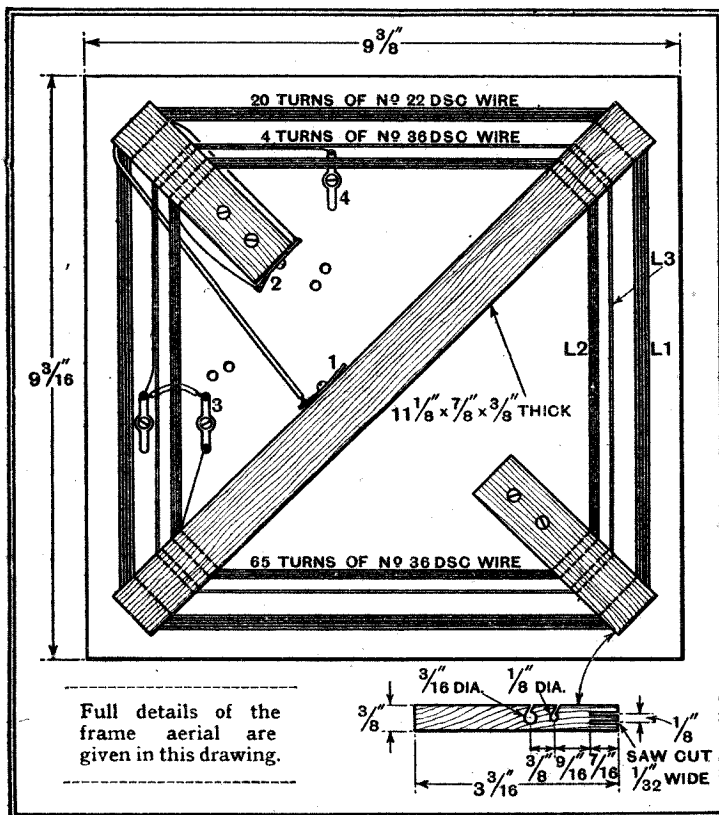
The receiver gave a very good account of itself on test. In a steel-framed building in London it proved possible to obtain very good reception of the two trans-

mitters at Brookmans Park, Droitwich and Radio-Paris, as well as the weather reports from Daventry. North Regional could just be heard in daylight, but could not be called an intelligible signal.

Further tests were carried out under more normal conditions in North London, and it was then found that London Regional was too strong even with reaction at minimum, and volume had to be reduced either by mistuning or, better, by rotating the set so that less pick-up was obtained. The spread of this signal was, of course, considerable, but by setting the frame for minimum pick-up no serious interference was experienced.

After dark, the following stations were well received on the medium waveband: Bologna, Lille, Frankfurt, Fécamp, Midland Regional, Northern Ireland Regional, Poste Parisien, Breslau, Berlin, West Regional, Leipzig, Scottish Regional, Paris (PTT), North Regional, Cologne, Brussels, Budapest, in addition to the two locals. On the long waveband, Hilversum, Radio-Paris, Luxemburg, Kalundborg and Daventry were all excellent, in addition to Droitwich. It was even possible to hear signs of Deutschlandsender, but the interference from Droitwich was severe.

Many of the stations, particularly those on long wavelengths, were strong enough to render critical tuning unnecessary, but on some of the weaker stations some skill



Full details of the frame aerial are given in this drawing.

in tuning was undoubtedly needed, and the adjustments were really critical. This is unimportant, however, for the set is not intended for the reception of such stations; the fact that they can be received, however, does give some indication of the sensitivity of the receiver.

LIST OF PARTS

- 1 Variable condenser, 0.0005 mfd. slow motion drive, C1 Polar 25M
- 1 Reaction condenser, 0.0003 mfd. with knob, C2 Polar "Compax"
- Condensers**
 - 2 0.1 mfd. tubular, C3, C9 Dubilier 4513
 - 1 0.5 mfd. tubular, C7 Dubilier 4517
 - 1 0.01 mfd., C6 Dubilier 670
 - 1 0.001 mfd., C5 Dubilier 670
 - 1 0.0005 mfd., C8 Dubilier 665
 - 1 0.0002 mfd., C4 Dubilier 665
- Resistances**
 - 1 10,000 ohms 1/2 watt, R5 Erie
 - 2 50,000 ohms 1/2 watt, R2, R4 Erie
 - 2 250,000 ohms, R1, R3 Erie
 - 1 2 ohms 10 watts, R6 Bulgin AR2
- 2 HF Chokes, Ch1, Ch2 Bulgin HF8
- 1 LF Transformer Bulgin LF33
- 4 Valve holders, 4-pin Clix "Midget"
- 1 3-spring automatic jack B.T.S.
- 1 Telephone plug B.T.S.
- 1 Toggle switch, on/off, S1 Bulgin S80T
- 3 Wander plugs Ealex
- 2 Spade ends Ealex
- 1 Plug-top connector Belling-Lee 1175
- 1 HT battery, 60 volts Ever Ready "Winner"
- 1 LT battery, 4 1/2-volts Ever Ready 3-Cell 126
- 1 Pair headphones B.T.S.
- Chassis B.T.S.
- Cabinet Peto-Scott
- Miscellaneous:— Scientific Supply Stores
 - 1 oz. No. 36 DSC and 2 1/2 ozs. No. 22 DSC wire for frame aerial; 2 lengths systoflex; wood, wire, screws, etc.
- Valves, 1 XSG, 1 XL, 2 XD Hivac

Le Roi S'Amuse

THE B.B.C. Amateur Dramatic Society's performance of Ian Hay's "The Sport of Kings" at the Fortune Theatre (last week) had all the assurance and professional competence of a number one touring company. Sir John Reith's appearance in the role of Bates, the butler, added just that relish which is necessary to turn a normally enjoyable evening into a memorable occasion. His was no mere walking-on part, but a real character study of the dual personality of the butler, formerly bookmaker's clerk—perspicacious and full of dry humour. It would seem that the B.B.C. has yet another charge to answer, that of depriving the theatre of a talented natural actor.

Sound effects play an important part in this piece and Mr. Cecil Barker produced some really convincing crowd noises "off" with very simple equipment. Traffic noises recorded on special records were mixed with the output from a microphone surrounded by a small crowd of "supers" somewhere in the labyrinth under the stage. An amplifier with a 12-watt push-pull output feeding a single Magnavox "Duode" gave all the volume necessary, during the action of the play, but two speakers were used for relaying incidental music during the intervals.

Brunswick All-wave Receivers

THREE new all-wave receivers for AC mains, a table model, a console and a radio gramophone are announced by Brunswick, Ltd., 1-3, Brixton Road, London, S.W.9. All models incorporate the same chassis, the basic circuit of which comprises a signal-frequency HF amplifier, frequency-changer, two IF stages, diode detector and pentode output valve. Three wave ranges are provided, 16-49, 175-550 and 1,000-2,000 metres. The prices of the table model and console are 18 guineas and 22 guineas, while that of the radio-gramophone, which incorporates a record changer, is 39 guineas.

Radio in France

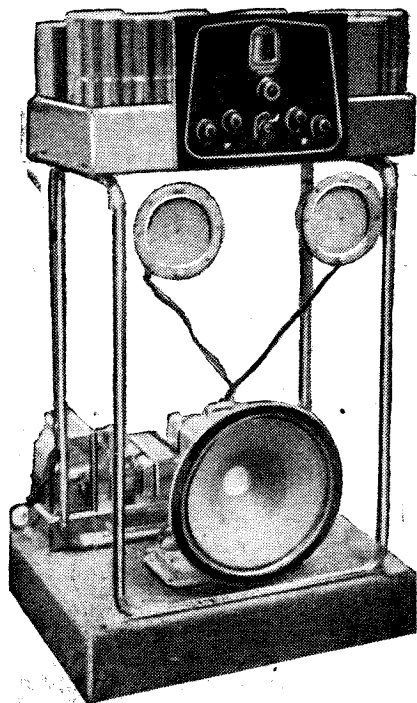
The "Salon de la T.S.F."
and the
"Foire de Paris"

By E. AISBERG
(Editor, *Toute La Radio*)

THE present year is rich in French wireless exhibitions. In February there was a show reserved strictly for the trade, where technicians and professional designers could examine new products and component parts and choose their requirements for the new season's sets.

From May 16th to June 2nd the usual annual Paris Fair took place, and wireless occupied quite an important section there, whilst at the same time—or, to be exact, from May 20th to June 2nd—the thirteenth Salon de la T.S.F. was held in the Musée Citroën. A second Salon will take place, as usual, at the end of September, in a section of the Grand Palais.

The curious circumstance of two exhibitions covering the same ground taking place concurrently is explained by the divergence of views held by the two radio associations, the S.P.I.R. (Syndicat Professionnel des Industries Radio-électriques)



Twenty-three valve receiver with two loud speakers for high-note reproduction and one for low-note reproduction. Below can be seen the 25-watt power amplifier. This is the American Scott receiver.

and the C.S.I.R. (Chambre Syndicale des Industries Radioélectriques), which hitherto have organised annual exhibitions together.



An example of very modern style (Olympic Radio).

It is the S.P.I.R. which has organised the Salon which has just taken place, whilst the C.S.I.R. has followed its tradition and will organise its own exhibition in September. The S.P.I.R., in its efforts, has been guided principally by the desire to reduce the length of the "dead" season in wireless, which in France is practically from January to August. When it is considered that radio provides a living for 50,000 persons in France, it is easy to understand how desirable it is to reduce the contrast between the over-intensive activity of the four working months and the slack time of the rest of the year. By organising the exhibition early it is possible for suppliers to settle their requirements at leisure for the approaching season, and for manufacturers to carry out their production to time. The future will show whether the Salon in May can bring about a reduction in length of the "dead" season and serve to distribute more evenly the period of construction of the 700,000 receivers which are sold annually in France.

Meanwhile, radio has attracted an enormous public, both to the Foire de Paris and to the Salon, where there were nearly 160 stands. No sensational invention to revolutionise technique has come to light,

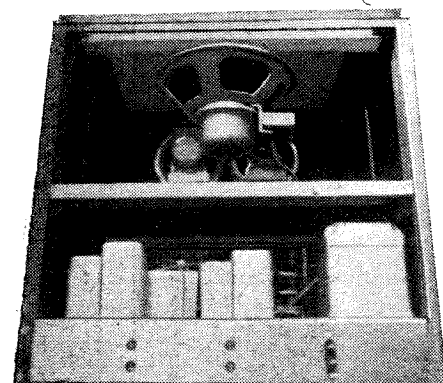
but it is interesting to observe how evolution has taken place with the introduction of some interesting novelties.

Television

France is offering television receivers to the public for the first time, and by no less than seven firms (Clarville, Emyradio, Férisol, Grammont, Loewe (who import from Germany), Radio-L.L., and S.S.M.-Radio). All these receivers are designed for reception of the French transmissions with 180 lines and 25 pictures a second. Tuning is fixed or variable between 7 and 9 metres. Time-bases employ thyratrons, except in the case of Clarville, where the designer uses a hard valve. The dimensions of the cathode-ray tube screens are from 9.5 to 32 cm., the latter being the size of the Cossor tube used in the Clarville receiver.

A superheterodyne is used for the wireless side, with an intermediate frequency of 6 megacycles; the price of receivers is of the order of 5,000 to 6,000 francs. In addition, S.S.M.-Radio sell their receiver, which goes by the name of "Visiodyne-Baby," in component parts at 1,600 francs.

Broadcast reception technique continues to develop in step with valve progress. France is still divided into two camps—



A Lemouzy receiver employing three loud speakers, one for low-note reproduction and two for high.

American technique and European technique. This year American technique is represented by metal valves or metal-glass valves, imported from America or manufactured in the country under American patents. European technique is represented by "Transcontinental valves," with side contacts. The new series of these valves, notable for their small dimensions, have heaters operating at 6.3 volts, with

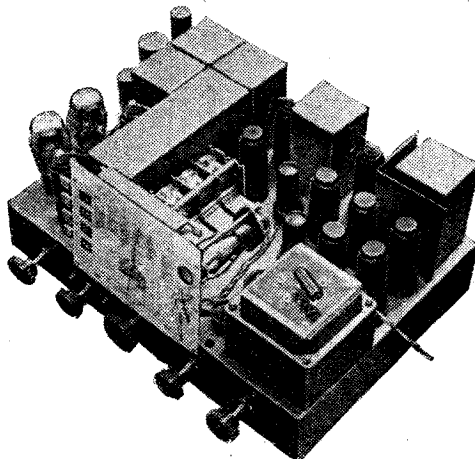
Radio in France—

low consumption and very small inter-electrode capacities. They are distinctive in appearance, being covered with red lacquer. Popularity is divided almost equally between these two classes of valves.

In the matter of coils there is also a distinct division into two classes—those who remain faithful to air-cored coils and those who have adopted iron cores. But some designers mix air-cored coils in HF stages with iron cores for intermediate frequency coils.

Amongst the iron cores, those which are particularly popular are "Ferrolite C" of high efficiency, which do not change their inductance with variations of temperature. Ferrolite coils are also made for short waves, and appear to be superior to air-cored coils. In the intermediate frequency

matter of air or iron cores, their views are equally divergent as to the choice of intermediate frequency for superheterodynes. Some drop to 130 kc/s, others go up to 450. With the lower value better amplification and selectivity are obtainable, but



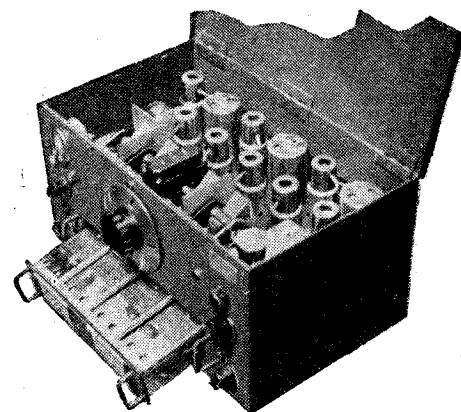
Sixteen-valve R.C.T. receiver with metal-glass valves and glass valves. Note the tuning indicator, which consists of a small cathode ray tube placed horizontally.

to obtain satisfactory image suppression it is necessary to use a preselector tuning system which, with a high intermediate frequency, would not be necessary.

At the moment, supporters of the intermediate frequency of 450 kc/s appear to be winning; this is, perhaps, due to the

Meanwhile, the standard type of French receiver which is adopted by most manufacturers and incorporates all new technical developments year by year is the four- or five-valve superheterodyne. This consists of one frequency-changing valve (American heptode or European octode), sometimes preceded by one HF stage, and followed by a pentode and a double-diode combined, or occasionally with an intermediate low-frequency amplifier and output valve, which generally is a pentode giving two or three watts. This receiver employs AVC, tone control, and even occasionally variable selectivity. These sets sell at very low prices, from 500 to 800 francs, and are often housed in quite luxurious cabinets.

Serious manufacturers who are in a position to make receivers of superior types have not hesitated this year to pro-



American receiver H.R.O. for short waves, with interchangeable coils (shown here partly removed).

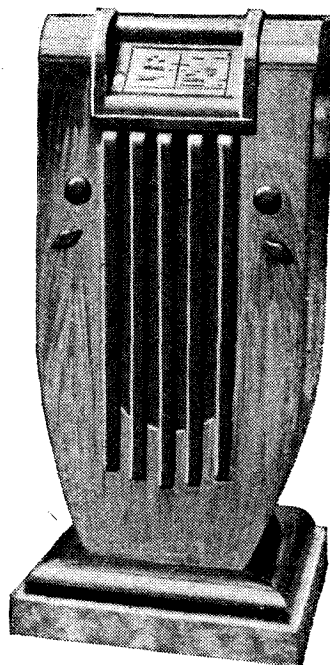
duce models using a large number of valves, so that, although the margin of profit on the four- and five-valve sets is very meagre, good business is possible with receivers employing eight, twelve, sixteen, or even as many as twenty-three valves, such as were to be seen at the Salon. The increase in the number of valves is largely due to improved low-frequency stages and push-pull stages. Special valves are used for high-note reproduction where separate loud-speakers of the tweeter type are incorporated. Other valves provide amplified AVC, silent tuning, separate source of local oscillations, or actuate a cathode-ray tuning indicator, etc.



Front view of the Lemouzy receiver showing the additional speaker fret on top.

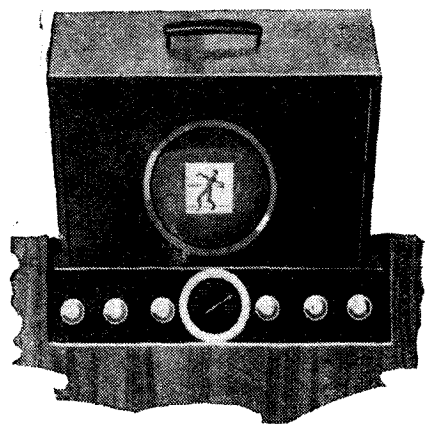
types fixed condensers are used for tuning, with, in parallel, condensers of very small capacity which are adjustable.

As a matter of interest, it is worth while to note the design of adjustable condensers used by the Ferrolite firm. The two plates of the condenser are both controlled by a screw thread, but the pitch of the thread is slightly different for each, so that a



Original design by Radialva.

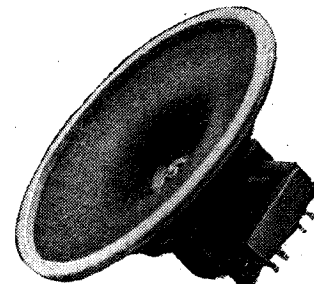
introduction of more wavebands, including short waves, in the design of the receivers. It is now only very low-priced sets which do not include short-wave reception, and these sets, the price of which varies between 250 and 500 francs, and which employ three or four valves, have achieved popularity because of the reduction in the purchasing power of a large proportion of the public, and also because of the fact that the public is becoming more reconciled to reception of the local station only.



Radio-L.L. television receiver; the picture appears in a mirror inclined at an angle of 45°.

relative movement which is extremely small can be obtained.

If designers are not in agreement on the



A loud speaker with an exponential "Dyna-chrone" diaphragm.

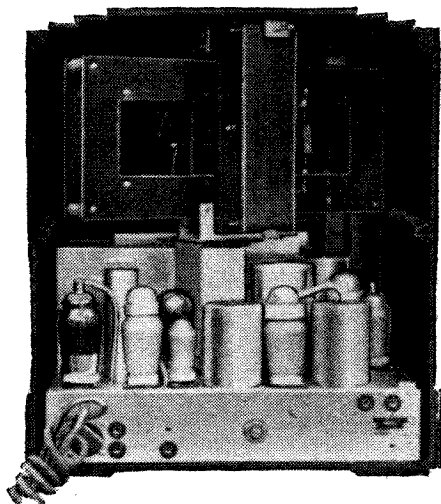
The use of several loud speakers is becoming more and more popular, as with existing speakers it is difficult to cover the full audio-frequency range, and two or

Radio in France—

three special types of speaker are employed with suitable filters.

Loud Speaker Developments

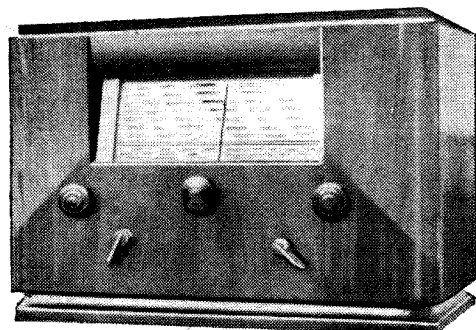
In the loud-speaker field there have been some interesting changes, notably in the production of the firm of Princeps, which uses two conical diaphragms. Pascal in their "Ultrasonor" add to the ordinary diaphragm a second small diaphragm of aluminium for high-note reproduction.



FAR receiver with frame aerial and anti-interference balancing.

A happy return to the "good old days" is made by two manufacturers, Lemouzy and Lyric Radio, who have produced models with separate loud speakers. The idea seems to be very logical, the advantage of being able to place the controls away from the speaker and to have the separate speaker placed where acoustic conditions are ideal is so obvious.

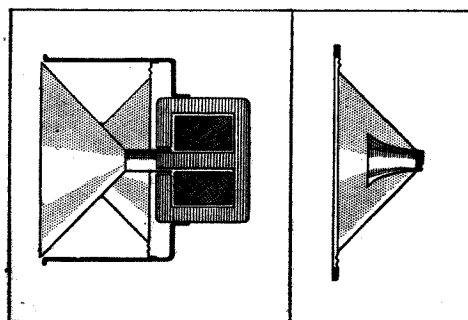
In another direction a return to the "good old times" is made with the re-appearance of battery receivers. Three portable suitcase receivers with battery supply were to be seen at the Salon. In a country so almost completely electrified as France, the only excuse for battery sets seems to be where they are portables.



This Lemouzy receiver is operated with an external speaker.

Still another return to the past was to be seen in frame aerials of modern type; the return to popularity is probably due to the ability to cut out certain forms of local interference with frames which respond

better to a magnetic than to an electric field. In particular, we should mention the Parasivore receiver by FAR, which includes a rotatable frame incorporated



Double cone loud speaker by Princeps, which does not employ a "spider" suspension; and (right) aluminium diaphragm added to the ordinary diaphragm of the Pascal "Ultrasonor" loud speaker.

within the cabinet. A small auxiliary aerial is coupled to the frame in such a way as to oppose parasitic interference picked up by the frame. It is claimed for this instrument that the arrangement eliminates a very large proportion of man-made static.

To conclude, mention should be made of the very attractive appearance of the cabinet work of most of the sets, which showed not only originality, but considerable artistic merit.

Distant Reception Notes

THE new Czechoslovakian high-powered station is now at work on 627 metres with a power output of over 100 kilowatts. It is situated at Banska-Bystrica, from which place a 30-kilowatt station has been in operation for some little time on 765 metres. A wavelength of 627 metres should be particularly suitable for an inland country such as Czechoslovakia. If you look at the map you will see that its nearest point to any kind of sea is some 200 miles from the top of the Adriatic. The extreme north of the country is just a little farther from the Baltic. Taking Czechoslovakia by and large it is just about as far from the sea as any part of Europe could be, and it will therefore be less affected than any other by Morse interference from ships working on wavelengths in the neighbourhood of 600 metres.

Speaking of such interference reminds me that it has been noticeably bad for some little while now at the upper end of the medium-wave band. I used to receive Budapest quite free from interference, but recently its transmissions have been spoilt at times by flat-tuned spark signals. It is surely about time that spark transmitters were relegated to museums. Still, I suppose that we mustn't grumble in view of the way in which the medium-wave band has been cleared of this particularly poisonous kind of interference during the last few years. Old hands may recall how FFB and some of the other French coastal stations used at times to

spread themselves over a large part of the whole wave-band.

I mentioned recently that Greece was worse off than any other European country in the matter of broadcasting service. Actually she has been run very close by Bulgaria, which at present has only one station in operation, the one-kilowatt Sofia. A Bulgarian broadcasting scheme is now happily well under way, and in the late autumn the new Sofia 100-kilowatt transmitter should be at work. It will be situated at Vakarel, a small place some miles south-east of the capital on the Stamboul Railway. At least two other stations of smaller power are to be erected in other parts of the country. At present Bulgaria must rely for the major part of her wireless entertainment on Yugoslavian, Roumanian and Russian stations.

Egyptian Broadcasting

A kind R.A.F. reader, to whom my best thanks, sends me a copy of that interesting publication "Egyptian Radio." This is a weekly which gives the detailed programmes not only of the Egyptian stations but also of Jerusalem and the short-wave services from this country, France, Germany, Holland and Italy. I was rather surprised to learn from it that Egypt already possesses no less than five broadcasting stations in regular operation. These are Cairo I 483.9 metres (20 kilowatts), Cairo II, 222.6 metres (0.5 kilowatt), Alexandria I 267.4 metres (0.5 kilowatt), Alexandria II 209.9 metres (0.5 kilowatt), and Assiut, 410 metres (0.1 kilowatt). Alternative programmes are transmitted, one in English or French and the other mainly in Arabic from all stations except Assiut, which transmits in Arabic only. Transmissions take place between 4.30 a.m. and 9.30 p.m. by our time, and those who are fond of logging out-of-the-way stations may find that the Egyptians offer some interesting possible captures.

I hear that a broadcasting station is likely to be at work before very long at Singapore, the wavelength used being in the neighbourhood of 250 metres. I don't yet know for certain what the output power will be, though I've heard 20 kilowatts mentioned as the probable figure. The logging of Singapore will indeed be a DX feat!

To turn from the Far East to the West, it is announced that WJZ of Boundbrook, New York, has applied to the Federal Radio Board for permission to increase its power to 500 kilowatts. WJZ, which operates on 394.5 metres, is the main station of the National Broadcasting Company's chain. It is well received over here under favourable conditions with its present power, and if it goes up to ten times as many kilowatts it should be amongst the best of the Transatlantics. At present there are only two 500-kilowatt stations in the world. The United States has one of them, WLW, and the other is Moscow No. 1, in Russia. As WLW, which is situated at Cincinnati, Ohio, has proved remarkably successful, I imagine that the authorities will be inclined to accede to the request of WJZ. When the new WLW first got to work (this station, by the way, also sprang from 50 to 500 kilowatts) it was feared that it might completely swamp a very large area. This, however, did not occur, and, though WLW was allowed at first to use its full power only at certain times, an extension was soon given when it was found that it covered admirably a large area in which reception had previously been none too good.

D. EXER.

CURRENT TOPICS

Events of the Week in Brief Review

Amateurs to the Rescue

MANY messages have been received from Governors of States and other important executive officers expressing thanks for the great services rendered by amateurs during the disastrous floods in the Eastern part of the United States last March and April. In many cases all normal methods of communication had been swept away, amateur radio being the only link remaining. President Roosevelt has himself praised amateurs at a Press conference.

German Televisophone Service

THE special service of telephone-cum-television which operated recently between Berlin and Leipzig during the famous Spring Fair at the latter place has now been opened for permanent use. There are two call offices in Berlin and calls are limited to three minutes, for which the total charge is 3.50 Rm. It is hoped to open a similar service between Hamburg and Munich early next year, using the special high-definition cable which is now being laid.

Viennese Broadcasting House

THE new H.Q. of broadcasting in Vienna are now rapidly taking shape, more than a thousand workmen being occupied in the constructional work. The concert hall has been designed to seat 500 people, and the whole building is being equipped on the most modern lines.

Broadcasting in N.Z. Parliament

ALTHOUGH the microphone plays a great part nowadays as a means of putting forth political views, it has never been looked upon very favourably when the question has arisen of its being introduced into Parliament itself. In New Zealand, however, an example has been set which other countries are likely to follow. On the opening day of the new session in the Parliament Buildings at Wellington, the proceedings were simultaneously broadcast through the various stations of the Dominion.

Fireworks in Old Madrid

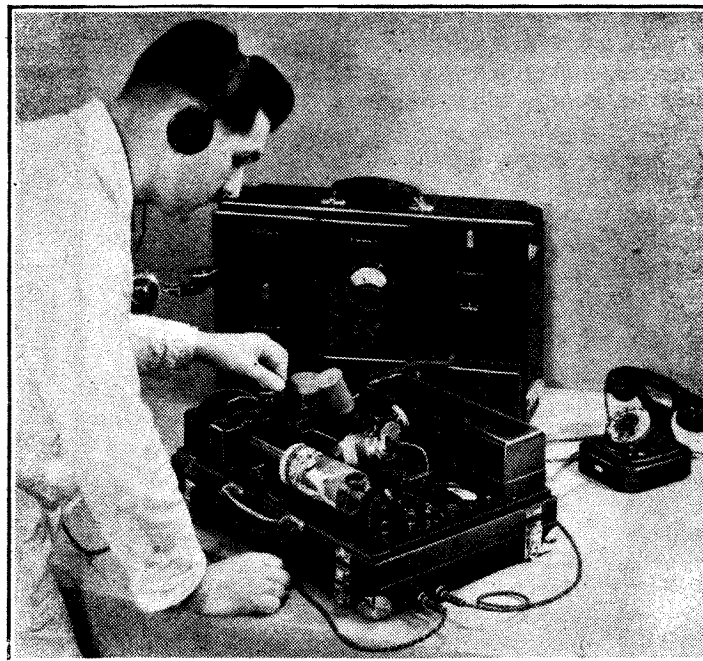
IT is reported that the Spanish Ministry of Communication is making determined efforts to

end all types of interference, including that due to electrical machinery and the equally annoying type caused by stations wandering off their allotted wavelength. With this end in view certain notorious offenders among the Spanish stations have been "invited" to confine their activities to certain well-defined frequency bands. Apparently in Spain a Government "invitation," like the word "Manaña," has a meaning other than the strict dictionary one.

fore, that a knowledge of French should be increased by means of special transmissions to foreign countries. Possibly, if French announcers could be induced to speak with the same smoothness and clarity of diction as the B.B.C. announcers, foreign listeners would take more interest in what they were saying, and a knowledge of French would spread in that way.

A South Coast Regional Station?

GREAT dissatisfaction is being expressed in the South Coast area at the B.B.C. plans for replacing the antiquated



A PORTABLE PICTURE TELEGRAPH.—Siemens & Halske, in Germany, have produced a picture telegraph equipment in portable form so that whereas it has hitherto been necessary in order to transmit a picture to take it to a Post Office equipped with transmitting apparatus, a much more expeditious means is now available. The portable picture telegraph illustrated can be set up quickly; the picture is stretched on a drum and scanned by a light beam point by point. It can be connected up to any telephone line for the purpose of transmission. The equipment is completely self-contained, the necessary batteries being incorporated in the case.

Parlez vous Français?

ACCORDING to one of our contemporaries across the Channel there are grave dangers of the French tongue being soon numbered with Latin, Greek and Hebrew as a dead language unless something is done about it, and that "something" is broadcasting. If statistics are to be believed, the number of speakers of French has only increased from 32 to 45 millions during the past century, whereas English is now spoken by 220 millions instead of a mere 20 millions. It is proposed, there-

Bournemouth station. It is rumoured that the new station will have a power of a miserable 5 kW. and will radiate the National programme only. South Coast listeners are already catered for by Droitwich so far as the National programme is concerned, but have no reliable source from which to obtain an alternative British programme, the London and West Regional stations being far too distant. Furthermore, the new station would prevent South Coast listeners turning to Radio Normandie as an alternative owing

to the wavelength question. A good case seems to have been made out for a full-blown South Regional station.

France Leads in Television

THE new television transmitter at the Eiffel Tower, which commenced operations recently, has apparently been a great success. It is claimed, in fact, that results greatly exceeded expectations, and that France has now been put in front of all other nations in the matter of television technique. This position may, however, only be held for a few months, as the B.B.C. engineers are said to have something up their sleeve with regard to the Alexandra Palace transmitters, which are likely to confound the critics, who have been getting very impatient of late over the irritating delays which have occurred.

Yet Another Television System

A CZECHO-SLOVAKIAN engineer is said to have patented a new process of television in which natural colours are transmitted. No details are yet available. Possibly coloured television will be as long in "arriving" as coloured cinema films, which were hailed as being "just round the corner" when a first system was shown in London in pre-War days.

Arabian Nights' Entertainments

IT is reported that next year regular transmissions will commence from Baghdad using a much higher power than formerly. It is eventually hoped that the Baghdad station will take its place among listeners in Europe as a favourite source of entertainment. This is hardly likely to happen, however, unless the transmissions are sent out on short wavelengths.

N.R.E.A. Examinations

THE Fellowship examinations of the National Radio Engineers' Association will take place on June 17th, 18th and 19th. The practical section will be held at the workshops of Messrs. Keith, Prowse & Co., 49, Poland Street, W.1, between 3 p.m. and 7 p.m., and the theoretical section at the Northern Polytechnic Institute, Holloway Road, N.7, between 7 p.m. and 10 p.m. The standard text-book of reference adopted for the examination is the "Wireless Servicing Manual," by W. T. Cocking, of *The Wireless World*. All who wish to sit should apply to the Secretary of the Association at 114, City Road, London, E.C.1, before June 8th, stating on which day they wish to sit. The fee for the examination is 7s. 6d.

Biasing the Output Stage

By T. H. BRIDGEWATER

IMPORTANCE OF THE
BY-PASS CONDENSER

IT has become a universal practice in mains-driven receivers to derive automatic grid-bias from a series resistance in the cathode lead of each valve, thus eliminating the unreliability of a dry battery and rendering the set properly "all mains." Such a method, correctly used, is highly convenient and satisfactory, but it is surprising what a great deal of ignorance there is on the subject and how frequently one comes across amplifiers of both commercial and amateur make in which elementary principles have been sadly neglected.

Let us consider the simplest type of biasing circuit, which would be as depicted in Fig. 1 (a). The anode current produces a voltage drop which makes the cathode positive with respect to earth, that is to say, the grid, being at earth potential, becomes negative with respect to the cathode, the desired state of affairs in any ordinary amplifying stage. The AC component of the anode current, due to the AC input on the grid, will, however, cause an AC voltage to be developed across R₁, which will oppose the applied AC on the grid and reduce the amplification. It can be proved that the effect is the same as if the valve impedance were increased by $(\mu + 1) Z_1$, where μ is the amplification factor of the valve and Z_1 the impedance between cathode and earth. If this is a pure resistance, as in Fig. 1 (a), the expression then becomes $(\mu + 1) R_1$. As an illustration of the detrimental effect, take the case of a typical medium-impedance triode such as the AC/HL

THE loss of amplification due to an incorrectly designed bias system is likely to be particularly serious in the output stage, where the bias resistor may have a value comparable with the load. Fortunately, use of the appropriate type of low-voltage electrolytic condenser provides a simple and effective safeguard against such troubles

type. With battery bias and an anode resistance of 20,000 ohms, the amplification per stage would be approximately 22. With automatic bias, from a cathode resistance of 1,000 ohms, the amplification will have dropped to less than 11, i.e., by more than 6 db. The most obvious method of dealing with this discrepancy is to place in parallel with R₁ a condenser of such a size that at the lowest frequency involved its reactance, and hence Z, will be negligible (Fig. 1 (b)). For example, if we prescribe that down to 30 cycles, with the same valve and resistance of the previous example, the amplification must be within 1 db of 22, the capacity C₁ works out to 9 mfd. How frequently have we encountered a paltry 2 or 4 mfd.; with the latter the attenuation at 30 cycles is as much as 5 db. With a loss of 10 db. in only two stages, what surer way could there be of ruining the bass reproduction?

Decoupled Bias Circuit

An alternative arrangement for nullifying the effect of the AC component is that shown in Fig. 1 (c). The grid is returned, via the grid resistance, to the junction point of a condenser and resistance in series connected across the bias resistance R₁. R₂ may be anywhere between 10,000 and 100,000 ohms. Thus, although in this case the AC potential is allowed to develop across R₁, only a portion of it, depending on the values of R₂ to C₂, is fed back to the grid. The amount

of feed-back can be made as small as desired by suitable choice of C₂, R₂ being fixed, or vice versa. Applying this method to the same example as before and assuming R₂ be made 50,000 ohms, the capacity C₂ is found to be 0.2 mfd. for a 1 db. loss at 30 cycles.

Since large values of capacity can now be obtained at low cost in the electrolytic type of condenser, from the point of view of economy or efficiency there is little to

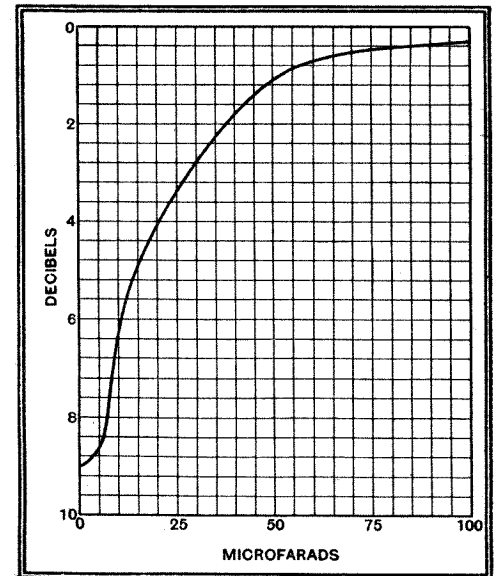


Fig. 2.—Power losses at 30 c/s with various capacities for C₁.

choose between either of the two decoupling methods described for any amplifying stage, with the important exception of the output valve.

On examining the matter a little more closely, we find, even if we have perfect decoupling, that with the arrangement of Fig. 1 (c) the valve impedance is increased by the amount of the bias resistance, so that we could never achieve the full amplification obtainable by either a battery bias or the method of Fig. 1 (b). However, provided the bias resistance is small compared with the valve impedance, which it will nearly always be *except in the output stage*, the amplitude discrepancy, which, in any case, is independent of frequency, will be small. In the case of our stock example it would amount to 0.25 db, which is negligible. But this important proviso, that the bias resistance be small compared with the valve impedance, will not necessarily hold in the case of an output valve. There are

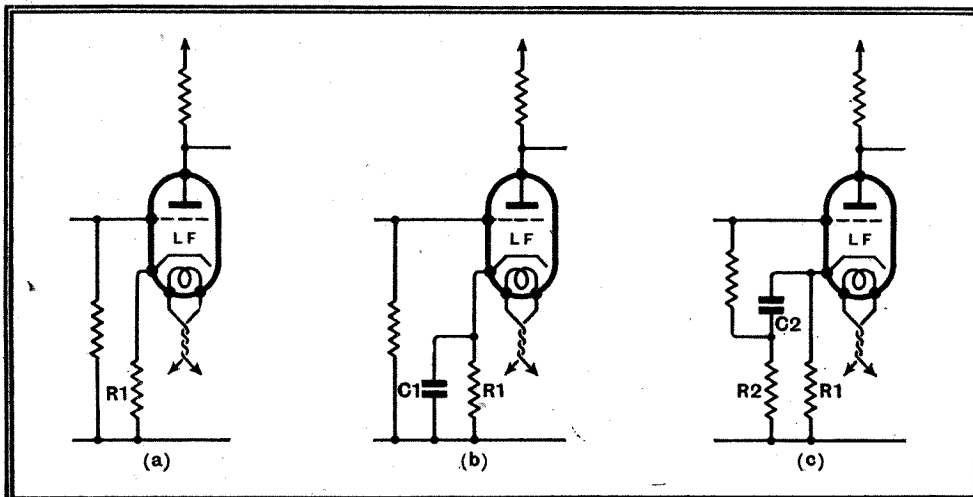


Fig. 1.—Methods of automatic bias discussed in the text.

Portable Ultra-Short Wave Wireless Telephone

THE HERMES MIDGET TRANSRECEIVER

Biassing the Output Stage—

now available a number of output triodes having internal impedances between 500 and 1,000 ohms, and requiring bias resistances of values equal to, or sometimes even greater than, the impedances of the valves themselves. Thus, the latter may be effectively doubled, which would result in an appreciable loss of power in the loud speaker. It is, therefore, clear on the face of it that the method of Fig. 1 (c) must be ruled out where low-impedance output valves are concerned.

It remains to consider the output conditions using the decoupling method of Fig. 1 (b), where the effective impedance between cathode and earth can be made as small as required, bearing in mind that we are now concerned with power rather than voltage output.

Since, as far as AC conditions are concerned, we can approximately represent the output transformer and loud speaker load as a pure resistance in the anode circuit equal to the loud speaker resistance times the square of the transformer ratio, the circuit of Fig. 1 (b) will serve for representing output conditions. As a practical example, let us take the case of a PP3/250 valve, having an internal impedance of 1,000 ohms (amplification factor 6.5), a bias resistance of 715 ohms, and an anode load of 2,000 ohms. A series of values for C_1 has been taken, and the power output calculated for each value at a frequency of 30 cycles. The results are exhibited in Fig. 2 as a curve connecting the deviation in decibels from maximum power (i.e., as would be obtained with a battery bias supply) with different values of C_1 . It will be seen, for example, that if the power output is to be within 1 db of the maximum, a capacity value of 50 mfd. is required; while, if a greater tolerance is allowed, say, 3 db, then C_1 need be no more than 28 mfd. In a commercial receiver in which the writer recently discovered the output valve bias resistance shunted by only 2 mfd. the attenuation at 30 cycles worked out at 10 db!

New Anti-Interference Aerial

THE introduction of what would appear to be a very highly developed and promising all-wave anti-interference aerial is announced in a preliminary statement issued by Belling and Lee, Ltd. The "Eliminoise" screened aerial system, as it is called, comprises two matching transformers covering waves between 15 and 2,000 metres without the use of switching. Belling-Lee twin screened cable type "C" is used as a transmission line, and it is claimed that efficiency is well maintained on the short wavebands, with a consequent improvement in signal-to-noise ratio.

It is understood that the loss over the whole wide wave-range covered is no more than about 4 db., which is practically negligible with a modern receiver.

Supplies of the new transformers are expected to become available in some five weeks, and before that time we hope to be able to publish curves showing the actual efficiency of transmission on the various wavebands.

TRANSRECEIVER is a very convenient way of describing a combined transmitter and receiver, though the expression is generally only applied where the same valves and components are employed for both purposes and the rearrangement of the circuit is effected by switching.

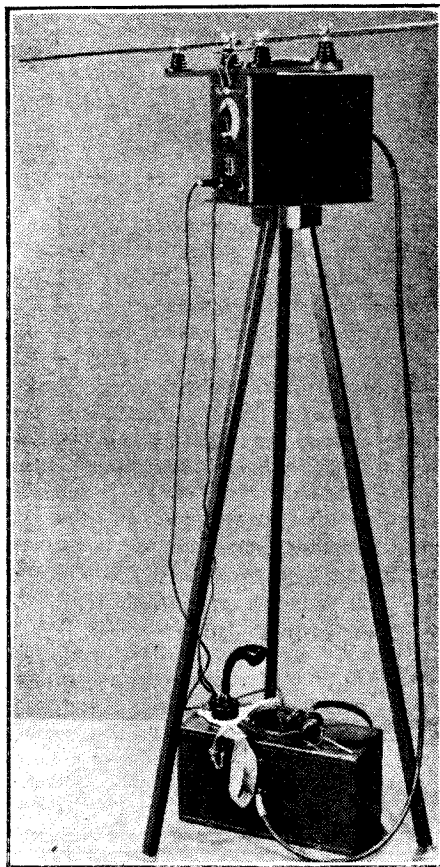


Fig. 1.—Hermes Midget Transreceiver with tripod and battery box. Leads of comfortable length attached to both microphone and headphones facilitate considerable movement of the operator. Contact to the transreceiver is by means of plugs and sockets.

The Hermes Midget Transreceiver is designed on this principle, and embodies two valves only, a triode and a pentode. It is an ultra-short-wave set, and in one position of the changeover switch functions as a super regenerative receiver, while in the other as a telephone transmitter.

As only the LF circuits are switched the efficiency of the HF oscillator is not affected, so that the maximum power output is obtained for transmission.

The equipment illustrated in Fig. 1 is the standard battery-operated model, and consists of the transreceiver unit, battery box, folding tripod stand, dipole aerial, headphones and microphone. It can be assembled and dismantled in a few minutes.

It is understood that with this apparatus telephone communication can be effected up to 30 miles under favourable conditions and in open country. Yet only a 145-volt HT battery is used, and a comparatively low power two-volt triode valve as the oscillator.

It is not essential that this Hermes transreceiver be operated from a fixed platform, and perfectly satisfactory results have been obtained with the set carried by the user, and it can be operated with the aerial either vertical or horizontal.

Some three years have been devoted to its development, and during this time tests were carried out on land, on sea, and in the air, and as a mobile telephone link it has been proved to be so satisfactory that endless possibilities can be envisaged for its future. It is simple to operate, and no technical knowledge is needed. There is a changeover switch marked "send" and "receive," a tuning control and one for sensitivity, and the last two mentioned need only be used for initial adjustment.



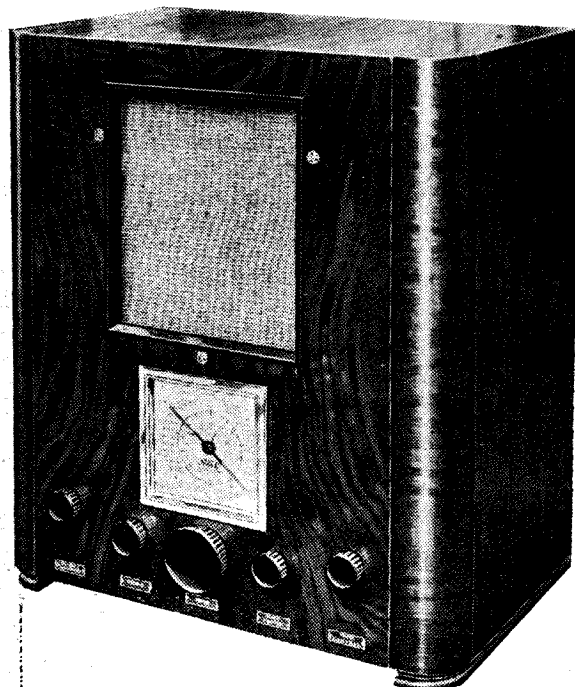
Fig. 2.—An infantryman's pack-model of the Hermes Transreceiver.

The value of portable wireless apparatus for the Services' use has not been overlooked, and a special model designed to fit in an infantryman's pack, as shown in Fig. 2, has been evolved, while a set for duplex working is also available. The makers are Transreceivers, Ltd., 444, Ewell Road, Surbiton, Surrey.

G.E.C. Fidelity All-wave Superhet

A RECEIVER DESIGNED FOR USE
IN ALL PARTS OF THE WORLD

FEATURES.—Type.—Table model superheterodyne for AC mains. **Wave-ranges.**—(1) 16-98 metres. (2) 200-550 metres. (3) 1,000-2,000 metres. **Circuit.**—HF amplifier—frequency-changer—two IF amplifiers—second detector—push-pull output valves. Full-wave rectifier. **Controls.**—(1) Tuning. (2) Volume. (3) Sensitivity and on-off switch. (4) Tone. (5) Wave-range. **Price.**—25 guineas. **Makers.**—General Electric Co., Ltd., Magnet House, Kingsway, London, W.C.2



It is now many years since the first G.E.C. "Overseas" receiver made its initial appearance. This firm was, in fact, one of the first to produce a short-wave superheterodyne on a commercial basis. These earlier sets were intended primarily for sale in the Colonies, and were produced at a time when interest in short-wave reception was confined to a few amateurs in this country. The experience which was gained in the design of the chassis to withstand destructive climatic conditions is reflected in the latest model, but as numbers will no doubt be sold to the many broadcast listeners in this country who have discovered the entertainment and instruction to be found on the short waves, it has more the appearance of a domestic receiver than had its predecessors. The dual role is further

emphasised by the inclusion of an unusually generous output stage and a specially designed loud speaker providing volume and quality of reproduction above the average.

A receiver which may be called upon to operate in remote parts of the world must, of course, be provided with an ample reserve of sensitivity, and so we find that of the seven valves employed in the circuit two are devoted to IF amplification and a third to HF amplification before the frequency-changer.

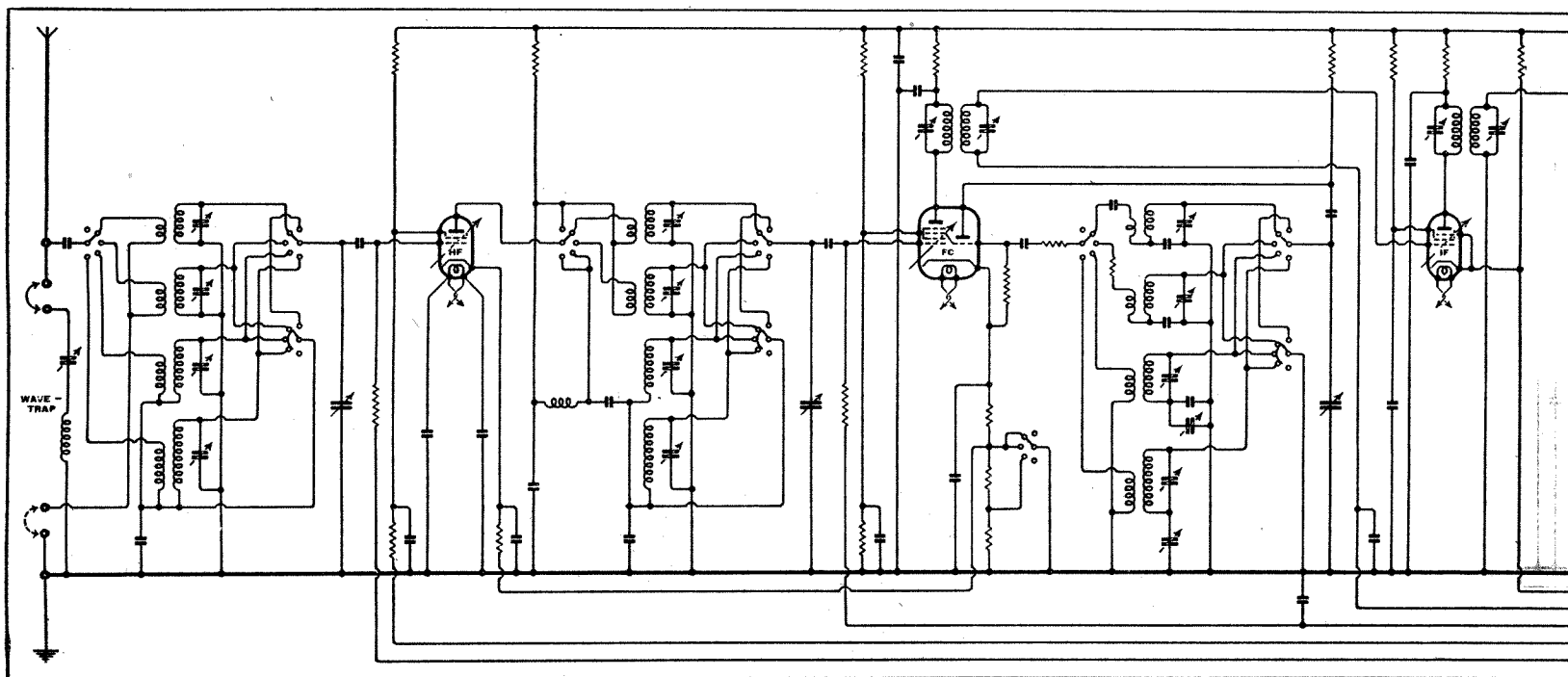
Special Aerials

The aerial coupling to the HF amplifier is through a series of tuned transformers. The coils associated with each waveband are separately screened and provided with

their own trimmers, while coils not in use are short-circuited by contacts on the rotary-type wave-range switch. The primary windings of the input transformers are designed for use either with conventional elevated aerial and earth systems or with one of the specialised short-wave aerials, such as the inverted V or di-pole, which are useful when the maximum efficiency on one particular wavelength is derived. The aerial circuit also includes a wave-trap which may be brought into circuit if trouble is experienced from certain types of heterodyne whistle interference.

The HF amplifier valve is of the variable-mu screened-grid type, and is transformer coupled on short waves, and tuned-grid coupled on the medium and long wavelengths to the triode hexode fre-

Complete circuit diagram. The aerial circuit is designed for operation with aerial systems of all current types, and by the insertion of a connecting link an adjustable wave-trap is brought into circuit for the suppression of heterodyne whistles.



quency-changer. This valve is of the X4T type, which has been specially designed for operation at very high frequencies. To ensure the best operating conditions on each waveband the bias derived from the cathode resistance is varied by means of the wave-range switch.

There are two IF stages of the variable-mu pentode type. Only the first of these is controlled from the AVC line, the second being supplied with a standing bias in order to prevent the possibility of overloading. Part of the bias resistance is common to both IF stages and is made variable to provide a sensitivity control.

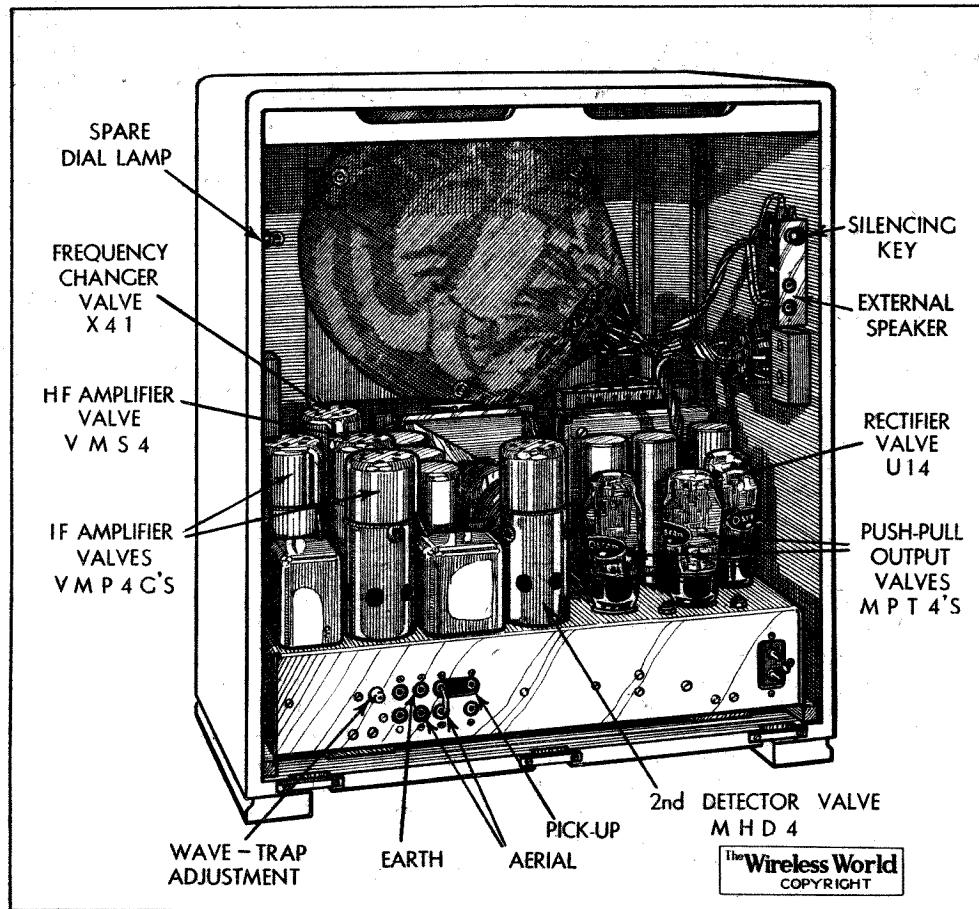
The second detector is a double-diode-triode in which the signal after rectification by one diode is passed to the triode amplifying portion through a volume control resistance. The other diode is fed from the primary of the last IF transformer, and after filtering applies a variable bias voltage to the AVC potentiometer. From this potentiometer AVC lines are taken to the HF amplifier, frequency-changer and first IF stages, the degree of control being progressively reduced for each successive stage.

Output Connections.

A parallel-fed push-pull transformer couples the triode amplifying portion of the second detector to the pentode output valves. Tone control in the form of a condenser and variable resistance is applied across the anodes of these valves, and the output transformer has an interesting circuit arrangement associated with its secondary by means of which the internal loud speaker can be disconnected and a resistance load substituted without breaking the continuity of the circuit. Not only does this safeguard the valves should the silencing key be operated without an external loud speaker in circuit, but the silencing of the internal loud speaker is not attended by any appreciable change of volume in the extension speaker.

A full-wave rectifier supplies the HT current and there is a stage of smoothing with a separate choke in addition to the smoothing provided by the loud speaker field. The mains transformer has a screened primary and a centre-tapped con-

The tuning-dial, which is of the clock-face type, is operated by a large diameter knob providing reduction ratios of 15:1 and 75:1. The fine adjustment is brought into operation by pulling out the control spindle. The four tuning scales are cali-



Both the cabinet and the chassis are heavily constructed and should stand up well to adverse climatic conditions.

denser across the mains further assists in reducing mains pick-up.

The operation of the five controls is perfectly straightforward and should not present the slightest difficulty to a novice.

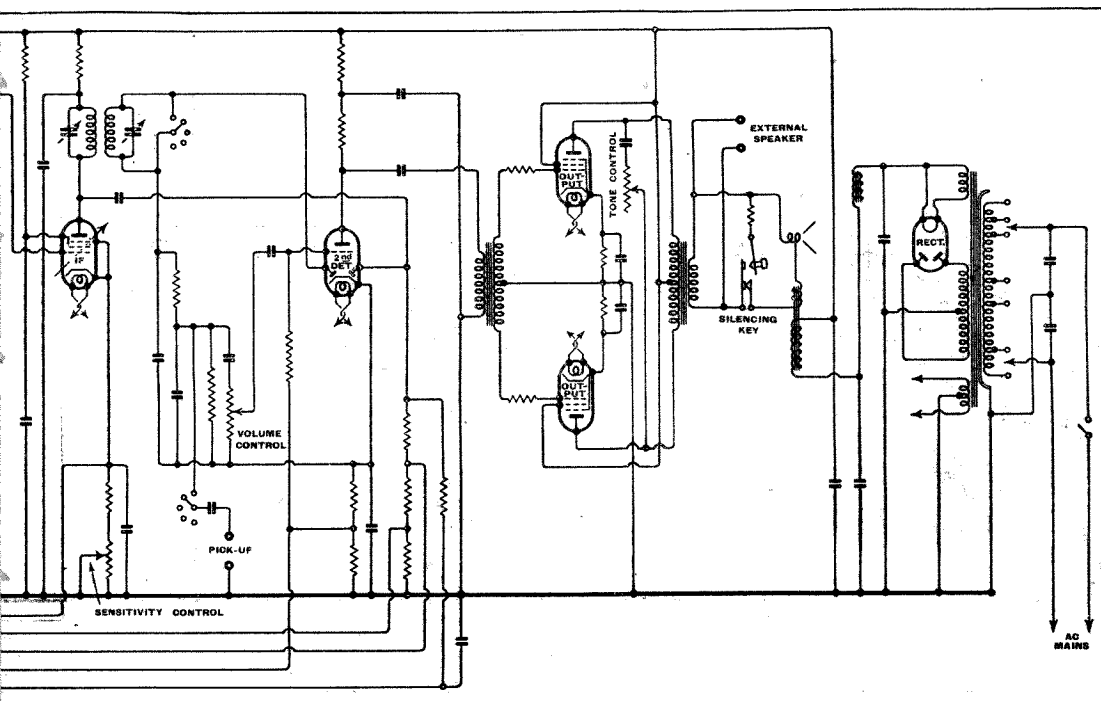
brated in wavelengths, and there is a subsidiary pointer showing the setting of the wave-range switch.

From the moment of switching on the efficiency of the circuit is never in any doubt, and yet there is no evidence that the operating conditions of one or more of the valves are approaching the point of instability, as is often the case in receivers of a lively disposition. The sensitivity control in particular can be turned up to maximum with a steady increase of sensitivity throughout its range. In fact, it behaves in quite a stable fashion as an LF volume control.

Efficient AVC

As regards range, there is no doubt that the additional IF stage is pulling its weight, and Bound Brook (W3XAL, 16.87 metres) was well received during the early afternoon in spite of a particularly bad patch of local interference. The steadiness of this station as regards volume, was favourably commented upon by all who heard it, and it is evident that the circuit values in the AVC system have been very carefully adjusted.

While testing for range, the impression was gained that selectivity was something out of the ordinary, and this impression



G.E.C. Fidelity All-wave Superhet—

was confirmed when the switch was turned to long waves and the Deutschlandsender tuned in at full volume with but the merest trace of sideband splash from Droitwich. On the medium waveband, too, it was easily possible to approach within one channel on either side of the two local stations without hearing any modulation. Unfortunately no whistles presented themselves upon which a test of the wave-trap could be made, but it was verified that the range of adjustment provided by the subsidiary knob at the back of the set was sufficient to cover the medium waveband as well as frequencies in the vicinity of the intermediate frequency (445 kc/s). Owing to the action of AVC it was difficult to judge by signal strength when the wave-trap was tuned to the local station, but the point of exact tune could be determined by virtue of the fact that the wave-trap condenser became slightly microphonic. In practice, of course, it would not be necessary to employ this ruse as all that is necessary is to turn the control until the whistle, if any, disappears.

Full Bass Response

The G.E.C. moving coil loud speaker which has been fitted in this receiver has a very freely suspended diaphragm, with the result that real bass, such as is seldom heard in a table model, is provided. There is more than sufficient output in the upper middle register to balance the strong bass output, and except at low volume levels it will probably be found that the high-note response will have to be reduced. The cabinet is strongly made and the back is braced with a rigid cross-bar, so that it is well able to stand up to the large amplitudes which are developed by the speaker diaphragm.

In the construction of the chassis "Keremot" insulation has been used at vital points, as it has been found that this material stands up well to tropical conditions. There is a perforated screen of fine mesh covering the underside of the chassis which, in addition to supplementing the electrical screening, should form sufficient discouragement to tropical insects looking for winter quarters.

The set is available in three models, the first for use in Western Europe, with station names marked on the medium and long-wave bands, the second for the Near East, South Africa, India, etc., in which the names of the "home" stations on the two highest wave ranges are omitted, and the third designed for use in the Far East, Australasia and South America, in which there is a continuous wavelength coverage from 16 to 550 metres.

The service manual deals very fully with the installation, operation and maintenance of the set, and, in addition, gives details for the erection of special aerial systems for efficient reception of individual wavelengths in the short-wave ranges.

Next Set Review.
AERODYNE MODEL 49

New York Television**Details of the Service**

ALTHOUGH the R.C.A. New York Television Service is expected to commence on June 29th, as has been already announced in *The Wireless World*, it is not intended to be a permanent service but only a large-scale experimental one such as the B.B.C. hope to commence in July. A very prominent R.C.A. official has stated that a regular service cannot be expected for at least eighteen months. The system adopted for the experimental period is "all electronic," no mechanical scanning arrangements being employed. The system is a 343 lines one, interlacing being employed similar to that being used in one of the systems adopted at the Alexandra Palace.

Already a preliminary demonstration has been given to Press representatives and the main "direct television" feature was a pre-arranged fire alarm call. The scenes were picked up directly on a Zworykin Iconoscope and transmitted on a wavelength of 6 metres to New York.

In the experiments a large combined sight and sound receiver built in the conventional console was used. The spectators followed the broadcast on the screen of a cathode-ray tube, the size of the picture being 7in. x 5in., although arrangements can be made for the picture to be seen in an enlarged form through the medium of a mirror. The combined sight and sound receiver employs 33 valves, and so is apt to be somewhat expensive. A large number of standard talking

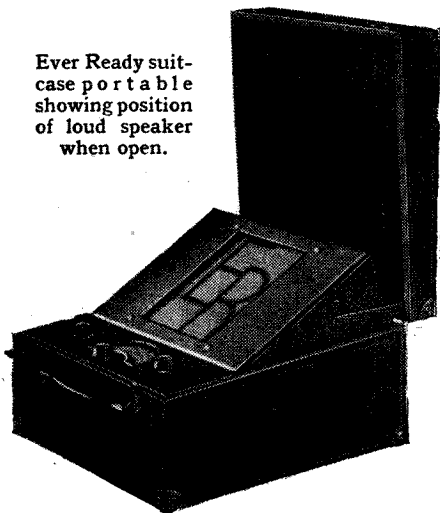
films were transmitted as it is estimated that these will at first form the bulk of the programmes. The films were delivered from the projector at the standard talkie rate of 24 frames per second, but in the course of transmission these were converted to the rate of 30 frames per second, the exact means of accomplishing this being at present not disclosed.

The transmitter from which the experimental transmissions will be made in June will employ a power of 10 kilowatts and a wavelength of 6 metres. It is being installed on the top of the Empire State building, which is the highest structure in the world. The aerial is of the "Turnstile" variety from which horizontally polarised waves are transmitted, there being a minimum of high-angle radiation. Several specially equipped studios are being prepared in Radio City. The main purpose of these tests is to demonstrate the practicability of high-definition television on ultra-short waves in the case of a city notorious for its steel-frame buildings and the large number of its cars. The former are, of course, potential sources of trouble in the shape of screening, and the latter of electrical interference from the ignition system.

If, as is anticipated, success is achieved, it is expected that receivers will be manufactured at a cost of from 500 to 800 dollars, which exceeds the price mentioned for television receivers in this country.

Ever Ready Portable

AN unusual method of mounting the loud speaker has been adopted in the Ever Ready Model 5010 suitcase portable. By an arrangement of levers connected to the hinged lid, the speaker baffle is tilted upwards at an angle of about 30 degrees when the set is opened, thus giving better directional radiation of sound when the set is placed on the ground or on a low table. The loud speaker is of the moving-coil type with a cobalt-aluminium alloy magnet.



Ever Ready suitcase portable showing position of loud speaker when open.

The circuit consists of a pentode HF amplifier, detector with reaction, and a pentode output valve. Reaction and HF volume are controlled by the same knob.

The price, complete with batteries, is nine

guineas, and the makers are the Ever Ready Co., Ltd., Hercules Place, Holloway, London, N.7.

THE RADIO INDUSTRY

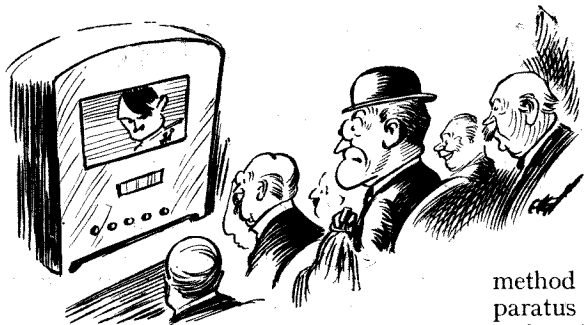
THE City Accumulator Co., Ltd., of Norman's Buildings, Central Street, London, E.C.1, will be pleased, on receipt of a 1½d. stamp, to send to any reader a 12-page booklet containing the complete constructional details of the 1936 Monodial AC Receiver.

The Instrument Department of E. K. Cole, Ltd., Southend-on-Sea, has just added a valve voltmeter, Type TF314, to its series. This instrument is of the direct-reading type with a high input impedance, and is operated from a 50-cycle mains supply. Special precautions are taken to render the calibration independent of the supply voltage.

The title of Kingsway Radio, Ltd., 3-9, Dane Street, High Holborn, London, W.C.1, has been changed to Kingsway Electricals, Ltd. The business will be carried on as before, and there is no alteration in the constitution of the company.

The installing of sound equipment at St. Pancras and Stoke-on-Trent L.M.S. stations has been entrusted to Tannoy. The same firm has undertaken a contract for equipping the Clacton-on-Sea band pavilion with an ambitious installation for reproducing either musical items from the concert hall or band pavilion or for gramophone records.

The Dublin branch of the General Electric Co., Ltd., will be installing sound reproduction equipment for the Davis Cup tennis contests in Dublin this season. The Irish broadcasting authorities have made arrangements to "tap in" on the G.E.C. system for the broadcasting of commentaries.



Seated among fellow-creatures.

"Delayed" Television

NOW that several European countries such as France and Germany have started some sort of television service, a golden opportunity has arisen for certain dealers of the undesirable sort to deceive their less-well-informed customers, and several of them, I grieve to relate, are already making use of these opportunities.

Only last week I was walking down a well-known thoroughfare in a certain Irish city, when I was astonished to see an invitation displayed outside a shop for all and sundry to come and see the high-definition television from Berlin. I need scarcely add that I lost no time in availing myself of this golden opportunity, and was soon seated among a large number of my fellow-creatures hailing from all grades of society. I was considerably astonished when there flashed on the screen televised pictures of scenes in the German capital which had an almost unnatural clarity.

A Gross Deception

It was not until I happened to pass the same place later in the day, and on going in saw exactly the same pictures that I realised what gross deception was being practised. The pictures were, of course, emanating from a small cinema projector situated in the back of the shop, its "beam" being hidden by a large stove-pipe suitably positioned. Needless to say, I at once challenged the dealer on the question of honesty, but, to my surprise, he was not in the least perturbed, explaining that no deception was being practised since the pictures were quite truly high-definition pictures televised from Berlin. It did not affect the accuracy of the statement, he said, just because they were televised merely from one room to another in Berlin and recorded on films. Furthermore, he added, the B.B.C. were admittedly going to give some of their broadcasts by means of the "delayed film" method, and what difference did it make to the pictures if the delay was thirty seconds or thirty days? My greatest surprise came, however, when the audience warmly defended the dealer, characterising me as a — intertering foreigner.

The deception reminded me of a similar one which was once practised by a young fellow-wearer of the old Borstalian tie, who owned a home-cinema. Desiring to give a talkie show, he was at a loss for a

method of converting his "silent" apparatus at minimum expense, but, being of Scottish extraction, this did not trouble him for long. He simply started the projector and then took up his position behind the screen and himself supplied the necessary speech to the lips of the various actors as they appeared on the screen, suitably disguising his voice for the many parts he had to play. He has now taken up an important position on the television publicity staff of the B.B.C., where he will have golden opportunities for the exercising of his misplaced genius.

Chez Ma Tante

I WAS not altogether surprised when I read in the columns of *The Wireless World* recently that the shelves of French pawnbrokers are groaning between the weight of wireless sets which had been placed in pledge. Such a state of affairs could never exist in this country for the reason that British pawnbrokers simply will not look at wireless sets, as I know from bitter experience.

This state of affairs is not entirely due to the fact that from the pawnbroker's point of view a wireless set, like a car, is rather a rapidly wasting asset owing to the fact that the new season's models are apt to cause rapid depreciation of the ones which were current last year. The real reason must be sought in the vast difference in the psychological make-up of British and French pawnbrokers. The difference is that while the first is always



Glancing furtively up the street.

thinking what he can make out of a transaction, the latter is invariably considering how best he can help his fellow-creatures. The result is that the manager of a French Mont-de-Piété is always ready to help those who are financially em-

UNBIASED

By

FREE

GRID

barrassed, by taking wireless sets in pledge, even though he may be perfectly well aware that if they are unredeemed there will be practically no chance of getting his money back by selling them.

This pleasant trait in the character of French "uncles," or "aunts," as they call them over there, is not only exemplified in their acceptance of wireless sets as security for loans. They go even further in their desire to enhance their clients' comfort. There is no risk, for instance, as there is over here, of your suddenly walking out of the door into the arms of some acquaintance who classes pawnbrokers with three-card tricksters, racing touts, and other unpleasant people.

This is obviated in France by the provision of a sort of mirror rather like they have in Holland, whereby you make a cautious inspection of the street before sallying forth from the pawnbroker's premises. As things are in this country it is necessary to glance furtively up and down the highway to see that the coast is clear before venturing to emerge.

A Shady Ruse

I NOTICE, by the way, that there is a growing habit of labelling ordinary battery eliminators as "converters." I myself was momentarily deceived the other day when I saw a price ticket in a shop window offering a "converter" at the ridiculously low price of thirty shillings. I had, in fact, almost got my cheque book out, thinking that I was going to get a first-class DC to AC rotary converter for this sum, when my eyes fell on a very mingy-looking AC eliminator.

There is, of course, nothing actually dishonest about this practice, for, after all, an AC eliminator does really and truly convert AC to DC, but that it is not intended to deceive I should not feel quite certain. At any rate, if the announcement is really made in all good faith, I strongly advise those dealers responsible to alter it in their own interests. To the non-technical the word "converter" will make no greater appeal than the more usual word "eliminator," while to the technical, who are momentarily deceived into thinking that they are going to get 9d. for 4d., it will only cause irritation.

I trust that all those concerned will take the hint.



KING EDWARD I presenting the first Prince of Wales to the Welsh people in 1284 as portrayed in the painting by Morris. This is an episode to be re-enacted in the Aldershot Tattoo and to be broadcast on Thursday.

THE Aldershot Tattoo, as a spectacle, is the greatest annual open-air show in the world, and its hold on the public is phenomenal. Tattoo originated in the tap-room in pre-barrack days when troops were billeted in village hosteleries and barns, etc., and the mustering of the men was somewhat laborious. King William of Orange ordained that the drums of the British Army should beat taptoo, as it was first called, from the Dutch word "taptoe" (closing the taps), as a signal for innkeepers to serve no more liquor to soldiers, and for the latter to parade before retiring.

In the National programme on Thursday will be included relays and commentaries from the Rushmoor Arena. The underlying theme for the 1936 Tattoo will be "Youth," "Physical Fitness," and a "Spirit of Adventure." At

9.40 a recorded programme of the work entailed in preparing the Tattoo will be given. At 9.46 until 10.40 there will be relays from the Arena, and again at 11.30 until 12, when the presentation of the first Prince of Wales to the Welsh chieftains at Caernarvon Castle in 1284 will be re-enacted, after which will follow the Grand Finale, which includes an epilogue and the singing of "Abide with Me."

A DISTINGUISHED VISITOR

INTERNATIONAL reciprocity, where music making is concerned, is obviously of the greatest importance, especially when it affords an opportunity of becoming acquainted with unfamiliar foreign works. On Sunday at 9.20 (Regional) Herr Adolf Wiklund, permanent conductor of the Stockholm Philharmonic Orchestra, will conduct the Symphony

Listeners' Guide

Outstanding Broadcasts

Concert, when, in addition to works by Lord Berners, Delius and Goossens, three orchestral compositions of Swedish composers will be given. Adolf Wiklund is not only a conductor of high standing, but also a composer of distinction.

ENGLISH SPIRITUALS

A RECITAL of religious and musical interest will be given at 5.10, Nationally, on Sunday, by Mr. Jacques Hopkins, who has made a speciality of religious folk music. English spirituals, like the negro spirituals, are simple utterances of great Christian truths clothed in the language and with the music most easily comprehended by the masses.

CEASING PUBLICATION

"SATURDAY MAGAZINE" discontinues publication for the summer months after this week's edition. In the issue published on Saturday at 7 o'clock (National), "In Town To-night" makes its final and centenary appearance. A. W. ("Bill") Hanson, the editor, has just recently returned from convalescence after a severe illness.

"EIGHT BELLS"

DESPITE the predominantly naval atmosphere of Mungo Dewar's "Eight Bells," the first production was enthusiastically received by land lubbers as well as those who go down to the sea in ships. A second edition with entirely new songs and dialogue will be broadcast in the National programme at 8.30 on Saturday. The show takes place on the quarter deck of H.M.S. *St. George*, with that "old salt" Harry S. Pepper as producer. Among those on deck will be Arthur Prince and "Jim," Harry Hudson, Denis O'Neil, and George Baker.

CEDRIC HARDWICKE

"SOCRATES," a play by Clifford Bax, comes into the National programme on Monday at 8.15, and at the same time in the Regional programme for the following night. Sir Cedric Hardwicke will be taking the name part. This will be his debut as a wireless actor.

TWENTY MILES UP

A TALK which will undoubtedly be of unusual interest to the readers of *The Wireless World* will be that given by Professor E. V. Appleton, F.R.S., "Above the Stratosphere," at 9 on Sunday (Reg.). He will deal with the effect of the area above the stratosphere on the reception of wireless transmissions at long distances.

FOREIGN LISTENING

THE B.B.C. Listening Station at Tatsfield will provide a half-hour's foreign relay on Wednesday in the Regional programme. For those whose listening is normally confined to the English stations this will provide an opportunity for them to partake of the fare offered by various European stations.

"FANTASTIC SYMPHONY"

"EPISODE in the Life of an Artist" is a musical story by Wilfred Rooke-Ley and Holt Marvell, based on scenes in the life of Berlioz, more especially those dealing with the history of the "Fantastic Symphony." Gordon McConnell is producing this in Sunday's Regional programme at 6.45, and on



ASTRA DESMOND, the B.B.C. singer, will be heard with the Macgibbon String Quartet in a programme of Chamber Music on Saturday at 8.30 (Reg.).

Wide for the Week

Broadcasts at Home and Abroad

Tuesday at 8.30 Nationally. Hector Berlioz received his chief inspiration for writing this Symphony from Harriet Simpson, to be played by Joan Matheson. The scene of the story is outside a Paris café in 1854.

POLO

A NEW sport introduced into the programmes this year is polo, which name, by the way, is derived from the Tibetan "Pulu"—a ball. The American International Team are sportingly competing for the Westchester Cup in this country, and not in America, as is their right. There will be three relays from Hurlingham during the three games which constitute the match. The first commentary will be on Wednesday at 4.15 (Reg.), when the last four chukkas will be described, and on Saturday, June 13th the whole of the game will be included in the commentary.

WELSH MINERS FROM DENMARK

THE Rhondda Valley Choir of Welsh Miners, whilst paying a visit to Copenhagen, will broadcast a special concert from the concert-hall studio of Copenhagen's Broadcasting House from 8.0 to 9.30 on Tuesday. For an hour and a half to be devoted to this one item is a compliment to the choir, as it is not the usual practice in Denmark to give a foreign vocal *ensemble* or even a Danish one so long a period.

OPERATIC STAR

A NUMBER of famous coloratura arias and some songs written by herself will be given by Ellinor Janson during a broadcast on Thursday at 8 from Kalundborg. This young Norwegian singer is rapidly rising to stardom in the international operatic firmament.

OPERA

THERE will be three relays from the Royal Opera House, Covent Garden, during this week, the first being in the



AT HURLINGHAM. The speed and control of the game will be vividly described in three forthcoming commentaries of the polo match between the U.S.A. and Great Britain.

National programme on Friday (to-night) at 8.30, when the second act of "Louise" will be heard. On Wednesday, at 7.30, in the Regional programme, the first act of this famous opera of Charpentier will be given. Act I of "Tales of Hoffmann," Offenbach's ever-popular light opera, will be given at 8 on Monday (Reg.). On Saturday Milan and the North Italian stations are giving Bizet's "Pearl Fishers" at 8.45. This opera has had a curious history. It was withdrawn after a few performances when first produced in 1863, and it was only after twenty-three years that it returned to favour. At 8.45 on Sunday Rome gives Mussorgsky's "Boris Godunov." This should please those who want a full-blooded "story" with their music. "Les Dragons de Villars," by Maillart, which was first produced in 1856, has kept its otherwise forgotten composer's name before the public, and will be given at 8.30 on Wednesday by Strasbourg in a studio perform-

ance. Puccini's "Tosca" comes from Rome at 8.45 on Thursday. This sombre tragedy, which has enthralled opera lovers for thirty-six years, still has a great appeal.

NATIONAL AND FOLK MUSIC

A DANISH folk-dance festival will be relayed from Fredericia by Kalundborg at 9.15 on Saturday. At 10.15 on Monday Warsaw includes a potpourri of Ukrainian folk songs which will be given by a Ukrainian choir and folk instrument *ensemble*. Paris PTT gives a programme of Basque folk music at 8.30 on Wednesday.

"ROMEO AND JULIET"

SCENES from Shakespeare's "Romeo and Juliet" will be given in the Munich programme at 11.20 on Thursday.

The well-known group of actors which periodically tours the continent under Edward Stirling, The English Players, will come to the Munich microphone to give Germans a sample of Shakespeare in English. THE AUDITOR.

HIGHLIGHTS OF THE WEEK

FRIDAY, JUNE 5th.

Nat., 7.30, "That Reminds Me"; Albert Whelan. 8.30, Royal Opera House Relay. Reg., 6.30, "Monsieur Beaucaire." 8.30, "Iona," the Holy Island. *Abroad.* Vienna, 7.30, Symphony Concert from the Mozarteum, Salzburg.

SATURDAY, JUNE 6th.

Nat., 7, Saturday Magazine. 7.30, Band of His Majesty's Coldstream Guards. 8.30, "Eight Bells." Reg., 7.15, Geraldo and his Gaucho Tango Orchestra. 9.30, B.B.C. Theatre Orchestra with Derek Oldham. 10.30, Henry Hall's Hour.

Abroad.

Munich, 7.35, "Der Rosenkavalier" from the National Theatre.

SUNDAY, JUNE 7th.

Nat., 5.10, English Spirituals. 7.55, Service from Derby Cathedral. 9, The Margate Municipal Orchestra, Walter Glynn (tenor), Harry Chapman (harp). Reg., 5.45, London Symphony Orchestra. 6.45, "Episode in the Life of an Artist." 7.55, Service from Queen's Park Congregationalist Church.

Abroad.

Stuttgart, 8, "The Gipsy Baron" (Johann Strauss).

MONDAY, JUNE 8th.

Nat., 8.15, "Socrates." 10.15, B.B.C. Orchestra (F) and Mark Hambourg. Reg., Savoy Hill Memories. 8, "The Tales of Hoffmann." (New Georgian Trio).

Abroad.

Breslau, 8.10, "Red-Letter Monday"—gala variety.

TUESDAY, JUNE 9th.

Nat., 8.30, "Episode in the Life of an Artist." (Chamber Music: The Griller String Quartet. Reg., The Alphas, presented by Frank Stewart. 7.45, Music from the Movies. 8.15, "Socrates."

Abroad.

Paris PTT, 8.30, "A Musical Trip Through the French Colonies."

WEDNESDAY, JUNE 10th.

Nat., 8, Josef Marais and his Bushveld Band. (Symphony Concert: B.B.C. Orchestra (B). 10.20, B.B.C. Theatre Orchestra with John McKenna (tenor). Reg., 7.30, Royal Opera House Relay. 9, Foreign Relay. 9.30, Mantovani and his Tipica Orchestra.

Abroad.

Hamburg, 8.45, "Captain's Music" and other specialities of the waterside.

THURSDAY, JUNE 11th.

Nat., "Romance in Rhythm." 9.40, Aldershot Tattoo. 10.40, Reginald King and his Orchestra. 11.30, Aldershot Tattoo. Reg., From the London Theatre. 7.30, The London Maccabi Choir. (Dove Days, or the Derbyshire Angler: Sport and Song. 8.45, Serenade; The B.B.C. Orchestra (C) and Heddle Nash.

Abroad.

Frankfurt, 8.10, Soldiers' Folk Songs, with marches old and new.

The Enigma of the Licence Figures

Does More Power or Better Programmes Draw the Greater Number of Listeners

By LESLIE BAILY



knows that it is one thing to build up a circulation and another thing to keep it. Is "popularisation" to be the B.B.C.'s only hope of keeping its "circulation"?

But we have heard prognostications of "saturation point" for years, and it has not come yet; and a glance at the graph herewith will show that the slump since 1934 is only slight. In that year licences increased about 800,000; last year the increase was 600,000 odd.

How far a policy of "popularisation" will affect licence figures is a hypothetical question, since it is a policy never before tried. In fact, what factors *do* influence licence sales? And does the B.B.C. consult these factors before deciding on changes of policy? Some interesting research could be carried out in licence statistics. There can hardly be dispute that programme quality, good or bad, must affect licence figures. Whether the

economic prosperity of the country is reflected in the changing gradients of the graph on this page nobody has yet troubled to elucidate for us. I note in passing that the 1931 economic crisis seems to have made no mark on the steeply ascending line; but it is not my intention to analyse strictly the causes of licence fluctuation, for that is an enquiry that only a committee of experts of several kinds—sociological and economic, as well as radio experts—could adequately encompass.

The Rise and Fall

It has interested me, however, to look back through B.B.C. programmes and to note the quality of broadcasting that was being given at some of the more interesting points along this licence graph.

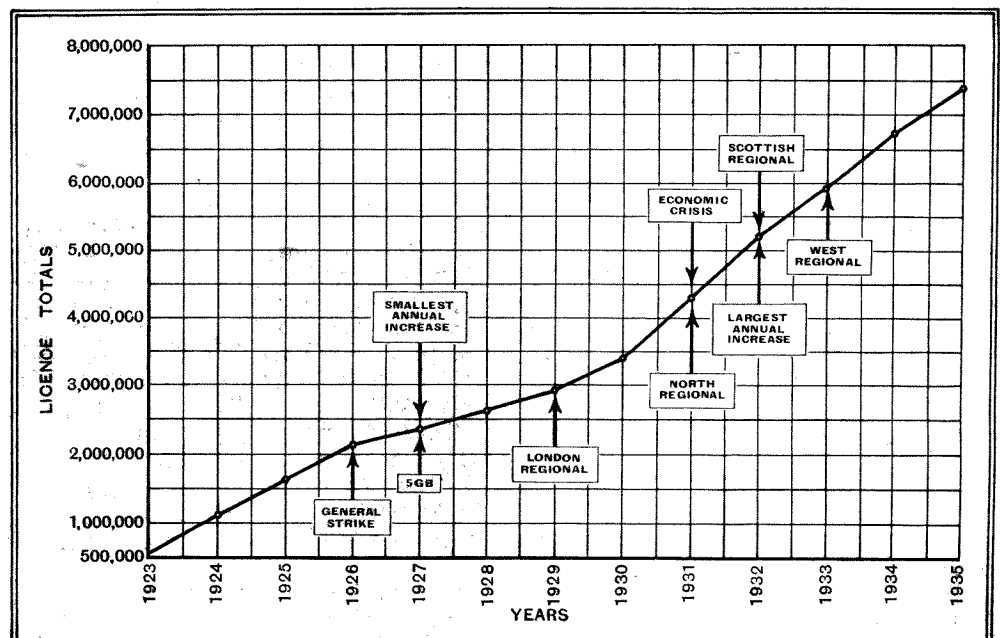
Why, for instance, the heavy drop after 1926, and the recovery again in 1930 to 1931—were programmes particularly unattractive in 1926 and was there a marked improvement in 1931?

In 1926—the year of the General Strike, which is often quoted as the first occasion to make Britain radio-conscious—licences

THE B.B.C., we are told, has embarked on a policy of "popularisation." Through the re-arrangement of programmes to provide more of a superficially popular appeal, through the curtailment of talks of an educational or "advanced" type, through the recent conference of women listeners at Broadcasting House and the idea that Sir Stephen Tallents shall go forth into the provinces and hold meetings to "get in touch," we see the one same urge of the B.B.C. to ingratiate itself with the masses.

Some of us who, since the early days, have nursed the belief that broadcasting has in it the capacity to be something more than a secondary substitute for the cinema and the newspaper, are somewhat bewildered by this *volte-face*, for though we did not agree in the past with the more pretentious heights of B.B.C. dictatorship there was something admirable in the sturdy individualism of Sir John Reith and his determination not to be stampeded into a standard of programmes based on the lowest common denominator of public demand. If anything is needed just now it is a clear statement by Sir John on the reasons for shifting the helm.

One reason, I gather semi-officially, is the feared approach of "saturation point" in the licence figures. The grand total has risen to nearly eight millions, and in the past year or so has shown signs of slowing down. When will the peak be reached? And after the peak, what? A slump? The B.B.C. is in some respects similar to a newspaper, and every newspaperman



The rise of the licence figures in graphical form with an indication of probable causes.

The Enigma of the Licence Figures—

were selling briskly, an increase of over half-a-million being registered in the year. Yet in the twelve months following there was deterioration of the annual increase to a mere 216,915. It is a curious fact that the General Strike, which is supposed to have popularised radio, was followed by the biggest licence slump in B.B.C. history, whereas the 1931 Economic Crisis was followed by a radio boom (see graph).

Company to Corporation

It was in 1927 that the British Broadcasting Company became a Corporation, but no one will suggest that the 1927 slump indicated public disapproval of that development. It was in that year that 5GB commenced an experimental alternative programme service, which one might expect, on the contrary, to have caused an increase of licences in the Midlands.

Something more likely to be connected with the licence figure is that the programmes of that year showed little advance in resourcefulness and quality over those as far back as 1925. Very much the same kind of stuff was being turned out, year after year. The proper organisation of B.B.C. music by Dr. Boulton was yet in the future, and Mr. Maschwitz had not yet brought a revolutionary dawn to radio variety, nor had radio drama yet found its legs. Is it unlikely that the licence figures reflected the fact that programmes made no major development for several years?

On the other hand, an inspection of B.B.C. programmes in 1930 and 1931, when the licence graph took a vigorous upward spurt, shows a great improvement in entertainment value and in intellectuality as compared with 1927. Moreover, the Regional Scheme was now going quickly forward. The Midlands and London both had high-power alternative programmes in 1930, and the opening of the North Regional station followed in 1931. Bringing vast areas within easy range of alternative programmes, these engineering enterprises undoubtedly gave a big fillip to the figures, and that experience causes one to wonder how far the new stations of 1936-37 (the North Irish, North Scottish, North-east Regionals, and others) will stave-off "saturation point."

What were the chief programme characteristics of 1930, the first year of recovery after the 1927-8-9 B.B.C. depression? It was in 1930 that the B.B.C. Symphony Orchestra was formed. It was in that year that "Diversions," that enormous popular "surprise" feature, was launched. Mr. Val Gielgud had now got the Drama Department organised so that it was giving not only adaptations of stage plays such as "St. Joan" and "Journey's End," but specially written radio-plays which included in this one year the German war play "Brigade Exchange," Tyrone Guthrie's "Squirrel's Cage" and "Flowers are Not for You to Pick," L. du Garde Peach's "Ingredient X," King-Bull's "Yes, and Back Again," Gielgud's "Red Tabs," and Holt Marvell's adapta-

tion of Compton Mackenzie's "Carnival"—a far more interesting harvest of original radio work, in fact, than we have had lately.

Variety was still under a cloud, though the John Watt-Gordon McConnel revues were a bright spot. The Talks Department had proved itself capable of big box-office appeal, not, be it noted, by any "popularisation," but with the "Points of View" series, given by a galaxy of the famous, including Shaw, Wells, Dean Inge, Viscount Grey, and Sir James Jeans, and with the "Science and Religion" series, with intellectual speakers like Julian Huxley.

These memorable talks were followed up in 1931 by the "Escape" series, which has certainly never been equalled in adventure talks. In fact, the talks aspect of B.B.C. programmes five years ago seems to me to have been superior to the present-day standard of work in that direction.

Boom

In 1931 the annual increase boomed by over 900,000 in the year, despite the economic crisis—though the crisis itself may have caused many people to invest in sets in order to hear the news and the speeches by National Government leaders. The Theatre Orchestra came into existence in that year, and Jack Payne's B.B.C. Dance Orchestra was at the height of its popularity. Mr. L. du Garde Peach (nowadays, it seems, lost by the B.B.C. to the film world) was turning out a steady stream of winners—in 1931 "Path of Glory" and "The Marie Celeste." Vernon Bartlett was talking regularly on "The Way of the World," and there was a series of talks by scientific celebrities, including Sir Oliver Lodge, Sir William Bragg, and Senatore Marconi. Two programme peaks which attracted much attention were the Schneider Cup commentary, and Sir Harry Lauder's programme.

The next year, 1932, brought the biggest licence increase ever recorded—932,282. Again, the opening of a new transmitter—Scottish Regional—must have helped. Again, Talks Department distinguished themselves with the "Hazard" and "Conversations in the

Train" series, and "Rungs in the Ladder" in which Shaw, J. H. Thomas, Sir Eric Geddes, and others told of their early struggles. It was a fine play year—"Flags on the Matterhorn," "Rope," "Christopher Wren," "Good-Night Vienna," and three more by Peach. And on the musical side, both lowbrow and highbrow, B.B.C. activity was now much less haphazard. The hours of Sunday programmes were extended and the B.B.C. moved from Savoy Hill to Broadcasting House.

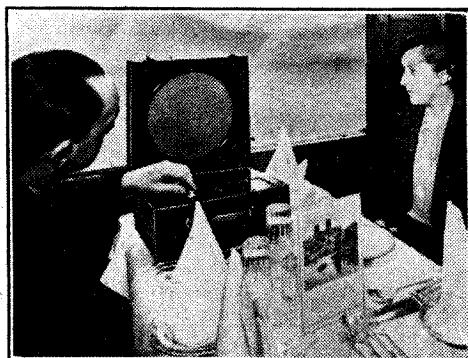
Scientific Analysis?

These few comments, as I say, do not pretend to plumb the licence problem to its depth, but they do, I think, raise interesting issues, and the chief question they leave in my mind is *whether the B.B.C. has ever taken the trouble to analyse scientifically this enigma of licence fluctuations*. So far as I know, nothing of the sort has been attempted, yet one would think it only prudent before any drastic change of policy was made, such as the new trend to "popularisation," that the B.B.C. should get to know exactly why in certain years its statistical popularity has waxed and waned.

I append the annual licence figures and increases:

Year ending	Total	Annual Increase
1923	595,496	—
1924	1,140,110	544,623
1925	1,645,207	505,088
1926	2,178,259	533,052
1927	2,395,174	216,915
1928	2,628,392	233,218
1929	2,956,736	328,344
1930	3,411,910	455,174
1931	4,330,735	918,825
1932	5,263,017	932,282
1933	5,973,759	710,742
1934	6,780,569	806,810
1935	7,403,109	622,540

Since writing the above, I have seen the *Wireless World's* leading article of May 15th on "What is the aim of broadcasting?" The leader-writer and I have evidently both been thinking along the same lines—that British broadcasting is at a dividing of the ways, and it is important to understand clearly which way we are going. The leading article, further, makes the important point that the television and Empire services are becoming a heavy financial burden, and that "the temptation must always be to increase the popularity of the programmes so long as the appetite for funds on the part of the broadcasting machine remains unsatiated."



ECHO OF TWO NOTABLE BROADCASTS : Special arrangements were made between McMichael Radio and the L.N.E.R. for reception of the Derby and "Queen Mary" broadcasts on the "Flying Scotsman."

Marconiphone All-wave Radio Gramophone

THE Model 345 all-wave receiver reviewed in our issue of February 28th, 1936, is now available as a radio-gramophone with automatic record changer.

The new instrument will be known as the Model 365, and the price is 36 guineas.

RANDOM RADIATIONS

By "DIALLIST"

Worth Seeing

SHOULD you be in the neighbourhood of Charing Cross Underground Station between now and June 13th and have a few minutes to spare, you may find it worth while to take a look at the exhibition staged there by the G.P.O. One part of it consists of a section of telephone tunnel, complete with manhole, in which an expert shows how defects in the lines are tracked down and set to rights. Of great interest to the wireless man is a section of the special cable used for linking up B.B.C. stations. It contains no fewer than forty wires, and a special form of screening is employed to avoid induction effects.

Wirelessing a Chart

A REMARKABLE wireless feat was reported by the chairman at a recent meeting of a cable company in London. One important cable broke down off the East African coast at a time when the nearest available repair ship was busily engaged upon work of her own at the head of the Persian Gulf. There was, however, another cable ship just about to sail from Melbourne for London which could undertake the work if she had the necessary chart to enable her to locate the cable. A facsimile of the required chart was wirelessed from London to Melbourne and was received in such perfect detail that the ship was able to sail right to the spot and to pick up the defective cable without difficulty. Pretty good work!

Stratosphere Radio

A MOST interesting experiment was made recently in the United States with a small stratosphere balloon carrying no passengers, but equipped with an automatic short-wave radio transmitter. In this first test the apparatus was so arranged that barometer readings should be automatically transmitted at regular intervals. Up to a point the experiment was successful; the balloon duly reported itself with unflinching regularity until it had reached a height of eight miles. Then for some reason not yet known the apparatus suddenly went out of action and nothing more was heard. This system opens great possibilities for the study of the upper atmosphere and in particular for the investigation of the effects of cosmic rays. One of its great advantages is its cheapness. It was stated that if a balloon became a total loss the cost involved would not be more than five or six pounds.

An All-Wave Year

THIS is certainly going to be a year of the "all-wave" wireless receiving set. Almost every manufacturing firm seems to be offering them or about to do so, and many companies believe that the majority of the receivers sold this year will be of the long, medium and short-wave type. There is a good deal of difference in the wave-range covered on the short waves. Some sets go down as low as 12 metres, whilst others will not tune below 16. Some, again, will go up to between 70 and 80

metres, though about 60 metres is the upper limit to many. At the present time a wave-length coverage of, say, 16 to 60 metres answers pretty well, though it does not, of course, allow its owner to explore the 10-metre band which is proving so interesting just now. I am rather wondering whether in the next year or two an upper limit of about 60 metres will prove sufficient. During the last sunspot cycle there was, as old hands will remember, a longish period in which distant stations using wavelengths well above 60 metres provided wonderful reception.

Room for More Ambitious Sets

The moderately priced all-wave receiver must of necessity be confined to three wave-bands only—long, medium and short. This means that the short-wave coverage must be limited. I feel, though, that there is definitely a place for the more ambitious type of receiving set with four or even five wave-bands. A set using three bands for the short waves could easily cover a range from, say, 8 to 80 metres, giving its owner at the same time the advantage of band-spread tuning. As its designer would not have to work to the severe price limitations that beset him when engaged upon the 15-guinea all-wave set he would be able to make it a much more sensitive instrument—and sensitiveness is more than half the battle on the short waves.

A Queer Mistake

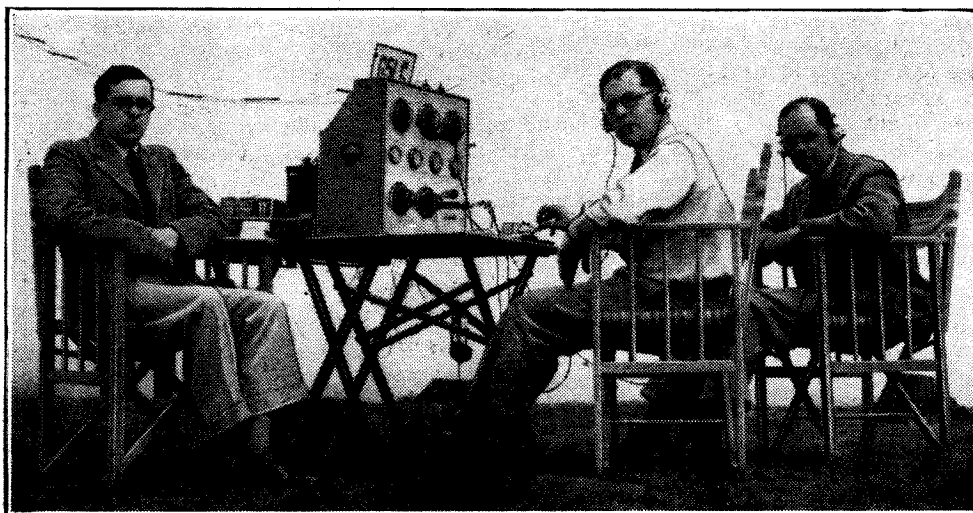
NOT once but several times I have come across people with little or no knowledge of wireless who regularly received the Regional programmes from a station other than their local, not in the least realising that they were doing so. With many modern sets automatic volume control is so effective that several Regionals at widely different distances can be heard at very much the same strength. Hence, when the

set is first installed the Regional programme may be picked up at good volume after the tuning knob has been given a few exploratory twiddles. The owner jumps to the conclusion that he is hearing the local Regional and makes use of the same setting ever after for the Regional programmes. His proneness to do so is increased if the names of stations on the dial are anything but accurately placed, as is not infrequently the case. What he doesn't realise is that he is obtaining nothing like the quality or freedom from background noises that he should in his reception of the Regional transmissions.

Aerials Can Be Guilty

Another often unsuspected cause of indifferently reception is the poor aerial. How many readers, I wonder, fixed up their aerials years ago and have hardly taken a look at them or their connections since? Yet soldered joints are apt to become unsound with the passage of time and the insulation of a down-lead exposed to the weather is pretty sure to develop defects if left neglected. Each of these things means unnecessary losses, and where such losses occur the receiving set cannot be at its best. I can say from experience that a complete overhaul of one's aerial system, accompanied by the rejection of any doubtful parts, can make a wonderful difference to the performance of a modern receiving set.

When the straight set was almost the only kind of receiver to be found in this country there was a tendency to shorten the roof portion of the aerial, in the fond hope that selectivity would be improved. In fact, during the early days of the B.B.C.'s Regional scheme, when twin high-powered transmitters were coming into operation, now here, now there, a perfect epidemic of aerial lopping broke out in order to minimise swamping effects. Then when the superheterodyne made its appearance and soon achieved popularity the aerial wasn't lengthened again, but continued in use—and so continues to this day—in its curtailed form. The less efficient the aerial the smaller the opportunities for AVC to cope successfully with fading and the greater the tendency of the apparatus to provide a noisy background.



CLUB FIELD-DAY.—The Thames Valley Amateur Radio and Television Society held a 40-metre field-day on Sunday, May 17th. Four portable transmitters were in use, G6GB (P) at Boxhill, G2VV (P) at Hog's Back, Guildford, G2KI (P) at Hindhead, and G5LC (P) at Chobham Common, all in Surrey. Apart from maintaining inter-communication, several contacts were made with European countries, including Germany, France, Denmark and Czechoslovakia. The illustration shows the transmitter of G5LC, which employed a 7,070 kc/s crystal-controlled oscillator and power amplifier with a 600-ohm transmission line to the aerial 60 feet away.

BROADCAST BREVITIES

NEWS FROM PORTLAND PLACE

Red-letter "O.B." Day

SATURDAYS, as is fit and proper, will enjoy the pick of this summer's notable outside broadcasts, and perhaps the Saturday of the summer will be June 27th.

The main event will be the R.A.F. Display at Hendon, which, despite its magnitude, is singularly easy to "put over" the microphone. The noise of the machines, the general buzz of the crowds, and the clear-cut programme designing all help to make the broadcast simple to comprehend at the loud speaker.

Sound Flashes

On the same day Col. Brand and Captain Wakelam will perform the miracle of keeping pace verbally with the flight of the ball at Wimbledon. There will also be descriptions of the first Test Match at Lord's, and, very probably, an account of cycle racing at the Herne Hill track. All these events, including the R.A.F. display, will be dealt with during the afternoon in the form of brief flashes from each.

Microphone in Pigeon Loft

THE R.A.F. is not to have the monopoly of flying events. One of the most novel of the summer O.B.s will be given by Major Osman, editor of *The Racing Pigeon*, towards the end of July, when he will describe, and listeners will hear, the early flights of young pigeons. Technically, this process of tuition is known as the "training toss." Listeners will hear the flapping of the young wings, and afterwards visit the pigeon lofts to greet the birds at the conclusion of their flights.

A Rare Broadcast

AN event which happens only once in fifteen years will be the subject of an "O.B." on July 16th. This is the presentation of new colours to the Brigade of Guards in Hyde Park by H.M. the King at 5.15 in the evening.

Major Bourne-May, who excels at military descriptions, will paint the sound picture at the microphone against a background of ceremonial band music and clipped words of command.

Television Scenery

THE question of scenery for television is closely engaging the attention of Peter Bax

and Harry Pringle, who are to be "stage managers" at Alexandra Palace. In the case of intermediate film transmission by the Baird system the scenery can, of course, be closely similar to that used on film sets, though it may have to be more mobile in order to facilitate rapid changing during actual transmission.

In the case of direct television by means of the "electric eye," scenery designs will be governed by the colour rules affecting artistes, to which reference was made in these columns a fortnight ago. Red scenery will be taboo, and there will be a preponderance of blues and blacks to contrast with the lighter tones.

Building "Sets"

Painted back-cloths are to be rigidly banned from the Alexandra Palace studios, it being the intention of the stage managers to begin building solid "sets" at the earliest possible moment. A carpenter's shop will be a *sine qua non*, and fortunately there is ample space for this.

"Properties" of all kinds may eventually be acquired, though it is unlikely that the early productions will call for elaborate stage furniture. It is probable that many artistes will bring their own "props."

How to See Television

While on the subject of television it is interesting to learn that the B.B.C. is receiving many applications from London stores, cabarets, and other places of public resort for information regarding the installation of television receivers for demonstration purposes.

The B.B.C. is not, of course, sponsoring demonstrations, but is very naturally interested in, and anxious to encourage, facilities for public viewing of the daily programmes.

In Town To-night

THE one hundredth programme in this series takes place to-morrow (June 6th) and marks the conclusion of the feature, which, however, may be revived next autumn. Mr. Hanson has a fund of good stories connected with his efforts to get material for "In Town To-night." One of the best concerns a Persian visitor to our shores who was travelling the world with rare and expensive scents. He could not speak



THE "D.G." AT PLAY. Sir John Reith revealed himself as a talented actor in the B.B.C. Amateur Dramatic Society's recent performance of "The Sport of Kings" at the Fortune Theatre.

English; Hanson could not speak Persian; and it took four hours and a half of preliminary diligent cross-examination in pidgin English to extract passably good material for a two and a half minutes' broadcast.

It was not until the visitor was leaving that the best of his anecdotes came, in broken English. "I travel the desert," said the Persian, "when enemies come to hurt me for I would not discover to them the secret way to make my perfume. To a big rock they bind me in very hot sun. I die. It is old way of torture. My skin shrivel as noonday approach." And then, with a dazzling smile, as he passed through the doorway, he added, simply: "Allah sent the rain."

Broadcasting to Everest

REGULAR reception of the B.B.C.'s Empire programmes has been reported by the Signals Officer of the Everest Expedition. Prior to the departure of the Expedition for India the Signals Officer called at Broadcasting House and discussed with Mr. Beresford Clark, the Director of the Empire Service, arrangements for obtaining programme details in advance. These details are being supplied each week and the results appear to be very encouraging, as a wireless message has reached Mr. Beresford Clark from the Expedition reporting satisfactory reception on most days of the GSH (13.97 metres) and GSF (19.82 metres) transmissions. Chief interest among the members of the Expedition centres round the news bulletins.

The D.G.'s Expletive

WHAT seemed very much like a mild leg-pull occurred in the B.B.C. Amateur Dramatic Society's production of "The Sport of Kings" at the Fortune Theatre, London, when the butler (Sir John Reith) on learning at the telephone that the favourite had been beaten, gave vent to an explosive "Hell!" This is regarded as a direct reply to critics of the recent broadcast of "London Wall," which was so freely besprinkled with "damns" and "hells" that as many as forty listeners wrote to Broadcasting House, registering protests against the use of these expletives.

Where the B.B.C. Draws the Line

The B.B.C. is unrepentant over the "London Wall" incident; its attitude being that if it is thought that additional emphasis is given to dialogue at a vital moment in a play by the use of slang terms which are "true to life," such terms are permissible. The B.B.C. is more meticulous over the use by artistes of apparently inoffensive words which are intended to rhyme with vulgar terms, or, when taken with their context, convey a double meaning. In spite of the elaborate precautions of producers, these do get on the air at the rate of one every three months, or thereabouts, and the result is a handful of protests from listeners and the suspension of the offending artists for a short period.

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.
Ankara (Turkey)	153		1961	5	Graz (Austria)	886		338.6	7
Kaunas (Lithuania)	155		1935	7	Helsinki (Finland)	895		335.2	10
Brasov (Romania)	160		1875	150	Hamburg (Germany)	904		331.9	100
Hilversum No. 1 (Holland) (10kW. till 2.40 p.m. G.M.T.)	160		1875	100	Toulouse (Radio Toulouse) (France)	913		323.6	60
Lahti (Finland)	166		1807	150	Brno (Czechoslovakia)	922		325.4	32
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172		1744	500	Brussels, No. 2 (Belgium)	932		321.9	15
Paris (Radio Paris) (France)	182		1648	80	Algiers (Algeria)	941		318.8	12
Istanbul (Turkey)	185		1622	3	Göteborg (Sweden)	941		318.8	10
Deutschlandsender (Germany)	191		1571	60	Breslau (Germany)	950		315.8	100
Droitwich	200		1500	150	Paris (Poste Parisien) (France)	959		312.8	60
Minsk, RW10 (U.S.S.R.)	208		1442	35	Odessa (U.S.S.R.)	968		309.9	10
Reykjavik (Iceland)	208		1442	16	Northern Ireland Regional (Lisburn)	977		307.1	100
Motala (Sweden)	216		1389	150	Genoa (Italy)	986		304.3	10
Novosibirsk, RW76 (U.S.S.R.)	217.5		1379	100	Torun (Poland)	986		304.3	24
Warsaw, No. 1 (Poland)	224		1339	120	Hilversum No. 2 (Holland) (15 kW. till 2.40 p.m. G.M.T.)	995		301.5	60
Luxembourg	232		1293	150	Bratislava (Czechoslovakia)	1004		298.8	13.5
Kharkov, RW20 (U.S.S.R.)	232		1293	20	Midland Regional (Droitwich)	1013		296.2	70
Kalundborg (Denmark)	240		1250	60	Chernigov (U.S.S.R.)	1013		296.2	5
Leningrad, RW53 (Kolpino) (U.S.S.R.)	245		1224	100	Barcelona, EAJ15 (Spain)	1022		293.5	3
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25	Cracow (Poland)	1022		293.5	2
Oslo (Norway)	260		1153.8	60	Königsberg No. 1 (Heilsberg) (Germany)	1031		291	100
Moscow, No. 2, RW49 (Stchelkovo) (U.S.S.R.)	271		1107	100	Paredo (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 (France)	1040		288.5	40
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 No. 1 (Italy)	1059		283.3	20
Sverdlovsk, RW5 (U.S.S.R.)	375		800	50	Paris (Radio Cité) (France)	1068		280.9	0.8
Geneva (Switzerland)	401		748	1.3	Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
Moscow, No. 3 (RCZ) (U.S.S.R.)	401		748	100	Bordeaux-Lafayette (France)	1077		278.6	25
Voroneje, RW25 (U.S.S.R.)	413.5		726	10	Zagreb (Yugoslavia)	1086		276.2	0.7
Oulu (Finland)	431		696	1.2	Falun (Sweden)	1086		276.2	2
Ufa, RW22 (U.S.S.R.)	436		688	10	Madrid, EAJ7 (Spain)	1095		274	10
Banska-Bystrica (Czechoslovakia)	478		627	100	Madona (Latvia)	1104		271.7	50
Tartu (Estonia)	517		580	0.5	Naples (Italy)	1104		271.7	1.5
Hamar (Norway)	519		578	0.7	Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Innsbruck (Austria)	519		578	1	Fécamp (Radio Normandie) (France)	1113		269.5	15
Ljubljana (Yugoslavia)	527		569.3	5	Alexandria, No. 1 (Egypt)	1122		267.4	0.25
Viipuri (Finland)	527		569.3	10	Newcastle	1122		267.4	1
Bolzano (Italy)	536		559.7	20	Nyiregyhaza (Hungary)	1122		267.4	6.2
Wilno (Poland)	536		559.7	16	Hörby (Sweden)	1131		265.3	10
Budapest, No. 1 (Hungary)	546		549.5	120	Turin, No. 1 (Italy)	1140		263.2	7
Beromünster (Switzerland)	556		539.6	100	Trieste (Italy)	1140		263.2	10
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 (Germany)	574		522.6	100	West National (Washford Cross)	1149		261.1	20
Alpes-Grenoble, P.T.T. (France)	583		514.6	15	Kosice (Czechoslovakia)	1158		259.1	2.6
Riga (Latvia)	583		514.6	15	Monte Ceneri (Switzerland)	1167		257.1	15
Vienna (Austria)	592		506.3	100	Copenhagen (Denmark)	1176		255.1	10
Rabat (Morocco)	601		499.2	30	Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Sundsvall (Sweden)	601		499.2	10	Nice-Corse (France)	1185		253.2	60
Florence (Italy)	610		491.3	20	Frankfurt (Germany)	1195		251	25
Cairo, No.1 (Egypt)	620		483.9	20	Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Brussels, No. 1 (Belgium)	620		483.9	15	Lille, P.T.T. (France)	1213		247.3	60
Lisbon (Portugal)	629		476.9	20	Gleiwitz (Germany)	1231		243.7	5
Trøndelag (Norway)	629		476.9	20	Cork (Irish Free State)	1240		241.9	1
Prague, No. 1 (Czechoslovakia)	638		470.2	120	Saarbrücken (Germany)	1249		240.2	17
Lyons, P.T.T. (France)	648		463	100	Kuldiga (Latvia)	1258		238.5	10
Cologne (Germany)	658		455.9	100	Rome, No. 3 (Italy)	1258		238.5	1
North Regional (Slaithwaite)	668		449.1	70	San Sebastian, EAJ8 (Spain)	1258		238.5	1
Sottens (Switzerland)	677		443.1	100	Nürnberg (Germany)	1267		236.8	2
Belgrade (Yugoslavia)	686		437.3	2.5	Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	0.8
Paris, P.T.T. (France)	695		431.7	120	Christiansand and Stavanger (Norway)	1276		235.1	0.5
Stockholm (Sweden)	704		426.1	55	Dresden (Germany)	1285		233.5	0.25
Rome, No. 1 (Italy)	713		420.8	50	Aberdeen	1285		233.5	1
Kiev, RW9 (U.S.S.R.)	722		415.5	36	Austrian Relay Stations	1294		231.8	6
Tallinn (Estonia)	731		410.4	20	Danzig	1303		230.2	0.5
Madrid, EAJ2 (Spain)	731		410.4	3	Swedish Relay Stations	1312		228.7	1.25
Seville (Spain)	731		410.4	5.5	Magyarovar (Hungary)	1321		227.1	1.25
Munich (Germany)	740		405.4	100	German Relay Stations	1330		225.6	2
Marseilles, P.T.T. (France)	749		400.5	120	Montpellier, P.T.T. (France)	1339		224	0.8
Katowice (Poland)	758		395.8	12	Lodz (Poland)	1339		224	2
Scottish Regional (Falkirk)	767		391.1	50	Dublin (Irish Free State)	1348		222.6	0.5
Stalino (U.S.S.R.)	776		386.6	10	Milan, No. 2 (Italy)	1357		221.1	4
Toulouse, P.T.T. (France)	776		386.6	1	Turin, No. 2 (Italy)	1357		221.1	0.2
Leipzig (Germany)	785		382.2	120	Basle and Berne (Switzerland)	1375		218.2	0.5
Barcelona, EAJ1 (Spain)	795		377.4	7.5	Warsaw, No. 2 (Poland)	1384		216.8	2
Lwow (Poland)	795		377.4	16	Lyons (Radio Lyons) (France)	1393		215.4	25
West Regional (Washford Cross)	804		373.1	70	Tampere (Finland)	1420		211.3	0.7
Milan, No. 1 (Italy)	814		368.6	50	International Common Wave	1429		209.9	0.5
Bucharest (Romania)	823		364.5	12	Miskolc (Hungary)	1438		208.6	1.25
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832		360.6	100	Paris (Eiffel Tower) (France)	1456		206	5
Berlin (Germany)	841		356.7	100	Pecs (Hungary)	1465		204.8	1.25
Bergen (Norway)	850		352.9	1	Antwerp and Courtrai (Belgium)	1465		204.8	0.1
Sofia (Bulgaria)	850		352.9	1	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	0.7
Strasbourg (France)	859		349.2	40	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.)

Metres.	kc/s.	Call Sign.	Station.	Tuning Positions.	Metres.	kc/s.	Call Sign.	Station.	Tuning Positions.
75.0	4,000	CT2AJ	Ponta Delgada (Azores). (Wed., Sat., 22.00 to 24.00.)		31.55	9,510	VK3ME	Melbourne (Australia). (Wed. 10.00 to 11.30, Sat. 10.00 to 12.00.)	
70.2	4,273	RV15	Kharbarovsk (U.S.S.R.). (Daily 06.00 to 14.00.)		31.48	9,530	LKJ1	Jelby (Norway). (Relays Oslo.) (Daily 10.00 to 13.00.)	
67.11	4,470	YDB	Sourabaya (Java). (Daily 03.30 to 06.30)		31.48	9,530	W2XAF	Schenectady, N.Y. (U.S.A.). (Relays WGY.) (Daily 23.30 to 04.00, Sat. 19.00 to 22.00 also.)	
51.28	5,850	YV5RMO	Maracaibo (Venezuela). (Daily, 22.00 to 02.00.)		31.45	9,540	DJN	Zeesen (Germany). (Daily 08.45 to 12.15, 13.00 to 16.30, 22.15 to 03.30.)	
50.26	5,969	HVJ	Vatican City. (Daily 19.00 to 19.15, Sun. 10.00 also.)		31.38	9,560	DJA	Zeesen (Germany). (Daily 13.00 to 16.30, 22.15 to 02.00.)	
50.16	5,980	HIX	Trojillo (Domenica). (Daily, 12.00, Sun. 00.38 also.)		31.36	9,565	VUB	Bombay (India). (Sun. 13.30 to 15.30, Wed., Thurs., Sat. 16.30 to 17.30, irregular Mon.)	
50.00	6,000	XEBT	Mexico City (Mexico). (Daily 00.00 to 09.00.)		31.35	9,570	W1XK	Millis, Mass. (U.S.A.). (Relays WBZ.) (Daily 12.00 to 06.00.)	
50.00	6,000	RW59	Moscow (U.S.S.R.). (Relays No. 1 Stn.) (Daily 20.00 to 23.00.)		31.32	9,580	GSC	Empire Broadcasting	
49.92	6,010	COCO	Havana (Cuba). (Daily 21.00 to 23.00, 01.00 to 03.00, Sun. 04.30 to 06.30 also.)		31.32	9,580	VK3LR	Lyndhurst (Australia). (Daily ex. Sun. 08.15 to 12.30.)	
49.85	6,018	HJ3ABH	Bogota (Colombia) ...		31.32	9,580	LRX	Buenos Aires (Argentina) ...	
49.85	6,018	ZHI	Singapore (Malaya). (Mon., Wed., Thurs. 23.00 to 01.30, Sun. 03.40 to 05.10.)		31.28	9,590	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 17.00 to 24.00.)	
49.83	6,020	DJC	Zeesen (Germany). (Daily 22.30 to 03.30, 17.00 to 21.30.)		31.28	9,590	VK2ME	Sydney (Australia). (Sun. 06.00 to 08.00, 10.00 to 14.00, 14.30 to 16.30.)	
49.75	6,030	HP5B	Panama City (Central America). (Daily 17.00 to 18.00, 01.00 to 03.30.)		31.28	9,590	PCJ	Eindhoven (Holland) ...	
49.75	6,030	VE9CA	Calgary (Canada). (Thurs. 14.00 to 07.00, Sun. 17.00 to 05.00.)		31.27	9,595	HBL	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)	
49.67	6,040	W1XAL	Boston, Mass. (U.S.A.). (Sun. 22.00 to 24.00, Wed., Fri. 00.30 to 01.45.)		31.13	9,635	2RO	Rome (Italy). (Tues., Thurs., Sat. 00.45 to 02.15.)	
49.67	6,040	W4XB	Miami, Fla. (U.S.A.) Daily 17.00 to 19.30, 22.30 to 05.00.)		31.09	9,650	CT1AA	Lisbon (Portugal) ...	
49.67	6,040	PRA8	Pernambuco (Brazil). (Daily 20.00 to 00.30.)		31.0	9,677	CT1CT	Lisbon (Portugal). (Thurs. 21.00 to 23.00, Sun. 12.00 to 14.00.)	
49.59	6,050	GSA	Empire Broadcasting ...		30.43	9,860	EAQ	Madrid (Spain). (Daily 22.15 to 00.30, Sat. 18.00 to 20.00 also.)	
49.5	6,060	W8XAL	Cincinnati, Ohio (U.S.A.). (Daily 12.00 to 01.00, 04.00 to 06.00.)		29.24	10,263	PMN	Rangoeng (Java). (Sun., 12.00 to 15.00) ...	
49.5	6,060	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 01.00 to 04.00.)		29.04	10,330	ORK	Ruyssedeo (Belgium). (Daily 18.30 to 20.30.)	
49.5	6,060	OXY	Skamlebaek (Denmark). (Relays Kalundborg.) (Daily 18.00 to 24.00, Sun. 16.00 also.)		28.01	10,710	JVM	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)	
49.41	6,072	OER2	Vienna Experimental. (Daily 14.00 to 22.00.)		27.93	10,740	JVM	Tokio (Japan). (Tues., Fri. 19.00 to 20.00)	
49.33	6,080	ZHJ	Penang (Malaya). (Daily ex. Sun., 11.40 to 13.40; Sun. 12.40 to 14.40)		25.6	11,720	TPA1	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 00.00 to 03.00, 04.00 to 06.00.)	
49.33	6,080	W9XAA	Chicago, Ill. (U.S.A.). (Relays WCLF.) (Sun. 19.00 to 20.30.)		25.53	11,750	GSD	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30 also.)	
49.31	6,083	VQ7LO	Nairobi (Kenya Colony). (Daily 16.00 to 19.00, Sat. to 20.00, Mon., Wed., Fri. 10.45 to 11.15 also, Tues. 08.00 to 09.00 also, Thurs. 13.00 to 14.00 also, Sun. 17.45 to 19.00 also.)		25.49	11,770	DJD	Empire Broadcasting	
49.26	6,090	CRCX	Bowmanville, Ont. (Canada). (Mon., Tues., Wed. 20.00 to 05.00, Thurs., Fri., Sat. 12.00 to 05.00, Sun. 18.00 to 02.00.)		25.45	11,790	W1XAL	Zeesen (Germany). (Daily 17.00 to 21.30)	
49.2	6,097	ZTJ	Johannesburg (S. Africa). (Daily ex. Sun. 04.30 to 05.30, 08.30 to 12.00, 14.00 to 20.00 (Sat. to 21.45), Sun. 13.00 to 15.15, 17.30 to 20.00.)		25.40	11,810	2RO	Boston, Mass. (U.S.A.). (Daily 23.00 to 00.30.)	
49.18	6,100	W3XAL	Bound Brook, N.Y. (U.S.A.). (Relays WJZ.) (Mon., Wed., Sat. 22.00 to 23.00, Sat. 05.00 to 06.00 also.)		25.38	11,820	GSN	Rome (Italy). (Mon., Wed., Fri. 23.00) ...	
49.18	6,100	W9XF	Chicago, Ill. (U.S.A.). (Daily ex. Mon., Wed., Sun. 21.00 to 07.00.)		25.36	11,830	W2XE	Empire Broadcasting	
49.1	6,110	GSL	Empire Broadcasting ...		25.36	11,830	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 20.00 to 03.00.)	
49.1	6,110	VUC	Calcutta (India). (Daily 07.06 to 08.06 irregular 13.06 to 16.36, Sat. from 12.36, Sun. 04.36 to 07.36, irregular 12.36 to 03.36.)		25.35	11,860	CT1AA	Lisbon (Portugal) ...	
49.1	6,110	HJ4ABE	Medellin (Colombia). (Daily, 16.30 to 18.30, Sun., Tues., Thurs., 23.30 to 03.00 also.)		25.29	11,860	GSE	Empire Broadcasting	
49.02	6,120	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 03.00 to 04.00.)		25.27	11,870	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 03.00.)	
48.92	6,130	COCD	Havana (Cuba) (Daily 23.00 to 05.00.)		25.23	11,880	TPA3	Paris, Radio Coloniale (France). (Colonial Stn. N-S.) (Daily 16.15 to 19.15, 20.00 to 23.00.)	
48.86	6,140	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 06.00.)		25.09	11,955	ETB	Addis Ababa (Abyssinia) (Irregular) ...	
48.78	6,150	CSL	Lisbon (Portugal). (Daily 11.00 to 12.30, 18.00 to 22.00.)		25.0	12,000	RW59	Moscow (U.S.S.R.). (Relays No. 2 Stn.) (Sun. 03.00 to 04.00, 11.00 to 12.00, 15.00 to 16.00.)	
48.78	6,160	YV3RC	Caracas (Venezuela). (Daily 20.30 to 01.30.)		24.83	12,082	CT1CT	Lisbon (Portugal). (Sun. 14.00 to 16.00, Thurs. 20.00 to 21.00.)	
48.78	6,150	CJRO	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30.)		24.52	12,235	TFJ	Reykjavik (Iceland). (Sun. 18.40 to 19.00.)	
48.4	6,198	CT1GO	Parde (Portugal). (Daily ex. Tues. 00.20 to 01.30, Sun. 16.30 to 18.00 also.)		24.2	12,396	CT1GO	Pared (Portugal). (Sun. 15.00 to 16.30, Tues., Thurs., Fri. 18.00 to 19.15.)	
47.50	6,316	HIZ	Trojillo (Domenica). (Daily 21.40 to 22.40, Sun. 16.00 to 17.30 also.)		22.94	13,075	VPD	Suva (Fiji). (Daily ex. Sun. 05.30 to 03.60)	
47.05	6,375	YV4RC	Caracas (Venezuela). (Daily 21.30 to 03.30.)		22.00	13,635	SPW	Warsaw (Poland). (Daily 16.30 to 17.30.)	
46.52	6,447	HJ1ABB	Barranquilla (Colombia). Daily 21.30 to 03.30.)		21.42	14,005		Band of wavelengths allotted to amateur transmitters.	
46.21	6,490	HJ5ABD	Cali (Colombia). (Daily 00.00 to 03.00) ...		20.84	14,395			
46.0	6,520	YV6RV	Valencia (Venezuela). (Daily 17.00 to 18.00, 23.00 to 03.00.)		19.84	15,123	HVJ	Vatican City. (Daily 10.00, 15.30 to 15.45)	
45.31	6,620	PRADO	Riobamba (Ecuador). (Fri. 02.00 to 03.40)		19.82	15,140	GSF	Empire Broadcasting	
45.0	6,667	HC2RL	Guayaquil (Ecuador). (Sun. 22.45 to 12.45, Wed. 02.15 to 04.15.)		19.76	15,180	GSO	Empire Broadcasting	
42.86	7,000		Band of wavelengths allotted to amateur transmitters.		19.74	15,200	DJB	Zeesen (Germany). (Daily 08.45 to 12.15)	
41.10	7,300				19.72	15,210	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 13.00 to 21.15.)	
39.95	7,510	JVP	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)		19.71	15,220	PCJ	Eindhoven (Holland). (Experimental) ...	
39.37	7,620	ETA	Addis Ababa (Abyssinia) (Irregular)		19.68	15,243	TPA2	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 12.00 to 16.00.)	
38.48	7,797	HBP	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)		19.67	15,250	W1XAL	Boston, Mass. (U.S.A.). (Daily 15.50 to 18.30.)	
36.5	8,214	HCJB	Quito (Ecuador). (Daily ex. Sun., Mon. 00.45 to 04.45, Sun. 21.45 to 04.15.)		19.66	15,260	GSI	Empire Broadcasting	
34.29	8,750	ZCK3	Hong Kong (China). (Daily 10.00 to 14.00.)		19.65	15,270	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 18.00 to 20.00.)	
32.88	9,125	HAT4	Budapest (Hungary). (Sat. 23.00 to 24.00)		19.63	15,280	DJQ	Zeesen (Germany). (Daily 04.30 to 06.00)	
31.8	9,428	COCH	Havana (Cuba) (Daily 16.00 to 17.00, 22.00 to 23.00, 01.00 to 02.00.)		19.62	15,290	LRU	Buenos Aires (Argentina) ...	
31.58	9,501	PRF5	Rio de Janeiro (Brazil). (Daily 22.30 to 23.15.)		19.60	15,310	GSP	Empire Broadcasting	
31.55	9,510	GSB	Empire Broadcasting ...		19.56	15,530	W2XAD	Schenectady, N.Y. (U.S.A.). (Daily 19.30 to 20.30.)	
					19.52	15,370	HAS3	Budapest (Hungary). (Sun. 13.00 to 14.00.)	
					16.89	17,760	DJE	Zeesen (Germany). (Daily 13.00 to 16.30)	
					16.89	17,760	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 16.00 to 18.00.)	
					16.88	17,770	PH1	Huizen (Holland). (Daily ex. Tues., Wed. 13.00 to 15.30, Sun., Sat. to 16.30.)	
					16.87	17,780	W3XAL	Bound Brook, N.J. (U.S.A.). (Relays WJZ.) (Daily except Sun. 14.00 to 15.00, Tues. Thurs., Fri. 20.00 to 21.00 also.)	
					16.86	17,790	GSG	Empire Broadcasting	
					16.42	18,270	ETA	Addis Ababa (Abyssinia) (Irregular) ...	
					15.93	18,830	PLE	Rangoeng (Java). (Tues., Thurs., Sat. 15.00 to 15.30.)	
					13.97	21,470	GSH	Empire Broadcasting	
					13.94	21,520	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 12.30 to 13.00.)	
					13.93	21,530	GSJ	Empire Broadcasting	
					13.92	21,540	W8XK	Pittsburg, Pa. (U.S.A.). (Daily 12.00 to 14.00.)	

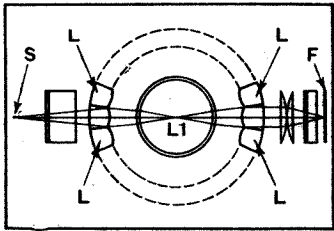
Recent Inventions

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.

SCANNING SYSTEMS

LIGHT from a source S is passed through a ring of thin cylindrical lenses L, arranged with their optical axes in the plane of the ring; then through a central cylindrical lens L₁, which rotates with the ring as a whole; and out through the opposite side of the



The scanning system described in patent No. 443393.

ring on to a cinema-film F, which it traverses in a scanning line. The other direction of scanning is provided by moving the film bodily. The ring of lenses L is enclosed in a casing so as to exclude dust.

Scophony, Ltd., and J. H. Jeffree. Application date December 28th, 1934. No. 443393.

"SHAPING" SYNCHRONISING SIGNALS

WHEN producing synchronising impulses for television by means of a slotted disc or "light-siren" at the transmitter, it is difficult to keep them free from extraneous interference, such as valve "noise" and microphonic pick-up, without using tuned circuits in the amplifier. On the other hand, if tuned circuits are used, the wave-shape of the impulse is changed from rectangular into a more or less sinusoidal form, which is not so effective in operation.

According to the invention, the original impulses are applied first to a grid-current rectifier, and then to an anode-bend rectifier. The first "narrows" the impulse into a peak, owing to the flow of grid-current, whilst the second responds only to the "peak" of the resulting wave-form and emphasises it. The final shape of the impulse is therefore mainly rectangular. Its width or "duration" can be regulated by adjusting the grid bias of the second valve.

T. M. C. Lance, D. W. Pugh and Baird Television, Ltd. Application date August 24th, 1934. No. 443032.

REMOTE TUNING-CONTROL

THE tuning of a superhet set is controlled from a distance through a variable-reactance unit which is adjusted by the listener to alter the frequency of the local-oscillator valve in the set, so as to bring in any desired station.

The control unit is coupled to the set through a screened cable with matched impedance transformers at the input and output ends. A second screened cable is provided to regulate the back-coupling between plate and grid of the oscillator valve.

Marconi's Wireless Telegraph Co., Ltd.; N. M. Rust; and J. D. Brailsford. Application date August 3rd, 1934. No. 443637.

o o o o

SHORT-WAVE MODULATORS

IT is difficult to apply intensive amplification to waves of three metres or less owing to the heavy capacity losses which occur through the valves. Further, it is not possible to modulate such waves deeply, because the oscillator valve ceases to generate when the applied signal currents exceed a certain strength.

According to the invention these drawbacks are overcome by applying the modulating signals to a valve inserted directly in the feed-line connecting the oscillation generator to the transmitting aerial.

L. H. Paddle. Application date January 3rd, 1935. No. 443803.

o o o o

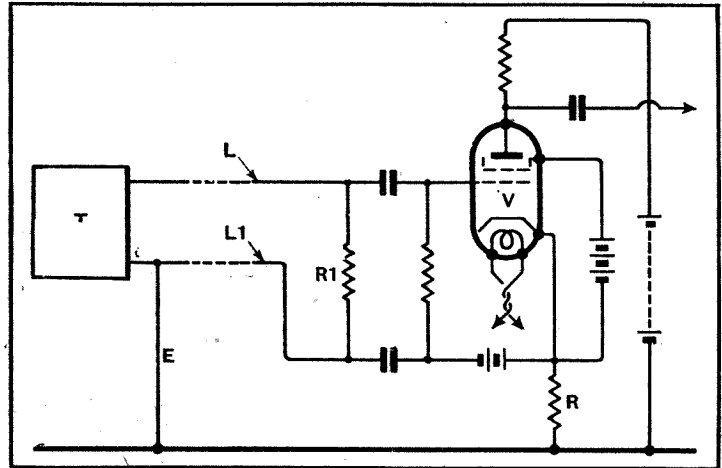
AUTOMATIC TUNING

A SLIGHT initial mistuning in a superhet receiver is automatically corrected, and the circuits brought into exact resonance with the incoming signal, by making use of the varying impedance of a valve shunted across the tuning condenser of the local oscillator valve. As shown in the figure, the frequency-changer V is followed by an intermediate-frequency amplifier V₁, an AVC diode D, and a pair of reversed

diodes D₁, D₂, the load resistance of the latter being included in the grid circuit of the tuning-control valve V₂. A switch S, frictionally mounted on the main

TRANSMISSION LINES

WHEN feeding high-frequency signals, say, from a television transmitter T through a high-frequency transmission line



High-frequency transmission line for television circuits.

tuning-shaft, determines which particular one of the pair of diodes D₁, D₂ is brought into action.

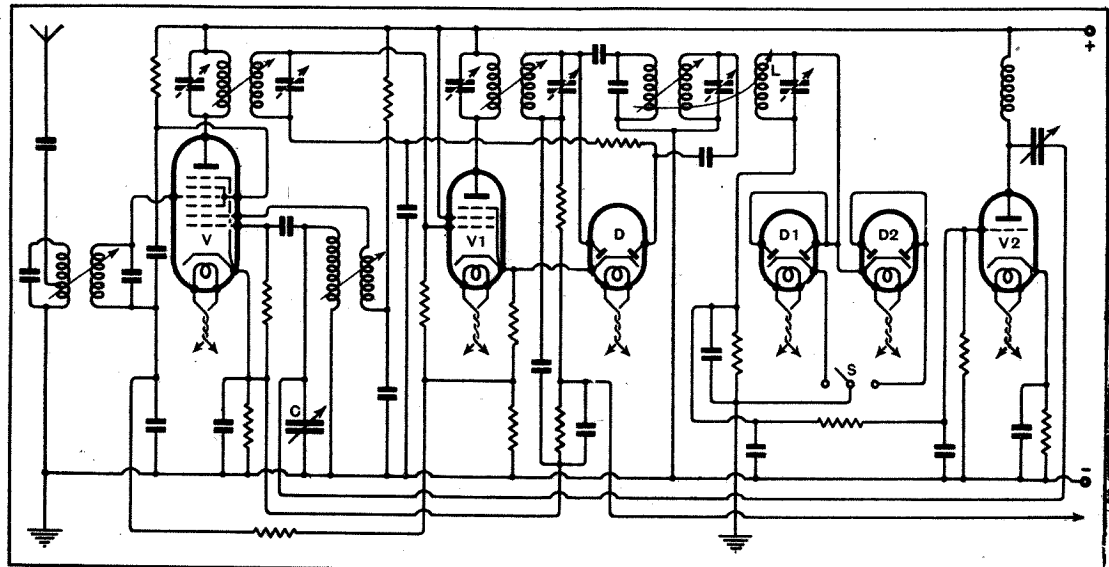
If the initial mistuning is such as to bring the diode D₂ into circuit, the intermediate frequency supplied from the circuit L to that diode throws the grid of the valve V₂ positive. The valve V₂ is, in effect, shunted across the main tuning condenser C, and in response to the positive grid bias its impedance falls and varies the tuning of the local oscillations until the circuits come into resonance with the signal. The diode D₁ acts in the reverse fashion, so that the circuits are corrected for over and under tuning.

E. K. Cole, Ltd.; A. W. Martin; and F. A. Inskip. Application date September 20th, 1934. No. 443595.

L, L₁ to a modulator or other valve V, it is desirable to cut-out any inductive pick-up along the line. The use of terminal coupling-transformers for this purpose is not practicable on account of the wide frequency band involved.

As shown, both lines L, L₁ are coupled directly to the input valve, one to the grid, and the other to the cathode, which is earthed through a very high resistance R. The other end of the line L₁ is directly earthed at E near the transmitter. The two lines are bridged by a resistance R₁ equal to the surge impedance of the line. The arrangement allows signal currents to reach the valve V unaltered in phase, though earth currents and similar disturbances are eliminated.

E. L. C. White. Application date August 31st, 1934. No. 443589.



Circuit for automatic tuning correction applied to a superheterodyne receiver.

The Wireless World

THE
PRACTICAL RADIO
JOURNAL
26th Year of Publication

No. 876.

FRIDAY, JUNE 12TH, 1936.

VOL. XXXVIII.

No. 24.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Waterloo 3333 (50 lines).
Telegrams: "Ethaworld, Sedist, London."

COVENTRY: Hertford Street.

Telegrams: "Autocar, Coventry."
Telephone: 5210 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham."
Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Iliffe, Manchester."
Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26b, Renfield Street, C.2.

Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates :

Home, £1 1s. 8d. ; Canada, £1 1s. 8d. ; other
countries, £1 3s. 10d. per annum.

*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

Amateur Broadcasts

A Well-intentioned Warning

IN the days before official broadcasting enveloped the country, the transmissions emanating from amateur experimental stations were constantly listened to by those who owned receivers, and the amateur concerts of gramophone records contributed in no small measure towards popularising listening in those early days. At that time amateur transmissions took place on wavelengths which were included in the band normally covered by broadcast receivers, but as the broadcasting service grew, amateurs were transferred to lower wavelengths for their experimental work and moved out of the normal limits of reception of broadcast receivers, and so out of the public ear.

To-day the most active amateur transmitters operate on short waves, and, with the constant increase in the number of all-wave receivers used by the general public, amateur transmissions are coming back into the limelight of publicity.

Whereas some time ago their transmissions would be picked up only by other experimenters, they are now listened to by thousands—perhaps tens of thousands—of the general public. This being so, amateurs should be particularly careful in regard to what they transmit, and some transmissions which have been overheard recently on normal all-wave sets prompt this warning to amateurs generally, that, in the common interests of their hobby, they should remember that they now have a very large audience listening in to everything they have to say. In particular, they should understand that in this country, where broadcast advertising is expressly forbidden, their stations, either intentionally or otherwise, must not be put to use for such a purpose.

The amateur here should be particularly careful to avoid any clash with the authorities which might result from misuse of the facilities granted in his licence. Already the rights which the transmitting amateur enjoys in this country are very meagre when compared with those of his brother experimenter in America, for there the status of the amateur is very high and, as a body, amateurs have frequently been of material service in maintaining communication in emergencies when other channels of contact have failed. In America, too, there is no monopoly of communication vested in a postmaster-general and, in consequence, amateurs may use their stations for the exchange of personal messages.

B.B.C. Thoroughness

Choosing a Station Site

THE B.B.C. as an organisation is continually in the news. Members of the administrative or programme staffs can become heroes overnight and command headlines in the Press, yet the engineering staff who have made efficient broadcasting possible are seldom heard of. It always gives satisfaction, therefore, when it is possible to chronicle facts concerning the engineering side of the B.B.C. and to give credit for the thoroughness with which their work is carried out.

We publish in this issue an article describing the systematic way in which B.B.C. engineers go about the selection of a site for a new station. There is nothing haphazard or casual in the choice, but the site is located after long and exhaustive tests as to its suitability to provide a service in the area which it is destined to cover.

The engineering staff, directed by Sir Noel Ashbridge, shoulder a most responsible task, and do so with commendable thoroughness and absence of ostentation.

Distortionless AVC

SIMPLE DIODE AND AMPLIFIED AUTOMATIC VOLUME CONTROL

RECENT investigation has shown that automatic volume control can introduce a considerable degree of distortion unless it is carefully applied. Two systems which are free from this defect are described in detail in this article

IN a recent article in *The Wireless World*¹ the writer discussed the question of whether AVC is worth while for general broadcast reception, and he pointed out that the most commonly used systems introduce a very appreciable degree of distortion. Whether the listener decides that AVC is advantageous or not, however, it is unlikely to fall into disuse, for there is no doubt that it is valuable in short-wave work, and reception on these bands is becoming increasingly popular. This fact need not discourage those who decide that AVC, as obtained at present, is definitely disadvantageous, however,

variation in detector input is permissible. Moreover, fading is often accompanied by distortion, which tends to mask any variations in volume; the result is that the detector input can be permitted to change by quite a large amount before the ear can detect much alteration in the volume.

Now the simplest method of AVC is to employ the DC output of the diode detector to bias variable- μ valves in the early stages of the receiver. There are many ways of arranging the detector circuit, but most in common use are similar to that of Fig. 1. It will be seen that the potentials developed across the secondary of the IF transformer are applied through C1 of about 100 mmfds. capacity between the anode and cathode of the diode. Rectification occurs, and there is a steady current with a superimposed modulation frequency current flowing through R1

The steady current flowing through R2 produces a voltage drop across it which is proportional to the detector input as long as the detector is linear, and the polarity is such that the anode of the diode becomes negative with respect to the cathode. The modulation frequency currents through R2 also set up modulation frequency potentials across it, and the purpose of the succeeding components is to filter out the required potentials. For operating the next valve only the modulation frequency potentials are required, so that the simple filter C3 R3 suffices. To secure a flat frequency response in this portion of the circuit it is only necessary that at the lowest frequency required the reactance of C3 be very small compared with the resistance of R3. For frequencies as low as 30 c/s satisfactory results are secured if R3 C3 is not less than 0.05 (R3 in megohms, C3 in microfarads).

The purpose of the second filter R4 C4 is to remove the modulation frequencies and permit the passage of direct current for AVC purposes, but since it has a time constant it governs the speed of operation of AVC. From the point of view of filtering, the reactance of C4 at the lowest modulation frequency should be negligible compared with the resistance of R4. Consequently, R4 C4 should be as large as possible. The time constant also depends on R4 C4, however, and to secure rapid action R4 C4 should be as small as possible. A compromise is thus necessary and customary values for R4 C4 range between 0.01 and 0.1, the smaller value being favoured in short-wave apparatus where high-speed fading, which necessitates quick action on the part of the AVC system, is likely to be found.

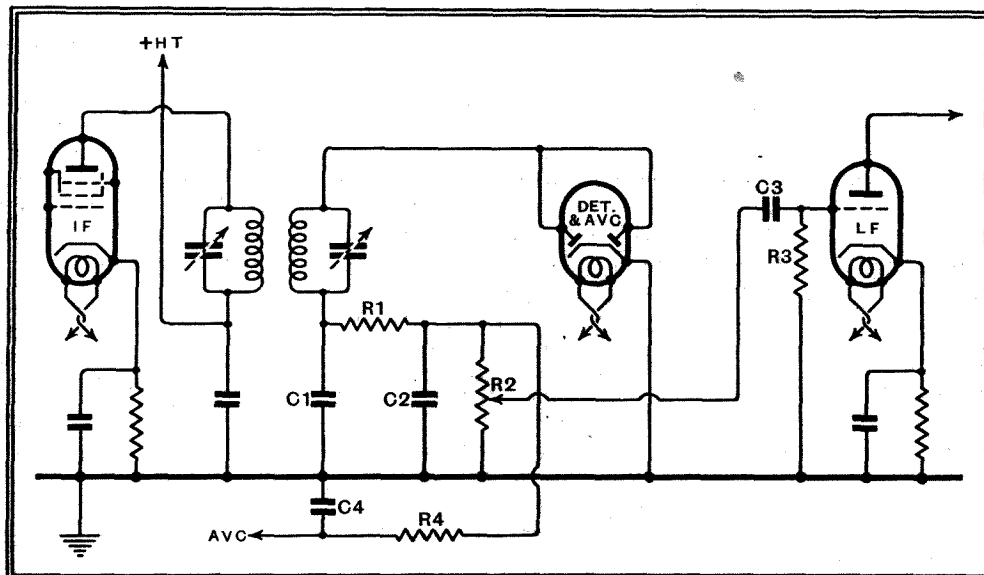


Fig. 1.—The arrangements for simple non-delayed AVC are shown here and it will be seen that the output of the diode detector is employed as AVC bias.

for it only means that better systems must be devised.

Ideally an automatic volume control system would introduce no distortion; it would be very rapid in action and inexpensive, and it would be efficient enough to maintain the detector input constant irrespective of the signal input to the receiver. In order that it may act properly to reduce fading it is necessary that it be quick in action, but it is not so necessary that it maintain the detector input constant, for since the ear cannot detect small changes in volume readily some

and the impedance of the following circuit to cathode. At zero frequency this impedance is the resistance of the volume control R2, so that the DC load of the diode detector is R1 + R2.

At modulation frequencies the reactances of the condensers C3 and C4 should be negligibly small and those of the condensers C1 and C2 so high that they can be ignored. Assuming that the volume control is at maximum, the AC load of the diode detector is R1 plus the parallel value of R2, R3 and R4, or $R_1 + R_2 / (1 + R_2 / R_3 + R_2 / R_4)$ where $R_5 = R_3 R_4 / (R_3 + R_4)$. The relative values of the DC and AC loads is an important matter to which we shall return later.

The Diode Detector

The remaining components R1 and C2 form a filter to prevent IF potentials from reaching the LF circuits and AVC system. At the highest modulation frequency R1 must be small compared with the reactance of C2 if attenuation is to be avoided, but at the intermediate frequency R1 must be very large compared with the reactance of C2 if the filtering is to be efficient. In general, C2 is about 100 mmfds. and R1 some 20,000-50,000 ohms. Better results are secured, however, with a double filter; that is, when R1 is split into two resistances, each of some 10,000 ohms, and an extra 100 mmfds. condenser is connected to earth from their junction. Much better filtering is then secured for a given upper limit of response to modulation frequencies. This same principle of

¹ Is Automatic Volume Control Worth While? *The Wireless World*, May 22nd, 1936, pp. 502-504.

Systems

By W. T. COCKING

double, or even triple, filtering is also sometimes of advantage in the AVC line.

Now the output of a diode detector is $mE\kappa/10,000=V$ where m is the percentage depth of modulation, κ is the efficiency of rectification expressed as a percentage, and E is the peak carrier input. Except at small inputs κ is about 90 per cent., so we can say approximately $V=0.9mE/100$, and this expression gives also the steady output if we write $m=100$. We have, however, to take into account the losses in the various filters, and the AVC voltage actually available on the AVC line is $V_{AVC}=0.9E R_2/(R_1+R_2)=0.9E/(1+R_1/R_2)$. The LF output, however, is $V_{LF}=0.9mE/\{1+(1+R_2/R_5)R_1/R_2\}$ with the volume control at maximum.

Distortionless Detection

It can be shown that for freedom from amplitude distortion at all modulation depths the DC and AC loads on the diode must be equal. We cannot obtain this condition, however, and distortion occurs whenever the modulation depth approaches $m=100$; the maximum percentage depth of modulation for which rectification is distortionless is equal to 100 times the ratio of the AC and DC loads. In the case of the circuit of Fig. 1,

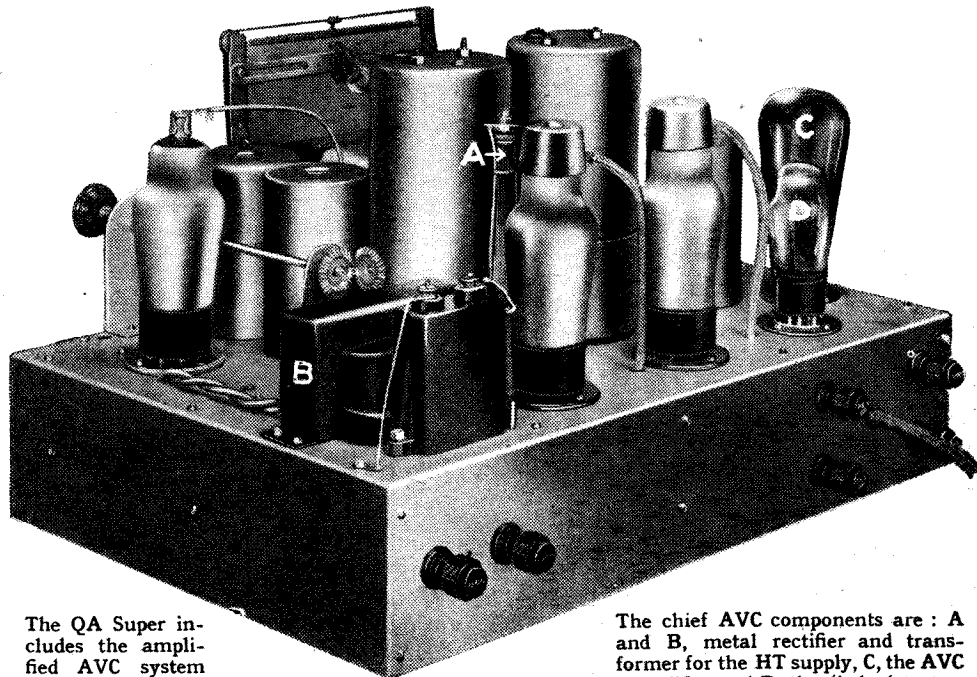
$$m_{MAX.} = 100 \left(R_1 + \frac{R_2 R_5}{R_2 + R_5} \right) / (R_1 + R_2);$$

in more useful form

$$R_{5MIN.} = \frac{R_2}{R_1} \left\{ \frac{m R_2}{100 - m} - R_1 \right\}$$

There would, of course, be little difficulty in meeting the various conditions if it were not for the fact that most valve makers place a limit to the maximum resistance which must be included in the grid-cathode circuit of the valve, and this is usually about 2 megohms. If it is common to more than one valve, the maximum value is 2 megohms divided by the number of valves. They also place a minimum limit to the DC load resistance of a diode detector, about 0.25 megohm for a single diode. Apart from this, it is disadvantageous to make the load resistance of low value, for the input resistance of the diode is approximately one-half the DC load resistance. The input resistance must be kept as high as possible, not only to maintain efficiency, but also to reduce distortion caused by overloading in the last IF valve.

Suppose we take $R_1=20,000$ ohms and $R_2=0.25$ megohm, then the DC load resistance is $R_1+R_2=0.27$ megohm and the detector input resistance is 0.135



The QA Super includes the amplified AVC system described here.

The chief AVC components are: A and B, metal rectifier and transformer for the HT supply, C, the AVC amplifier and D, the diode detector.

megohm. For distortionless rectification up to 80 per cent. modulation, R_5 must be not less than 0.906 megohm, which means that R_3 and R_4 cannot be appreciably less than 2 megohms each. Consequently, only one valve can be controlled. If we must control two valves, then R_4 cannot be greater than some 0.75 megohm, for R_2 is in the grid-cathode path of the controlled valves. Usually R_3 must not be greater than 2 megohms. Retaining R_1 and R_2 at 20,000 ohms and 0.25 megohm respectively, the maximum modulation depth which can be handled without distortion is 70.6 per cent.

In practice, it is generally found that distortion does not occur until the modulation depth exceeds the theoretical value by an appreciable degree. This is because the diode passes some current even in the absence of a signal. The theoretical limit can consequently be exceeded in some degree, particularly when the input is only moderate.

It can be seen, therefore, that with this system of obtaining AVC it is not unduly difficult to obtain a reasonable compromise between conflicting factors, and a compromise which is quite satisfactory

detector can handle deeper modulation before distortion appears. In the limit, the detector can handle modulation depths of nearly 77 per cent.

The arrangement is least satisfactory as regards its efficiency as an AVC system, for it does not maintain the detector input at anything approaching a constant level. It does, however, exercise sufficient control greatly to minimise the volume variations of fading and it is quite inexpensive, so that it must be regarded on balance as a very useful system. The tendency is for the detector input to be held at a lower level than with the more commonly used delayed diode circuit, so that a receiver in which it is used must include more LF amplification than is customary. This is probably no disadvantage, for the LF amplification of many sets has now been reduced to the point at which it is difficult to obtain good results with a gramophone pick-up, and more gain in the low-frequency circuits would undoubtedly ease this difficulty.

The Efficiency of Simple Diode AVC

The efficiency of AVC is well illustrated by the curve of Fig. 2, which shows the relation between the detector input and the input to the receiver with two controlled valves. The precise results obtained naturally depend upon the particular valves selected and their operating conditions, but these are typical of those with valves of moderate grid base and for a "normal" detector input of 1 volt. It can be seen that in spite of the simplicity of the circuit the control is not at all bad; for a variation in the input of 96 db. the detector input changes by 30 db. This sounds much more impressive when expressed in volts, and for the detector input to change from 1 volt to 32 volts the aerial input must change in the ratio of 1 to 63,100. Normal fading variations are of the order of 20 db., and the system will compress these to about 6 db., a figure

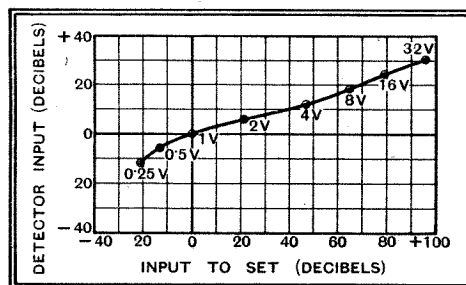


Fig. 2.—The type of AVC characteristic obtainable with simple diode automatic volume control.

from the point of view of quality of reproduction. Moreover, as the setting of the volume control is reduced, as it will be even for full volume on local stations, the shunting effect of R_3 decreases and the

Distortionless AVC Systems—

which represents a change only just audible.

With a sensitive receiver it is quite possible that in local reception the detector input will rise to 30 volts or so, and if distortion is to be avoided during deep modulation the last IF valve must be capable of giving at least twice this output without departing from linear conditions of operation. This does, indeed, represent one of the limits of the system, but the conditions are actually less severe than with delayed diode AVC, since the output required from the last IF valve with this system may easily be double. There is a much greater chance of distortion occurring, therefore, apart altogether from the distortion caused by the delay. Its one advantage is that it can keep the detector input much more constant.

There is no doubt that an ideal AVC system would include delay and it would also include amplification, for these two factors together would permit the detector input being held very nearly constant at any desired level for wide variations in the input, and since the detector input would never greatly exceed the normal level, all danger of overloading in the IF valve would be overcome.

Amplified AVC

There are various methods of obtaining amplified AVC, but the one which experience shows to be the most satisfactory is the system employed in the QA Super.² This has its basis in the simple diode circuit already discussed, but instead of

² *The Wireless World*, Feb. 28th and March 6th, 1936.

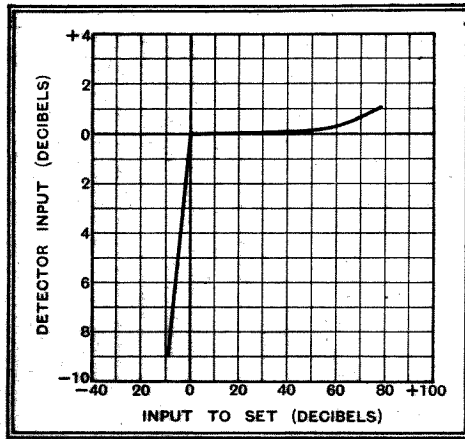


Fig. 4.—The AVC characteristics obtainable with the amplified system are practically perfect.

using the voltage on the AVC line of Fig. 1 to control the early valves, it is first amplified and delay is introduced. Examination of Fig. 3 shows that with two exceptions the circuit of the detector is the same as in the arrangement of Fig. 1; the two exceptions are, first that the "earthy" point of the detector is taken to a point negative with respect to the earth line instead of to the earth line itself, and, secondly, the anode and cathode leads of the diode are reversed. This is done in order that a positive output voltage may be secured instead of a negative. So far as the detector is concerned, therefore, the operation is identical with the simpler arrangement already discussed. The LF potentials appearing across R2 are fed off through C3 and R3 to the LF amplifier, while the steady potential which is positive with respect to negative HT is applied through the filter R4 C4 to the grid of the AVC amplifier.

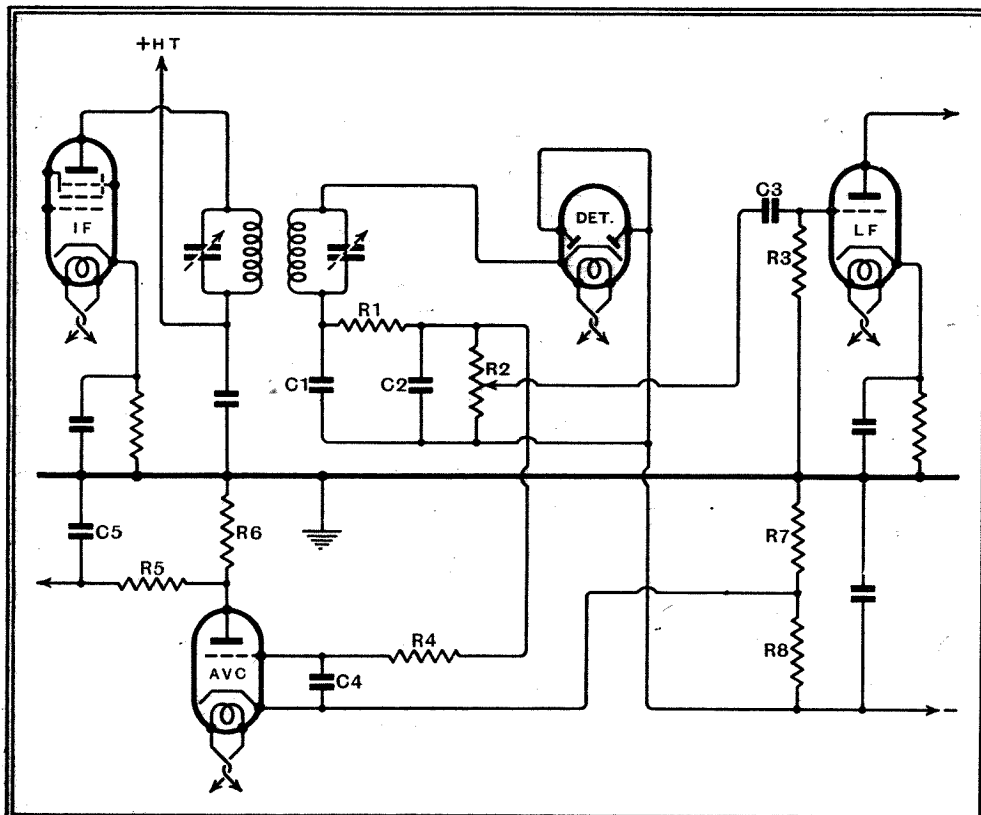


Fig. 3.—A distortionless system of delayed and amplified AVC which gives very efficient control.

This valve has its anode returned to the positive of its HT supply through R6, and its cathode is taken to a point positive with respect to the negative line, its exact potential being determined by the values of R7 and R8. This initial bias is the voltage across R8, and in the absence of a signal it must be great enough for the valve to pass no current—its anode potential then being the voltage across R7. When a signal is tuned in, the true bias on the AVC valve is the difference between the voltages across R7 and R2. As long as this bias is sufficient to prevent the valve from passing current, AVC is inoperative, but when the bias falls below this value the valve commences to pass current, and there is consequently a voltage drop across R6. The direction of this is such that the valve anode becomes negative with respect to the earth line, and it can consequently be used for AVC purposes and taken off through the filter R5 C5.

Avoiding Distortion

If distortion is to be avoided, the AVC valve must never pass grid current; consequently its bias must never be less than -1.5 volts. But at this bias it must develop as much AVC bias across R6 as will ever be required by the controlled valves. The volts across R6 plus the voltage lost across the valve equals the voltage across R7. Now the voltage required across R8 is equal to the voltage

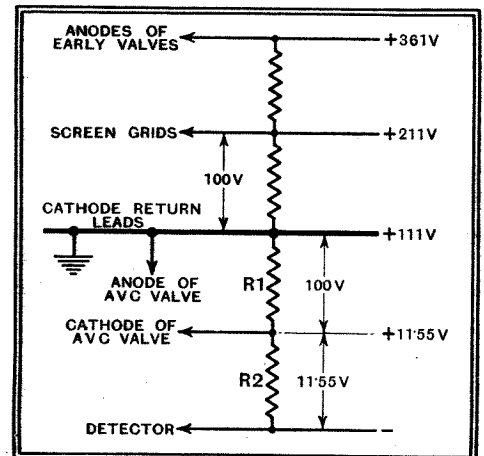


Fig. 5.—The voltage supplies for a receiver including the amplified AVC system may be obtained in the manner shown here.

needed to reduce the anode current to zero plus the voltage developed across R2 at the detector input at which AVC must commence to operate. The HT supply must be equal to the sum of the voltages across R7 and R8.

The values of components selected for C5 and R5 are not critical, and can be chosen to give a suitable time constant; there is no necessity to make R5 very large, so that it is easily possible to control many valves. The same applies to R6, and if each resistance were given a value of 0.1 megohm it would be possible to control as many as ten valves without overstepping the maker's limit. There is consequently no difficulty in meeting the conditions here.

Distortionless AVC Systems—

In the detector circuit the same conditions apply as before, save that they are rather easier, for R4 feeds only one valve, and this a triode. Both R3 and R4 can now be 2 megohms, therefore, and with R1 = 20,000 ohms and R2 = 0.25 MΩ, modulation depths up to at least

and it is easy to see that it represents an enormous improvement, for when comparing the curves it must not be forgotten that the scales are different. For a variation in the input to the set of 70 db. (3,160-1) the detector input varies only 0.62 db. (1.074-1) as compared with 20 db. (10-1) for the simple diode system. It

The resistances R1 and R2 in this circuit, however, carry the total anode current of all valves, except possibly the last, with the result that LF currents are likely to flow through them unless they can be adequately by-passed. This is by no means easy, and the result is that it is extremely difficult to prevent LF potentials being applied to the AVC valve and thence to the controlled valves. In practice a form of motor-boating occurs which manifests itself at its worst when a strong signal is tuned in. It is not, of course, impossible to prevent this, but very extensive decoupling is called for.

The easiest way to prevent it is to adopt the second method of feeding the AVC valve, which is to use an entirely separate HT supply, as in Fig. 6. The normal mains equipment of the set can be used without alteration, and a metal rectifier employed for the AVC supply. The transformer feeding this can have a primary wound to suit the mains voltage, or alternatively it can be constructed to operate from the 4-volts LT supply, or it can be an extra winding on the mains transformer in the mains equipment proper. Since the current is quite small, resistances can be used for smoothing (R3, R4) in conjunction with electrolytic condensers, and the cost of the apparatus can consequently be kept at quite a low figure. Actually, this arrangement is probably no more expensive than the extra decoupling needed when the alternative arrangement of a common supply is used.

When setting up a circuit of this nature little adjustment is required, and good results can be obtained as long as the HT supply is adequate. There is in general no need for exact design, since there is plenty of latitude, and most requirements will be met if a voltage of about 100-130 volts is maintained across R1 and R2 of Figs. 5 and 6 or R7 and R8 of Fig. 3. R1 can be given a convenient fixed value, such as 20,000 ohms, and R2 varied until the detector input is held at the required level. Almost any triode valve can be used. The MH4 type gives the best control, but such a widely different type as the ML4 is nearly as good and only demands a different value for R2.

THE RADIO INDUSTRY

ORMISTON'S ALUMINA, Ltd., of Great West Road, Brentford, Middlesex, have been awarded a contract by the General Post Office for the supply of 7½ tons of their proprietary non-corrosive cored solder.

Tannoy sound equipment was used to start the recent Outlon Broad speed-boat races by transatlantic telephone from America.

Film Industries, Ltd., announce the opening of enlarged premises in Glasgow; the new address is 229, St. Vincent Street, Glasgow, C.2.

A leaflet describing a new all-wave aerial kit (wave-range 15-2,100 metres) is issued by Ward and Goldstone, Ltd., Pendleton, Manchester. A receiver coupler fitted with a three-position switch is included in the kit, which costs 17s. 6d. complete.

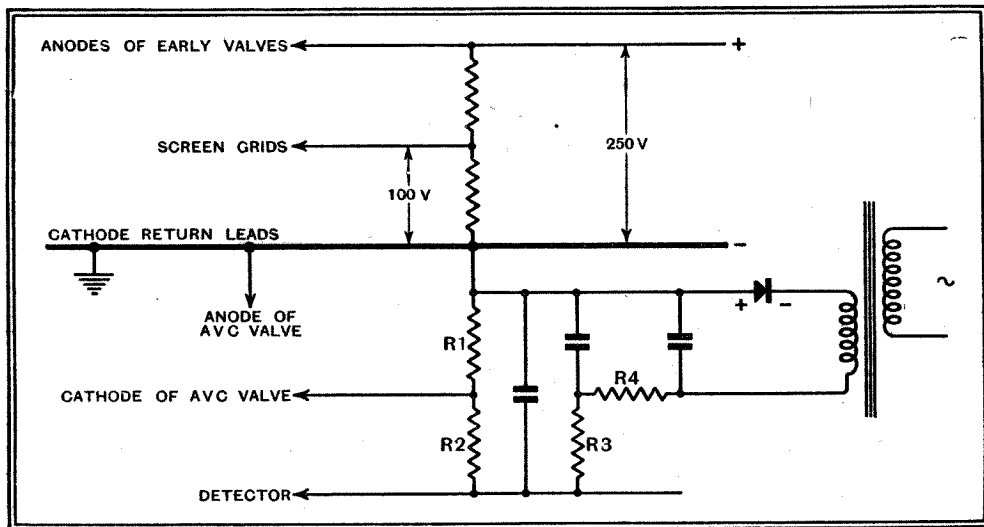


Fig. 6.—The best results are secured by using an entirely separate HT supply for the AVC valve and quite simple equipment is needed.

81.5 per cent. can be safely handled. In practice, with a moderate detector input, noticeable distortion is unlikely until the modulation depth exceeds 90 per cent.

The values assigned to R4 and C4 govern the filtering and time constant. If the filtering is not sufficient, the grid voltage of the AVC valve will have a ripple on it due to the modulation, with the result that it will pass grid current earlier than it should do, and then distortion will appear. If the values are too large, however, the time constant will also be large and AVC slow in acting. On the broadcast band a satisfactory value for C4 is 0.1 mfd. with 2 megohms for R4, but on short waves C4 might have to be reduced.

Now consider the operating conditions; the valve curves can be used in the customary way, and we find that with 100 volts across R7 and a value of 100,000 ohms for R6, the anode potential of the valve is 52 volts for -1.5 volts grid bias, so that there is a drop of 48 volts across R6. This is the maximum bias obtainable for this condition. The anode current and voltage across R6 fall to zero when the grid bias reaches about -3.2 volts. The amplification is very nearly linear and is $40 / (3.2 - 1.5) = 28.2$ times.

Feeding the Amplifier Valve

Suppose we wish to work with a normal detector input of 10 volts peak, then the voltage across R2 will be about $10 \times 0.9 \times 0.25 / 0.27 = 8.35$ volts, using the formula given earlier. The voltage across R8 must thus be $8.35 + 3.2 = 11.55$ volts, and the total supply across R7 and R8 111.55 volts.

The performance with two controlled valves having the same characteristics as before is shown by the curve of Fig. 4,

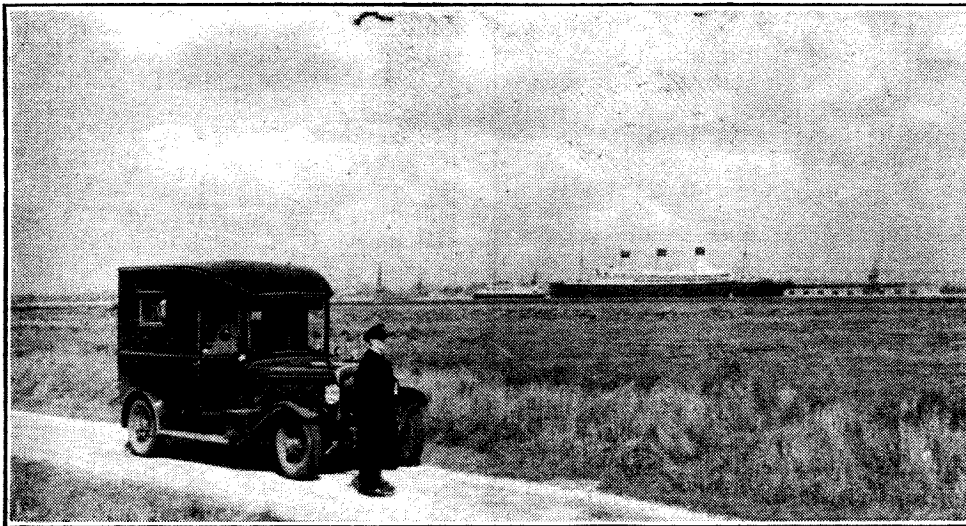
should be noted that the tail upward of the curve in Fig. 4 is not caused by a fault in the AVC circuit, but is due to the mutual conductance characteristics of the particular valves used. At the limit taken here of +77.5 db., the circuit is developing only 30 volts AVC bias, and it could easily provide more if the input were still further increased.

The superiority of amplified AVC is thus very evident, and this particular system is particularly good from the point of view of quality. It causes less distortion in the detector than simple AVC, and it greatly reduces the risk of overloading in the IF amplifier. Thus, in the example quoted, the detector input will not normally rise above 11 volts peak, so that the last IF valve need only be capable of an output of 22 volts peak as compared with the 60 volts needed with simple AVC and the 120 volts or more required with the delayed diode system.

With any system of amplified AVC, however, there are two points requiring careful attention. The first is the filtering in the AVC line, and this must be greater than that needed when amplification is not used by the amount of the amplification. This causes little difficulty in this case, for the filter R5 C5 is supplementary and readily gives sufficient extra attenuation at modulation frequencies. The second point is connected with the HT supply for the AVC amplifier. There are two ways of obtaining this. The first and apparently simplest is to increase the output of the mains equipment and to take the voltage across a resistance in the negative HT lead. Thus 250 volts might be needed for the receiver, and 111 volts for the AVC system, so that a total supply of 361 volts arranged as in Fig. 5 would meet the case discussed.

SITE-

The Work of the B.B.C.



The B.B.C. mobile station van on the road near Southampton.

THERE is nothing haphazard about selecting a site for a new B.B.C. station. The engineers have got to know before the station is built that it will serve the area intended without being influenced by geographical conditions which might cause screening of some areas. Once erected, a modern broadcast station ceases to be portable.

A HEAT-HAZE shrouded the Needles so that I could only just discern them across the narrow, glittering strip of the Solent, as I stood in a meadow that runs sheer to the shore at Milford-on-Sea: one of the possible sites for the South Coast Relay Transmitter, with which it is proposed to replace Bournemouth's antiquated and under-powered station. Across the Solent, in the Isle of Wight, three other sites had been tested, and now the B.B.C.'s mobile transmitting van had come to Milford to investigate a fourth. It stood in the centre of the field, that large plain green van with its pot insulator sticking out at the rear. The steady drone of its motor, driving the generator, mingled with the fall of the surf on the nearby shingle. From two light masts hung a T-aerial some 60ft. high, its lead-in terminating at the van's insulator.

It was hot outside, but hotter within, where the rectifying and transmitting valves glowed a vivid whitish-red, and the voltage-dividing resistances gave off a heat which the crew enjoys—in the winter. I was greeted by Mr. Parsons, the engineer-in-charge of the nomadic detachment of the B.B.C. Research Department. He had been "warned" by his London headquarters of my approach, and so did not adopt that evasive defence which is usually put up towards sight-seers—the country paper reporters, holiday-makers, hikers, and farm labourers—whose curiosity is aroused by this mysterious green van. Indeed, I was immediately invited within, a privilege rarely accorded; this I owe to Sir Noel Ashbridge, B.B.C. Chief Engineer, who, on the eve of my excursion to Milford, received me in his office at Broadcasting House, to explain these tests in and near the Isle of Wight.

In previous articles I have outlined the schemes which Sir Noel is turning over in his mind with a view to improving the service along the South Coast, the unsatisfactory nature of which I reported during my recent *Wireless World* tour of the British Isles; what now interested me was to see how the site-testers carry out their work, and what theoretical and practical considerations enter into this question. It was, therefore, particularly interesting to discover the van working at Milford on a site only a few feet above sea-level, for one of the points made by Sir Noel in our pre-

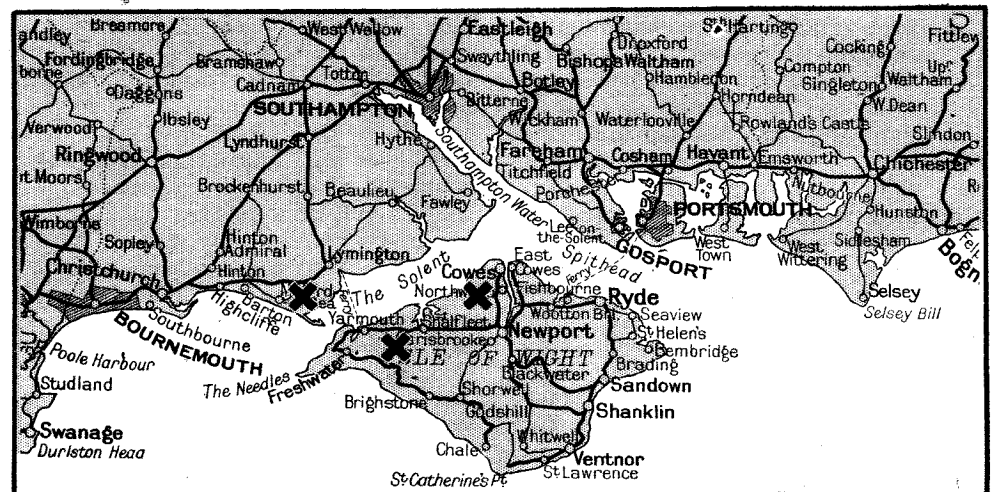
In this instance, we want to cover Bournemouth, Southampton and Portsmouth, and as far along the coast on either side as is possible in view of the fact that the wavelength will be a very short one, near 200 metres, and probably shared.

Geographical Conditions

"Next you look at a map and consider the formation of the ground—the hills and dales. You'd conclude that a certain spot might be suitable. That's all we used to consider in the old days, but now we know it's necessary to consider the sub-soil. We have found that it is possible to get bad attenuation from a station built in flat country; nor does it pay to put your transmitter on a hill which is made of 'bad' soil.

"In the case of this particular site," added Sir Noel, "there is another factor. We are trying to take advantage of the low rate of attenuation of wireless waves across water, and thus extending the range of our station. That is why we have tested sites on the Isle of Wight—so that we get an over-sea path to Portsmouth and in the direction of Bognor and Worthing to the east, and also to Bournemouth to the west, and also up Southampton Water to Southampton (see map).

"And next one tries to reconcile these various considerations. It usually in-



Map including the area surveyed for the new South Coast transmitter. Projected sites are marked with a cross.

liminary talk was that nowadays many other factors are taken into account besides height, which not many years ago was considered of paramount importance. Other factors may outweigh that of height, as in the case of Milford.

"To begin with," said Sir Noel, "one has to consider where the population is.

volves a compromise. You can't always get what you want, though Brookmans Park is near to ideal, and so is Moorside Edge, which was a gift from the gods—an unexpectedly favourable soil for a mountainous district. Usually mountains are a bane, because granite and all the hard and geologically old sub-soils are un-

"Geographia"

TESTING

Mobile Transmitter

By LESLIE BAILY

favourable from a radiation point of view. That is why for our North Wales transmitter we have gone on to the Isle of Anglesey—again the idea of using a path over water.

"Well, all this involves many meetings and discussions here at Broadcasting House, but at last we decide roughly on three or four sites, and then an engineer goes down to pick the actual fields—bear-



A kite used to fly a half-wave aerial to a height of 325 feet. This is in addition to the trials with 72ft. masts.

ing in mind the convenience of water supply, of getting landlines to the site, and so on. We take an option to purchase these sites, and then the van radiates test signals from each, measurements being taken close to the site to see if there is serious loss due to the nature of the site itself. If there is, we give it up; otherwise our field strength measuring van explores further afield, and in the case of a seriously considered site it may take a couple of hundred readings. But you'll see how they do that down at Milford."

Unmodulated Transmission

So off I went to Milford. This meadow by the sea is easily approached, but Mr. Parsons told me what a tough job they had getting the van into position on one of the Isle of Wight sites, a sloping field deep in mud.

"There are five of us—two engineers and an assistant, and two drivers," said Mr. Parsons, "and it usually takes us a couple of days to erect the 72ft. masts, bury our earth wires, unpack valves and get the transmitter going. Then we remain on the site for several weeks, while the field strength measuring van goes off

on its excursions, sometimes a day out and back, sometimes on longer trips which take several days. The transmitter and the receiver keep in touch by telephone calls at local post offices, at pre-arranged hours; and similarly we report results regularly to London. Tests are carried out in daylight, generally between 9.30 and 5.30. The transmission is never modulated, not even by a tuning note. All the listener might hear would be a slight carrier hum."

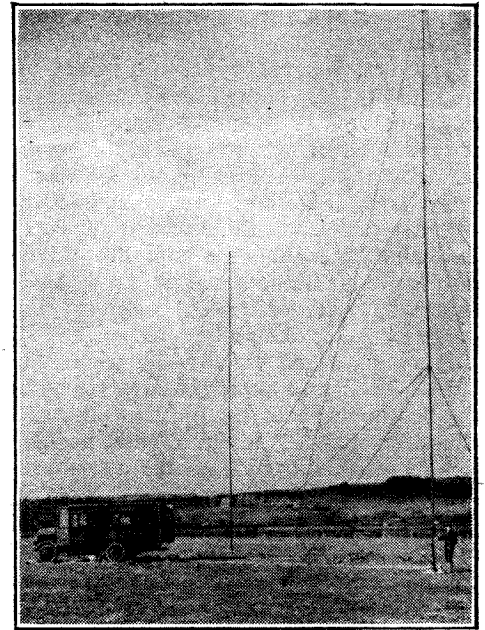
Source of Supply

I did not stay perspiring inside the transmitter van at Milford any longer than was necessary to note its equipment. As you enter by a door at the rear the transmitter occupies the whole of the right-hand side. At the far end is a D.C. generator coupled to an alternator, and driven by chain from the 45 horse-power motor, via a special gear-box arrangement. The alternator and generator are directly coupled, the output of the latter at 110 volts being used to excite the alternator-field system, and to provide current for interior lighting of the lorry and for auxiliary battery charging. The output of the alternator is at 500 volts, 300 cycles, single phase, and is used for filament heating for the transmitter valves, and, after valve rectification and transformation, forms the HT supply at 11,000 volts.

As it is important that the wavelength should remain steady during operation of the transmitter, the master-oscillator system is used, in which a valve is employed as the master-oscillator or "drive," followed by a stage of radio-frequency amplification. A split capacity output circuit is used for the drive, the condenser being sub-divided on either side of the earth tap to facilitate adjustments of reaction, and efficiency of wavelength, fine tuning being carried out by means of a variable air condenser connected across a few turns of the inductance. This type of circuit has the advantage that an easy path to earth, via the condenser, is provided for harmonics generated by the valve, lessening the possibility of instability due to parasitic short-wave oscillations, which are further damped out by a grid stopper of 50 ohms connected close up to the grid of the valve.

The input power to the HF amplifier is $2\frac{1}{2}$ kilowatts, of which approximately 750 watts is dissipated at the valve anode, representing a conversion efficiency of 70 per cent.

On the left in the van are lockers for stowing the mast sections, a work bench, shovels, tarpaulins, oil lamps, log-books and maps, and the inevitable teapot, which was brought out in my honour.



Two 72ft. masts and a mobile station making tests on the Isle of Wight.

The field strength measurements in connection with Milford and the three Isle of Wight sites are now being correlated, and maps prepared to show the probable service area from each site. The sub-soil in all cases is Oligocene, an alluvial deposit which is favourable to good radiation. Whether the low altitude at Milford will be a serious drawback is a question the B.B.C. hopes to settle by means of special tests with kite aerials. In addition to transmissions from the 60ft. T-aerial, kites are being flown with a half-wave aerial attached, some 325 feet high.

All the results will be studied by Sir Noel Ashbridge and his assistants. But before it is even decided definitely to build this station other and wider problems with which it is linked must be settled.

One or Several Stations?

First, is it better to serve South England by building a series of low-power relay stations on headlands along the coast—say, on the Isle of Wight, somewhere near Exmouth, and near Prawle Point—so as to get a sea-path to as many of the coastal towns as possible? Or is it better to do the job with one high-power transmitter at some such promontory as Prawle Point, again using the sea-path both westwards and eastwards? And what wavelengths are available for either scheme? That thorny question, in turn, links up with the problem of a wavelength for the Burghead station in North Scotland, which must be decided first, because it is the next station to be opened.

So the entire wavelength position is wrapped up in this problem. It is to give the experts in London reliable data on which to base their judgments in a very complicated and difficult situation that the mobile transmitters and receivers go to and fro, all the year round, testing one site after another. The B.B.C. keeps two

Site-Testing —

transmitter vans and five receiving vans continually in use.

The receiving van which is working on the Milford job happened to be parked alongside the transmitter van when I arrived. It was preparing to get away for its daily tour. Inside its small, plain, green body there is a seat, an oil stove, and the field-strength measuring apparatus, which consists of a superheterodyne receiver, with frame aerial, and a separate external oscillator, both receiver and oscillator being carefully screened.

Having arrived at a place where the B.B.C. desires to know the field strength, the little van parks by the roadside, and measurements are made as follow: The signals received from the lorry transmitter are tuned-in on the superheterodyne receiver; a galvanometer, plugged into the output, gives a reading of rectified cur-

superheterodyne gives the same reading as was obtained from the distant station. It is then only necessary to measure the strength of the locally generated oscillation to ascertain the strength of signal from the distant station.

This is accomplished by means of a thermo-couple included in the oscillator circuit and calibrated with the galvanometer. By means of a jack the galvanometer is transferred from the receiver output circuit to the thermo-couple, and the reading is adjusted by introducing attenuation until it corresponds with that obtained in the receiver output circuit. The attenuator is calibrated in decibels and, therefore, the signal strength injected into the receiver can be calculated. If this is divided by the effective height of the frame aerial in metres, the strength of the received signal in millivolts-per-metre will be obtained.



Map of Northern Ireland, showing the large number of points (X) investigated as possible station sites before the Lisburn station was erected.

rent, the steady DC from the batteries, which would normally flow through the instrument, being balanced out. The frame aerial is then rotated through 90 degrees until the received signal is reduced to zero, and the separate oscillator is switched on and tuned to the same frequency as the distant station. The locally generated signal is fed to the frame aerial circuit of the superheterodyne receiver and is adjusted until the galvanometer in the output circuit of the

Almost always the measurements are taken in towns, where the van attracts the lively speculation of passers-by. Often they think it is an ambulance. Once this dialogue occurred:—

Passer-by: It looks something like a horsebox.

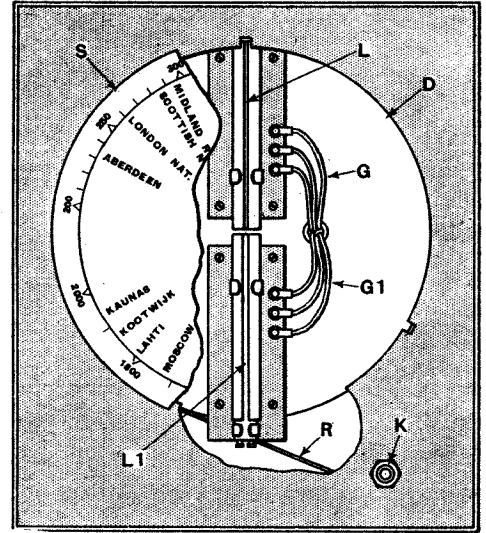
Engineer: Yes.

Passer-by: But it doesn't seem big enough.

Engineer: Oh, you see, we've taught our horses to kneel.

TUNING MADE EASY

ONE finds almost as much variety, nowadays, in the ways and means of tuning a set as in the design of the circuits which really do the work.



Resonance and station-name indicator combined.

The use of AVC has now brought the visual indicator into fashion, so that in addition to seeing the scale flash out into different colours, as he changes from one wave-band to another, the listener must also keep watch upon a flickering column of light which tells him when the circuits are exactly in resonance with the incoming carrier.

This is quite fascinating, but perhaps a trifle confusing until the beginner has got both hand and eye thoroughly accustomed to the job.

The drawing illustrates an arrangement (Patent No. 442158) in which an attempt is made to simplify matters a little by using the "resonance" indicator not only to show when the circuits are in tune, but also to point out the name or wavelength of the station that is being received.

The tuning-knob K is geared through a cord R and a disc D to the tuning condenser, though the latter is not shown on the drawing. The disc carries two neon lamps L, L1, which serve as resonance indicators, one on the medium and the other on the long-wave setting of the wave-change switch. In front of the disc is a translucent scale S (shown partly cut away) which is marked with station names and wavelengths. The AVC voltage for the neon lamps is supplied through leads G, G1, which are made flexible to allow for rotation. When a signal is accurately tuned in, the glow discharge through one or other of the tubes L, L1 reaches its maximum, and is then seen, through the translucent scale, pointing to the name and wavelength of the corresponding station.

NEW K.B. RECEIVERS

THE Model 510 receiver described in our issue of May 1st has now been followed by three additional sets of similar circuit design and of identical external appearance.

One of these, the Model 515, is an all-wave receiver for AC mains with a short-wave range from 19 to 50 metres, and costs 9½ guineas. The Model 520 is an AC/DC receiver for medium and long waves suitable for supplies from 200 to 220 volts 40 to 60 cycles, while the Model 530, with a similar wave range, is for battery operation. The prices of the last two models are 8½ guineas and 7½ guineas respectively.

EVENTS OF THE
WEEK IN
BRIEF REVIEW

**New Canadian SW
Station**

A NEW short-wave Canadian station, stated to be more powerful than any other in the Dominion, has been opened at Drummondville, Quebec. The station operates on 6,005 kilocycles, 49.96 metres, and its call sign is CFCX.

New Icelandic Station

WHEN the present Icelandic station at Reykjavik is replaced by a new 100-kW one it is expected that it will become one of the most well known of the European transmitters. The station employs one of the youngest female announcers in the world, Miss Sigrun Ogmundsdottir, the lady in question being only twenty years of age.

News Without Views

THE French radio authorities are said to be keeping a close eye on certain announcers who have, in the past, been in the habit of allowing their own private opinions or points of view to colour the news items that have been given out. It is not suggested that any deliberate falsification, or even exaggeration of the news has been indulged in. So much, however, can be conveyed, especially in France, by delicate manipulation of the tone of voice, and this is one of the things which is henceforth to be forbidden. French announcers are in future to deal with "plain facts in a plain manner" without any of the ornate flourishes of rhetoric which have, in certain cases, been the rule in the past.

Another Jutland Battle

TROUBLE is reported to be brewing in Denmark. Some time ago foreign valve manufacturers introduced certain types of multi-grid valves to the Danish set makers, and with honeyed words and free blue prints induced them to adopt these innovations in their sets. Unfortunately the Danish manufacturers imagined that payment for the valves marked the limit of their financial obligations in the matter, but now the valve makers are demanding royalties and other "extras." The result is to be a long and bitter legal fight which will probably be carried to the Supreme Court of Denmark.

Current Topics

Amateurs in France

FRENCH amateur radio is definitely on the up grade according to figures given at the recent meeting of the French Amateur Transmitters' Association. There is now said to be a total of 1,268 members.

Broadcasting in Esperanto

EARNEST students of the various International languages such as Esperanto and Latinesco are finding in broadcasting a new aid to the achievement of their ambition to have everybody speaking a common tongue. Remarkable success is reported to have followed the recent broadcasting in Esperanto of one of Smetana's operas from the Brno station. The authorities at Brno are stated to have been completely overwhelmed by a flood of appreciative letters received from abroad, and already other stations have plans afoot to broadcast in one or more of the various synthetic languages which exist.

broadcasting. The old sets which are brought in are completely destroyed by the authorities. The scheme is to be tried out for a period of two months.

French Legal Anomaly

IN France, apparently, if you possess electrical machinery which interferes with broadcasting on a large enough scale you are exempt from the law. A merchant of Belfort recently made a strong protest in practical form against this anomaly by refusing to "silence" a small electrical motor in one of his workshops. According to him, a humble user of an electrically driven sewing machine can be heavily fined if she causes trouble with her bread-winner while the tramway authorities are allowed to disseminate interference with impunity. The result of the "protest" was conviction and a fine, but it has, at any rate, drawn the attention of the powers-that-be to the anomalous state of affairs that exists with regard to this matter.

**Clothes Lines to be
Taxed?**

ACCORDING to a correspondent in Roumania people who are in the habit of stretching clothes lines on their premises will henceforth have to be careful that they cannot be mistaken for wireless aerials. A new law has apparently just come into force whereby any householder having an aerial attached to his property will, unless he has taken out a wireless licence, be considered as a pirate even if no receiving set is found in the house.

**Television Demonstration
in Paris**

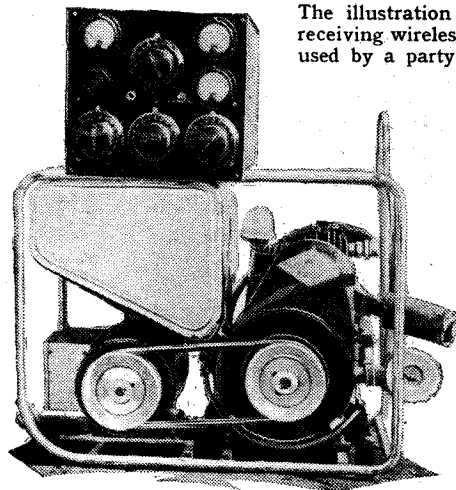
THERE are very definite indications that in France the "film" method of television is at present looked upon with far greater favour than the direct system. In the first place it is pointed out that until the technique of the direct system has been further developed, it will be difficult, if not impossible, to televise certain public events. Such events are, however, very easily recorded by a cinema camera, and subsequently televised within a very short period or many hours later, as may be desired. Apart from technical considerations, however, it is pointed out that for some time television programmes will have to be made up, to a large extent, of talkie films.

In order to emphasise this point of view, a special television demonstration was given to the French Press recently. Pictures were shown including various sporting events, all the pictures emanating from films fed to a television transmitter about a quarter of a mile away. The receiver used was of comparatively small dimensions, and was equipped for receiving both the P.T.T. 180-line pictures and the 240-line ones of the Grammont Co. who were sponsoring the demonstration. The size of the pictures shown was 18 x 19 cms., and at a distance of three yards the clarity was said to be about the same as that of an amateur cinema film.

**French Wireless
Exhibition**

THE two recently held wireless exhibitions, that of the Paris Fair and the S.P.I.R., are to be followed by another in September, and, in addition, a wireless section is to be added to the Lyons Fair. The two spring shows proved very popular and may become a permanent feature.

PORTABLE TRANSMITTER AND RECEIVER



The illustration shows a transmitting and receiving wireless equipment which is being used by a party of Americans who are exploring unknown regions of the jungle in New Guinea. The expedition is being led by Mr. Richard Archbold, a well-known naturalist, and the apparatus, which can be used both for phone and CW communication for greater distances, has been designed to be transportable in separate loads which must not exceed 40 lb. each. The use of batteries is avoided by employing a miniature generating plant driven by a small petrol engine.

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New Sets for Old

AN excellent idea for encouraging people to buy new receivers has been put into operation by the German Chamber of Broadcasting. Anybody owning a battery set before July 31st, 1931, can exchange it for a voucher entitling him to a 10 per cent. reduction on any new receiver he may buy. In the case of mains sets, 15 per cent. reduction is granted. Apart from the monetary benefit obtained by owners of these old sets, the idea tends to benefit broadcasting as a whole, since the results obtained from these sets, especially in the matter of quality, cannot be a very good advertisement for

Portable "Volksempfänger"

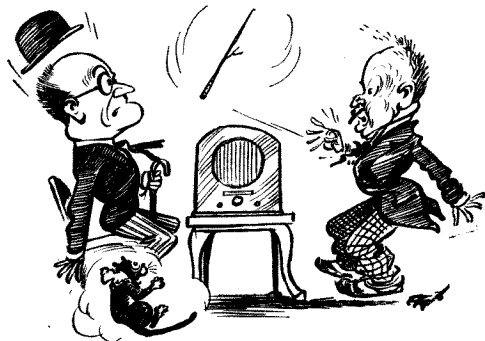
THE German Chamber of Broadcasting has announced the result of the recently arranged competition to obtain suitable designs for a "popular" portable set to be manufactured jointly by the German radio industry in the same manner as the well-known "People's Receiver." The winning design has two tuned circuits and uses four of a new German 2-volt valve fed from dry batteries. The batteries are constructed to give a hundred hours' operation. A permanent magnet moving coil loud speaker is employed, this bringing the total weight up to the equivalent of 20 lb.

UNBIASED

Dowsers for the B.B.C.

IT is extraordinary how, as you delve deeper and deeper into the mysteries of radio, the more you realise how inextricably interlinked it is with other branches of science. Only the other day a remarkable instance of what I am talking about came my way, but, at the same time, it brought home to me in a most forcible manner what a rash thing it is to jump to conclusions when engaged in serious scientific research.

I had been called in at the suggestion of a mutual friend to diagnose the cause of a remarkable occurrence which had been experienced by a well-known dowser. It appeared that recently, when wandering over some farm lands with his hazel-twig, endeavouring to locate water, he



It leapt into the air.

happened to pass near a loud speaker which the farmer had placed in the middle of a field and had connected up to a set in the house in a last desperate endeavour to scare off the crows. Almost immediately the dowser's twig bent almost double, and he was hard put to it to prevent it jumping out of his hand. Water in abundance was indicated, and it was not long before digging operations were in full swing. To his dismay, however, no water was found, and his professional reputation was almost ruined.

Since then he has made the amazing discovery that the twig frequently becomes agitated when he approaches a wireless set or an extension loud speaker, but only when they are in operation, and not always then. When the problem was put to me I at once jumped to the erroneous conclusion that it was due to the effect of the wireless waves, since I recollected an article published in *The Wireless World* many years ago, in which a well-known scientist suggested that there might be some relationship between ultra-short waves and the "emanations" which are responsible for the dowser's art; in fact, had it not been for pure chance I might have made a fool of myself by reading a paper on the matter before the wireless section of the I.E.E.

The pure chance to which I have made reference was the fact that Mrs. Free Grid

is rather addicted to programmes of the "moral uplift" type, not, indeed, because she has any real leanings in that direction, but because, I understand, it is considered the thing to do by the obnoxious circle of females who move and have their being in her "set."

The dowser and myself happened to be experimenting in my house when Mrs. Free Grid entered the room and commanded that the set be tuned to a certain B.B.C. programme in preparation for an "At Home" for which the guests were then arriving. To our amazement the twig leapt bodily into the air. This startling occurrence at once gave me the clue to the whole phenomena, and a few evenings experimental work quickly confirmed my suspicions. I had, of course, been led astray at first by foolishly ignoring the fundamental datum that the twig moved under the influence of neighbouring moisture. It turned out to be nothing more nor less than the excessive humidity of certain B.B.C. programmes which caused the phenomenon, and this fully explains why, at certain times, the behaviour of the twig was quite placid, for, after all, even the B.B.C. has its moments of greatness.

The hazel-twig is, in fact, a natural "applause machine" towards the invention of which wireless engineers have been busily bending their energies for years past. No doubt my startling scientific discovery will lead before long to the establishment of a proper dowsing department at Broadcasting House, so that programmes may be properly tested for "wetness" before they are inflicted on the long-suffering public.

A Two-edged Sword

I WAS extremely interested in the suggestion made in *The Wireless World* the other week by my old friend "Diallist" that it might be possible to "get" obstinate owners of interference-causing electrical apparatus by prosecuting them for transmitting without a licence. I sincerely hope, however, that if "Diallist" or anybody else brings a test case they will lose their money.

It is not that I am in favour of interference with broadcasting, except, of course, in the case of some of the B.B.C.'s more offensive programme items such as chamber music, but the whole point is that if the case were decided against the interference causer none of us would be safe in our beds. The reason is that the wireless telegraphy act deals with the question of communicating by means of ether waves, but no mention is made of any limitation in the matter of wavelength. This being so, it must be clear that it is an offence to communicate on any length of ether wave, ranging from an Angström

unit to a light-year, without a Post Office permit.

Apart, therefore, from the fact that people who left their blinds up at night would be as much liable to be hauled before a magistrate as they were during the war, there would be wholesale arrests on Brighton Promenade, where, as many people know, ether waves are used to convey very definite messages which, I am

By FREE GRID

told, are vulgarly and collectively known as the "glad eye." While, therefore, these innocent and harmless disturbers of the ether would be hauled through the sordid surroundings of a police court, owners of too-loud speakers and bawling babies, who constantly make the night hideous with their ill-timed caterwaulings, would go scot-free just because they were using the air instead of the ether.

A Grave Error

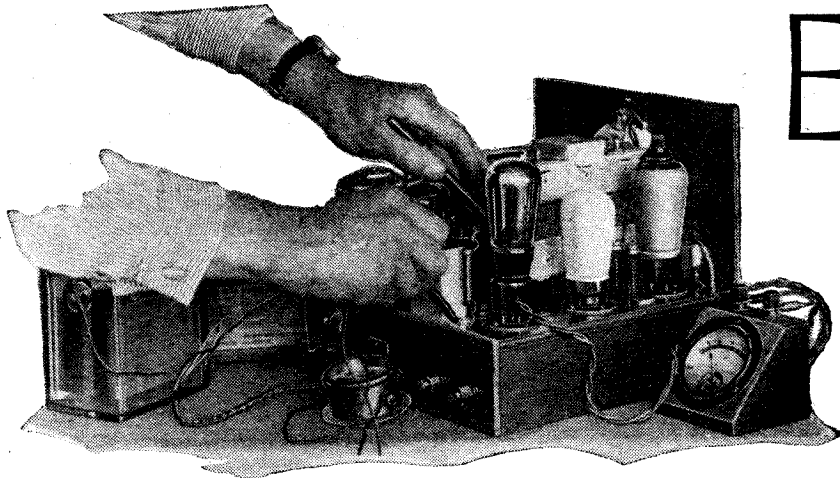
I VIEW with extreme gravity the publication by the International Broadcasting Union in Switzerland of the number of units of electrical energy which listeners of the world are supposed to have used up during 1935. I have definite evidence that the published figure of 1.997 millions cannot possibly be accurate. The reason is a very simple one.

On New Year's Eve, when the Union man called on the stroke of midnight to ascertain the figure for my house, Mrs. Free Grid, being of North Country extraction, mistook him for a fellow-countryman



Took the reading of the gas meter.

who had called to indulge in the time-honoured practice of "first-footing," which is so much enjoyed in her part of the country. The result was that she plied him so freely with the national beverage immediately he crossed the threshold, that in the subsequent confusion he unfortunately took the reading of the gas meter instead of that of the electric light instrument adjoining it, and this fact is therefore bound to lead to an error in the official figures. Unfortunately, I was absent at the time conducting a party of glee-singers outside St. Paul's Cathedral, otherwise this regrettable incident would never have occurred.



Experiments

THE JOY OF FINDING
OUT FOR ONESELF

By "CATHODE RAY"

SOME time ago I wrote about Inventions and Inventors; on the whole, in a discouraging vein. Invention, if one has to depend on it for a livelihood, is a discouraging occupation. So much so that determination and persistence and other anti-discouragement qualifications are more necessary for it than cleverness.

This time I am not thinking primarily of the professional but of the much larger proportion of *Wireless World* readers who try experiments for the fun of it. Don't misunderstand me. I do not mean the sort of "experiments" or the sort of fun that is connected with such things as the throwing of stink bombs or the immersion of calcium carbide in the school ink. I mean experiments that are sensible and informative, but which are done because one likes to do them and not merely for fear of getting the sack. Some people try things out of curiosity, others to get better results; but whether the motive be intellectual or practical there are all sorts of degrees of seriousness with which it appears. Some experimenters are very light-hearted and spasmodic; others pursue their hobby with such relentless zeal that they are swept into the ranks of the professionals or else attain at least equal competence within the amateur status.

Learning by Doing

An ounce of practice is worth a ton of theory, we are told. While the exact numerical ratio implied by this statement does not appear to have been rigorously proved, there is no doubt that even a moderately intelligent "messing about" (as the unsympathetic observers call it) is more instructive than any amount of reading or listening unaccompanied by doing. This is so even though one may not consciously set out to be "instructed." But most experimenters would admit, even if reluctantly, that they do it because they want to know more about radio. The ultimate object may ostensibly be to improve their reception. But how often does it happen that, immediately a receiver has been made to work, the plans for its alteration or reconstruction, or perhaps for an entirely new design, are considered!

Now that the motive of making one's set because it was cheaper than buying it

is no longer the prime motive, the constructors of to-day are those who find it fascinating to compare different methods, to indulge in the latest ideas before they find their way into factory-built sets, to learn enough about the working of radio to get the most out of it, and to entertain a lurking hope that they may be able, in the fulness of time, to discover something really new and valuable for themselves.

Let no one imagine that real research is not an exceptionally painstaking and often exasperating business. But the satisfaction of working through these difficulties to an acceptable conclusion is ample reward. It is so with most worth-while experiences. Explorers, I strongly suspect, curse themselves thoroughly during every arduous expedition for being such mutts as to leave their comfortable homes for this sort of thing. When it is all over they wouldn't have missed it for worlds, and they start planning the next.

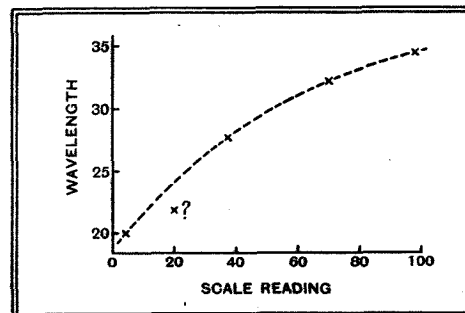


Fig. 1.—Is one justified in drawing a calibration curve through the four regular points, thus assuming the odd one to be a mistake; or might not investigation reveal an actual tuning irregularity, due, perhaps, to some unsuspected absorption?

This does not mean that it is the discomforts of exploring, or the minor irritations of radio experimenting that in themselves constitute the chief joy. It does not enhance a good explorer's feeling of satisfaction to recall that through ignorance and lack of foresight he needlessly lost his way and muddled through only by an exceptional stroke of luck.

The scope for going astray in experimental work enormously exceeds that in terrestrial exploration, so perhaps a few hints from one who has done quite a lot of it may not be entirely devoid of interest.

Never take anything for granted. Impossible to obey literally, of course; but it is a principle that can scarcely be overdone. How often I have been led up the garden by some component that was not what it pretended to be! The more complex and elaborate the experiment, the more thoroughly one is liable to become knotted up by this sort of thing. But even if it is such a simple matter as finding by trial the best resistance or capacity to use in a certain position, the result of the test may be entirely misleading if one or more of the resistors or condensers has an internal short-circuit, open-circuit, or leak. That is why it is so very valuable to have some reliable means of checking components. But even when the equipment is guiltless it may mislead. There is the now-familiar example of the error that a perfectly good and accurate voltmeter may cause unless account is taken of the possible change in voltage due to the presence of the instrument. Similarly, one must beware of accepting without question the readings of a milliammeter connected to read the anode current of a valve. Its addition to the circuit may alter the operating conditions of the valve and with them the current to be measured. One would not measure the temperature of a small quantity of hot liquid by dipping into it a large cold thermometer.

Contradictory Results

Sometimes the fault in the apparatus or the system may be detected after one has wasted a lot of time on the job, and the thing has to be done all over again in a temper less conducive to acute and balanced observation. Or perhaps the erroneous results may be blissfully accepted, only to lead to confusion at a later date when they are required as the foundation for something else.

Sometimes, but not always, something wrong in the set-up may be revealed by some irregularity or contradiction in the results. That is why it is so helpful if one can plot the results as a curve. If all the points except one lie on a smooth curve there is ground for suspecting the odd one. But never just say so and let it go at that. Run back over the experi-

Experiments—

ment and check that point. Sometimes investigation of such an apparent anomaly may lead to the most interesting discovery of all. Everybody quotes the classical example of the discovery of a previously unknown element, argon, in the atmosphere, due to refusal to put down a minute discrepancy in measurements of density as "experimental error." It is hardly an exaggeration to say that radio itself began when experimenters ceased to accept the conventional explanations of certain obscure phenomena.

If you have been led to expect one sort of result and you get another, don't just examine it with a blind eye, or, worse still, cook the results till they come "right."

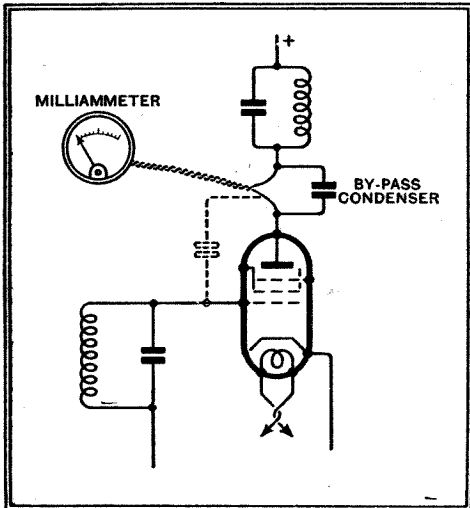


Fig. 2.—When checking anode current by means of the usual break-in plug, an elementary precaution is to see that the stray capacity introduced by the meter and its leads does not cause the valve to oscillate, so altering the current to be measured; another necessary precaution is to connect a by-pass condenser close up.

Investigation may show the rest of the world to be wrong. At worst it will show where *you* have been wrong, so that you will have a clearer grasp of the subject next time.

The books say that if you interpose a condenser of, say, 0.0001 mfd. in series with a large aerial you improve the selectivity, at the cost of reduced signal strength. You try it, and the signal strength goes up. This does not prove that, in a general statement, all the books are wrong. It just shows that in your particular receiver the large aerial was too tightly coupled, and overdamped and probably mistuned the circuit; or else that the receiver tends to be unstable due to stray reaction, which was kept in check by the large aerial and released by interposing the condenser. Or perhaps a bit of both. In either case, the effect quite correctly predicted by the books is concealed by a larger effect due to peculiarities of your receiver.

That leads us on to another tip. Take great care to isolate the particular matter you are investigating. It would be no good contributing a paper to a scientific society claiming to have proved by means

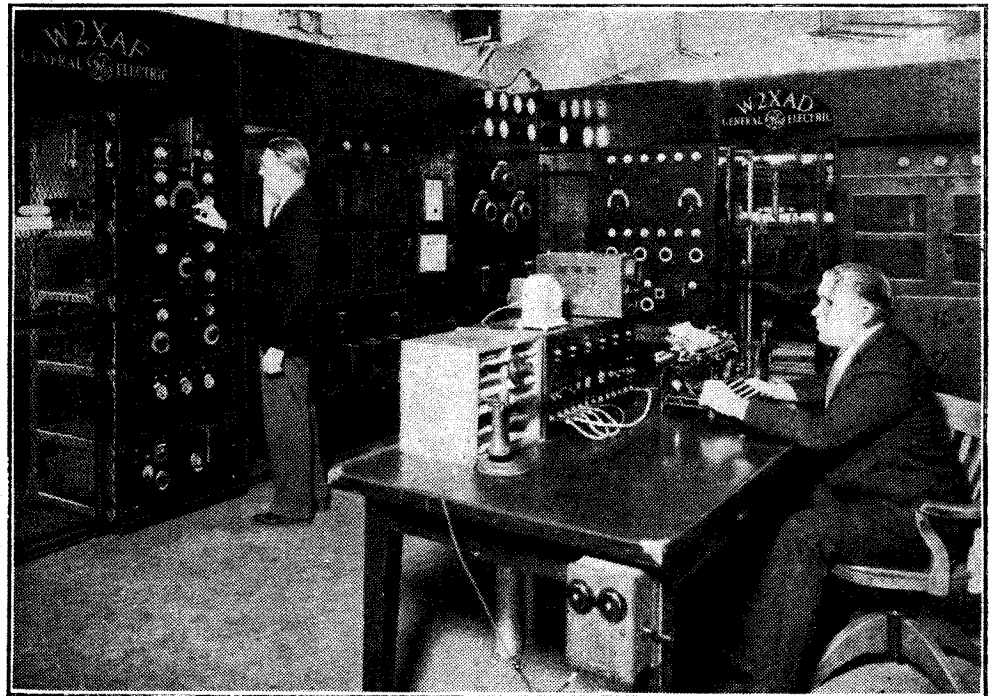
of experimental evidence that the accepted theory with regard to aerial series condensers is wrong. Your experiments were not conducted with sufficient attention to the possibilities of other influences, irrelevant to your experiment, acting at the same time. Sometimes it is very difficult indeed to exclude disturbing influences. The wise experimenters are those who so devise their tests that any such effects cancel out.

You make an experiment using a valve voltmeter. If you have to take several different readings with the voltmeter you are assuming that nothing has happened, or is happening, to upset the calibration. But if you can arrange the test so that a comparison is made with the instrument giving the same reading in each case, it doesn't even matter if it is not calibrated at all.

The old practice of sending out signals, which are reported "R5"; then making

an alteration, and getting reports, perhaps on another day, of an advance to "R7," is typical of the worst sort of experimenting. What you want to know is the result of making a change in the transmitter. Your tests *may* indicate an improvement due to this. On the other hand, they may show that the second test was conducted when atmospheric conditions were more favourable, or when your reporter's receiver was better tuned, or when he was feeling more optimistic, or had just been listening to very faint transmissions, or that the background noises were less, or that your morse was more legible.

It is unfortunate that one has to rely a good deal on individual judgment in radio or else pay thousands of pounds for apparatus. But the experimenter who uses humble equipment with resourcefulness and intelligence is likely to do better than the unimaginative worker with glorious laboratory gear at his disposal.



The General Electric relay short-wave broadcasting transmitters, W2XAD and W2XAF, at South Schenectady, N.Y., which are well received in this country.

On the Short Waves

NOTES FROM A LISTENER'S LOG

THE correspondence columns of *Nature* during the last few weeks have been of considerable interest to the more experienced short-wave enthusiasts. This interest was occasioned in the first place by a letter from the Americans, Professor R. C. Colwell and A. W. Friend (*Nature*, May 9th, 1936, Vol. 137, page 782), in which these investigators described how they had measured the virtual height of a new layer, "D," situated in the middle atmosphere—that is, far nearer to the earth than are the now well-known "E" and "F" layers.

This communication called forth two further letters, the first from Dr. R. A. Watson-Watt, and others of the N.P.L.,

Teddington (*Nature*, May 23rd, 1936, Vol. 137, page 866), in which it was stated that similar results to those obtained in America had also been obtained by the Radio Research Board in this country, and that, in general, two new layers have been found to exist in the middle atmosphere, with heights as follows:—

- (1) 6 km. (but sometimes at 10 or 14 km.).
- (2) 15-50 km.

A third communication, and to me the most interesting of the three, came from Professor S. K. Mitra, who is at present in this country on a visit from India. Professor Mitra points out (*Nature*, May 23rd, 1936, Vol. 137, page 867) that it is prob-

able that a different method of propagation mechanics from that envisaged by the classical Eccles-Lamor theory may have to be envisaged for this new layer. In attempting to explain to readers the implications of this statement, I must assume that you are conversant with the meaning of the terms refractive index and dielectric constant (or S.I.C., as it used to be called). In brief, the Eccles-Lamor theory defines the relationship between the refractive index and the degree of ionisation of an electrified medium such as the ionosphere, and states that when the degree of ionisation is great enough to make the dielectric constant of the medium zero (or negative), then the refractive index of the medium will be such that even normally incident rays cannot enter the medium and will undergo complete reflection.

A normally incident ray is one which strikes the layer at right angles—i.e., projected vertically upwards from the earth; for rays striking the layer at more glancing angles of incidence it is obvious that lower degrees of ionisation will produce complete reflection. (Even a sheet of paper makes a good reflector if you hold it up and look glancingly along it.)

If you have grasped this (and realised that a tuning condenser taken up into the ionosphere might have no, or even less than no, capacity!) then we may return to Professor Mitra's letter. He went on to state that for the high frequencies used in the experiments and owing to the nearness of the layers to the earth, "an enormous electron concentration" (i.e., degree of ionisation) would be required to make the dielectric constant zero, which could scarcely have been missed by those workers who have studied the conditions in the middle atmosphere by means of balloons, aeroplanes, etc.

Therefore it appears that there is something quite strange about these new layers.

With the increasing amount of solar activity consequent upon the advancement of the eleven-year cycle, the number of Dellinger fade-outs is becoming more and more marked, and some recent examples are tabulated below:—

May 26th—1129-1135 GMT, India and Australia most affected.

May 28th—0731-0746 GMT, Complete. 1206-1212 GMT, Partial. 1237-1245 GMT, Complete. 1800-1826 GMT, Nearly complete. May 29th—1023-1043 GMT, Complete.

The fade-out of May 26th coincided with a very brilliant hydrogen eruption on the sun, which was observed by Greenwich from 11.30 a.m. GMT onwards. It now seems certain that these fade-outs will occur in future, and presumably until we approach the next sunspot minimum period, at much shorter intervals than fifty-four days! It is suggested that the reason for the fade-out is the sudden heating-up and expansion of the F2 layer, since signals below 6 Mc/s are not generally affected.

Review of Conditions

Starting with Friday, May 22nd, we note that conditions were reasonably good, many of the commercial stations being very strong, but only one U.S. broadcaster was really any good, namely, W8XK on 15.21 Mc/s (19.72 m.), although W3XAL on 17.78 Mc/s (16.87 m.) was fair; W8XK was best after 10 p.m., at which time W3XAL closes down.

It was noted this evening that the 12 Mc/s band (25 m.) was badly cut up by

key-clicks from FYR, Lyons, at one end, and the Italian station IBK at the other. This latter station is the one which badly jams the Moscow station RNE on 12.00 Mc/s (25 m.).

This business of key-click jamming is becoming quite serious, and there is really no excuse for this sort of thing nowadays; it merely indicates a very low standard of technique on the part of the station concerned. Nearly all the Italian stations offend in this manner, including HVJ; so much so that one feels that some obsolete system of keying must be in vogue in Italy!

American Transmissions

Conditions seemed to have improved somewhat on Saturday, May 23rd, and W2XAD on 15.33 Mc/s (19.56 m.) was quite good at 10.20 p.m., and on Sunday were even better, W3XAL being an excellent signal all the evening.

A return of activity on 28 Mc/s (10 m.) was also noted at midday Sunday, EI and F stations being intercepted, and PMA, Bandoeng on 19.34 Mc/s (15.51 m.) was an excellent signal at 12.45 p.m. relaying the NIROM programme.

Celestion Senior Auditorium

THIS loud speaker has been designed primarily for public address work and is of exceptionally massive construction. The diaphragm is 12in. in diameter and is driven by a 2½in. speech coil, which, in conjunction with the high total magnetic energy available in a gap of this length gives a very high electro-acoustic efficiency.

The response curve is remarkable for its uniformity. Apart from the dip at about 1,500 cycles it is flat within ±5 db. from 60 to 5,500 cycles. Thereafter there is a rapid cut off, but for the type of work for which this unit is intended this is not necessarily a disadvantage. At all events, there is no sense of loss of top when listening to most broadcast transmissions, and breadth and body of tone is the dominating impression. Frequency doubling was negligible up to 4 watts, the maximum output from the test gear.

The price of the AC model tested, which

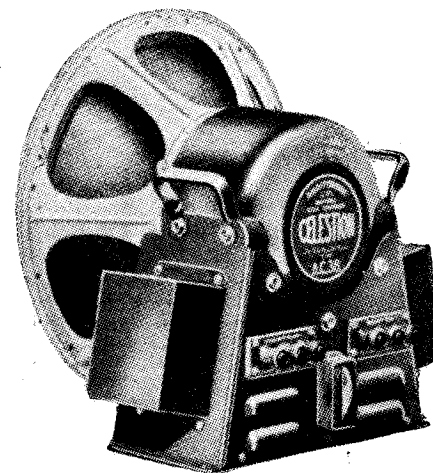
Reasonably good reception was again obtained from W3XAL and W8XK on Monday evening, but modulation seemed to be low on the former, and speech was boomy on the latter; results on W3XAL were, however, much better on Tuesday, when this station was again an excellent signal until close down.

Earlier in the evening of Tuesday W2XAD had been peaking to excellent at times, especially around 6.30 p.m., with a good hum-free carrier and clean modulation. It would appear that W2XAD's new low-power-modulated transmitter is now in service.

An outstanding amateur station on Tuesday evening was SU1CH, who was working G2AX and others in the 14 Mc/s (20 m.) band. The speech quality from SU1CH was very good, but I do not think one would call a Reisz a single-button microphone!

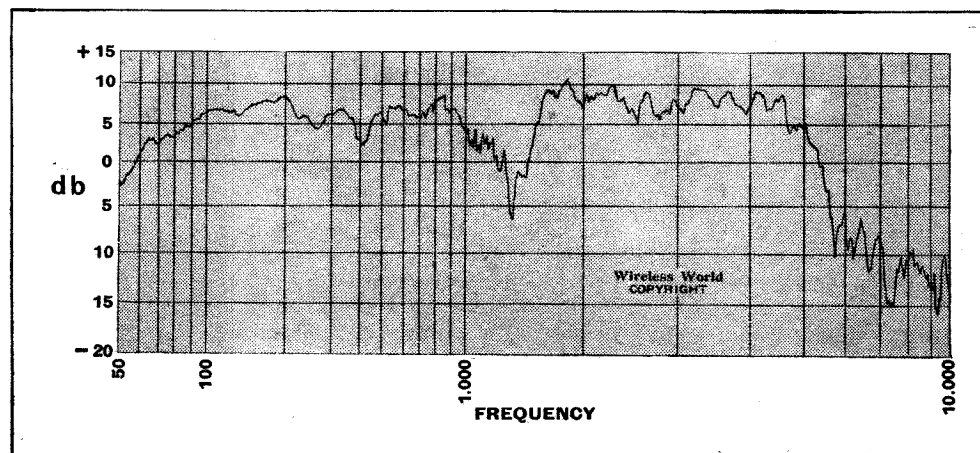
Excellent results were again obtained from W3XAL on Wednesday evening, and one must mention the very noticeable decrease in the noise level during the latter half of this week, which fact, coupled with good equipment and good conditions, helped to make the broadcasts from the *Queen Mary*, GBTT, so successful.

ETHACOMBER.



Celestion Senior Auditorium (energised) loud speaker

includes a Westinghouse rectifier for the field, is 18 guineas. A model for DC excitation is available at 15 guineas. Supplies are obtainable from Cyril French, 29, High Street, Hampton Wick, Kingston-on-Thames.



Axial response curve of Celestion Senior Auditorium on irregular baffle (area approx. 22 sq. ft.). Microphone distance 4ft., power input 1 watt.



The Times

GLYNDEBOURNE, SUSSEX, the Opera House in the heart of the country, from which a performance of "Figaro" will be broadcast on Thursday.

TENNIS enthusiasts everywhere will look forward to the commentary by Col. R. H. Brand from the Centre Court, Wimbledon, when, at three o'clock on Friday afternoon, he will keep listeners informed as to the progress of play in the Wightman Cup competition. He will broadcast again at 3.0, 4.50, and 5.15 on Saturday afternoon. This annual competition between American and British women players takes place alternately here and in America. The competition has already run for thirteen years, and America has won nine times as against Britain's four.

A fitting close to a tennis afternoon will be a Sports Talk on "Lawn Tennis" by F. J. Perry, also in the National programme, at 6.30 on Saturday.

BOUQUET OF BEADS

A RELAY of Hungarian music from Budapest will be a feature of the National programme on Sunday evening at 9. The relay is on the occasion of a popular peasant festival, when men, women and children congregate from all over the country, wearing their national costumes, and perform folk dances and national games.

The name of the festival comes from the custom in certain country districts for the young men to wear in their hats a posy made of glass beads.

OLYMPIC GAMES

THIS year the Olympic Games, the outstanding event in the athletic world, which occurs every four years, will be held in Germany from August 1st to 16th, but already there is

great activity in preparation for the occasion. At the time the B.B.C. will give a series of broadcasts, and are arranging to select experts on the various sports, who will go over to Germany for the purpose, but it is not yet decided which particular events will be chosen for broadcasting to British listeners.

On Tuesday, June 16th, all German stations will relay, at 6.30 p.m., an account from Paris, giving details of French preparations for the event.

SAVOY ORPHEANS

CARROLL GIBBONS returns to the National studio on June 17th, at 8 o'clock, with the Savoy Orpheans. This dance combination is now one of the most popular bands on both sides of the Atlantic, Carroll Gibbons being well-known in New York both on the stage and radio. James Dyrenforth, who went with Carroll Gibbons to New York, is again collaborating in the book and will compère Carroll Gibbons' programme. The usual popular team of singers will be in support, including Brian Lawrance, Anne Lenner and the Three Ginx.

"TALES OF HOFFMANN"

THE opera season closes on Friday night with the performance of Offenbach's opera "Tales of Hoffmann," Acts II and III of which will be broadcast from the Royal Opera House. Act II comes into the Regional programme at 9.20,

with an introduction at 9.15, and listeners can then turn to the National programme at 10 o'clock for Act III.

On the opening night of the opera season a complete opera was broadcast, and there have been, in addition, broadcasts of separate acts on seventeen evenings, so that the opera season has been very well represented in the programmes.

SYDNEY HOWARD

A SECOND instalment of "Household Hints," by Sydney Howard, will help to lighten the National programme at 8.20 on June 12th. Sydney Howard's earliest experiences in the entertainment world were as a member of a



REGINALD PAUL, who gives a piano-forte recital of works by John Ireland from the Regional station on Wednesday (8-8.30).

Listeners

Outstanding B

concert party, and his first stage appearance in London was at the Hippodrome in 1919 in "Box 'o' Tricks." Since then his popularity with his audiences has steadily increased, and although his appearance before the microphone is of comparatively recent date he has already proved himself a valuable asset.

"I SCREAM TOO MUCH"

OR "One Week of Love," is a light-hearted musical play, with music and lyrics by Spike Hughes. The story is of a young opera singer and her career, which ends with an Opera House triumph in New York, after successes in Hollywood.

The story is written as a satire on grand opera and on many features of modern life in America, and includes amongst its targets "bottle parties," dance band announcers, American-sponsored programmes and Hollywood receptions to stars. The cast includes many well-known singers. Gina Malo and Aubrey Mather play the principal parts, supported by Nora Gruhn, Gladys Young, Mira B. Johnson, Diana Morrison, Peter Bernard, Eddie Pola, John Miller, Bryan Michie. Hyam Greenbaum, the new Director of Music for Television, will conduct the Theatre Orchestra and the B.B.C. Revue Chorus. The production is in the hands of Max Kester.

The play will be broadcast from 8.30 to 9.30 on Tuesday, June 16th, on the National wavelength, and again on Wednesday at 7 o'clock from the Regional station.

"Guide for the Week

roadcasts at Home and Abroad

HIGHLIGHTS OF THE WEEK

FRIDAY, JUNE 12th.

Nat., 8.30, Recital for two pianos: Ethel Bartlett and Rae Robertson. Reg., 9.15, "Tales of Hoffmann," Act II from Royal Opera House (Act III from Nat., 10).

Abroad.

Radio Paris, 8.45, "Les Brigands," Offenbach, Concert version.

SATURDAY, JUNE 13th.

Nat., 3, 4.50 and 5.15, Wightman Cup commentary from Centre Court, Wimbledon. 6.30, "Lawn Tennis": Talk by F. J. Perry. Reg., 8.30, Haigh Marshall String Orchestra with Winifred Small (violin).

Abroad.

Milan I, 8.45, "Tosca," Puccini, conducted by Santini.

SUNDAY, JUNE 14th.

Nat., 5.20, "The Tempest," adapted by Val Gielgud and E. A. Harding: B.B.C. Orchestra. Reg., 9.20, Symphony Concert.

Abroad.

Vienna, 6, Beethoven Memorial Concert for Vienna Festival Week. Vienna Male Choir.

MONDAY, JUNE 15th.

Nat., 8.30, "The Thin Man," Murder Mystery of New York, adapted by Laurence Gilliam. Reg., 7, "The World We Listen In," Revue of Revues: B.B.C. Variety Orchestra.

Abroad.

Berlin, 8.10, "Cats on the Roof," Radio Fantasy with guitars.

TUESDAY, JUNE 16th.

Nat., 8.30, "I Scream Too Much," or "One Week of Love," Satire with additional music from operatic sources. Reg., 11.40, Recital of Oriental Folk Music.

Abroad.

Paris PTT, Music of Other Countries. National Orchestra and Raugel Choirs.

WEDNESDAY, JUNE 17th.

Nat., 8.30, Symphony Concert, B.B.C. Orchestra conducted by Sir Hamilton Harty. Reg., 11.40, Chopin Recital by Claude Pollard.

Abroad.

Frankfurt, 8.45, "I, You and He," musical variety.

THURSDAY, JUNE 18th.

Nat., 8, Will C. Pepper's "White Coons," Concert Party. Reg., 6.45, Five-minute introduction to "Figaro," Acts 1 and 2, relayed from Glyndebourne, 6.50 and 7.55.

Abroad.

Munich, 8.10, Happy Family Evening. Variety.

THE WORLD WE LISTEN IN

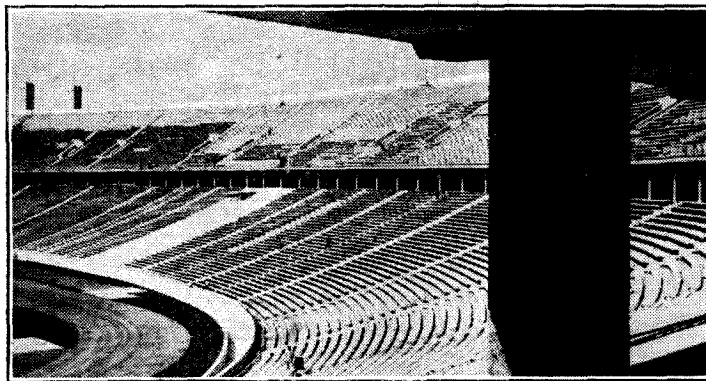
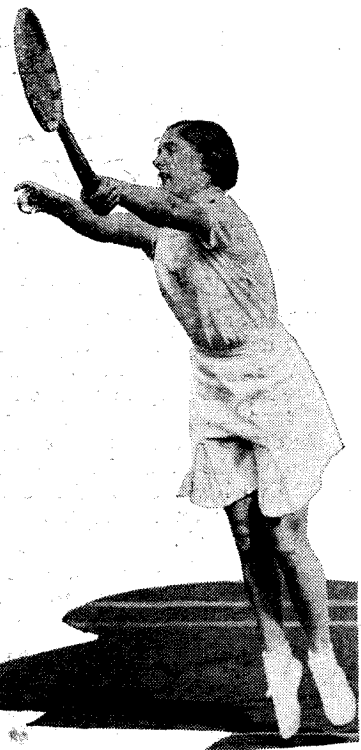
MANY listeners have regretted that the Monthly Revues of 1935 and 1936 were not repeated the following night. "The World we Listen In," at 7 p.m. on the Regional on June 15th—A Review of Revues, by Jack Strachey and Holt Marvell, will give some of these the opportunity of hearing, possibly for the first time, hits of the past revues. In this Revue there will be no original material, all numbers and sketches having been heard in the monthly series. Added attraction is that all the items have proved themselves successful. It will be a fast-moving, fast-changing broadcast.

Nelson Keys heads a cast, which includes Hermione Gingold, Effie Atherton, just back from her successful tour of America, Lyle Evans, a Canadian comedian who has made a hit in "Spread it Abroad," and the inimitable

store for listeners who tune in to the National programme at 10 on June 13th. It should be explained that the play centres around New York, where, when you want to know the time, you dial Meridian 7-1212 and hear a voice which is continually repeating the time for the benefit of any telephone subscriber who dials that number. The play is by Irving Reiss, and was a great success with American listeners when it was put over on the Columbia broadcasting network some time ago.

MISS K. STAMMERS, who will be a Wightman Cup competitor at Wimbledon. Broadcasts will take place to-day (Friday) and to-morrow.

The play concerns itself with events in the lives of different people who call up Meridian 7-1212. The cast, as one might expect, includes a crook, detectives, and journalists, as well as a number of other characters. The production is by Owen Reed.



THE OLYMPIA STADIUM, in Berlin, which has now been completed in time for the Olympic Games in August this year.

Arthur Marshall in two of his most successful thumb-nail sketches of dame school life. The majority of the music is by Jack Strachey, the writer of London's great song hit of the moment, "These Foolish Things," which was first heard in the Monthly Revues. The lyrics and sketches are mainly by Holt Marvell. The B.B.C. Variety Orchestra will be conducted by Charles Shadwell. The production is by Max Kester and Bertram Henson.

MERIDIAN 7-1212

SOMETHING very new in the way of dramatic plays is in

HAPPY FAMILY

WHAT is described as a "Happy Family" evening is an event on Thursday, at 8.10, from the Munich station, transmitted also from Nuremberg and Augsburg. The performers will include a yodeller, a humorist, and the famous Munich radio "Schrammeln Orchestra." There will also be a radio dance orchestra, a soprano, and a tenor at Nuremberg, and accordion, guitar, and lute performing from Augsburg.

YOUTH HOSTEL BROADCAST

THE Midland Station microphone will visit Ludlow Youth Hostel on June 13th, in order to give a sound picture of life there on a Saturday night in the summer. Walkers and cyclists will exchange experiences in the Common Room in the hour before lights out. There will be several Continental visitors, so possibly the Englishman's aversion from singing will be overcome for the occasion. Ludlow is one of five Shropshire hostels organised by the Birmingham Regional group of the Y.H.A.

THE AUDITOR,

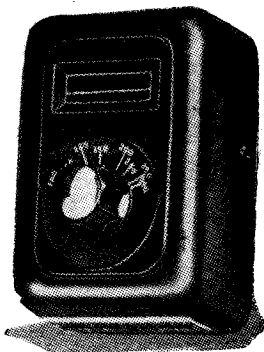
GLYNDEBOURNE RELAY

A FESTIVAL performance of Mozart's "Figaro" will be relayed from Glyndebourne in the Regional programme on

New Apparatus Reviewed

GLIMM VOLTMETER

THIS is quite a novel type of voltmeter, as it does not include any moving parts, voltage being indicated by a glow in a small neon tube. It can be used on either AC or DC supplies, and will answer as an indicator for direct or alternating current by the position of the glow about the electrodes. On DC the glow is confined to one electrode only, whereas on AC it is equally distributed about both.



Neon-type voltmeter for AC and DC measurements.

The meter is provided with a knob and scale calibrated from 100 to 440 volts. Having joined the instrument across the points where a measurement is required, the knob is adjusted so that a faint glow just appears between the two electrodes. The voltage is then read off the scale. It is surprisingly accurate for a neon device, and its measurements agree very well with those made with other instruments.

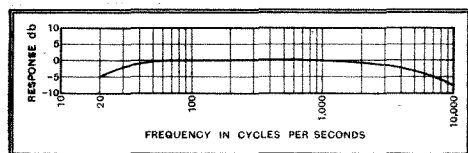
Its most useful feature is that current consumption is practically nil; for example, at 200 volts it passes less than 0.05 mA.

It is obtainable from Eugen J. Forbat, 28-29, Southampton Street, Strand, London, W.C.2, and the price is 27s. 6d.

L.T.P. OUTPUT TRANSFORMER

THE transformer illustrated is one of the new range now being made by London Transformer Products, Ltd., L.T.P. Works, Cobbold Road, Willesden, London, N.W.10.

This particular model provides two ratios, viz., 22½ to 1 and 15 to 1, and is designed

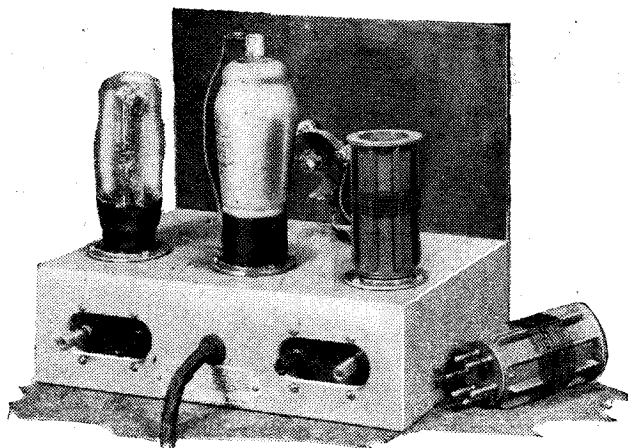


Response curve of the L.T.P. two-ratio output transformer.

to carry DC currents up to 90 mA., and is suitable for use with power valves giving up to about 10 watts AC output.

The windings are sectionalised to keep the

Recent Products of the Manufacturers

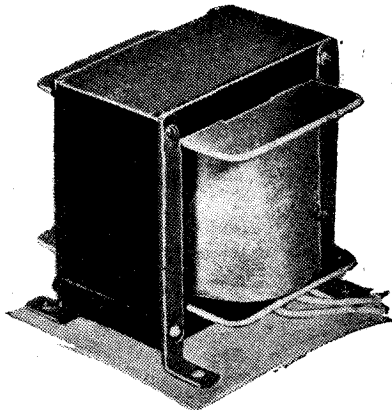


Eddystone All-World-Two receiver assembled from the kit of parts.

leakage inductance small, and to render it suitable for tropical use it is thoroughly impregnated.

Our measurements give the primary inductance as 35 henrys without DC flowing, 29 henrys with 40 mA., 24 with 60 mA., and 20 henrys with 90 mA. The resistance of the primary is 270 ohms.

The response characteristic was taken following a valve requiring a load of 4,000 ohms and the 15 to 1 ratio was employed with a suitable resistance joined across the secondary. The curve obtained with this combination is given in the accompanying graph. It is quite satisfactory, as the response is virtually constant over the major part of the audible scale.



Manufacturers' type two-ratio output transformer made by London Transformer Products.

As a skeleton, or manufacturers' type, the price is 24s. 6d., but the transformer can be obtained in a more attractively finished form with shrouded windings and terminals for an additional 4s.

EDDYSTONE ALL-WORLD-TWO RECEIVER

THIS new Eddystone receiver is a compact two-valve model designed expressly for short-wave reception. It is supplied as a kit of parts, but the assembly is perfectly straightforward, the layout being very well planned so that all components are readily accessible.

An HF pentode is used for the detector, and this is resistance-capacity coupled to a small power output valve, for, as a rule, headphones only will be used with this set. Either a triode or a pentode can be used in the output position, and a choice of valves is given in the instructional booklet. These have been chosen with a view to economy in operation, and by adopting the maker's recommendations the total HT

consumption can be kept within 5 mA. with a 120-volt battery.

Reaction is obtained by capacity-feedback through a reaction coil, but control of detector oscillation is effected by varying the screen voltage.

This arrangement is very satisfactory in practice, for the smoothness of the regeneration is one of the outstanding features of this receiver.

The Eddystone band-spread tuning system is employed, the small band-spread condenser, which has about 20 m-mfd capacity, being mounted in the centre and fitted with a neatly engraved scale, while the "tank" unit is located on the left and below the chassis.

The drive reduction ratio of the band-spread unit is about 8½ to 1, but this is quite slow enough in view of its small capacity.

Standard six-pin plug-in coils are used, and with the Eddystone Type 6LB size the waverange covered was found to be 15.75 to 29.6 metres. At the bottom end of this band the band-spread condenser gave a coverage of two metres, whilst at the top it was reduced to just over one metre.

The band-spread system is a great help, for, despite the small capacity of this condenser, some care is needed in tuning, especially at the lower end of the Type 6LB coil.

The next size coil, Type 6Y, overlapped the other one amply sufficient to take care of variation in stray capacities in different sets, its range being 27.3 metres to 54 metres.

The sensitivity of this set is exceptionally good, so also is the selectivity, for it is possible to receive DJN Zeesen, 31.45 metres, clear of its companion transmitter DJA on 31.38 metres, with one an R8 signal, and yet leave a clear space between them. For a simple detector-LF set this is very satisfactory.

European and American short-wave stations were received well during the time the set was on test, though conditions must be favourable for good reception of the latter.

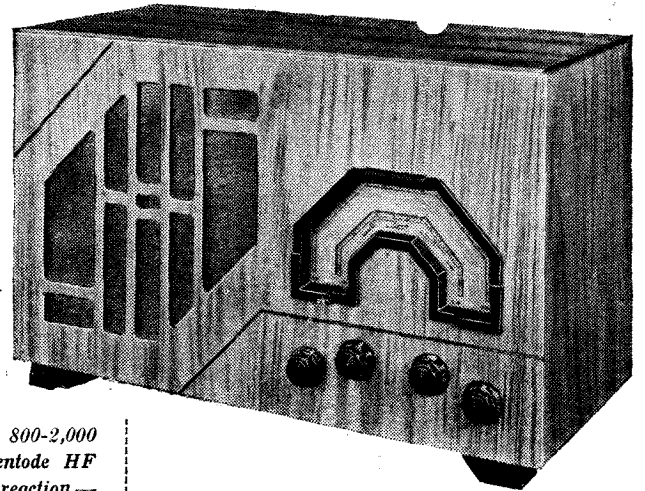
To sum up, the All-World-Two is a soundly designed and very efficient detector-LF set, and as it is so easy to operate it is ideal for the beginner, yet it forms a valuable stand-by for the more experienced short-wave experimenter.

The price of the complete kit is £3 7s. 6d., and the valves cost 20s. 6d. extra. The makers are Stratton & Co., Ltd., Bromsgrove Street, Birmingham, 5.

Aerodyne

AN ECONOMICAL ALL-WAVE BATTERY RECEIVER

MODEL 49



FEATURES. — *Type.* — Table model battery receiver for short, medium and long waves.

Wave ranges. — (1) 18-50 metres. (2) 200-550 metres. (3) 800-2,000 metres. **Circuit.** — Var.-mu pentode HF amplifier — triode detector with reaction — pentode output valve. **Controls.** — (1) Tuning. (2) Volume and on-off switch. (3) Reaction. (4) Wave range. **Price.** — (Excluding batteries) 7 guineas. **Makers.** — Aerodyne Radio Ltd., Tottenham, N.17

THE testing of this set has been attended by certain elements of surprise. In the first place, it was somewhat startling on removing the back to find so much empty space inside the cabinet. The receiver chassis is, in fact, little bigger than that of a modern compact portable, but as the choice of batteries is left to the purchaser the makers are undoubtedly right in leaving plenty of space for the accommodation of HT and LT units of different sizes and shapes.

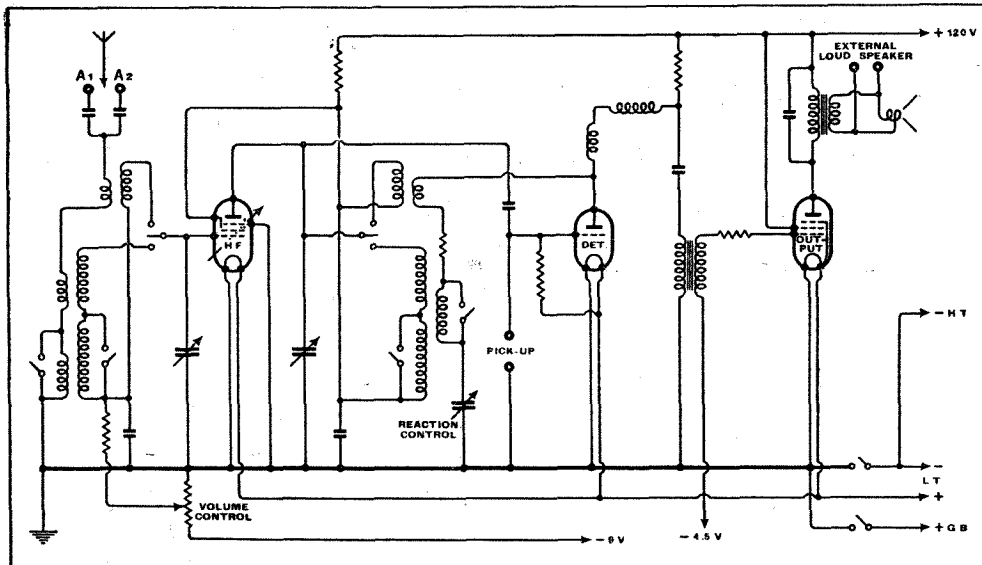
The second surprise was that a chassis of such small size and superficially, at any rate, of so simple a design should give an all-round performance so well in keeping with the imposing dimensions of the cabinet in which it is housed. An aspect of

be ample for any normal living room.

The quality of reproduction is very natural, and there is a foundation of real bass response which is broad in frequency range, but which in no way exercises a dominating influence on the quality. Another welcome feature of the reproduction is the complete absence of shriek in

age of the additional selectivity and amplification which must result from a properly tuned HF stage. Incidentally, the medium-wave aerial coupling transformer has an iron core.

The HF amplifier valve is of the variable-mu pentode type, and volume is controlled in this stage by varying the grid bias through the medium of a potentiometer connected across the 9-volt grid bias battery. Contacts on the on-off switch are arranged to disconnect this potentiometer while the set is not in use. The coupling between the HF amplifier and the grid detector is of the tuned anode type and reaction is applied to the tuned anode circuit. Separate HF chokes are connected in series in the anode circuit of the detector stage, one choke being designed for the short-wave range and the other for the medium- and long-wave ranges. A parallel-fed transformer couples the detector to the pentode output valve. Fixed tone correction is provided by a condenser shunting the primary of the output transformer, in the secondary of which there is provision for the connection of an external loud speaker. Sockets are also provided for injecting the output from a gramophone pick-up into the detector stage.



Complete circuit diagram. The HF amplifier is tuned on the short waves as well as on the medium- and long-wave ranges, and iron-cored coils are used in the medium-wave aerial coupling transformer.

the performance which calls for special commendation is the good quality and volume provided for an almost negligible expenditure of HT current. A milliammeter connected in the common negative HT lead showed that even with the volume control at maximum and the set fully extended for long-distance reception not more than 6.5 mA could be induced to flow. When tuned to Droitwich or the local medium-wave stations when the volume control will be necessarily near the minimum the HT current consumption falls to 5 mA, and in return for this a level of volume is given which will

the upper middle register, the credit for which must be shared by the designer's treatment of the pentode output stage and by the qualities of the permanent magnet moving-coil loud speaker itself.

The circuit is a straightforward arrangement of HF amplifier, detector with reaction and output valve. It is interesting to find that the HF stage is tuned on the short-wave range as well as on the medium- and long-wave ranges. It is, of course, much easier to design a set with an aperiodic aerial coupling on the short waves, but from the performance point of view it is obviously better to take advant-

Short-wave Performance

The makers' claims for the performance of the set on the short-wave range are limited to the reception of the growing number of interesting Continental transmissions, but the liveliness of performance on this range is such that it is certain that American broadcasting will be well received when conditions over the Atlantic are good. Care must be exercised to avoid the use of excessive reaction on this range, as this is attended by a reduction in sensitivity. The set is at its best just below the threshold of oscillation (or just above the oscillation point when receiving CW signals). The HF stage forms an effective buffer for capacity effects and re-radiation, and it is possible to grasp the aerial lead-in without changing the frequency stability of the detector and reaction circuits. The reaction control itself is smooth and free from backlash in the critical region near the oscillation point.

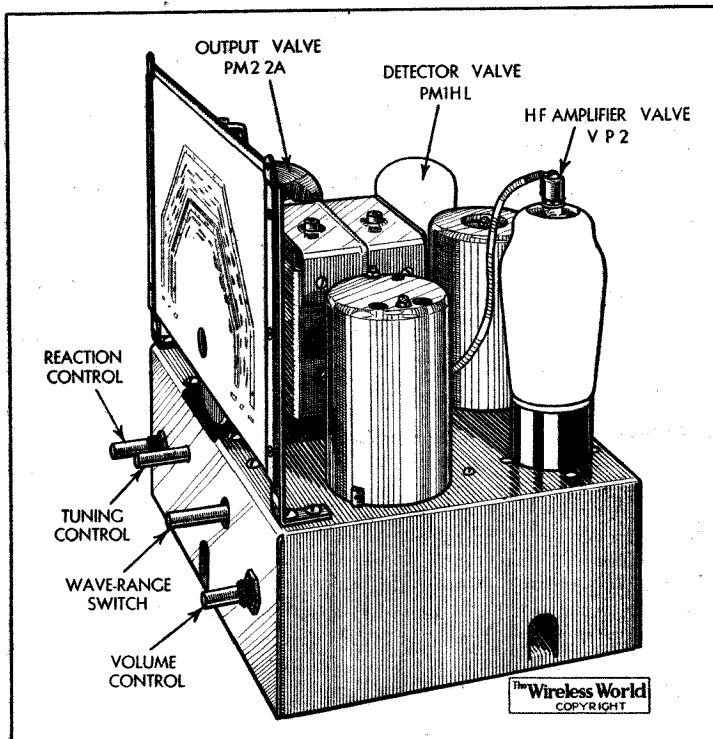
Aerodyne Model 49—

The medium-wave sensitivity is good, and upwards of five or six Continental transmissions can be relied upon to give a good programme during the hours of daylight. Radio-Normandie can be tuned-in clear of London National by connecting the aerial to the more selective of the two alternative aerial sockets. Some reaction is necessary to clear the French station of interference from the local when using the set in Central London, but the adjustment is not at all critical. Under similar circumstances the section of the dial from 325 to 375 metres is more or less "dead ground," due to the spread of the London Regional station, but there is plenty of free space in other parts of the dial for the reception of Continental transmissions. Droitwich and Radio-Paris, on the long waves, are easily separated without resorting either to reaction or to the use of the more selective of the two aerial terminals. The standard "Aerodyne" dial in which the pilot light follows the station pointer is a standard item of the specification. This dial, which, incidentally,

is calibrated with station names, is commendably free from parallax, as the tip of the pointer carries a small roller which keeps the point a small fixed distance off the back of the translucent scale.

Undoubtedly the outstanding achievement of the designers of this receiver has

100 kilowatts, are needed for the London, West, Northern, Midland and Scottish Regionals if this country is not to drop behind in the high-power race and if the broadcasting service is to be made as good as it ought to be.



The chassis is compact, leaving ample space in the cabinet for batteries of all types.

been the happy choice of component and circuit values which has provided such good quality of reproduction and all-round efficiency for so small an expenditure of HT current.

RANDOM RADIATIONS

Television Demonstrations

IT is announced that the B.B.C. has abandoned its original intention of having public demonstration rooms in the London area, the idea of which was to let the man in the street see just what could be done by modern high definition methods. This is, I think, a pity, though, doubtless, shortage of money—the £180,000 set aside for television this year has already been spent—makes it inevitable. However, even though the B.B.C. won't have so much as one viewing room of its own open to the public, a good many of the big London shops intend to give television displays for their customers. This will fill the gap to some extent, though for a long time the demand for places in the demonstration rooms will vastly exceed the available supply. If television gets a fair chance it is going to arouse enormous popular interest this summer and autumn.

Belfast's Broadcasting House

THE news that the B.B.C. has purchased a large site near the middle of Belfast and intends to build on it an Ulster Broadcasting House indicates that the Corporation

By "DIALLIST"

is going on with its policy of having important and imposing radio centres in different parts of the country. One can't help wondering, though, where the money is to come from. At the present time the B.B.C. realises that it has to face enormous expenditure for developments during the next ten years. The site for the "second half" of the London Broadcasting House has already been acquired and that building is urgently needed, for the present one has proved far too small and the staff has had to overflow into hired buildings dotted about here and there. Then television is going to call for a heap of money. Once London has had its taste of high definition pictures there is going to be a loud and insistent demand from the provinces, in whose most thickly populated areas at any rate high definition stations will have to be put up as quickly as possible. Funds for the building of the North Scottish and North-east Regionals are probably already ear-marked, but there is still the new relay in the Isle of Wight to be considered, to say nothing of the rebuilding of the Plymouth plant. On top of all this new transmitters, rated at least at

A Short-wave Boon

BEING unfortunate enough to live on a main road, along which passes a heavy stream of traffic—the week-end average is some 800 motor vehicles an hour—I had to give up short-wave reception some time ago, except in the early morning if I happened to be up, or late at night if I hadn't felt like going to bed. The interference from car, bus and lorry ignition systems was so poisonous and so continuous that there was no pleasure or profit in short-wave listening. I tried a screened transmission line, but the result was that though the interference had disappeared, most of the short-wave transmissions did so, too. Recently I have rigged up a short-wave aerial with an un-screened transmission line, and results are remarkably good. Ignition-system interference has not entirely disappeared, but only a few types of car, bus or lorry produce any response from the loud speaker as they pass. I believe that even these worst offenders would be quelled were it not for the fact that for various reasons I can't raise the roof of the aerial above a certain height. As it is I can once more listen with pleasure to short-wave transmissions without the feeling that the loud speaker cone is going to be torn out by the roots as each vehicle speeds past.

No Place for D.X.-ers

IN Germany, if you wish to listen to foreign stations, you have apparently to be a little careful about those which you select. The other day three men and two women living at Bremerhaven were sent to prison with sentences varying from fifteen months to two years for listening to the Moscow broadcasts and discussing them afterwards. The Court held that this amounted to "contemplated high treason." There have been one or two similar instances in other European countries, and, in some, attempts have been made to make it a punishable offence to tune in certain foreign stations. Curiously enough, regulations of this kind are nearly always made by countries which spend a great deal of money in erecting high-powered stations, sometimes of the short-wave variety, sometimes with long or medium wavelengths, which are largely used for transmitting their propaganda to places outside their own borders. I suppose that we shall never free broadcasting now from politics and propaganda, but it is a thousand pities that this kind of thing ever crept into it.

FIELD DAYS

THE Golders Green and Hendon Radio Scientific Society has arranged to hold three field days for five-metre experiments this season, the dates being June 21st, July 12th, and September 13th respectively. The first will be in the neighbourhood of Wheathampstead, Herts, and any reader of *The Wireless World* interested in these experiments will be welcome. Details of the arrangements can be obtained from the Assistant Hon. Sec. Hornbeams, Priory Drive, Stanmore, Middlesex.

On July 26th an 80-metre D.F. field-day will be held at Bradwell-on-Sea, Essex.

Broadcast Brevities

An Empire "Try-Out"

THOSE readers who picked up the Empire transmission at 12.15 B.S.T. this morning (Friday, June 12th) will have realised that Canada and America have been able to enjoy a "live" broadcast by the women television announcers far exceeding in interest and importance their brief and feverish introduction to home listeners in the Geraldo programme on May 26.

New York cocktail parties doubtless heard Cecil Madden interview the two girls on their new work, and listened eagerly while each in turn announced the subsequent items in the "Empire Magazine."

By the way, lest you should think that the "Empire Magazine" is a brazen copy of the "Saturday" variety, it is worth pointing out that Cecil Madden's Empire feature originally known as the "Gossip Hour," has run more than two years. It is truer to say that the "Saturday Magazine" is modelled on its Empire prototype, which is broadcast monthly.

O.B. Engineer as Tattoo Performer

THE B.B.C. has repeated, in connection with the Aldershot Tattoo, the experiment tried two or three years ago at Tidworth, when, in order to avoid clashing with the setting of various scenes, the O.B. engineer in charge of the microphone point on the parade ground was dressed in green and russet so as to blend with the landscape. In the bivouac scene at Aldershot all those taking part were in uniform. The O.B. Department, therefore, decided to put their engineer in a similar uniform. Thus the audience was in complete ignorance of the fact that one lusty performer had a concealed microphone as part of his make-up, and that a buried cable virtually connected him to the control point.

Wanted—a Name

A LITTLE problem of nomenclature is troubling the B.B.C. What is the correct designation for the imposing instrument, now under construction, which is to flood St. George's Hall with almost every variety of musical tone? The generic term would be *organ*, but this will be no ordinary organ, for it falls under none of the usual classifications — church, cinema or concert.

Actually it will be comprised of four separate units; it will combine an orchestral organ, a

NEWS FROM PORTLAND PLACE

"straight" organ, one of the cinema type, and an Electrone. The last-named, which produces its tones electrically, was first described in *The Wireless World* of May 24th, 1935.

Whether we call it a theatre organ or a variety organ, there can be no doubt that it will transcend in versatility any other organ in existence. Constructional work is going ahead rapidly at the Compton factory, and the console case is expected to be ready in ten days or so.

A Thing of Beauty

The Electrone section, although basically similar to the specimen which was demonstrated at Radiolympia last year, will be more advanced in design, besides being much more presentable in appearance. In fact the manufacturers are anxious that the whole organ shall be a joy to the eye as well as to the ear.

The work of installing the organ will begin in September and should be completed in two or three weeks. The manufacturers are rejoicing over the fact that there is much more elbow-room at St. George's Hall than in the Concert Hall, where the job of installing the organ called for superhuman efforts in space-saving.

The inauguration of the organ in the autumn should give a grand fillip to the variety side of broadcasting, which has not always had a square deal in matters musical.

Single-Room Drama

"PROGRESS" has been the watchword of broadcasting since the earliest days, and very rarely has the art gone back on its own tracks. Yet this happened last week—with pronounced success—in the case of "Monsieur Beaucaire." All the elaborate doctrine of the dramatic control panel and multi-studio technique was swept by the board, for Gordon McConnell produced the whole affair in St. George's Hall, using both stage and auditorium as one vast studio.

The Master Hand at Work

Even the votaries of the D.C. panel would not deny that this method made for unity of effort. Watching Gordon McConnell "in command" in the centre of the stage, one could note how he was able to direct the show down to the minutest detail by

a flick of the hand, very much in the manner of an orchestral conductor.

Grouped around him were the principals; a few feet away in the orchestra pit were the Effects men with swords, horses' hooves, a gravel-filled cloth covering a drum, and other gadgets; stationed in the auditorium itself were the "crowd" retreating through velvet curtains or advancing towards the stage as the action demanded.

The only attempt at a separate studio was a microphone for the announcer's use, mounted behind a folding screen to the right of the stage.

Two Schools of Thought?

The D.C. panel still has a very strong following at Broadcasting House, and no doubt it is the ideal instrument for large-scale dramatic effort; but Gordon McConnell has had the courage to revert to the older system. Whether he is justified in doing so must be left to listeners to decide. Have readers any pronounced views on the subject?

A Send-off for Burghead?

IF Belfast, why not Burghead? "is the question now levelled at the B.B.C., in regard to North Scottish Regional, which will soon be in the news again with the start of transmission tests.

As all the world knows, the new Belfast transmitter was opened with all the ceremonial usually attaching to the inauguration of a new Lido or West-end Crèche. Everyone, from the Governor-General of Northern Ireland downwards, was present at Lisburn, and the question on Scottish lips is, will the powers-that-be travel to the Morayshire coast to give a similar fillip to Burghead? Of course, this question must be decided by Mr. Dinwiddie, the Scottish Regional Director.

Synchronisation Tests

Whichever way the question is settled, the fact remains that Burghead is rapidly nearing completion and will be testing in the late summer. No wavelength has yet been chosen as it has not been decided whether the station shall be synchronised with Scottish Regional. Synchronisation tests have been carried out and the engineers are fairly well satisfied with the results, but some listeners are known not to be too happy about them.

It is always difficult to avoid mush areas when synchronisation is resorted to.



HISTORIC SITE FOR TELEVISION.—Mr. T. M. B. Elliott, of Brisbane, Queensland, has converted this historic convict treadmill tower to a very modern use, as a wireless and television experimental station. The tower is the property of the Government, but has been placed at the disposal of Mr. Elliott for his research work.

Television Demonstration Rooms

SHALL we soon have television on trains? Several of the big railway organisations are seriously interested, and it is understood that at least two London termini will be equipped with television demonstration rooms.

Those organisations which have already applied to the B.B.C. for guidance in the matter of demonstration facilities have been sent a helpful memo. giving suggestions as to the size of the hall and audience.

The Five-Row Plan

Pointing out that demonstration halls should be fairly dark so that no direct light falls on the picture, the Corporation suggests an arrangement consisting of five rows of seats with eight seats per row, the first row being about 5ft. from the picture.

Indoor aerials are not likely to be of any use. The recommended outdoor antenna will have to be well raised above the roof of the building and connected by feeder to the receiver.

Any number of receivers can be operated in the same hall.

Brighter London

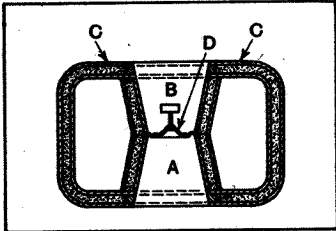
Whilst on the subject of television aerials, may we suggest that the B.B.C. attempt to brighten North London by making the television mast at Alexandra Palace an object that will attract and please the eye in the matter of colour—silver or gold, or, perhaps, just aluminium?

Recent Inventions

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

LOUD SPEAKERS

THE figure shows a dual loud speaker in which a single diaphragm D supplies front and rear openings A, B, which are enclosed in a common double-walled casing



Constructional details of loud-speaker described in patent No. 443816.

C filled with sound-absorbing material. The construction is stated to be free from undesirable resonance, and from any noticeable directional effect.

Lenzola Lautsprecher-Fabrik, and J. Lenzen. Application date June 7th, 1935. No. 443816.

HOMODYNE RECEIVERS

THIS type of receiver is generally used to handle signals in which the carrier-wave is suppressed at the transmitting end, and is then restored at the receiver by a local oscillator valve. In some cases, however, the signal is radiated in the ordinary way, and the carrier-wave is filtered out at the receiver, and separately amplified, before being again mixed with the signal components and rectified. In such systems it is necessary to use a high degree of screening, or isolation, between the amplifying channels handling the two kinds of signal energy.

According to the invention the difficulty is minimised by using two separate aerials for reception, each being coupled to its own chain of amplifiers. One aerial is used to handle the signal proper, whilst the carrier-wave is derived from the other aerial. The two aerials are arranged so that there is no mutual coupling between them.

Marconi's Wireless Telegraph Co., Ltd., and G. M. Wright. Application date August 30th, 1934. No. 443582.

RECEIVER CONTROL

IT is usual to provide means for suppressing the background noise which would otherwise be heard when changing the tuning of a set from one station to another. It has also been proposed to provide means for controlling the degree of suppression, i.e., the threshold point at which incoming signals can pass through to the loud speaker, so that the circuits can be made to exclude all but

very strong signals, or, on the other hand, can be set to respond to relatively weak or distant stations.

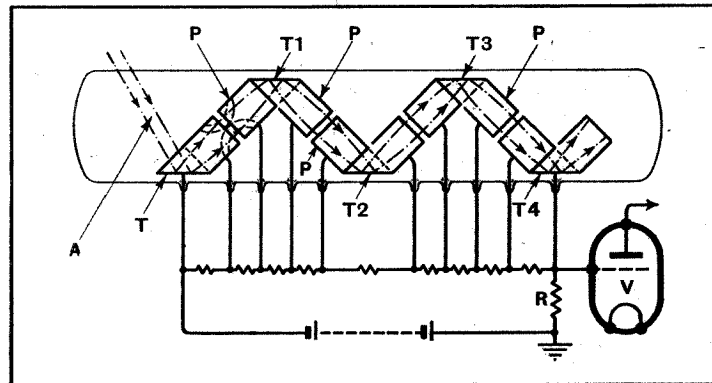
According to the invention, the control knob used to regulate this aspect of the receiver is arranged simultaneously to modify other circuit conditions. For instance, when the circuits are set to receive strong signals only, one or more of the high-frequency valves are switched out of circuit; or the local-oscillator valve is cut out so that the set operates as a "straight" instead of a superhet receiver; or the tone-response is appropriately modified.

E. K. Cole, Ltd., and E. J. Wyborn. Application date September 28th, 1934. No. 442903.

SECONDARY-EMISSION AMPLIFIERS

RELATES to amplifiers of the kind in which a ray of light A impinging upon a photo-sensitive cathode or target T liberates a supply of electrons, which are drawn towards a second cathode or target T₁, at a higher potential than the first, and there produce a larger number of secondary electrons. These are, in turn, attracted towards a third target T₂, and so on, in succession, until the amplified stream reaches the output target or anode T₄, which is coupled to a thermionic amplifier V through a resistance R.

The invention is concerned with the method of supplying graduated voltages to the electrodes P, which are used to focus the electron



Method of supplying graduated voltages to electron discharge amplifier.

stream in its passage from one target to another across the tube. Magnetic coils may be added to assist in concentrating the electron stream in its passage through the tube.

J. D. McGee. Application date July 5th, 1934. No. 443777.

TELEVISION RECEIVERS

IN order to prevent damage due to the "implosion" or inward collapse of a cathode ray tube, when used for receiving television,

the tube is permanently fitted into a metallic container which surrounds both the stem and the flared end. The tube and its case are transported as one unit and are fitted as such in the television cabinet. The end of the container facing the viewing-screen is fitted with a stout glass "window," secured in position by means of a bayonet joint.

Radio Akt D. S. Loewe. Convention date (Germany) May 27th, 1933. No. 443484.

A PORTABLE television outfit, suitable for military or police use, consists of a cathode ray tube capable of producing a picture up to 6 by 9 cms. and operated by a high-tension supply derived through a vibrating-contact "converter" from a 6-volt battery.

The framing voltages required for the deflecting electrodes are produced by a rotating commutator disc fitted with a number of segments which are tapped across a potentiometer resistance so as to produce a corresponding series of stepped impulses. The line-scanning voltages are generated across a condenser, the rotary plate of which is driven from the commutator shaft to produce a saw-toothed impulse. The connection of the commutator-disc segments may be varied at will, so as to handle "secret" or cipher signals.

Radio Akt. D. S. Loewe. Convention date (Germany) July 21st, 1933. No. 443286.

"OUTSIDE" BROADCASTS

WHEN broadcasting a football match or similar sporting event, there may be in action (a) the main microphone used by the commentator, (b) a second micro-

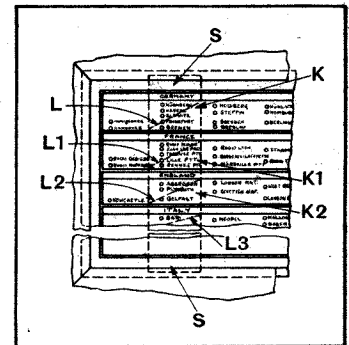
ing." Also, it is desirable to be able to give the commentator's voice precedence over all other sounds at critical moments in the game.

These various objects are attained by rectifying part of the output from the main microphone, and using the rectified voltage to regulate automatically the volume from the various secondary microphones.

W. A. Mueller (Assignor to United Research Corporation). No. 2008082. (U.S.A.)

TUNING SCALES

INSTEAD of arranging all the station names in the natural sequence of wavelengths, they are "catalogued" according to nationality in a series of transverse compartments on the panel, as shown. A vertical strip S is moved both up-and-down and to-and-fro by the tuning-control (not shown), until an inclined line L,



Tuning scale on which station names are grouped under their respective countries.

L₁ or L₂ intersects with a cursor mark in front of the desired station. A lamp is illuminated at K, K₁, K₂ to indicate the country from which the programme originates. It is stated that the indicator passes over only one country at a time, and is transferred from country to country by a suitable construction of driving-device. Details of this construction are not, however, given.

Ideal Werke Akt. für drahtlose Telephonie. Convention date (Germany) 9th December, 1933. No. 443172.

DISTRIBUTING PROGRAMMES

BROADCAST programmes are picked up on a common aerial and distributed in high-frequency form to a number of different receivers, located, for instance, in the various rooms of an hotel. The aerial is coupled through a filter circuit to two primary amplifiers, one of which handles, say, the medium wave-band and the other the long wave-band. The output frequencies are coupled to a two-wire transmission line through separate transformers each of which is balanced at its own frequency to the impedance of the line.

J. van Slooten (Assignor to Radio Corporation of America). No. 2020813. (U.S.A.)

The Wireless World

THE
PRACTICAL RADIO
JOURNAL
26th Year of Publication

No. 877.

FRIDAY, JUNE 19TH, 1936.

VOL. XXXVIII.

No. 25.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Waterloo 3333 (50 lines).
Telegrams: "Ethaworld, Sedist, London."

COVENTRY: Hertford Street.

Telegrams: "Autocar, Coventry." Telephone: 5210 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Hilfe, Manchester." Telephone: Blackfriars 4112 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.

Telegrams: "Hilfe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates :

Home, £1 1s. 8d. ; Canada, £1 1s. 8d. ; other
countries, £1 3s. 10d. per annum.

*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

Ultra Short Waves Applications for Miniature Transmitters

IT is quite obvious that the Postmaster General must keep a tight hand on the number of licences issued for wireless or telephony transmission, because even with the extension down to ultra short wavelengths, there is still risk of overcrowding on certain wavebands. On extremely short waves, however, the advantage exists that transmissions do not normally carry to great distances, so that, in allotting wavelengths, if the locality in which the stations are to be used can be prescribed, then there is room for considerably greater latitude.

Under the Wireless Telegraphy Act, whilst the monopoly of communications is securely vested in the Postmaster General, provision is made for the licensing of commercial stations and also private stations under certain circumstances.

We have always understood that the clause concerning the licensing of private stations was intended to make provision where other means of communication were not available.

The applications for wireless have increased very considerably since the date of the Act and wireless can now be put to useful purposes which could not be visualised at that date. Portable short wave transmitters having a limited range of operation certainly were not contemplated then.

Newspaper Needs

The daily newspapers of our modern world are dependent on having available to them the best and most rapid means of collecting news and communicating it to their editorial offices. To-day

they have to meet competition such as broadcast running commentaries, and any restrictions which artificially deprive the newspapers of effective means available for speeding up or improving their news services might almost be argued to be a "restraint of trade."

In America, in particular, the Press makes the fullest use of wireless for news gathering purposes, and recently extremely portable ultra short-wave transmitters have been prominently in use by reporters to communicate to their head offices, or to other reporters at the end of a telephone line, a story of important events as they are taking place.

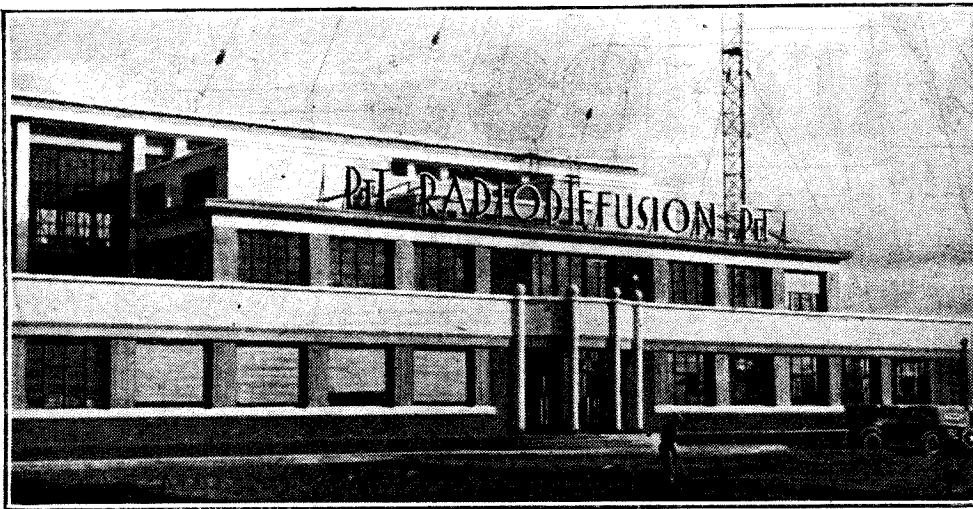
Invention Creates Applications

If private stations were intended to supply the need where other forms of communication did not exist, then surely the ultra short-wave portable transmitter has created a new service to the Press which ought to be utilised.

Elsewhere in this issue we illustrate a portable transmitter used in America, which enables a reporter at conferences or similar events to move about freely, talking and describing events as he goes, even obtaining direct interviews with prominent persons.

No Post Office telephone receiver can supply this need and, therefore, if a good case can be made out it would seem that the Post Office ought to permit such private stations for a service which wireless developments have made possible.

The Post Office would not be deprived of any revenue but would instead gain to the extent the revenue of the licence fees, and the use of post office telephone or telegraph lines from the point where these could be utilised in conjunction with the wireless transmitters.



The station building at the Toulouse-Murat broadcasting station. This station is run by the PTT Government department, and employs a power of 120 kilowatts.

THERE seems to be talk of armaments in every quarter of the world at the present moment. In a number of countries people regard the news of new broadcasting stations much in the same light as they do that of new armaments. Broadcasting has developed far beyond our first conception of it, as a national service. It has become even more international than anyone ever expected in spite of the protestations of European governments at wavelength conferences that the value of wavelengths should only be considered in the light of national requirements.

During the past few months the number of new stations and power increases that have been announced are so great that it is difficult to keep count of them all. Viewed collectively they certainly form an alarming array.

Official U.I.R. statistics show that, compared to the present, the total power of European broadcasting stations will increase by 1,700 kW to 8,000 kW in 1937. This compares with 4,500 kW at the time the Lucerne wave plan came into force and with a mere 420 kilowatts in 1929 (Plan de Prague).

More 100 kW Stations

Europe's power increase of 1,700 kW will be achieved more by increases in the power of existing stations than by the opening of new transmitters. One-hundred-kilowatt stations will increase by 18 from 26 at the present moment to 44 in 1937. The number of stations with more than 50 kW but less than 100 kW will be raised from 46 now to 64 in 1937. Only five new transmitters are contemplated in Europe and another five in European Russia.

Taking in detail some of the more outstanding developments foreshadowed, these are as follows: Athlone will increase its power from 60 kW to 100 kW, the two Brussels stations from 15 kW each to 100 kW each. In Lithuania the Kaunas station at present operating on 7 kW will be replaced by a new 100 kW transmitter. In Southern Sweden a new 100 kW

station will be opened. In Bulgaria, about 25 miles from Sofia, at Vakarel, there will be an entirely new 100 kW station which at present is under construction. In Italy work is progressing favourably on the two new 120 kW stations at Rome. In Czechoslovakia the present Prague II station of 5 kW will be replaced by one of 60 kW. The Kosice station will be scrapped and a new 60 kW transmitter will be opened at a place about midway between Kosice and Uzhorod. In France, apart from the recently opened high-power stations, two new 120 kW transmitters, one near Bordeaux and one in the centre of the country, are under construction. A giant long-wave transmitter of at least 200 kW-in-aerial has been ordered to take the place of the present 80 kW Poste National, the old Radio-Paris. The new station will be in the centre of France.

Spain Joins In

These details only refer to stations which are at present under construction and which will actually be completed by next year. Plans for power increases—I stress the word "plan"—are many. Spain, for instance, intends at some future date to modernise its broadcasting system. These plans include a 150 kW long-wave transmitter for Madrid. In Yugoslavia there has been talk of increasing the power of the present transmitters for the past four years or so.

In addition to these countries there are more concrete proposals for power increases in Poland. Warsaw is to erect a 20 kW local station, a new 100 kW transmitter is planned near Cracow. Czechoslovakia intends building two new 100 kW stations in 1938, one near Brno and the other near Bratislava. In Estonia a British firm is said to have received an order for a 60 kW transmitter to be erected in the centre of the country.

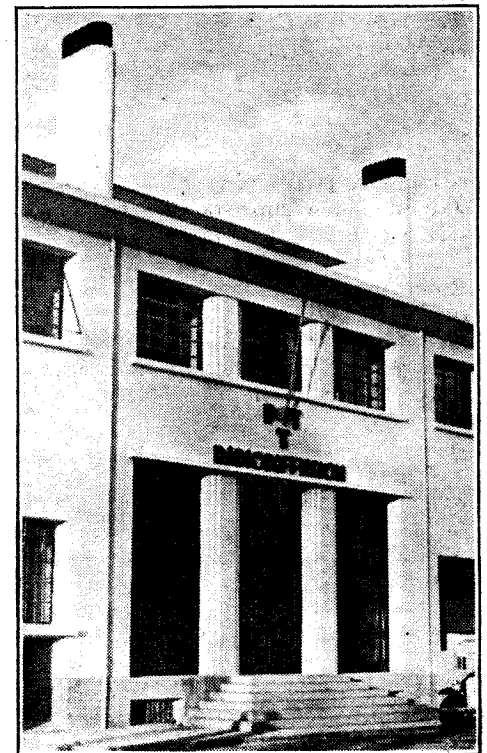
Of Russia I confess ignorance, except that the present number of stations in the European part of the country is said to be 50 and that five are to be added by 1937.

All these developments only refer to medium and to long-wave stations.

Europe's

ARE KILOWATTS AN A

On the short waves France has planned and has under construction a powerful centre of four SW transmitters of 100 kW each. In Germany, the Post Office is just completing a set of short-wave transmitters which, it is rumoured, and the rumour has not been contradicted, will be of equal power. Great Britain is also engaged on short-wave development, and a number of other European countries have opened or intend opening services to overseas. Even Yugoslavia which is so very backward as regards the ordinary broadcasting



The imposing entrance to the 100-kilowatt Government broadcasting station at Lyons-Tramoyes.

service has recently started short-wave broadcasting.

With one exception and, of course, excluding the short waves, these power increases are more or less justified by the needs and requirements of the individual national listener. The amazing development in France seems to imply aggression, but in reality this is not so. Until last year that country was without an adequate modern service. If the French seem to have a bigger programme, this only means that they are making up for lost time.

Others, again, comment on the opening of a 100-kW station in Sofia, but they forget that Bulgaria has skipped the period of gradual development from 1 kW to 10

Race for Radio Power

TO INTERNATIONAL AGREEMENT?

By "WANDERING WAVE"

kW, and starts at once on higher power. In 1936 100 kW are what 1 kW was in 1926, ten years ago. To-day it is the normal power of a medium-wave transmitter.

Super-power "Mystery" Station

Germany was one of the first European countries to go up to the international limit, but in spite of this there are vast stretches in that country which are still unprovided for. It would therefore not be surprising if the Germans were to announce the erection of new high-power stations in the near future. Work on the 60 kW transmitter for Saarbrücken is progressing, as well as on the "mystery" station, a new super-power Deutschland-sender to be ready in 1937.

The two new 120 kW transmitters at Rome seem to be the only exception to the rule that present power increases are largely due to national requirements.

Direct broadcasting to foreign listeners has now become the order of the day, but no country, not even Russia, has developed it as thoroughly as Italy. I have before me an official report from Italy which states that during 1935 Italy broadcast to the world in 18 foreign languages: Albanian, Bulgarian, Rumanian, Arabian, German, Hungarian, English, Serbo-Croatian, French, Greek, Spanish, Portuguese, Japanese, Chinese, Hindustani,

Dutch, Esperanto and Hebrew. The last three languages, the report says, i.e., Dutch, Esperanto and Hebrew, were only used for tourist propaganda.

As a result of regular news bulletins and other broadcasts in foreign languages the Italian foreign language announcers have received 59,084 letters from foreign listeners during the course of the year. The Italian language lessons for English, French, Spanish, Hungarian and Greek listeners attracted 30,000 pupils.

The Italian broadcasting authorities sent 24,008 publi-

The special aerial mast employed at the 60-kilowatt Nice-La-Brague station.

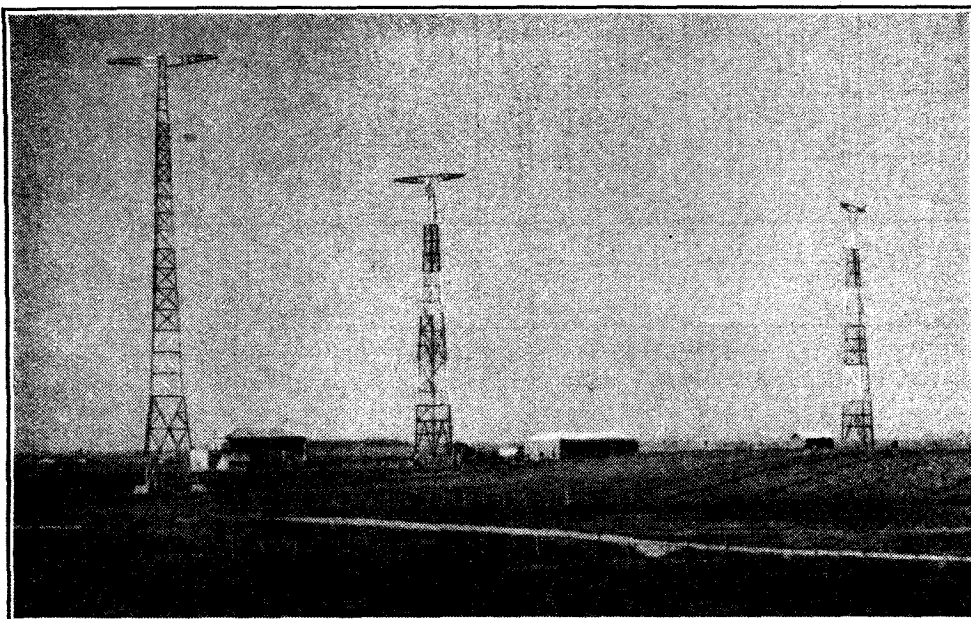
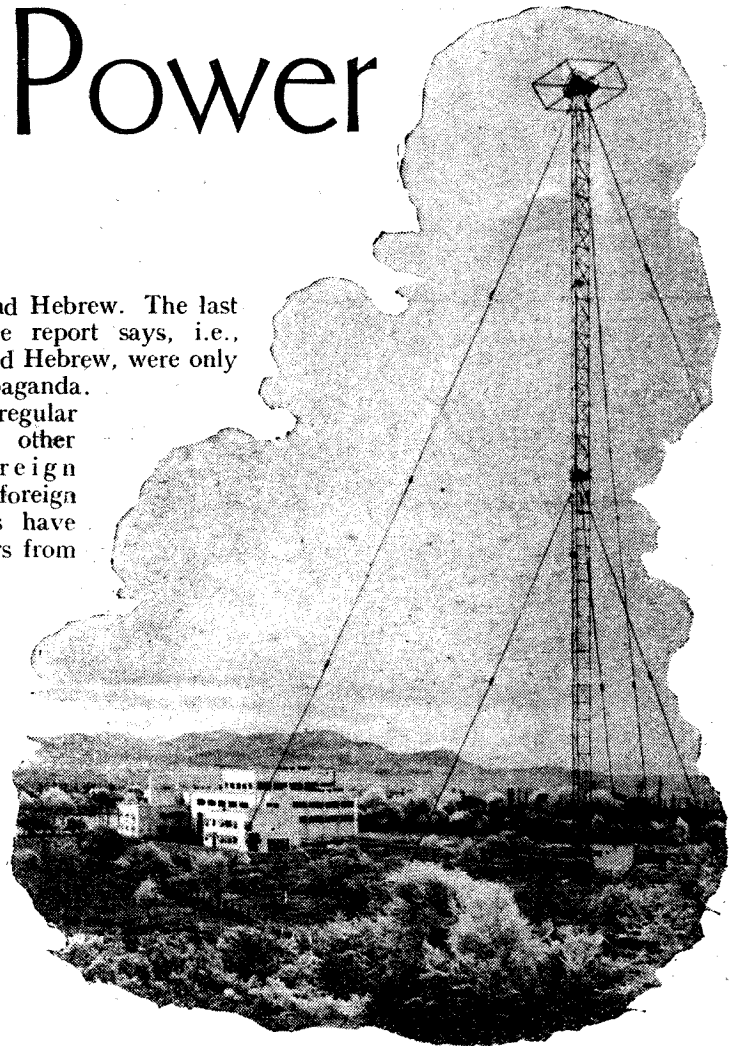
cations on Fascism and on the Abyssinian conflict to people who had requested this information. In addition 124,546 general pamphlets were sent out.

These figures show the surprising effect of organised foreign language broadcasts directed to listeners in foreign countries. Italy has created an interesting precedent.

Some reader may ask why limitation of wavelengths to those countries which use

them for legitimate national service would not be a possible means of coercion. But then by the time the Lucerne plan comes up for revision after the Cairo conference in 1938 an "hour for foreign listeners" may figure even in most of those programmes which at present still refrain from directly addressing the "listener beyond the frontier."

In the light of the facts which I have enumerated there is no reason to be alarmed at the present race for power in the ether. Stimulated by international competition, and probably also by the ever-increasing amount of electrical interference, countries are at present bringing their broadcasting services up to date. Work is proceeding in most places with an eye to the possibility of reaching out to listeners across the borders. From the very fact that broadcasting wavelengths do not recognise frontiers we must accustom ourselves to an entirely new conception of international broadcasting. Strictly speaking, the requirements of a national service are also the requirements of national prestige. If considered in this light, the necessity to be able to reach out and to broadcast to the man on the other side of the wall will be understood. But in the interests of peace it is to be hoped that some really binding agreement may be reached, at least in Europe, to prevent recurrence of unfortunate cases where broadcasting has been used for aggressive propaganda.



Three of the special directional masts at the new Rome short-wave broadcasting station.

Superheterodyne

ULTRA-SHORT WAVE RECEIVER

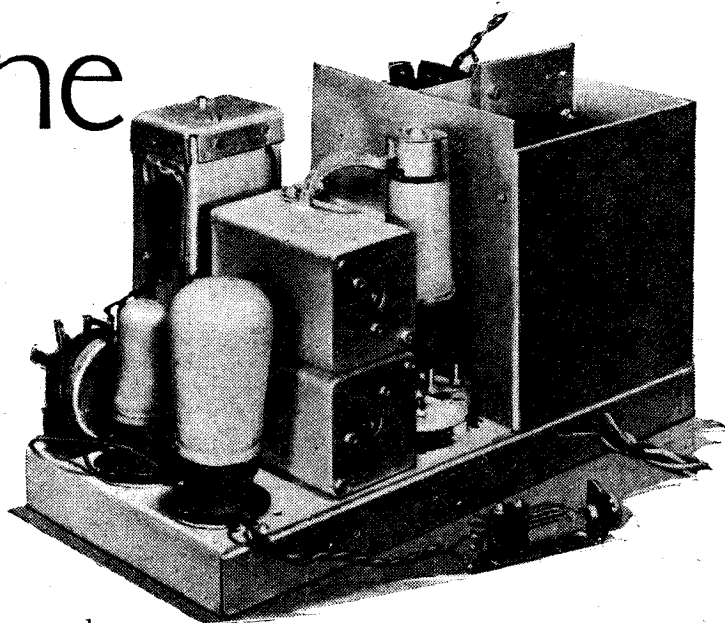
By H. B. DENT

lator coil, but tracking is effected on the signal circuit, as it is considerably easier to line up the circuits this way than by tracking the oscillator. It somewhat restricts the waveband coverage, which is one reason why such comparatively large tuning condensers as 50 m-mfds. were used.

The grid of the mixing valve is joined to a tapping on coil L2 as this enabled the stray capacities to be matched fairly closely to that of the oscillator, though some additional parallel capacity is

tical and not a difficult matter, for with self-supporting coils the spacing of the turns may vary slightly in different coils and specifying inductance value by turns and length is not always satisfactory unless they are wound on threaded formers.

In order to keep the size of the



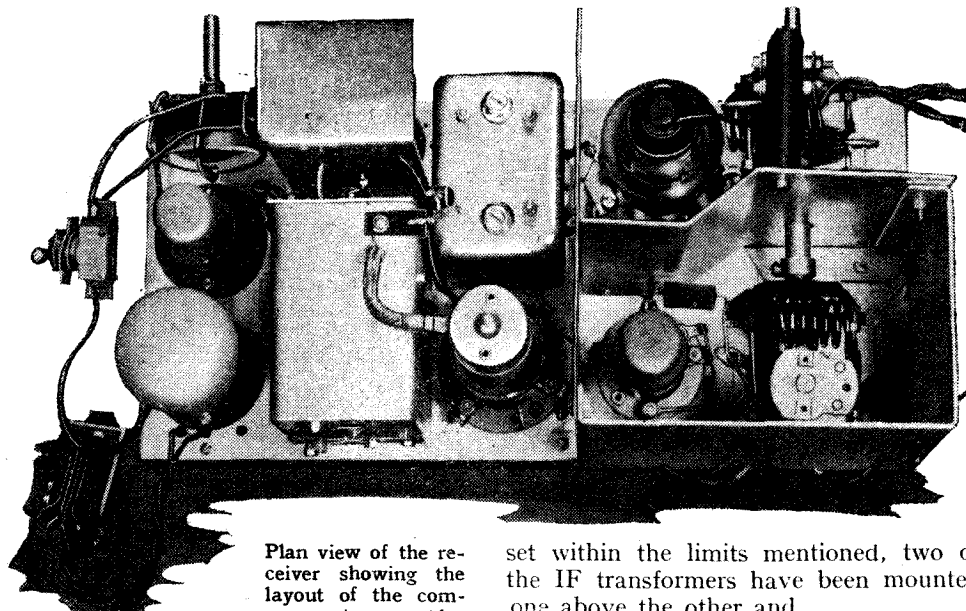
This view shows the method adopted of mounting the two IF transformers IFT2 and IFT3.

of the IF stages by adjustment of the grid bias. The theoretical circuit shows how this is arranged in the set.

For the first transformer a Varley air-tune 465 kc/s IF transformer was sacrificed, as the screening can in which it is assembled was just the right size for this set. Any other size or shape can be used if the layout is adjusted accordingly and the chassis increased in size to accommodate it.

It is, however, most desirable to keep the lead from the tetrode anode of the mixing valves as short as possible as a long lead has been found to introduce peculiar effects, which in some instances were traced to parasitic oscillation in the anode circuit of this valve.

As shown in the illustration the two coils which replaced the original ones in the Varley component are assembled with their axes parallel and their centres



Plan view of the receiver showing the layout of the components on the chassis. The oscillator is contained in the enclosed compartment on the right.

needed across this circuit to comply with the requirements of ganging.

Coil L2 has 7 turns of No. 15 SWG enamel wire, and it is tapped at the third turn from the grid end. Turns are spaced to occupy about 1 in., but some adjustment will be needed to obtain the correct inductance to ensure that the two circuits track correctly at all settings of the tuning condensers.

A fixed series padding condenser can be used, and although the optimum value was found to be approximately 0.0004 mfd. an 0.0005 mfd. serves quite well in practice.

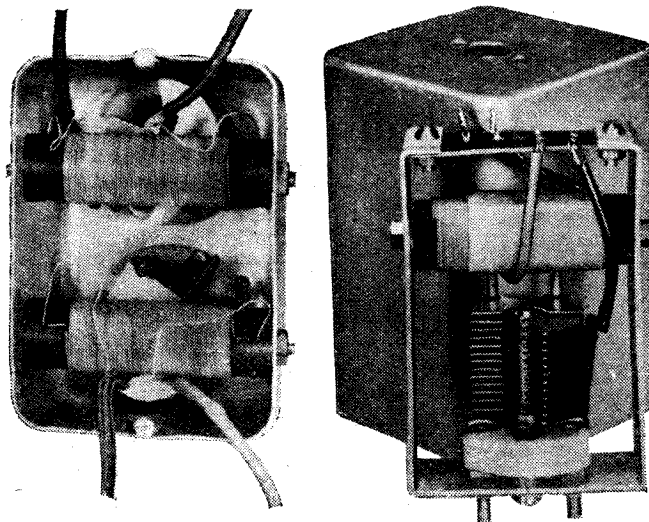
The oscillator coil, L3, is the same size and has the same number of turns as L2, only the spacing between them is a shade closer to give it the necessary higher inductance, for the oscillator is tuned to a lower frequency than the signal circuit.

The adjustment of the coils' inductance by variation in the length is quite prac-

set within the limits mentioned, two of the IF transformers have been mounted one above the other and the second IF valve inverted to keep its anode and grid leads short.

The first IF transformer consists of a coupled pair, but the others have a single tuned circuit and a close-coupled primary winding of about two-thirds the secondary turns. Air-dielectric tuning condensers of about 100 m-mfds. are used.

The transformers are designed for a frequency of 5,000 kc/s, i.e., 60 metres, and at this frequency it is possible to obtain an amplification of about 15 to 20 per stage, according to the amount of regeneration permitted. Whilst there is no intentional reaction in the accepted sense, regeneration can be obtained by varying the gain



The IF transformers shown above are home constructed. The one on the left is the IFT1 that follows the frequency-changer, while on the right is shown the construction of the two other models IFT2 and IFT3.

spaced by about 1 1/4 in. They are wound on ebonite tubes 1/2 in. outside diameter and 1/4 in. inside, though solid rod of this

Five-Metre Superheterodyne

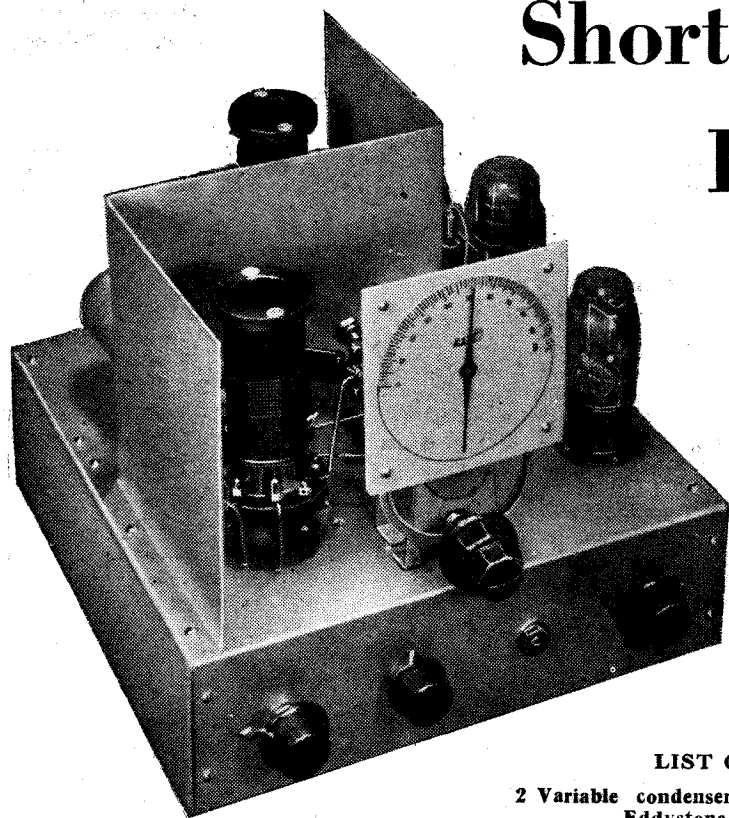
size could be used and the ends drilled and tapped to take the fixing screws. On the other hand, the tubular formers can be mounted by passing suitable lengths of 6 BA screwed rod through their centres and securing by nuts on the outside of the can.

A close-wound single layer of No. 28 SWG DSC wire is required for these coils.

The other two IF transformers have a secondary winding as described above and an overwound primary located at the "earthy" end of the coil. Four layers of thin paper can be wound on for insulating the windings and then 50 turns of No. 40 SWG DSC for the primary.

These transformers were assembled on a skeleton framework and fitted into Goltone square aluminium cans measuring 2in. x 2in. x 3in. high, miniature 100 m-mfds. air-dielectric trimming condensers were used, those actually employed being the Polar type, though Bulgin also makes one of similar capacity and shape.

It is not proposed to deal fully with the construction of this receiver, since it was built to fit a special portable case, and the layout could be modified considerably, though it must be remembered that as the intermediate frequency is 5,000 kc/s this portion of the set must be treated as a short-wave HF amplifier and the usual precautions taken in its assembly.

In Next Week's Issue

Short-Wave Battery Four

7.4—77.8
Metres
Using Plug-in
Coils

LIST OF PARTS

- 2 Variable condensers, 100 mmfds.
Eddystone "Microdenser" 900/100
- 1 Flexible coupler Eddystone 1009
- 1 Slow-motion condenser drive B.T.S.
- 1 Slow-motion reaction condenser, 0.0002 mfd. Polar "QJ"
(B.T.S., Eddystone)
- Fixed condensers:**
- 2 2 mfd., 300 volts DC working T.M.C. 30
- 2 0.1 mfd., tubular, 350 volts DC working T.C.C. 250
- 3 0.01 mfd. T.C.C. "M"
- 2 0.001 mfd. T.C.C. "M"
- 1 0.0001 mfd. T.C.C. "M"
(Dubilier)
- Resistances, 1/2 watt**
- 1 1,000 ohms Ferranti
- 3 10,000 ohms Ferranti
- 1 20,000 ohms Ferranti
- 1 50,000 ohms Ferranti
- 1 100,000 ohms Ferranti
- 1 1 megohm Ferranti
(Bulgin, Erie)
- 1 Volume control, graded, 0.5 megohm
(without switch) Polar-N.S.F.V/4
(Bulgin, Erie, Ferranti)
- 1 Switch, rotary, single pole, on-off
Bulgin S91

- 2 Valve holders, 4-pin (without terminals)
Clix Short-wave Chassis Mounting Type V5
- 1 Valve holder, 4-pin (without terminals)
Clix Chassis Mounting Standard Type VI
- 1 Valve holder, 5-pin (without terminals)
Clix Chassis Mounting Standard Type VI
- 3 Plug-in coils, 6-pin B.T.S. S2, S3 and S4
- 3 Plug-in coils, 4-pin 12 to 94 metres
B.T.S. Type E

- (Eddystone)
- 1 Coil holder, 6-pin, baseboard type B.T.S.
- 1 Coil holder, 4-pin, baseboard type B.T.S.
(Eddystone)
- 1 Five-spring automatic jack B.T.S.
- 1 Universal plug B.T.S.
- 1 Connector, 4-way Bryce Light Pattern
- 1 Battery cable, 5-way, 30in. with wander
plugs and spade ends Belling-Lee
- 1 Grid bias battery, 9 volts
- 5 Ebonite shrouded terminals, A (2), E, LS+
LS— Belling-Lee "B"
- 1 Midget stand-off insulator Eddystone 1019
- 3 Wander plugs Ealex
- Chassis, aluminium 11 x 11 x 3in. C.A.C.
- Screen, aluminium 17 1/2 x 6 1/2 in. C.A.C.
- Brackets for condensers and bias battery
C.A.C.

Miscellaneous:— Scientific Supply Stores

4 lengths systoflex, 2 ozs. No. 18 tinned
copper wire. Ebonite pillars and 6BA
studding for valve holder supports. Screws:
6 4BA 1/2 in. r/hd., 2 4BA 3/4 in. r/hd., 2
6BA 1/2 in. r/hd., 42 6BA 1/4 in. r/hd., all
with nuts and washers.
(Peto-Scott)

Valves:—

1 Hivac SG 220 SW; 1 Hivac D 210
metallised; 1 Hivac L 210 plain, or Mar-
coni or Osram L21, or Mazda L2, or Mul-
lard PM2 DL; 1 Hivac Z 220 or Marconi
or Osram PT2, or Mazda PM 220A, or
Mullard PM22.

Radio Engineering Handbook. Edited by
Keith Henney. 850 pages, second edi-
tion. McGraw-Hill Publishing Co., Ald-
wych House, London, W.C.2. Price
30s.

THIS book is divided into twenty-four sec-
tions written by different authors who
are specialists in various departments of
radio engineering. It commences with a sec-
tion comprising twenty-nine pages of mathe-
matical and electrical tables, and this is fol-
lowed by one dealing with the fundamentals
of electrical circuits. Resistance, inductance
and capacity are treated in following
chapters, the various types of components
and their design being described. A chapter
on various circuits combining these three
quantities follows and includes many useful
formulae, among which must be mentioned
the basic equations for filters.

Measurements, valves, oscillators, de-
tectors, modulators, and amplifiers of all
types are dealt with in a comprehensive
manner in succeeding chapters, and com-
plete receivers, mains equipment, and loud
speakers all receive thorough attention.
The second half of the book contains more
general information in the sense that there
is little connecting link between the different
chapters. It contains sections dealing with
such diverse subjects as short-wave equip-
ment, code apparatus, television, transmit-
ting gear for broadcasting, aircraft trans-
mitters and receivers, and aeri-als, among
others.

As its title suggests, the book is primarily
one of reference, and it should prove in-
valuable to all who are seriously interested
in the design of wireless equipment. An
enormous amount of information is included
in a concise form; the book is well printed
and bound, and remarkably free from
errors.
W. T. C.

THIS receiver has been designed
especially for the keen short-wave
listener requiring to receive broad-
cast as well as amateur and other trans-
missions on the short waves. In order
to make the set as flexible as possible plug-
in coils are used, and special care is
taken to reduce stray capacities to the
bare minimum so that the scope of the
receiver can be extended to take in a part
of the ultra-short waveband.

Coils for the ultra-short range have been
designed, and the lowest wavelength
covered is a shade over 7 metres. The
receiver embodies one tuned HF stage,
followed by a grid detector with reaction
and optional one or two LF amplifying
valves, so that headphones or a loud
speaker can be employed. It also
includes several features not generally
found in short-wave receivers.

Current Topics

EVENTS OF THE WEEK IN BRIEF REVIEW

New French Radio Chief

GREATLY to the regret of radio listeners of all political creeds, M. Georges Mandel, the French P.M.G., who has done so much to help the cause of radio, is no longer in office, owing to the change of government. Fortunately, however, his successor, M. Robert Jardillier, is a man of exceptional ability and energy, and there is every reason to believe that he will carry on M. Mandel's good work with the same enthusiasm as shown by his predecessor.

U.S.A. Short-wave Boom

MANY attempts have been made in American wireless circles to find out what is the cause of the great boom in short-wave listening which that country is enjoying. The most widely accepted reason is that the Americans are merely following the example of the Athenians of old, or in other words, behaving like a child with a new toy. A more probable reason, however, is that in spite of the fact that there are over 600 broadcasting stations in the U.S.A. there is a tremendous number of set users who have no local station. This in itself is partly due to the vast size of the country and partly to the fact that many people find their local station inadequate either in power, quality of transmission or entertainment value. It has, in fact, been estimated that no less than 65 per cent. of the country's area is outside "local" range. It is the inhabitants of these areas, which are dead spots in more senses than one, who are said to be the biggest buyers of short-wave receivers.

Wireless Workers' Trade Union

A NEW trade union known as the Electrical and Radio Workers of America has been formed in the U.S.A. It is an amalgamation of various smaller unions and is said to include 32,000 employees of firms engaged in the radio and electrical appliance business.

Light-weight Portables Wanted

IN other countries, as well as in our own, a search is being made for a truly light-weight portable, for the Swiss Radio Union has just arranged a competition to discover the most suitable instrument of this kind. In judging the sets, consideration is to be given to size, weight and cost. The first prize is stated to be only 200 Swiss francs, and so the number of entries is not likely to be large.

Germany Builds Television Stations

FOLLOWING recent demonstrations in Frankfurt, two permanent ultra-short-wave sight and sound broadcasting stations are to be built on the summit of the Brocken and on the Grosse Feldberg in the Taunus mountains. No details are given of power or definition, but it is probable that the latter will be in the neighbourhood of 375 lines. It is hoped to complete the stations by next year. It is stated that although these two transmitters are to be permanent structures they must not be considered as anything more than experiments, as it is not possible at present to decide on the final method of providing the country with a television service.

Belgian Licence Fund Raided

GREAT indignation has been aroused among Belgium's three-quarters of a million listeners at the proposal to devote part of the revenue derived from licences to the support of the theatres. It is stated that originally Belgian listeners were promised that all the money derived from the sale of licences should be devoted to furthering the cause of broadcasting both on the entertainment and on the technical side. The proposal to give half of the money to the theatres has come like a bolt from the blue, and the National Institute of Radio is said to be considering the question of taking strong action in the matter.

No Irish Daventry Yet

THE Irish Free State is not to set up a short-wave broadcasting station after all. There has for some time past been a strong feeling in favour of an all-Irish SW station to perform the same service for Irish exiles abroad as is accomplished by

Daventry for those natives of Great Britain who are scattered in various parts of the world. Apparently, however, £ s. d. has proved the deciding factor as it has in so many other schemes and so, for the time being, the idea has been shelved.

Pirate Transmitters Imprisoned

GREAT BRITAIN is evidently not the only country that is troubled from time to time by the activities of pirate transmitters. Over here, however, they are treated with comparative leniency, merely being subjected to a fine. In certain Continental countries they regard these things very differently, and in Switzerland it is reported that two pirates were recently sentenced to imprisonment, one to five months and the other to one month.

Long-range Aircraft Wireless

MANY people are apt to imagine that the range of wireless transmitters fitted to aircraft is necessarily small owing to the fact that there is not the same space available for installing a powerful transmitter as in the case of a land or ship station. This is far from being the case, however, and several instances of the exchange of messages over exceptionally long distances have been recorded. These distances run into several thousands of miles, a most noteworthy case being that of a machine on the Australian route which communicated with Sydney over a distance of 5,000 miles.

U.S.A. to Overhaul Short- wave Broadcasting

IT is reported from Washington that the whole question of short-wave broadcasting is under review by the authorities and that these stations, owing to their long range, will henceforth be designated as international broadcasting stations. Just as on many American roads there is a minimum speed below which it is forbidden for cars to travel, so also it is proposed that there shall be a minimum power below which short-wave stations shall not be allowed to work. The idea behind this is to prevent valuable ether-space being cluttered up by innumerable stations using too small a power to be of any real value for distant reception purposes.



REPORTING BY MICRO-WAVES.

Micro-wave transmitters used as practical radio broadcasting stations are playing an important part in NBC broadcasts and Press work in America. The transmitter, which broadcasts on micro-waves requiring low power, relieves the announcer from the restrictions of wire lines so that he can wander freely talking as he goes.

U.I.R. Meeting

THE annual meeting of the International Broadcasting Union will commence on June 22nd at Ouchy, near Lausanne. Apart from routine business, the whole question of big international transmissions is to be raised and an interesting discussion is expected.

Meteorology and Wireless

AN improved system of wireless weather reporting has been established in South Africa. The reports from fifteen meteorological stations located at specially selected points are correlated and issued twice daily from the transmitters at Germiston and Salisbury.

Windmill-driven Trickle Chargers

IT is astonishing how popular the windmill-driven trickle charger is becoming in various parts of the New World. It must be remembered that conditions on the other side of the Atlantic are very different, in certain localities, from anything met with over here. There is a large number of sparsely populated districts with no electric supply, and these wind-driven generators are invaluable there in saving the cost of fuel for a petrol engine which would otherwise have to be used, since the nearest battery-charging station may be a tremendous distance away.



Operation of a set from a distant room is only one of the applications of remote control; an "armchair tuning" system, as in the "Aeromagic" receiver, is attractive from another point of view.

AMERICANS, on their own admission, are reluctant to concentrate on any one programme for more than 15 to 30 minutes. But it has been seriously suggested in a responsible transatlantic journal that a recent tendency towards a demand for longer programmes is due to listeners tiring of having to get up at such frequent intervals to tune to another station. If this is so, it just shows that mental laziness is exceeded only by physical laziness. It also seems to show that, in America as well as here, it would be helpful if each station addressed itself in the main to one particular height of brow.

Leaving the programme aspects of the matter aside, and considering only the technical way out; how badly do we want remote control?

It will be agreed, I think, that the proportion of receivers fitted with some form of remote control is so small as to be almost negligible. Is that because the demand is correspondingly small, or because there are difficulties? Or both?

The Apathetic Public

I have very little idea as to what demand there is among the listening public. Probably the listening public itself has very little idea, never having given the matter its mature consideration. Although several remote control systems have been on the market for some time, the majority of people are so ignorant of the whole business that any daily paper could easily pass it off as something entirely novel (and, of course, "amazing").

There are numerous reasons why I think there ought to be a demand for remote control.

It will readily be granted that anybody who in the slightest degree truly listens to the broadcast finds it very unsatisfactory to adjust the receiver once and leave it at that. Owing to the curious ideas of the B.B.C. on the subject of

modulation depth, the gentle tones of the announcer are liable to sound at least as loud as a full orchestra unless controlled fairly frequently at the receiving end. One evening recently the modulation was so shallow during the broadcasting of an organ—which, of all things, requires considerable volume to be at all realistic—that I began to suspect a receiver fault. But directly the programme changed to a dance band the volume became enormously greater, and quite intolerable without control.

Apart from any disagreement with the relative volume levels as arranged from the transmitting end, there are reasons for wanting control of volume at the receiver—if the phone goes, for example, in which case a partial or complete quenching is necessary; or if lorries full of iron rods pass by outside, or somebody bursts into conversation, when a smart raising of the level of volume is desirable; an application of the well-known acoustic masking effect.

Then of course the programme may change from Irving Berlin to Bach (or *vice versa*), compelling a rapid manipulation of the tuning control.

Finally, all available programmes may be so foul as to make switching-off the most pleasurable sensation in life.

All this argues merely for control, not necessarily *remote* control. One can sit closely enough to the receiver to have it under constant supervision. But apart from the inconvenience of being chained to such a position, it is actually the very last one would select for listening purposes. Then there is the case of extension loud speakers. They become an exasperating sort of amenity if they continue to boom out when one would have them silent, or when the volume is just below comfortable hearing, and one has to make constant journeys to another room to adjust the receiver, perhaps to find on returning that the result is still not just so.

There is little doubt, then, as to the

Remote

THERE SHOULD BE

PROVISION for controlling a receiver from a distance—not necessarily from another room—is so attractive that it is hard to see why this refinement is not in more general use

advantages of being able to control the receiver from any desired point. How about the difficulties?

They increase very rapidly with the degree of control one proposes to exercise. The simplest sort of control is merely switching on and off—sometimes just off. That is quite handy when you listen in bed from a receiver fixed downstairs, and (quite naturally) fail to see the fun of wandering downstairs to switch off just when you are comfortably warm and drowsy. Even this simplest of systems calls for some thought. There are two main ways of doing it. The first is to con-

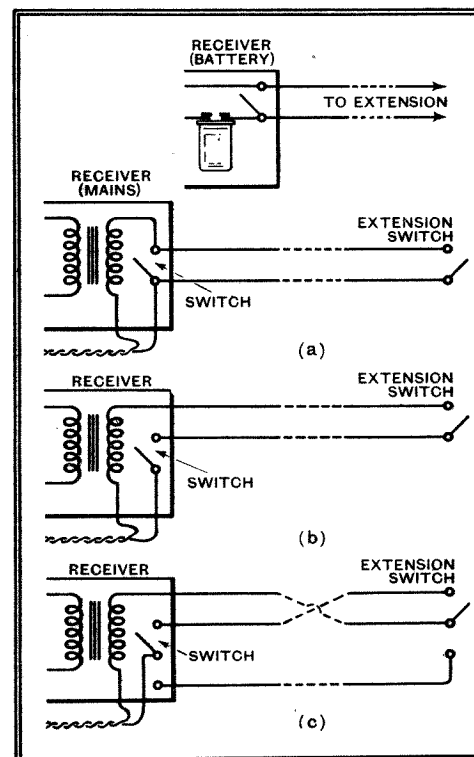


Fig. 1.—There are three ways of connecting a simple extension on-off switch: (a) parallel, (b) series, and (c) series-parallel. Only (c) enables the receiver to be fully controlled at both ends. The choice between (a) and (b) depends on how the extension is likely to be used.

nect one or more switches in parallel with the on-off switch in the set. The other is to work the switch indirectly by means of a relay.

The first method is simple enough in principle, but if the set is mains-driven it means running a pair of wires of electric

Control

A DEMAND FOR IT

lighting quality to the control points. Considering the limited control provided, this is rather hard work and not at all inexpensive. Trailing a long flex about the house cuts out most of the work, but cheap

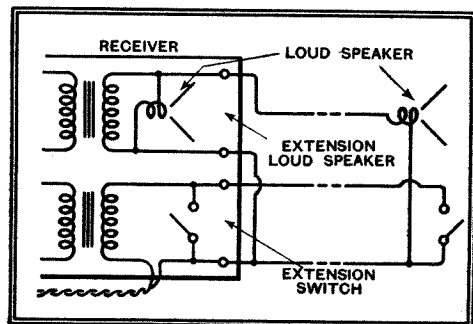


Fig. 2.—Shows how one wire out of four may, with suitable precautions, be saved when both switch and loud speaker are extended.

flex is slightly dangerous when it is exposed to wear of this sort, as well as being a potential tripper-up; and the robust sorts of flex are even more obstructive, so much so as to prevent doors from shutting. The electrical danger is slight, because a short-circuit merely switches on the set—it is not like the blow-up that occurs when the flex of a portable lamp, iron, etc., goes. But there is the possibility of shock if the wire becomes uncovered and, as should be the case, the switch is in the "live" side of the supply.

Low-resistance Extension Leads

The undesirability of short circuits is more marked in the case of a battery receiver, because there is more to waste if it switches itself on unobserved. The danger of shock is, of course, nil; but the wires must be of fairly heavy gauge or they will drop the volts appreciably. The resistance, there and back, ought to be less than a tenth of an ohm. To make sure you are all right about this, see if there is any brightening of the filaments or of the reception when the local switch is turned on in addition to the distant one.

I said that the extension switch is connected in parallel (Fig. 1a). But it could be connected in series (Fig. 1b). It depends upon how you want to use it. With a parallel extension, the set can be switched on at either end, but off only at the place where it was switched on. And vice versa with a series system. To switch on or off at either end, it is necessary to use 2-way switches and a triple wire (Fig. 1c). This is likely to be too much trouble for most owners, because it may mean messing the receiver about to fit the special switch. The 2-wire extension can

By "CATHODE RAY"

conveniently be arranged to plug into a socket or jack on the set. So can an *n*-wire extension, for the matter of that, but—well, it is more trouble! Note that if a series switch line is unplugged it must be replaced by a short-circuit if the internal switch is to be available. Otherwise it is a good "lock" to prevent unauthorised use!

When the extension is a long one, so that extension loud speaker leads go all or most of the way with it, a saving of wires can usually be contrived. This is generally not practicable when thrift has already vetoed the use of an output transformer. But a transformer is now customary even among cheap battery sets, and it allows one of the speaker leads to be run at earth or any other potential, and so pressed into use for control purposes. Just one example of this—Fig. 2. Officially it ought not to be done with mains. But, really, with reasonable care, I don't see why not. One thing: none of the wires must be earthed, but the loud speaker frame ought to be. And sockets, etc., must be of the recessed type, to prevent accidental human contact.

The relay method has two objects—to save lines and to avoid any dangers or disadvantages of taking the battery or main leads around the house. Obviously it is worth considering only when the extension is of fair length, otherwise the saving of wires fails to compensate for the cost of the extra equipment required. The number of different ways of switching by relay is limited only by the ingenuity of the people who think about these things. Fig. 3 is one example. The relay must be of the polarised type—that is to say, switching on when a current is passed for a moment one way through the coil, and switching off when the current is sent in the reverse direction. Further, the coil must be so low in impedance that it has

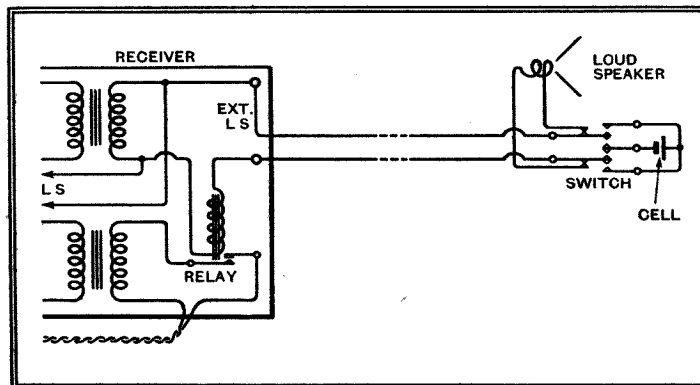


Fig. 3.—One example of a relay system superimposed on the extension loud speaker lines. Several such extensions may be connected in parallel.

no unpleasant effect on the performance—particularly the high-note response—of the extension speaker. As the current from the control battery flows only for an instant at the times of switching on and off

there is no great objection to winding it to a very low resistance.

At the extension end there is a battery—a small dry cell is enough—and a special switch, normally resting in the central position where it puts the set through to the speaker. When pressed, say, down for an instant, the battery sends a current through the relay, switching the set on. On releasing the switch the speaker is connected. Pressing the switch up sends a reverse current, which turns the receiver off.

Controlling the Loud Speaker

If a superficial tour of methods for obtaining the very simplest degree of control takes so much time, there is no hope of covering even in such bare outline the more comprehensive remote control systems. I am just going to sketch the way to proceed. After on-off switching there is the still more valuable volume control. A simple method of controlling an extension speaker is to use an ordinary potentiometer, having about 5 to 10 times the resistance of the loud speaker. Many extension speakers are about $2\frac{1}{2}$ ohms, so a 20-ohm control is about right; Fig. 4.

This controls the extension independently of any others, which may be an advantage.

But there is no ability to cut down distortion due to overloading of the receiver, as one can do when the volume control is on the receiver itself. So it is rather important to arrange that overloading is not likely to take place even with the most deeply modulated programmes. Unless the receiver has an exceptional reserve of undistorted power, this may cramp the style of the extension listener—with battery sets, for example.

Control equivalent to that at the receiver itself is much more difficult to obtain than it used to be. Years ago the best form of volume control was a variable resistance of potentiometer, varying the bias on the HF valves and sometimes filament current at the same time. It was of reasonable impedance, could be (in fact, ought to be) shunted by a large condenser, and could therefore be extended without ill-effects.

Now volume is almost always controlled by a potentiometer of about half a megohm, and the capacity effects of extension wiring, if connected, would cause no end of trouble—hum, distortion, and so forth.

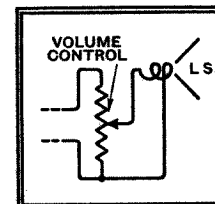


Fig. 4.—Simple remote control of volume at an extension speaker.

Remote Control—

This refers, of course, to receivers with AVC. If a volume control of the old style, acting on the HF valves, is applied to this class of set, it is largely a waste of time, because while you are busy applying more negative bias to cut the volume down, the AVC is running it off again to keep the

receiver by a low-impedance aerial line. Whether this can be strictly regarded as remote control is questionable, but it does seem to serve the purpose to some extent.

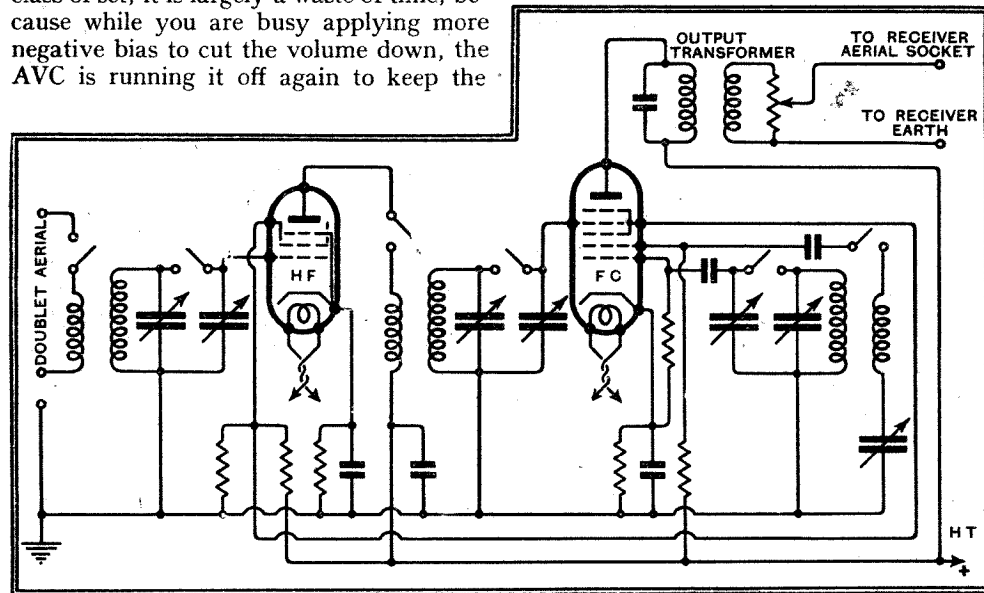


Fig. 5.—An American suggestion for remote tuning control: the "local" unit comprises a frequency changer, with transmission-line connection to the distant receiver.

volume as it was. The control is effective only over a limited part of the scale, and it is no good proposing to "spread" that part by adding fixed resistors in series, because the part shifts along with the strength of the transmission tuned in.

Volume controls in non-AVC sets, which are generally something moderate—not over 50,000 ohms, anyway—can be extended, like a snail's eye, without loss of action. And if this were an exhaustive treatise, I could show how some of the others can be tackled too.

Remote tuning control is a fascinating subject. Even a low-capacity line of 30ft. or so (to make a modest demand) would add too much "stray" capacity—to say nothing about losses—to allow of the tuning condenser being connected at the end of it. While such a scheme is not wildly impossible, it is at least out of touch with accepted requirements of receiver design. Then there is mechanical operation of the tuning control by means of a Bowden wire, motor-bike fashion. It is difficult enough to avoid backlash at a couple of yards distance. The most successful systems make use of a motor to drive the tuning knob. It is relatively simple to control the motor from a distance. But the whole gear is cheap at £10 extra. The most fully worked-out system I know is the "Aeromagic" receiver, described in *The Wireless World* of October 18th, 1935. A ten-way cable is used to provide complete remote control of a very ingenious character.

There are all sorts of intriguing possibilities. Somebody has tried installing at the extension end a "converter"—the detached frequency-changer stage generally applied to add short waves to the conventional receiver. But it can be made to work on most of the ordinary wavebands too. The converter is linked to the

Full details are in the American *Radio News* for December last.

If a bright manufacturer produced a satisfactory variable condenser of 0.01 mfd., it could be connected by a line across a few turns tightly coupled to the tuning coil. Marconi's made a condenser of this capacity for their ship sets in days gone by, but the broadcast listener would consider it rather heavy and expensive.

It is possible to control the capacity thrown into a circuit by a valve by varying the voltages on the electrodes of the valve—easily done from a distance. So far as can be seen, it is not practicable to provide a wide enough capacity change by this method. And there is heavy "lossing." Still, you never know what valve makers can bring out of the hat. It is worth a thought.



**HIVAC
OUTPUT
VALVES**

A NEW output triode, type PX41, has been introduced by The High Vacuum Valve Co., Ltd., of 113-117, Farringdon Road, London, E.C.1. It is of the directly-heated type with a filament consuming one ampere at 4 volts, and it is rated for an anode potential of 250 volts. At the standard test voltages of 100 for the anode and zero for the grid, a mutual conductance of 6.0 mA/V. is claimed with an AC resistance of 830 ohms.

At its full anode voltage, a grid bias of -38 volts is required and the anode current is then 48 mA. With the optimum load of 3,500 ohms, an output of 2.5 watts can be obtained. The above figure for grid bias

refers to the case when the filament is heated by direct current. Under normal conditions AC will be used, however, and then the grid bias must be -40 volts. The valve has a 4-pin base and costs 13s. 6d.

DISTANT RECEPTION NOTES

IF you were asked to guess the number of stations rated at 100 kilowatts or more on the medium waveband I wonder what your answer would be? I have tried it lately on several people, and estimates have varied between twelve and thirty-five. Try it on friends of yours and see what they have to say. As a matter of fact, the total is eighteen. In addition, there is one 100-kilowatt station (Moscow No. 3) on the intermediate band and eleven on the long waves. Within the next twelve months the total on the medium waveband will be very largely increased, and there will be at least three newcomers—France's Radio National, the Deutschlandsender and Madrid—on the long waves.

A week or two ago I mentioned that the new Czechoslovakian high-powered station was working on 627 metres with a power output of over 100 kilowatts. The information came from a Continental correspondent who is usually most reliable, but this time he seems to have gone astray, and really I can't blame him, for it is rather difficult to get at the facts of the situation. A reader in Czechoslovakia now tells me that the new transmitter, Radio-Masaryk, close to Banska Bystrica, was officially opened on May 24th. The power rating is 30 kilowatts, but, under the Lucerne agreement, this is reduced to 15 kilowatts after dark. He also mentions that the new transmitter, which operates on 765 metres, had been testing for a considerable period before its official opening. This leads me to believe that the two Czechoslovakian stations, Banska Bystrica and Radio-Masaryk, which appear in the official lists are one and the same, though the lists show them as working, one with a power of 20 kilowatts on 627 metres and the other with a daylight power of 30 kilowatts on 765 metres. The truth is, I believe, that Banska Bystrica conducted its tests on 765 metres for many months and that when it was officially opened it was renamed Radio-Masaryk. Perhaps the afore-mentioned reader will be kind enough to confirm.

In any event, it is unlikely that the Czechoslovakian transmissions on the intermediate band will be well heard in this country, since Radio-Masaryk's aerial is directed towards the east, again in accordance with the Lucerne Plan.

All wireless folk will regret that M. Mandel is no longer Minister of Posts and Telegraphs. As such he directed French broadcasting for a good many years, and it is largely owing to his energy that the French anti-interference laws were passed and that the Ferié Regional scheme is not far from completion. His successor at the Ministry will have a difficult task so far as broadcasting is concerned, for the many private stations in France have always been somewhat resentful of control. In this connection it is announced that until the Ferié plan is completed some of the lower-powered French stations are likely to be using more than their nominal power.* D. EXER.

[This subject is more fully dealt with on pages 594-595 of this issue.—Ed.]

BROADCAST BREVITIES

News from
Portland Place

Getting a Look-in

VISITORS to Radiolympia will not expect to see television there at its best, for the simple reason that the transmissions from Alexandra Palace in August will not have passed the embryo stage. It would be as reasonable to gauge the capabilities of a new loud speaker on the engineers' tests from North Scottish Regional at Burghead.

Those who are determined to have television installed by Christmas, however, need not despair, for, if present plans materialise, there should be an excellent opportunity to see all that is newest and best in television before the autumn is far advanced.

Completing the Chain

WHENEVER plans for a new transmitter reach the stage where the engineers begin to show a lively interest in the erection of the aerial mast it is taken for granted that listeners in the area concerned are within measurable distance of getting their new service. Thus, in the North-east of England the news that a contract has now been placed with the Radio Communication Company for the construction of a 475ft. lattice-steel mast will no doubt be welcome. With Burghead ready for service next autumn and the North-east transmitter probably at work in the spring of 1937, the high-power chain will be complete. Thereafter will come the consideration of a low-power transmitter, or perhaps two, to serve the South and South-west of England, and the way will then be free for television transmitters in Birmingham, Manchester and elsewhere. But that is looking rather far ahead.

The Best B.B.C. Transmitter

CONNOISSEURS of quality can often be heard discussing the relative merits of the different Continental stations; less often do they clash swords on the varying performances of the B.B.C. transmitters, for it is generally felt that the Corporation's standard of quality must be pretty much the same all over the country.

How many listeners realise

that at the present moment there is no better B.B.C. signal than that emanating from London National?

And Why

That this is a fact could be proved technically, though most listeners—given the hint—will be able to confirm it by ear, and the explanation is simple. Between the Broadcasting House control room and Brookman's Park there is now one cable which can carry frequencies considerably exceeding 15,000 cycles. At present this is being used for the "Little Nat."

Droitwich quality is good, but there is a noticeable top "cut-off."

It Looks so Simple

ONE of the attractions of the Dramatic Control panel—and it does attract clever people like moths to a candle—is that it looks so simple to operate. You turn this knob here, you turn this one there, and the music goes round and round. At least, so it works out in theory.

Members of the television production staff, now in training at Broadcasting House, are learning that theory can be widely separated from practice.

Fading-in Effects

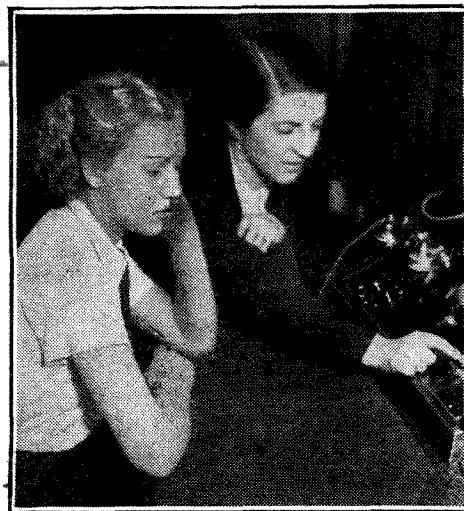
This week, as part of their training, they have spent several palpitating hours in staging their own "closed circuit" version of "The Green Goddess." The producers each took a turn at the panel while their colleagues, including the hostess-announcers, played their parts in three different studios. Dialogue was "easy going," but when it came to introducing the aeroplane crash, the click of billiard balls, the lighting of a match, and the fading in and out of music at appropriate moments, the complexities of sound broadcasting became more apparent.

A certain amount of sound mixing may be necessary in television, but in any case it has been a useful experience.

Are Empire Listeners More Technical?

SIR NOEL ASHBRIDGE, Chief Engineer of the B.B.C., has been agreeably surprised by the response which has greeted a series of technical talks which he recently gave from the Empire station at

Whilst the B.B.C. have been canvassing the fair sex for candidates to grace the television screen, the authorities at Radio Budapest have been busy on a somewhat similar task to provide announcers for the Hungarian short-wave programmes, during which announcements are also made in English. Miss Gitta Natter and Dr. Agota Fedak (right), two of the successful candidates, are seen in the announcers' studio.



Daventry. He dealt with the transmission and reception of short waves, and although he treated the subject in a comparatively simple manner, the resultant postbag has shown that listeners scattered about the Empire have a good grounding in the fundamentals of wireless.

It is probably true to say that the average short-wave listener abroad has a clearer grasp of the functioning of his receiver than the average listener at home, and the reason is not far to seek. Service stations are not available at every street corner in Kenya Colony or the Malay States; and it is remarkable how this makes for independence on the part of the set owner.

If all the service stations and "radio doctor's" establishments in Great Britain were closed down for six months, the technical abilities of the ordinary man would amazingly increase.

Arthur Catterall as a Worker

ARTHUR CATERALL'S violin recital in the Empire programmes on July 16 will probably be the last performance of his to be heard from Daventry in his capacity as leader of the B.B.C. Symphony Orchestra, although he will continue to broadcast in the home programmes during the remainder of his contract as orchestra leader. Thereafter it is hoped that listeners will still be given opportunities of hearing him as a soloist or in some other capacity.

The fact is that for a number of years Mr. Catterall has worked extremely hard. His duties have included a vast amount of solo work; he founded the "Catterall String Quartet," he led the Chamber Music Players, was Professor for many

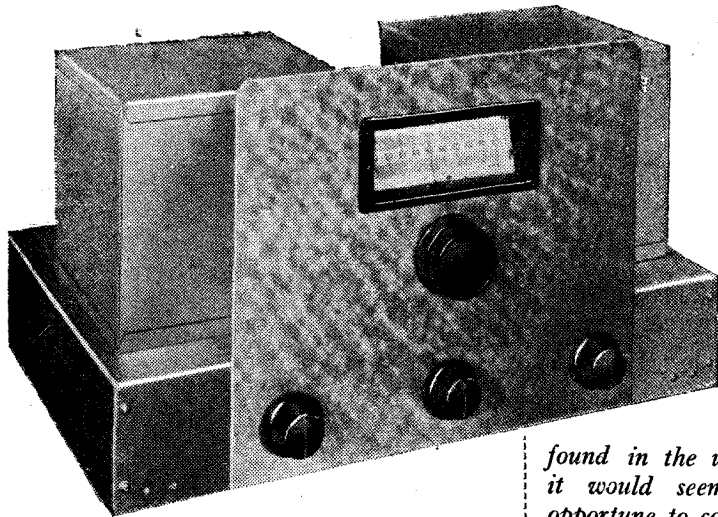
years at the Royal Manchester College of Music, and has been Professor at the Royal Academy of Music in London at the same time as he has acted as leader of the B.B.C. Symphony Orchestra.

Fortunately, his constitution has stood the strain up to now. His tall figure and rather rugged face, tanned by the open air, show that he takes every available opportunity of indulging in his favourite hobbies of gardening and hiking, the things that keep him fit.

Those Missing Turns

THE hundredth and, for the time being, the last broadcast of "In Town To-night" provided a touch of drama for the editor, "Bill" Hanson, his staff and the producers, and more than a touch of disappointment for three of the people who were to have appeared in it. They were Wilfred Turner, a cobbler-singer, William James Emmings, a bricklayer's labourer who does imitations, and Rose White, an 18-year-old dressmaker, of Bow, who sings at her work and in her leisure time.

At rehearsal, an hour before the programme was due on the air, something appeared to go wrong with the wiring between the Control Room of Broadcasting House and studio 6A. The engineers were quickly on the job, but discovered no serious fault, and the studio was reported OK well before 7 p.m. It was not until Bryan Michie was actually introducing the three people at the microphone that Mr. Hanson found that nothing was coming over; but after the programme had finished and he had said "Au revoir" until October (from another studio, of course), everything was all right again with No. 6A.



Modifications to

SOME NOTES ON IMPROVING ON THE ULTRA

OWING to the greater interest now to be found in the ultra-short wave-band it would seem that the time is opportune to consider how to obtain the best reception with the Imperial Short Wave Six. The few minor alterations necessary to improve its sensitivity below 10 metres are clearly explained in this article.

It is, one supposes, almost axiomatic to say that no designer is ever sure that any particular receiver is a really finished product on the day when the drawing office at last insists on absolute finality, but would go on altering this and that for quite a long time if he were allowed to do so.

In any case, the designers of the Imperial Short Wave Six* make no apologies for having something further to say about this particular model because they hope that the remarks which are to follow will assist the man who has already made one to improve its performance, especially on the ultra-highs, and also to interest those who have not yet constructed a similar receiver to do so now and gain a lot of experience and fun.

After all, why not gang 16 circuits where only 2 were ganged before?

For some time now a model of the Short Wave Six has been in continuous use by "Ethacomber"—especially for the purpose of checking conditions on the ultra-short waves; and as a result a lot of valuable experience has been gained in the operation and performance of this particular multiband receiver.

In its original form (the receiver used by Ethacomber is a modified one—we shall deal with these changes a little later on) this receiver was designed to have what is commonly and perhaps loosely called "microvolt sensitivity" on all the major ranges, that is, bands 2, 3 and 4, i.e., 12 to 100 metres.

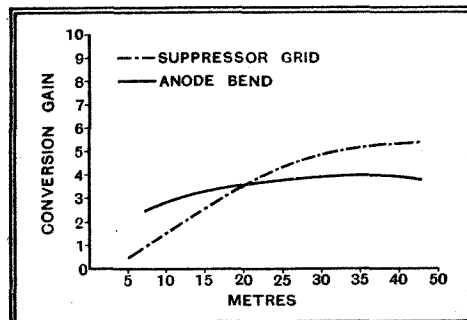


Fig. 1.—Curves showing the performance of the frequency changer with suppressor grid injection and used as an anode-bend detector with local oscillator volts injected into the signal circuit for wavelengths below 40 metres.

The lowest range, Band 1, 6-12 metres, was not expected to give such results as were to be obtained on the higher ranges, and it was rather the "local station" ultra-short wave sound broadcasts which were in mind when this range was incorporated, with the result that it was thought that "millivolt sensitivity" on this range would be sufficient.

Experience of the last few months has shown, however, that it is as desirable to have "microvolt sensitivity" on this range as on the others, otherwise quite a lot of good things, such as reception of the U.S. police cars on 8-9 metres, may be missed, also reception of the various U.S. ultra-short wave high-fidelity relay stations on 9 metres, such as W9XAZ and W8XAI, will be weak.

Whilst strong reception of these signals is often reported, the field strength is generally of the order of 10-50 microvolts per metre, so that a sensitive receiver is necessary, although the signal-to-noise ratio is good apart from car ignition interference, which is a curse and could well be eliminated.

The obvious point now is—why does the performance of the receiver fall off below 12 metres? Which part of the receiver is responsible?

The answer is simple—but the remedy

* The Imperial Short Wave Six was described in the issues of Jan 3rd and 10th, 1936.

not quite so easily found. Certainly the gain of the IF and LF stages does not change; obviously the HF stage and the frequency change-cum-oscillator are to blame.

The curves shown in Fig. 1 illustrate the change in performance of two types of frequency changer over the range 4-50 metres and also suggest a solution to our problem.

The solution is to arrange for the frequency changer to function as an anode bend detector on Band 1 and as an electron-coupled frequency changer on the other bands, and with this object in view some interesting tests were made with various valves. Amongst those tried were the X31 triode hexode, and two HF pentodes, the Mazda VP132I and Mullard SP13C, the last mentioned being particularly interesting because of the fact that

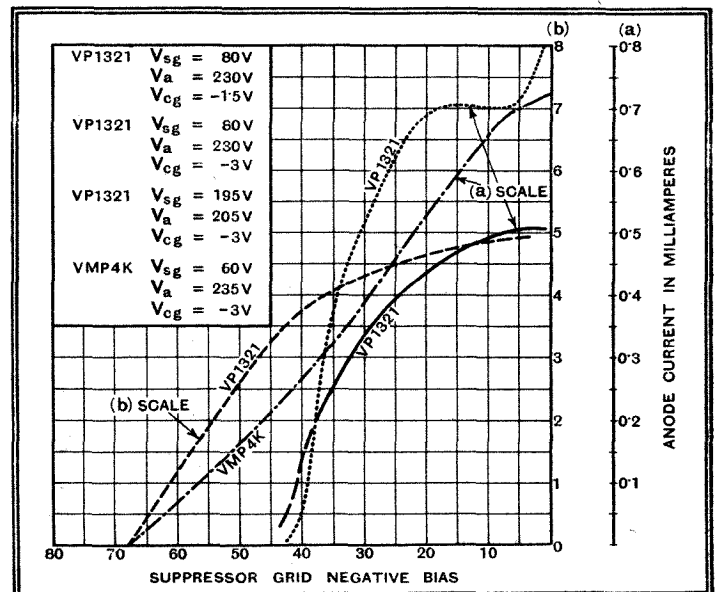


Fig. 2.—Curves showing change in anode current, and thus conversion efficiency, for some selected valves with different values of suppressor grid bias. The operating conditions indicated for the VP132I relate, in the order shown, to the dotted curve, the full-line curve and the broken-line curve, respectively.

the top cap is the control grid connection.

Using the H30 separate oscillator in all cases, very little difference (less than 2db) was found in the performance of these valves as frequency changers of the electron-coupled type (suppressor grid injection in the case of the pentodes) above about 13 metres. In these tests it should be noted that the pentodes were operated with less than half their normal rated screen voltage—i.e., +70-80 volts instead of +200-250 volts.

The curves shown in Fig. 2 show some

the Imperial Short Wave Six

THE PERFORMANCE HIGH FREQUENCIES

characteristic curves for several HF pentodes in which suppressor grid bias is plotted against anode currents for various conditions.

The effect of reducing the screen volts is clearly shown by the steeper curves.

When the three valves taken above were

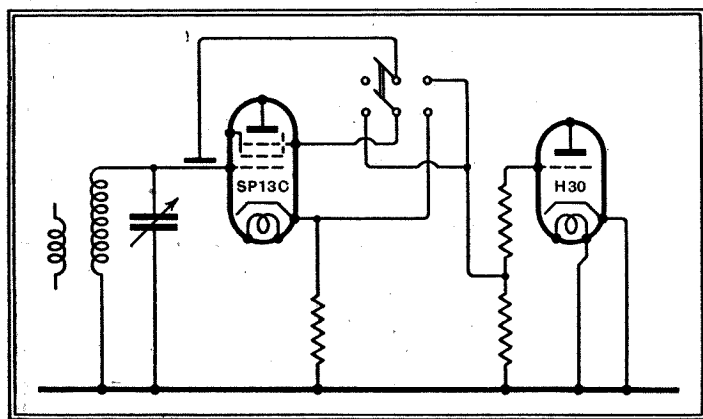


Fig. 3.—Connections and switching for quick change-over from suppressor grid injection to signal circuit injection and anode-bend operation.

tried as anode bend detectors, however, only one, the SP13C, was found to give satisfactory results—especially on Band 1. In the modified Imperial Short Wave Six, the SP13C is used as the frequency changer, a small DPCO (see Fig. 3) switch being used to change from anode bending to suppressor grid injection when desired, which is usually when switching from Band 1 (6.5-11.5 metres) to the higher bands. It is essential that the DPCO switch be mounted very close to the H30 and SP13C valves.

The coupling capacity required is very small—a "U" shaped piece of Systoflex-insulated 18 SWG gauge wire round (partially) the top cap of the SP13C. In some cases even this capacity may be too great.

HF Stage

Further experience, after carrying out the above modifications, indicated the gain afforded by the HF stage on 8-10 metres; a most interesting part of the short-wave spectrum, was small, mainly due to the unfavourable L/C ratio in this region on Range 1, and it was therefore decided to modify the receiver-tuning ranges and to split the U/SW coverage into two bands, which would be $4\frac{1}{2}$ -10 metres and 7.5-15 metres, such that 10 metres would fall about midway on the 7.5-16-metre band, instead of at the top

of the lowest band in the original receiver.

Experiment showed that no appreciable gain could be obtained from the HF stage on the proposed $4\frac{1}{2}$ -10-metre range; indeed, owing to ganging difficulties and the difficulty of making an efficient HF transformer on this band, a loss was more often realised, with the result that the HF stage is cut out on this lowest range. On the other hand, a definite improvement in performance was noted on 10 metres on the new 7.5-16-metre range.

In this modification the 7.5-16-metre range takes the place of the previous Band 1 on the switch, the new lower range being accommodated on the spare switch contacts.

Three new coils are required for the 7.5 to 16-metre range, and these are wound on the reduced parts of the right band formers (viewed from the underside) that originally carried the 6.5 to 11-metre coils.

For the HF transformer a primary winding of 6 turns is required, while the secondary has $6\frac{1}{2}$ turns of No. 14 SWG enamel wire. Turns are spaced about $1\frac{1}{2}$ times the diameter of the wire, while the primary is interwound with the secondary.

The aerial and the oscillator circuits each have one coil, tapped as shown in Fig. 4, which gives the connections to the switches.

The former has $6\frac{1}{2}$ turns of the wire mentioned, and is centre-tapped. The same number of turns is used for the aerial, but this has a tapping two turns from the earth end.

For the new ultra-short wave range, i.e. 4.5 to 10 metres, a piece of No. 14 SWG enamel wire is cut $5\frac{1}{2}$ in. long and bent into three-quarters of a circle and soldered direct to the spare contacts on the switches, in the case of the oscillator, and to one switch contact and an earthing tag in the case of the aerial. The HF stage is not used on this band, so only two coils are required.

The oscillator coil is centre-tapped, while the tapping on the aerial coil is

made one-third distant from the "earthy" end.

Referring again to Fig. 4, it will be observed that the new ultra-short wave coil is shown as a part of a rectangle, but this is only to avoid confusion in the drawing, and, as mentioned already, it should be bent into three-quarters of a circle.

A parallel trimmer will be required across the new $7\frac{1}{2}$ -16 metre range, and another may also be useful across the $4\frac{1}{2}$ -10 metre range, but no tracking condensers are needed. Anode-bend operation of the frequency changer (SP13C) is recommended on both these new bands.

De-coupling

A recent survey of service faults on all-wave receivers has shown that almost 50 per cent. of cases of instability have been traced to faulty IF and HF by-pass condensers, although the condensers may seem satisfactory on simple tests. In a receiver of this type, with very high IF gain, it becomes most important to tie the grid and anode circuits where necessary effectively to earth. In some cases the capacity of IF grid-circuit decoupling condenser in the AVC line (.01 mfd.) may be increased to .1 mfd., although this will alter the time constant of the AVC system to a certain extent.

Instability in the HF circuit may occur, more particularly round about 30-35 metres on the 27-55 metre range; the symptoms in this case are that the tracking and trimming condensers show no control over the signals heard in the loud

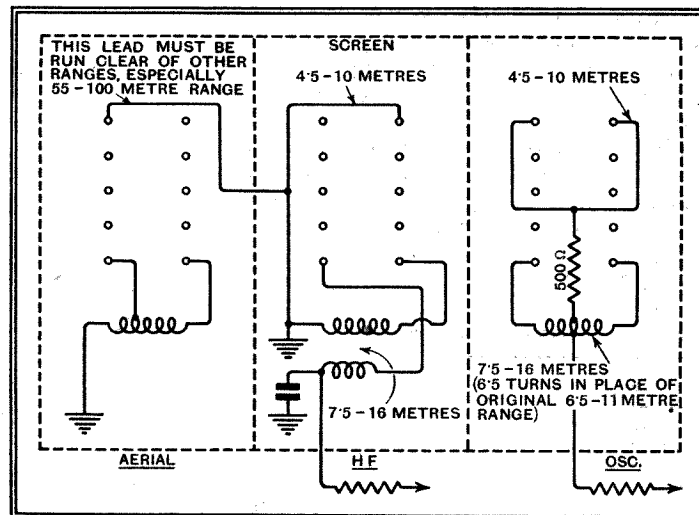


Fig. 4.—Switch connection for the new coils described in the text.

speaker, because the HF valve is self-oscillating and supplying the heterodyne voltage required.

Removal of the oscillator valve will not in this case have any effect, and signals

The Imperial Short Wave Six—

may be tuned in without the oscillator valve in circuit, over a restricted portion of the tuning range.

The cure for this trouble is to reduce the "gain" of the HF stage by removing turns from the primary of the HF transformer; one or two turns will usually effect a cure.

Many alternative valve combinations are possible in this receiver other than those originally given. For example,

Since the screen voltages of the Philips and American valves are of the order of 70 to 100 volts only, the 500-ohm screen decoupling resistances should be increased to 100,000 ohms.

In other cases, a separate diode must be used, or a double

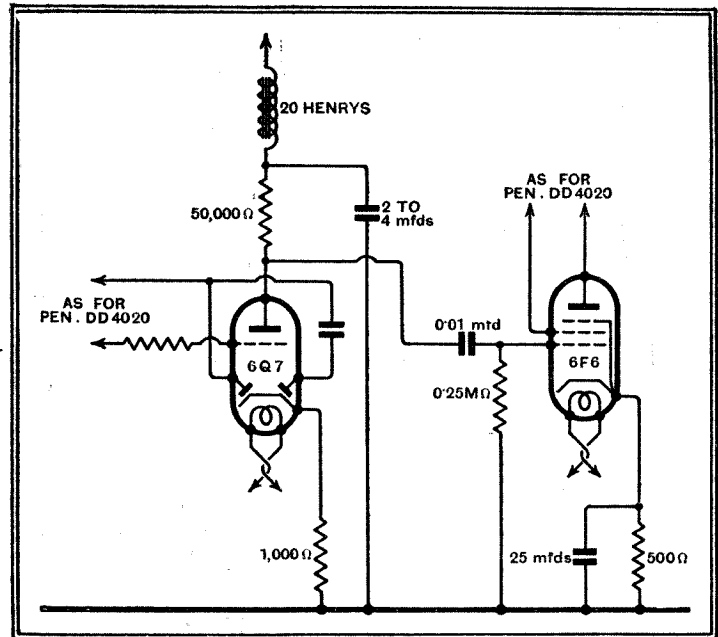


Fig. 5.—Modifications to the output stage when it is necessary to fit a duo-diode-triode and an output pentode in place of the original stage.

of the set so that a short lead can be taken to the grid terminal, from C2 in the theoretical diagram.

A screened hood and cable will not be required for the mixer valve, but the grid leads of the IF stages will require screening in the same manner as the anode leads in the original design.

Short pieces of screened cable should be used for joining the anodes of the mixer and first and second IF valves to the primaries of IF transformers 1, 2, and 3 respectively.

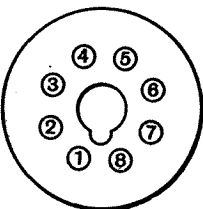
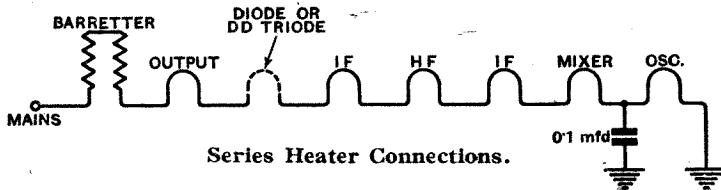
Trimming the Variable Selectivity Four

A CONSTRUCTOR of the Variable Selectivity Four is perturbed to find that the adjustments of all the trimmers controlling the IF circuits are not equally critical.

This state of affairs is by no means abnormal; indeed, there are few receivers in which the tuning of all circuits is of apparently equal sharpness.

So far as the Variable Selectivity Four is concerned the adjustment of the trimmers in transformer T1 should be quite critical, but the settings of those controlling T2, though definite, are usually considerably flatter.

CONNECTIONS FOR ALTERNATIVE FOREIGN TYPES OF VALVES.

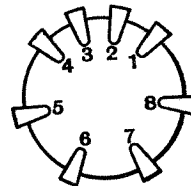


U.S. Octal Base (seen from underside)

Type.	1	2	3	4	5	6	7	8	Top Cap.
6C5 ...	Met.	H	A	—	G1	—	H	C	—
6L7 ...	Met.	H	A	G2-G4	G3	—	H	C-G5	G1
6K7 ...	Met.	H	A	G2	G3	—	H	C	G1
6Q7 ...	Met.	H	A	D1	D2	—	H	C	G1
6F6 ...	Met.	H	A	G2	G1	—	H	C	—

Philips' "Golden Series" "P" Type Side Contact Base.

Type.	1	2	3	4	5	6	7	8	Top Cap.
AC2 ...	Met.	H	H	C	—	—	A	A	G1
AF3 ...	Met.	H	H	C	G3	—	G2	A	G1
AL3 ...	—	H	H	C-G3	—	G1	G2	A	—



Philips' "Golden Series" "V" Type Base.

Type.	1	2	3	4	5
AB2 ...	D1	H	H	C-Met.	D2

4-volt AC types may be substituted readily, or a series heater connection for DC operation may be necessary.

Finally, the receiver may be modified to take either Philips' "Golden Series" side-contact valves for use in Australia and the East, or the popular American metal or metal-glass types may be fitted. It is important to note, however, that in some cases, particularly in the case of the Philips and U.S. valves, the *anode and grid leads must be transposed.*

diode triode when no steep-slope output pentode is available.

When valves having the grid connection on top of the bulb are used in the receiver sundry minor changes in the wiring will have to be made. So far as the HF valve is concerned, this can best be arranged by altering the position of the valve-holder and mounting it so that the base part is adjacent to the centre section of the three-gang condenser, and with the valve pointing towards the front

CONNECTIONS FOR ALTERNATIVE BRITISH TYPES OF VALVES.

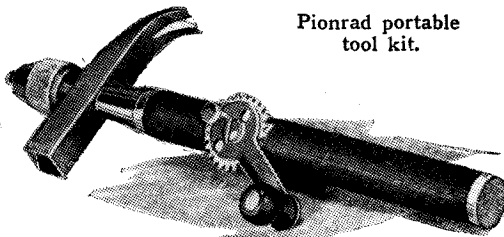
Types.	Oscillator.	Freq. Changer.	HF and IF.	Output Stage.	Barretter.	Remarks.
D.C. Series conn., 0.2 Amp. ...	Ferranti DA Mazda HL1320	Mazda VP1321 [Mullard SP13C*]	Mazda VP1321 —	Mazda PEN-DD4020 —	Philips C1 —	*Grid = top cap, for modified rec.
D.C. Series conn., 0.3 Amp. ...	Marconi H30	Marconi W30	Marconi W30	Marconi D41 and N31 (N31 = 26 v. type)	Marconi 302	Separate double-diode necessary.
English 4 v. AC Parallel conn. ...	Mazda AC2/HL Marconi MH41	Mazda ACVP1 [Mullard SP4B*]	Mazda ACVP1 —	Mazda AC2PEN/DD Marconi DN41	— —	*Grid = top cap, for modified rec.
Philips "Golden Series" 4 v. AC parallel conn., side-contact grid = top cap.	AC2	AF3	AF3	AB2 and AL3	—	Separate double diode and steep slope output pentode.
U.S. Metal or Metal Glass Valves, 6.3 v., parallel conn. grid = top cap.	6C5	6L7 (special mixer valve)	6K7	6Q7 and 6F6	—	Separate double diode triode and low conductance output pentode.

New Apparatus

Recent Products of the Manufacturers Reviewed

PIONRAD POCKET WORKSHOP

A HANDY combination tool that can, without inconvenience, be carried in the pocket, has been introduced by the Pionrad Trading Co., Ltd., Coptic Street, New Oxford Street, London, W.C.1. It measures 9½ in. long, and has embodied in the handle the mechanism of a small wheel-brace to which it fitted a removable chuck. The driving mechanism of the wheel-brace can be locked when the tool is used as either a screwdriver, a hammer, or as a chisel, to mention some of its functions.



Pionrad portable tool kit.

The accessories, which include two screw-driver bits, a twist-drill, wood bit, counter-sink bit, chisel and awl, are accommodated in a chamber in the handle, whilst the hammer-head can be quickly removed when not required.

The adjustable chuck will take drills up to ¼ in. It is finished in nickel-plate and black, and costs 8s. 6d.

PYE ALL-WAVE AERIAL

THIS is described by the makers as a Matched Dipole Aerial and has been introduced primarily for use with this firm's all-wave and Empire receivers.

As a dipole arrangement it shows up to best advantage on the short wavebands, also, it does give a far better signal-to-noise ratio in localities where electrical interference is particularly troublesome.

The aerial consists of a horizontal portion 40 feet long divided in the centre by an insulator, from which point a twisted two-wire feeder is taken to a matching transformer located near the aerial and earth terminals of the set.

Pye Matched Dipole Aerial kit for use with all-waves sets

The system will only prove beneficial in reducing background provided the horizontal span is outside the zone of interference, so it is necessary to erect the aerial as high as possible and well clear of all buildings. Though the twisted feeder passes through the interference area it is naturally a poor collector, and so will convey very little of the electrical noise to the set.

The special coupling transformer is provided with a switch to convert the system in a normal "T" aerial when required, and this arrangement may sometimes be found preferable to the dipole system on the medium and the long waves.

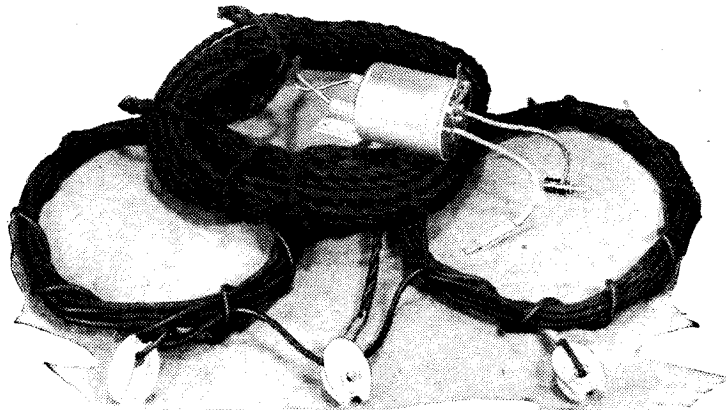
Where hitherto a long and high aerial has been used a reduction in signal strength will probably be noticed on substituting the Pye system, but it must be remembered that when used as a dipole only the horizontal span is the useful part of the aerial, so that its effectiveness as a collector on wave-lengths far removed from its fundamental is not so good as the orthodox pattern, but as the background will be lower, the resulting signal-to-noise ratio is better. A weaker signal bereft of noise is always more pleasant to listen to than one of greater strength encased in "mush." These advantages, however, are most marked on the short waves.

The aerial is obtainable from Pye Radio, Ltd., Radio Works, Cambridge, and the price is 25s.

LYONS-HICKOK CAPACITY TESTER MODEL 47X

THIS self-contained capacity test set will form a valuable addition to the serviceman's kit if the apparatus available does not offer facilities for testing and measuring the capacity of condensers. It operates from the 50 c/s supply mains and on any voltage from 200 to 250 volts, and gives direct readings in microfarads from 0.0001 to 20.

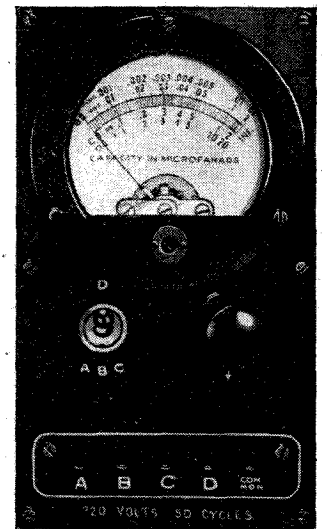
This range is covered in four steps, the separate scales being marked A, B, C and D respectively, the desired range being selected by plugging the test leads into the appropriate socket on the unit. These are marked to correspond with the scales, and there is also a range selector switch, but this has to be changed only for the highest range.



The unit is simple to operate, and will give the capacity of any condenser within its scope sufficiently accurate for all practical purposes. Tests made with the unit show its accuracy to be far better than the usual tolerances allowed for condensers used in wireless receivers.

Certain precautions must be taken when using the meter to test condensers wired in a receiver, for other components, such as a

Lyons-Hickok capacity and inductance test set.



resistance, condenser, or coil in parallel with it will result in the meter giving a false reading.

This point is dealt with fully in the instructional literature accompanying each instrument; incidentally, these instructions explain very clearly the operation and scope of the unit.

The tester can be used also to measure inductance from 0.7 henry up to 703 henrys, a conversion table being supplied for this purpose.

Since receiving this unit for test we have been informed that an improved model has become available. Known as the Type 4780B, it has a fifth range extending the scope of the tester to 200 mfd., for electrolytic condensers as well as other types can be measured with either unit.

Both models cost £8 10s. each, and they are obtainable from Claude Lyons, Ltd., 40, Buckingham Gate, London, S.W.1.

THE RADIO INDUSTRY

ELECTRIC bells, which act more or less as miniature spark transmitters, are one of the minor annoyances which interfere with radio reception. Ward & Goldstone, of Pendleton, Manchester, have now introduced an AC mains bell without make-and-break contacts from which no radiation can take place. The bell, which embodies its own step-down transformer, costs only 6s. 3d.

Scophony, Ltd., the firm which is developing the Scophony optical-mechanical system of television, is to be converted from a private company into a public company with a capital of £300,000 in 1,200,000 5s. shares.

A new catalogue describing baffles, horns, and other loud-speaker accessories has just been issued by Scientific Supply Stores, Ltd., 126, Newington Causeway, London, S.E.1.

The head office of Baird Television, Ltd., has been transferred to Greener House, 66, Haymarket, London, S.W.1, where accounts and all other matters (except technical and manufacturing) will be dealt with. (Telephone: Whitehall 5454.) Correspondence on technical and manufacturing subjects should be addressed to the company's laboratories at the Crystal Palace (Anerley Road entrance), London, S.E.19. (Telephone: Sydenham 6030.)

Copies of the American books, "The Cathode Ray Tube at Work" and "Servicing Superheterodynes," are obtainable from Holiday and Hemmerdinger, Dolefield, Bridge Street, Manchester, 3. Prices (post free) 11s. and 4s. 10d. Both these volumes have been reviewed in *The Wireless World*.

Listeners' Guide for the



COMING as it did at a time when the feelings of the nation were electric because of the tremendous financial scare which had caused a General Election, "Cavalcade," Noel Coward's epic at Drury Lane, had a wonderful run of 405 performances. Many will remember that it is a pageant of the events in England during the period from New Year's Eve, 1899, to New Year's Eve, 1929. The broadcast version, for which Val Gielgud and Felix Felton are responsible, is to be given Nationally at 8 on Wednesday and again Regionally on June 26th. It is an ambitious production in which will be used five studios in addition to the Concert Hall. The leading part of Jane Marryat will be played by Mary O'Farrell, and that of her husband, Robert, by Martin Lewis, while the narrator will be Carleton Hobbs.

"JONAH"

In this Oratorio, the composer, Lennox Berkeley, has aimed at providing a perfectly straightforward musical setting to the story as given in the Book of Jonah without altera-

tion, although he found it necessary to take the words for the last chorus from the Book of Psalms. The first performance will be given before an audience in the Concert Hall, Broadcasting House, and radiated in the National programme at 10.20 to-night (Friday). Clarence Raybould will conduct, and the artistes will be Joan Cross, Jan Van der Gucht, and William Parsons.

It was first written in 1933, and entirely reorchestrated in 1935 for this performance.

DIALECT

MANY people fear that the dialects of different parts of the country will in time die out, due largely to the fact that wireless announcements are made to a standard pronunciation. It will be interesting to listen to the National programme at 8.45 to-night (Friday), when Geoffrey Whitworth presents "An Adventure in Dialects," illustrated by gramophone records of

various dialects current throughout the United Kingdom.

ROMANCE IN THE PAST

WHAT should prove of interest to the younger generation and serve as a comparison between their ways and those of their forebears is "Living in the Past," a talk by G. B. Harrison on love, courtship and marriage of yesteryear, from the National transmitter at 6.45 on Sunday.

FOUR THOUSAND VOICES

A CHOIR of about 4,000 drawn from some 250 choirs of cathedrals and town and village churches affiliated to the School of English Church Music will take part in the Festival which will be relayed from the Crystal Palace at 8 to-night (Friday) Regionally. His Grace the Lord Archbishop of Canterbury will give the address, after which will be heard Handel's "Hallelujah Chorus."

HIGHLIGHTS OF THE WEEK

FRIDAY, JUNE 19th.

Nat., 8, Café Colette Orchestra. 8.45, "An Adventure in Dialects." 10.20, "Jonah," oratorio. Reg., 11 & 2, Commentary on the Senior T.T. Race. 8, Festival of English Church Music.

Abroad.

Bucharest, 8.20, "Il Seraglio," (Mozart).

SATURDAY, JUNE 20th.

Nat., 2.40, Aviation Service from Canterbury Cathedral. 8.30, Variety. 10.20, B.B.C. Theatre Orchestra.

Reg., 6.30, Band of His Majesty's Welsh Guards. 9.30, The New Georgian Trio. 10.30, Henry Hall's Hour.

Abroad.

Budapest I, 8.45, Operetta Music: Budapest Concert Orchestra.

SUNDAY, JUNE 21st.

Nat., 6.45, "Living in the Past," 9, Recital: Lionel Tertis (viola) and Solomon (pianoforte).

Reg., 6.45, Symphony Concert. 7.45, Service, All Saints', Margaret St., W.I. ¶Fred Hartley and his Novelty Quintet.

Abroad.

Frankfurt, 8, "Dancing Through the Centuries," Ancient and Modern Dance Music.

MONDAY, JUNE 22nd.

Nat., Romance in Rhythm. 10.15, B.B.C. Orchestra (F) with Harriet Cohen (piano).

Reg., The Bernard Crook Quintet. 8, "Lancashire Slam." ¶Troise and his Mandoliers.

Abroad.

Hamburg, 8.10, Mozart Concert from Bremen.

TUESDAY, JUNE 23rd.

Nat., 10.45 a.m., Trooping the Colour. 8, "Midsummer's Eve."

Reg., Medvedeff's Balalaika Orchestra. 8.30, B.B.C. Midland Orchestra. ¶The Cellini Trio.

Abroad.

Paris PTT, 8.30, "Un Carnaval Romantique à Paris" (Inghelbrecht), from the Salle Pleyel.

WEDNESDAY, JUNE 24th.

Nat., 8, "Cavalcade." 10, "Almonds and Raisins," a Jewish revue.

Reg., 5.45, Relay from Canterbury. 8, B.B.C. Military Band. 8.45, Relay from Canterbury.

Abroad.

Kalundborg, 9-12, Radio Ball for the Older Generation.

THURSDAY, JUNE 25th.

Nat., 8, Relay from Canterbury. ¶Sydney Howard. 10.20, Revue.

Reg., 7.10, From the London Theatre (Last of the present series). ¶The B.B.C. Dance Orchestra. 9, Two Pianos: Heinz and Robert Scholz.

Abroad.

Kalundborg, 8.30, A Summer Trip to the Land of the Midnight Sun.

Week Outstanding Broadcasts at Home and Abroad

MIDSUMMER'S EVE

AFTER ransacking museums for old documents dealing with the origin of customs and festivals associated with midsummer, Felix Felton and A. K. Hamilton Jenkin present a programme from the National transmitter at 8 on Tuesday which will be a mosaic of old and new customs and an enquiry into their origin. Among those included are: St. John's Eve, The Watch March, Bone Fires, the "Feu de Joie," and Sunrise at Stonehenge. The cast includes Carleton Hobbs, V. C. Clinton-Baddeley, and Monsieur Stéphan, who will, in his own delightful way, describe a few of the customs in France.

"ALMONDS AND RAISINS"

THE title given to this all-Jewish revue, which will be heard at 10 on Wednesday (Nat.), is that of a famous traditional Jewish melody which will be sung during the programme. Although all the performers are Jewish it will be presented in English, with occasional interpolations and explanations in Yiddish.

THE KING'S BIRTHDAY

"TROOPING THE COLOUR," on the occasion of the King's birthday is one of those ceremonies that are admirably suited to broadcasting, for the microphone succeeds in capturing the martial strains and

the crisp orders enabling millions to visualise the scenes on the Horse Guards Parade. The ceremony this year will be of particular interest, as it will be the first since His Majesty King Edward VIII's accession. It will be broadcast at 10.45 a.m. on Tuesday (Nat.).

MUSIC NEWS

A JOINT recital of music for viola and pianoforte will be given by Tertis and Solomon on Sunday (Nat.), at 9, when they will play the Delius Sonata No. 2 and the Suite by Ernest Bloch.

On Monday, at 10.15 (Nat.), Heathcote Statham, organist of Norwich Cathedral, will conduct, in this his first broadcast, Section F of the B.B.C. Orchestra, with Harriet Cohen as soloist.

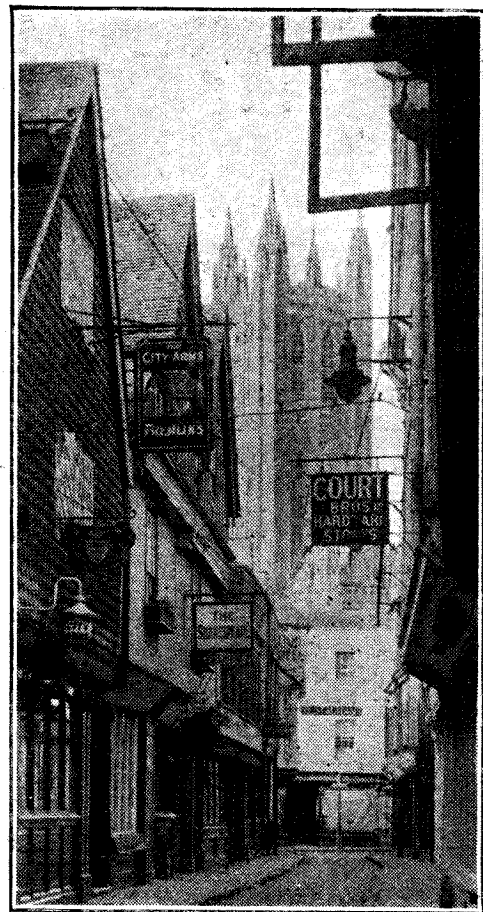
CANTERBURY

DURING this week there will be no fewer than four relays from the Cathedral and its precincts. On Saturday Nationally comes the Aviation service at which will be presented by the Secretary of State for Air, as gifts to the Cathedral, a Royal Air Force Ensign and Civil Air Ensign. The Band of His Majesty's Royal Air Force will accompany the singing and play before the service, at which the address will be given by His Grace the Lord Archbishop of Canterbury. A commentator inside the Cathedral will describe the scene for listeners.

Musical interest is centred this week on the Canterbury Festival of Music and Drama which was created by "The Friends of Canterbury Cathedral," the proceeds from which are devoted to the upkeep of the Cathedral. Dr. Adrian Boult with a section of the B.B.C. Symphony Orchestra will again take part. A portion of the Holst Memorial Concert

from the Chapter House, that consisting of the "St. Paul's Suite," will be heard at 5.45 on Wednesday (Reg.). The same evening from 8.45 to 10 will be relayed Regionally a "Serenade" Concert from the Cloisters. On the following evening, June 25th, the Festival Choir with the Orchestra will give a con-

CANTERBURY CATHEDRAL seen from Butchery Lane, Canterbury. Relays on four occasions during the Festival Week will come from this centre of the English Church.



cert in the Cathedral itself which will be relayed in the National programme at 8.

FOR OPERA LOVERS

ON Monday Toulouse is continuing its custom of giving concert versions of popular operas, and on this occasion, at 10, gives Verdi's "Aïda." Frankfurt is relaying from the Opera, at 8.5 on Tuesday, "Madame Butterfly" (Puccini). A programme of peasant opera music should prove of real interest to many listeners. Tune in Hamburg at 8.45 on Wednesday. Léhar's "Paganini" will be relayed by Poste Parisien at 9 on Thursday from the Théâtre de la Porte St. Martin.

ENGLISH TALK

FROM Kalundborg on Sunday afternoon, at 1, a talk on the English Riviera will be given by Mr. George Fox, an English teacher now resident in Denmark.

MIDSUMMER PROGRAMMES

TO-MORROW (Saturday), at 3, Kalundborg gives a special broadcast for Danes abroad when a midsummer programme from the famous castle of Kronborg, near Elsinore, will include Danish operatic stars and a students' choir.

At 10.45 on Tuesday a Midsummer Festival will be broad-

cast from the Land of the Midnight Sun in Finnmarken, the most northerly province of Norway. The programme will include visits to native villages, when descriptions of the huge bonfires lit by the people in order to drive away evil spirits will be given. This will be radiated by all Norwegian and Finnish stations.

LISZT

ON Sunday a great Liszt Festival will be relayed by Vienna on the occasion of the unveiling of a memorial at Eisenstadt to this great composer. At 9.30 a.m. Coronation Mass (Liszt) will be relayed from the Bergkirche, Oberberg-Eisenstadt, followed at 11 by the unveiling of the memorial, and at 12 noon a festival concert will be heard from the Rosensaal, Eisenstadt, when Weingartner will conduct the Vienna Symphony Orchestra.

"THE PROPELLER-SHAFT"

FOR those with a knowledge of German this interesting new play by Adolf C. Schmidt, which deals with the breaking of the propeller-shaft of an old freight steamer on the High Seas and its repair by a young engineer, should be worth listening to on Deutschland-sender at 9 on Tuesday.

THE AUDITOR.



FRANZ von LISZT, whose music will be heard in a commemorative broadcast from Vienna on Sunday at 9.30 a.m., 11 a.m. and 12 noon.

High-pass and Low-pass Filters

SIMPLIFYING THE PROBLEM OF DESIGN

By A. L. M. SOWERBY, M.Sc.

PROPERLY designed filters, as opposed to haphazard combinations of inductances and capacities, are already to be found in broadcast receivers and their use will probably become widespread in high quality apparatus. In a short series of articles, simple rules for the design of filters for various purposes will be formulated

I—The Structure of Filters

A FILTER, in the sense in which the term is used in this article, consists of an assemblage of coils and condensers designed to discriminate sharply between high and low frequencies, passing the low (or high) with as little diminution of strength as possible, and suppressing the high (or low) as completely as may be necessary.

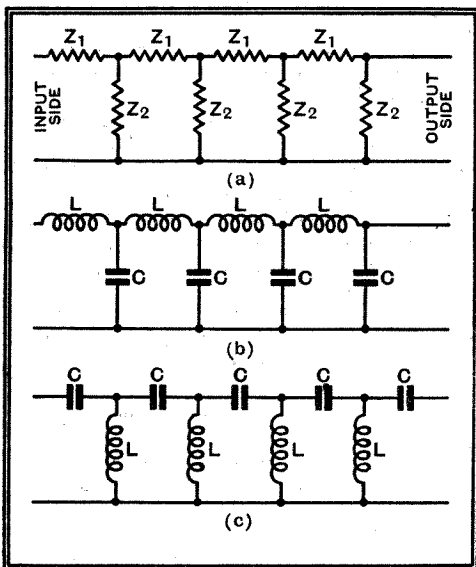


Fig. 1.—Diagram (a) shows the general circuit of all filters. All Z_1 's are equal; all Z_2 's are equal; both are pure reactances, simple or complex. Diagrams (b) and (c) represent low-pass and high-pass filters respectively.

Filters of this type are more widely used in telephone engineering than in wireless practice, though their use in this direction is spreading. In particular, the ability to design a filter for a specific purpose is valuable to the experimenter. A high-pass filter inserted in series with a "tweeter" speaker will serve to keep from it the low notes with which it cannot deal, or a low-pass filter with a sharp cut at 5,000 cycles may be useful in reducing "sideband splash" with a minimum loss of quality. The smoothing circuits of a mains set constitute a crude kind of filter that might often be the better for being correctly designed, while another type of low-pass filter, again usually of the "hit-or-miss"

variety, is frequently used after a detector valve to keep HF or IF currents out of the audio-frequency side of a set.

The mathematics underlying the theory of filters is usually regarded, not without reason, as being complex and difficult to follow. The conclusions to which the mathematics lead are, fortunately, fairly simple, so that the practical design of a simple filter can be successfully and confidently undertaken with no more equipment than a knowledge of half a dozen technical terms, a grasp of the way in which the component parts of a filter fit together (vitaly important, this) and a few very simple rules.

Fig. 1a shows a schematic diagram typical of all filters. The assembly of reactances Z_1 and Z_2 is intended to allow certain of the frequencies present at the input terminals to reach the output terminals while preventing others from doing so. To achieve this, Z_1 is made of high impedance and Z_2 of low impedance to the frequencies it is desired to suppress. To currents of the higher frequencies, inductances have a high impedance, and capacities a low one; Fig. 1b, therefore, shows a low-pass filter. By a simple inversion of the rôles of capacity and inductance there emerges Fig. 1c, the simplest type of high-pass filter.

Any random collection of coils and condensers connected as at 1b will attenuate high frequencies more than low, but the attenuation will probably rise only slowly as the frequency is increased, giving a response-curve like that at Fig. 2a. The most valuable property of a filter, that of cutting sharply at some predetermined frequency in the manner suggested at 2b,

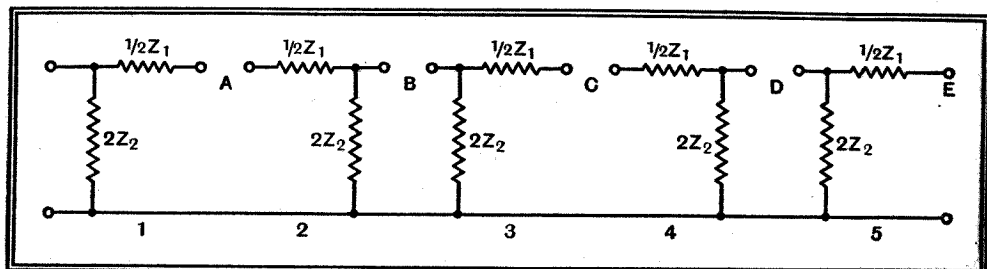


Fig. 3.—Five half-cells of generalised filter of Fig. 1a. Nos. 1 and 2, joined at A, make one π -cell; 2 and 3, joined at B, make one T-cell. A filter may end only at the points lettered.

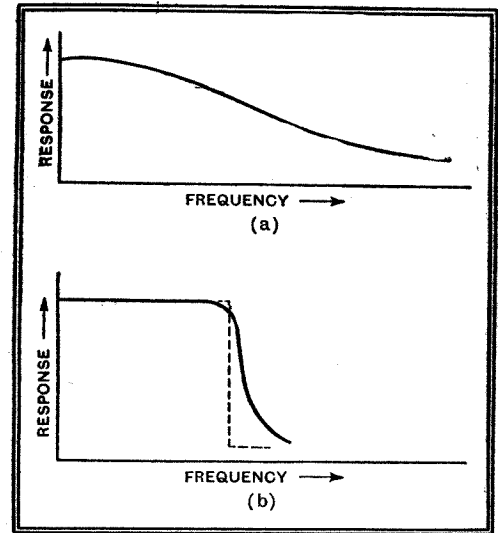


Fig. 2.—Response curves of low-pass filters: (a) the circuit of Fig. 1b, but L and C chosen at random; (b) dotted line, theoretical filter, of an infinitely large number of resistance-less cells; full line, practical filter of a few cells of moderate resistance.

can only be realised in a filter designed strictly according to the rules.

The theory of these structures is based on the consideration of an infinitely long chain of these coils and condensers, all regarded as free from resistance. This chain can be considered as being made up from a number of identical three-element cells, and it is of vital importance to correct use of rules for design that the types of cell (and the way they can be combined) should be fully grasped.

Half-cells in Cascade

In Fig. 3 is shown a portion of an infinitely long filter, the part depicted consisting of five half-cells, numbered for convenience of reference. If 1 and 2 are joined at A they make one complete cell, the two series impedances, each of $\frac{1}{2}Z_1$, together making up the full value. A

High-pass and Low-pass Filters—

second cell of the same type is made by joining up 3 and 4 at C. By then joining the two cells together at B, the two shunt impedances, each of value $2Z_2$, are put in parallel, making the normal value Z_2 , and re-assembling from the four half-cells a portion of the complete filter of Fig. 1. The two separate cells are known as π -type cells, for their likeness to that letter.

Another combination of these half-cells is possible. If we join 2 to 3 at B, Z_2 is reconstituted from the two shunt-arms of value $2Z_2$ each, and the whole is called, again from its shape, a *T-type* cell. A second T-cell is made by joining 4 and 5 at D, after which the two cells can be connected at C to form, as before, a portion of the complete filter of Fig. 1 a.

Filter Terminations

In considering a filter of infinite length, the distinction between π and T cells is clearly of no importance. But any practical filter has to end at some point or another. Imagine that Fig. 3 shows the right-hand (output) end of a long chain beginning far to the left of half-cell 1. The rule is that the filter must finish with a complete half-cell, i.e., with $\frac{1}{2}Z_1$ at the end, as at A, C, or E (T-termination), or with $2Z_2$ at the end, as at B or D (π -termination). It must not finish, as do the

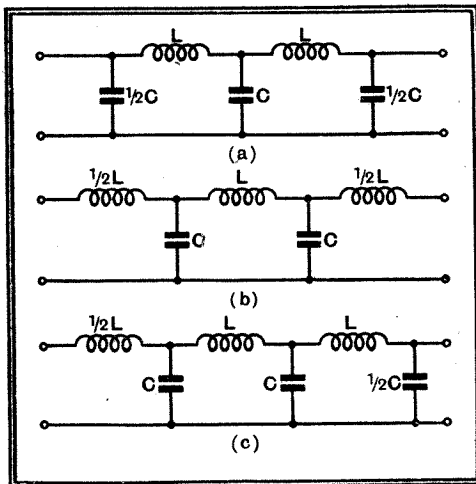


Fig. 4.—Low-pass filters. (a) Two cells, π -terminated both ends; (b) two cells, T-terminated both ends; (c) $2\frac{1}{2}$ cells, T-terminated one end, π -terminated the other.

filters of Fig. 1, just by ceasing to add more components, and leaving Z_1 or Z_2 as the last impedance.

Applying these rules to a low-pass filter, we have in Fig. 4 the two possible circuits for a filter of two cells. That at *a* has a π -termination at each end, that at *b* is T-terminated. Since each contains two cells of a complete chain, the filtering effect of the two will be identical. But their impedances will be different. This is evident if we consider the impedance across the input terminals of each; for high frequencies the condenser across the input of *a* ensures low impedance, while the choke in series with the input at *b* ensures high impedance.

This difference of impedance need not worry us much, for both filters require the same load-resistance, having the same average impedance over the band of frequencies which they are designed to pass. The point it is desired to emphasise is that if we want a four-cell filter we cannot get it by connecting these two in series, for the mis-matching of impedances at the junction would hopelessly upset the filtering action. By adding a further half-cell to the beginning of *a* or the end of *b* we get *c*, a $2\frac{1}{2}$ -cell structure with a T-termination at one end and a π -termination at the other. Besides being usable as it stands, *c* can quite safely be joined in series with either *a* or *b*, its place being before the former or after the latter; in either case, the junction is then between points of like impedance.

Reverting to Fig. 3, we see that a whole cell (2 and 3, or 3 and 4) may be left out without upsetting the filter, but a half-cell may not. We must not join 1, 2, and 4 in series on account of the mis-matching at the 2-4 junction, but we may take 4 round to the input if we like and join up in the order 4-1-2.

In short, π may be joined to π , or T to T, but never π to T.

A theoretical filter—an infinite number of cells, each made up of resistance-free reactances—of the type shown in Fig. 4 has a response-curve like that shown dotted on Fig. 2 b. All frequencies below a certain value are passed without loss, and all above that value are suppressed. The frequency at which this sudden jump in behaviour takes place is called the *frequency of cut-off* and is denoted by the symbol f_c . The actual value of the frequency of cut-off is determined by the product of L and C.

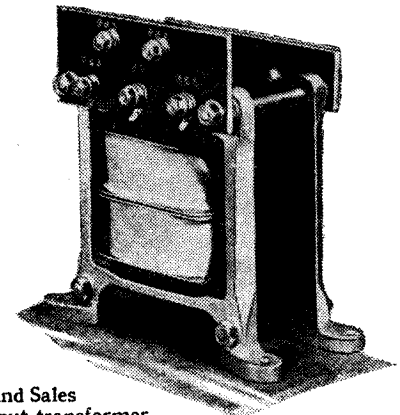
A practical filter, of a few cells only, and built of coils and condensers having at least a little resistance, naturally does not behave in this ideal manner. The necessary limitation in the number of cells results in a response curve showing a cut-off that is less sudden and less complete—it has, in fact, the faults shown in the full-line curve of Fig. 2 b. Apart from this, which depends only on its own structure, there is the further difficulty that the input impedance of the filter, whether ended with a π -cell or a T-cell, does not remain constant over the range of frequencies it is designed to pass. As a consequence, proper impedance-matching at the end is difficult, and there results a certain amount of loss in the pass-region. As this loss grows greater towards the cut-off frequency, this mis-matching at the ends contributes further towards blurring the sharpness with which the filter discriminates between wanted and unwanted frequencies. For these two reasons the simple type of filter we have been discussing, where Z_1 and Z_2 of Fig. 1 a each consist of a single coil or condenser, is only useful for discriminating between currents of frequencies widely separated from one another.

Part II will deal with the more elaborate types of filters derived from the simple prototype.

Push-Pull Output Transformer

20-2,000 Cycles Response

A NEW output transformer has been introduced by Sound Sales, Ltd., of Marlborough Road, Upper Holloway, London, N.19, which is claimed to have an unusually wide response. It is of the push-pull type and is designed for use with an output stage requiring a load resistance of 10,000 ohms, such as one consisting of a pair of PX4 valves. The primary is, however, tapped so that an amplifier employ-

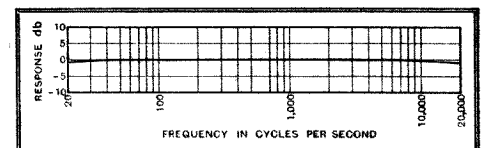


Sound Sales output transformer.

ing PX25 or similar valves can be matched by an impedance of 6,000 ohms. In the case of the model submitted for test, the secondary was wound to match a speaker having a 15-ohm speech coil impedance.

The primary inductance measured with 3.5 volts AC was found to be no less than 77 H. so that there should be no risk of amplitude distortion through the load on the output stage falling off at low frequencies. The core is large and contains a generous quantity of iron; as a result, there should be little amplitude distortion introduced by the transformer.

It is in the matter of the frequency response, however, that the transformer is so outstanding. With such a high primary inductance it goes without saying that the bass response will be good, but this makes it all the more difficult to secure a good response in the treble. With a high primary inductance, it is often considered something of an achievement if the loss at 10,000 c/s is no more than 5 db. or so. In this case, however, the loss at this frequency has been kept less than 0.5 db. and at as high a frequency as 20,000 c/s it is only 1 db. As the response curve shows, over the enormous range of 20 c/s to 20,000 c/s, the variation is no more than ± 0.5 db.



Response curve showing very slight loss.

The transformer can confidently be recommended for use with any push-pull stage, for it can be obtained with different windings to suit various valves. The model tested is eminently suitable for use with either *The Wireless World* Push-Pull Quality or PA Amplifiers; it is listed as the Model SS 036 and is priced at 35s.

UNBIASED



In the midst of a somnolent throng.

A Seaside Mystery

I SUPPOSE that many of you, like myself, are accustomed at this time of the year to drop down to the sad sea waves at the week-ends, and some of you, perhaps, hardened by listening to the B.B.C. programmes, may even venture to tarry awhile in the vicinity of the bandstand and listen to the efforts of the local "phil-harmonic."

I must confess that I do not often indulge in this particular pastime, but last week-end I happened to fall asleep in a comfortable chair while the band was absent, and when I awoke I found myself in the midst of a somnolent throng with all avenues of escape cut off. I was therefore compelled to listen to the band whether I liked it or not.

I was very pleasantly surprised by the spirited rendering of the first item, and as the programme went on my surprise and admiration rose to considerable heights, and I commented on the matter to my immediate neighbour. She thoroughly agreed with me, and said that the performance was the more creditable in so much as that all the bandmen seemed to know the various items by heart, as they were not bothering to look at the music. To my astonishment I realised that this was so, and, furthermore, one or two bandmen even had the music open at the wrong page.

Now I am no musician, but I must confess to an elementary working knowledge of the cornet, with the learning of which I sometimes while away the long winter evenings. I was not long, therefore, in spotting that the cornet players, in addition to being able to do their job without looking at the score, were producing the music without pressing the right keys.

Sorely puzzled I spent all the next day in visiting the various bandstands in the large and straggling combination of seaside resorts in which I was staying. I was very surprised to see the same phenomenon in every bandstand save one, where it was clear that all the players were studiously applying themselves to the score in front of them.

I am still without a satisfactory explanation, but that some form of wireless is at the bottom of the whole business I feel

sure. At first I naturally suspected a microphone in one bandstand and loud speakers in all the others, the various bandmen in these subsidiary stands being merely "dummies" with no knowledge whatever of how to play their instruments. Yet I am com-

pletely baffled, as microphones and loud speakers were conspicuous by their absence, and, furthermore, closer investigation has clearly shown me that the music was, without doubt, issuing from the various instruments it was supposed to come from, and, moreover, the music coming from each one was the music peculiar to that particular one and no more.

By FREE GRID

I intend to spend several days in the locality next month investigating this mystery, and meanwhile, if any of you can help me with suggestions, I shall be extremely grateful.

How to Save 10/-

I HAVE received quite a number of letters arising out of my recent references to the Caledonian market being popularly known as the Mecca of London Scottish listeners owing to the fact that almost every programme broadcast in Europe can be heard emanating from the innumerable receivers there. One reader tells me of a remarkable instance of a friend of his who is definitely not a Scotsman, but, on the contrary, a Welshman, who possesses the most economical receiver in existence, for which he doesn't even have a licence.

This friend dwells almost under the shadow of the aerial masts of one of the Regional transmitters, and when the station first began transmitting he noticed tiny sparks leaping across between the two ends of a broken piece of gutter-spouting attached to his house. There is, of course, nothing very remarkable in this, as sometimes a somewhat similar phenomenon has been observed on board ship, where the power of a transmitter is relatively insignificant.

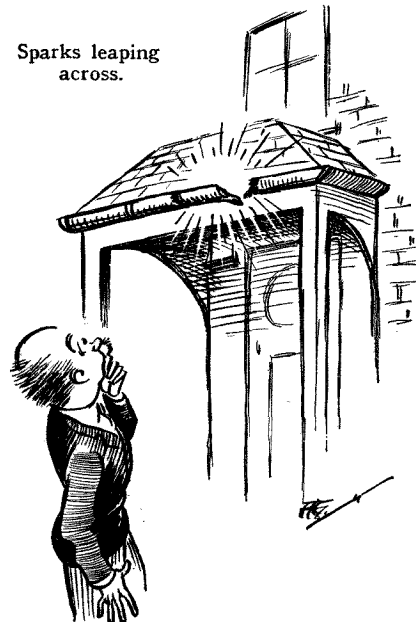
This native of old Cymru, with that in-born eye to business which has made his race so famous the world over, proceeded to erect an aerial and couple to it a simple coil and condenser. To his delight sparks

rattled merrily across the condenser plates when the circuit was tuned to the local transmitter. This steady stream of sparks was naturally due to the action of the carrier wave, but to his surprise there suddenly burst on his ears the familiar strains of "Onaway! awake, beloved," with which the B.B.C. used to dose us so liberally.

Since this date, my correspondent avers, his Welsh friend has been enjoying the B.B.C. programmes by listening to the modulation of the sparks chasing each other across the condenser plates. Furthermore, he asserts, since the coil and condenser is not a complete wireless receiver within the meaning of the Act, he is not obliged to take out a licence. Now it is not my intention to argue about the legal aspects of the case, of which I have no knowledge, but, quite frankly, I fail to see how any recognisable speech and music are obtained from the modulated spark stream without any rectification. I am not, of course, for the moment disputing that the carrier wave causes sparking across the condenser plates; indeed, I well recollect that in the days when the 2LO transmitter was situated on the roof of a well-known London store, sufficient energy was picked up by an aerial on the top floor to light a neon sign and supply filament current to a receiver, even though the power of the transmitter was only 3 kilowatts.

I am not one to cast doubts on other

Sparks leaping across.



people's word, but, unfortunately, I do not live near enough to any powerful transmitter to carry out the experimental work necessary to confirm these extraordinary asseverations. There must be some of you, however, who are more fortunately situated, and I should therefore be extremely grateful if you could rig up the necessary gear and inform me of the results you obtain.

Letters to the Editor

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

Is AVC Worth While ?

THE article appearing in a recent issue under the title, "Is AVC Worth While?" by Mr. Cocking, of whose work in the design of the receivers described in your periodical I have the highest appreciation, by its provocative nature has stimulated me to write pointing out at least one of the factors not therein given due consideration.

Granted that AVC not only may in certain designs introduce distortion, but further leads to the reproduction of a fading programme subject to distortion at full, or even enhanced, volume. Many programmes, however, with mean level even in my electrically noisy district above that at which local interference detracts seriously from enjoyment fade frequently without distortion. AVC not only boosts signals during the "troughs," it also holds them in check on the "peaks." As a one-time owner of a *Wireless World* Single-Dial Super of high sensitivity but limited output, I can speak with experience of the horrible distortion produced by a pentode output valve overloaded by signals on "fading peaks" without any AVC system to reduce automatically the amplification. These remarks apply with some force to any owner of a receiver having a pentode output stage, however great its rated output may be.

Practically all consistent distant station listening is, in my opinion, done by those who prefer second-rate (?) reproduction of a programme of interest rather than first-class reproduction of a programme of no interest to them. To this apparently large class AVC is a definite boon.

London, S.E.2. V. T. S. FOSTER.

Technical Data on Sets

IT is well known that the sensitivity, selectivity and fidelity of a radio receiver can each be measured and expressed in definite units, now practically universally agreed upon. Why, then, do not all manufacturers, as a matter of course, give the ratings of their receivers in these units? Even though the general public is, perhaps, not yet conversant with these units, they could be included in the technical specifications, and technically interested people would soon learn to understand them, as they have other technical expressions.

Even if these quantities were not included in the general specifications, could not at least the sensitivity in millivolts or microvolts be available in the official Service Manuals, for the benefit of those service engineers, say, who are frequently called upon to decide whether a certain receiver is, perhaps, a little below standard?

I appreciate that the figures for different models in the same class may vary a little; but, even then, if only an approximate figure were given, it would be a much quicker, more reliable and more exact method of testing a receiver, with the aid of a calibrated oscillator and an output meter — two fundamental instruments which every service department should possess.

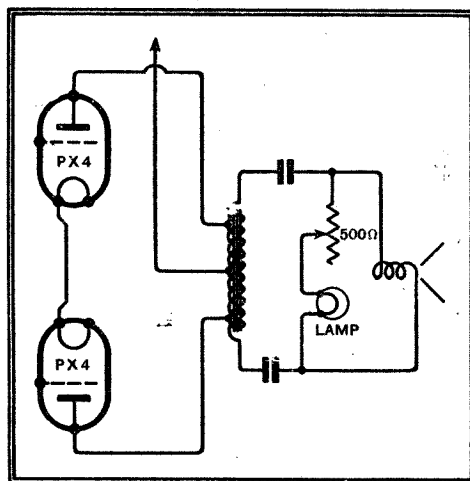
Of course, I expect the various manu-

facturers would supply these figures on request, but one has not time to write to every manufacturer about every past and every new model.

P. TREVOR
Croydon, Surrey. (Service Engineer).

Simplified Volume Expansion

THANK you for the further article in *The Wireless World* of May 22nd. Following the particulars given in issue of April 24th, I tried the scheme indicated in the accompanying diagram. It operates



Has simplification reached the limit? Volume expansion circuit used by Mr. E. D. Selway.

tolerably well, but at present I have not found a lamp of entirely suitable wattage for other constants; the one used does not develop sufficient resistance until the 4 watts modulated output of the PX4's is exceeded.

However, I send this note in case it may interest other experimenters who wish to try it in conjunction with the older type of high-resistance speech coil, as it gives a very good idea (on gramophone records) of what can be done. I may have missed some fundamental advantages of the bridge scheme (which I have not tried) as compared with this even more simple parallel feed scheme. The lamp is a Mazda 100-volt "Two-Purpose Lamp," which has one of its two separate filaments (i.e., the one used) rated at 4.5 watts. (Probably this type of lamp would be better with PX25's.) There is also a 200-volt 4.5-watt one. Speech-coil DC resistance is 2,000 ohms.

Westminster. E. D. SELWAY.

Frequency or Wavelength

I WAS pleased to see the question of frequency or wavelength being brought into discussion again, and I would like to add my plea to those who desire to see the use of frequency being adopted.

It is very elementary theory that this is the correct way of naming waves, and it would do a great deal, I think, in making technical articles more explicit. For instance, I noticed quite recently in your paper the claim for a set of being able to separate two stations on the medium-frequency band that were stated to be only "two point something" metres apart. To my way of thinking, this gave the impression of a much

superior selectivity than was actually the case, for the stations were their full nine kilocycles apart.

Anybody who has experienced the modern method of description adopted in the Services, as pointed out in John Lawn's letter printed recently, will agree that it does help to clarify matters, and certainly electricity and its branches is the science most in need of simplification.

Portsmouth. GEO. F. DAY.
Leading Telegraphist.

Home Recording

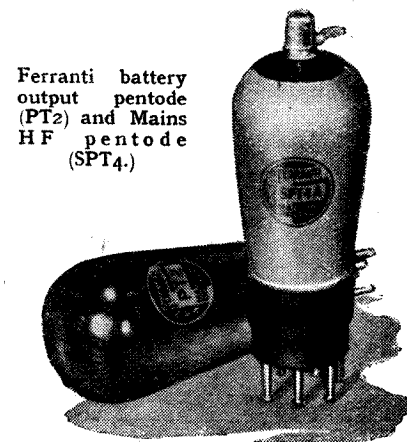
MR. ARNOLD, in his article on the above subject, makes the following observation: "A synchronous type motor will not prove sufficiently powerful in most cases."

We should like to take this opportunity of pointing out that we are at present manufacturing a synchronous recording motor which has sufficient power for cutting a 12in. record of either the wax coated or the aluminium disc type.

Kingsway Radio, Ltd.,
London, W.C.1. G. L. d'OMBRAIN,
Technical Dept.

NEW FERRANTI VALVES

TWO new valves have been introduced by Ferranti, Ltd., of Moston, Manchester, 10. The first is a battery output pentode, Type PT2, rated for 150 volts on both anode and space charge grid. At this voltage a grid bias of -4.5 volts is required and the valve consumes 10.3 mA. anode and 2.2 mA. screen currents. The optimum load is 14,000 ohms and the output 525 milliwatts. When used at 120 volts, however, the output falls to 283 milliwatts and the optimum load becomes 25,000 ohms, but the anode and screen currents fall to 5.3 mA. and 1.1 mA. respectively. The valve is priced at 13s. 6d.



Ferranti battery output pentode (PT2) and Mains HF pentode (SPT4.)

The second valve is of the mains type with a heater rated at 4 volts 1 ampere. It is the SPT4A, an HF pentode of the non-variable- μ type. It is intended for use as an anode bend detector with a 0.5 megohm coupling resistance in its anode circuit. Under operating conditions as an amplifier, that is anode, screen and grid voltages of 250, 100, and -1.5 volts, it has a mutual conductance of 2.3 mA/V. It is fitted with a 7-pin base and costs 17s. 6d.

RANDOM RADIATIONS

By "DIALLIST"

"Diallist" on Dials

WHEN are our manufacturers going to be kind enough to offer alternative tuning dials for some, at any rate, of their models? Like most of those who take wireless at all seriously, I detest the station-name dial for many, many reasons. Chief amongst them are that it seldom contains more than a selection of the available European stations, and never any Americans at all; that it is seldom more than roughly accurate in its calibration, and that as a rule the indicating device, whether it be pointer or what-not, is generally so coarse that anything like close calibration is impossible.

There must be thousands of wireless enthusiasts to whom the only kind of tuning arrangement that is of any real use is the plain dial of adequate size marked off into easy-to-read divisions or degrees and provided with a fine pointer that travels close to its surface in order to avoid parallax effects. If only it were possible to buy good-quality standard commercial receiving sets fitted with such dials, instead of the station-name horrors which they loathe, there would be a brisk demand—even if a small extra charge were made for the plain dial.

Re-calibration

I am using a set just now which is quite excellent as regards both sensitiveness and selectivity, but hopeless in the matter of dial indications. There is, for example, no station name between Milan (814 kilocycles) and London Regional (877 kilocycles). There is a small additional scale alleged to give the kilocycle readings, but this is, on the average, 9 or 10 kilocycles out over the medium waveband. It is thus no easy business either to find a station that one wants

or to identify one that has been tuned in—or, rather, it wasn't an easy business until I trimmed up the pointer to respectable fineness and made a simple calibration chart, plotting observed readings against true readings. That's one way of dealing with the matter, of course, but I do wish that I had a nice open simple scale not cluttered up with the names of stations. Don't you share my views?

A B.B.C. Staff College?

THE B.B.C.'s proposal to institute a training college for its staff is one that seems to have distinct possibilities. In big concerns such as the B.B.C. the newcomer is apt to be more or less lost during the first few months of his service. He is expected at Broadcasting House to pick up a fair general knowledge of the way in which broadcasting is organised and conducted, but as there is no one specially told off to instruct him under present arrangements he may find this not too easy. A staff college with instructors who would teach the newly joined the whole business from A to Z should mean a considerable increase in efficiency and a great saving of time that would otherwise be more or less wasted.

It would be no bad idea if those newly appointed were on probation during the period of instruction. It could then be seen who was likely to be a success and who was not, and those who showed no promise could be dropped by the simple process of not confirming their appointments.

The G.P.O. and Interference

I AM very glad to see that the G.P.O. is actively pursuing its campaign against man-made interference. Manufacturers of electrical machinery are being asked by the G.P.O. for permission to carry out tests of their products at the works themselves. The idea is to discover the simplest and the most suitable means of rendering these products innocuous from the interference point of view and to endeavour to induce manufacturers to fit the necessary suppressing devices.

Those who make domestic electrical appliances, at any rate, will be well advised if they fall in with the G.P.O.'s suggestions.

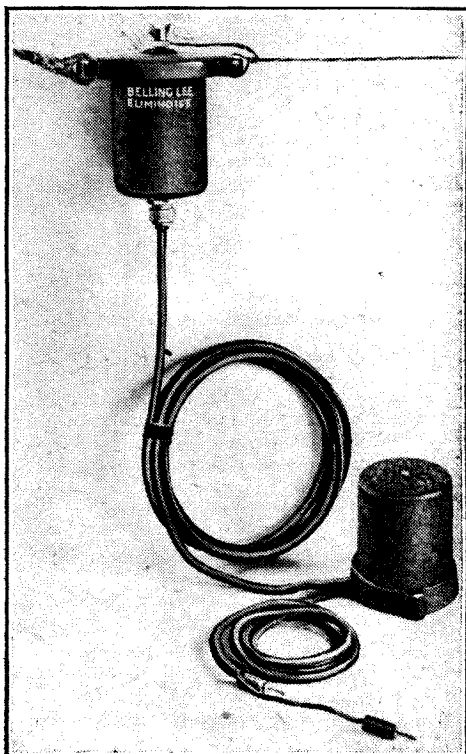
They could make a strong selling point of the fact that their appliances were guaranteed not to interfere with wireless reception. And they could go further than that. If and when we do have effective anti-interference legislation in this country those who own machines of any kind that can generate interference will no doubt be compelled to fit them with suppressors within a given time. In the modern all-electric house the cost of doing this might be quite considerable. Clearly, then, it is sound business to buy from now onwards only apparatus that is completely blameless.

The Bigger Broadcasting House

IT is announced that the B.B.C. is to go right ahead with part two of Broadcasting House, which will extend all the way from the north end of the present building to Duchess Street. The demolition of the buildings now covering that site is to start next year and, if all goes according to plan, the complete double-size Broadcasting House should be ready in four years' time. The present building cost half a million, but the extension should not run to nearly as much. It is, in fact, expected that the cost, spread over four years, can be met out of income.

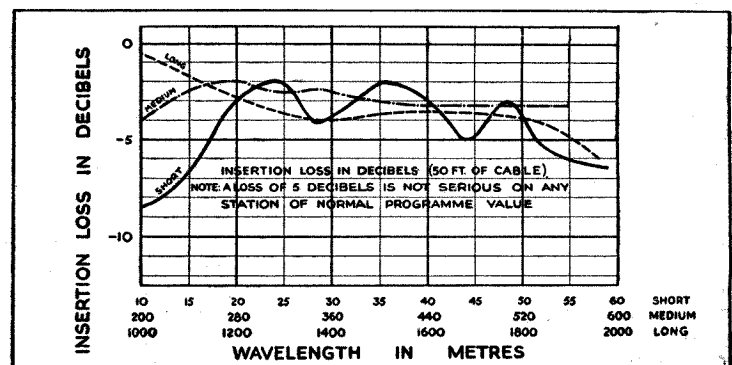
Olympia and Television

THERE still seems to be some doubt about the kind of television demonstration that is to be given at Olympia; whether, indeed, anything of the kind can be done at all. One can quite understand that from one point of view the set manufacturers are rather concerned about the enormous publicity that it will obtain in the lay papers when it comes. If that publicity takes the wrong turning, as it did a while ago when irresponsible writers declared that television would shortly render all existing receiving sets obsolete, it will not only mislead the public but harm the industry too. At the same time we cannot lose sight of the fact that the public is eagerly looking forward to television demonstrations, and there is quite a possibility that if it doesn't get them at Olympia it will jump to the erroneous conclusion that television has been boycotted. The sound course for the set manufacturers is to stage the best possible demonstration if television is available for the show, but to explain to the public that for a long while television must be the hobby of a few only, and that broadcasting will continue as at present on the medium and long waves.



THE "ELIMINOISE" AERIAL: As recorded in our issue of June 5th, Belling and Lee are about to introduce a new type of screened downlead coupling system, as shown in the photograph, for operation on all wavelengths between 15 and 2,000 metres. The maker's graph, reproduced, shows the average loss to be virtually negligible

ALL-WAVE ANTI-INTERFERENCE AERIAL



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.

Selectivity and Tuned Circuits

UNLESS a radical change in its design is to be made, the only practical way of improving the selectivity of a receiver is to add to the number of its tuned circuits. Possible criticism of this statement should be disarmed by admitting that the addition of tuned circuits is perhaps a radical alteration, but not necessarily of fundamental design.

This matter is brought up by a querist who wishes to increase the selectivity of a HF-det.-LF set by adding an extra HF valve, converting one element of the present input band-pass filter into an intervalve coupling and thus retaining the same number of circuits.

Although a tuned circuit acting as a coupling will probably give higher selectivity than when it forms a part of a band-pass filter, the gain will not be considerable and it is more than doubtful if the alteration proposed is worth while. Besides, there is a risk that the high-note response to the receiver may be impaired by the omission of the filter.

Earth Tests

EXCEPT in cases where elaborate measuring apparatus is available, the only way of determining the effectiveness of an earth connection is that suggested diagrammatically in Fig. 1, where EARTH 1 represents the working earth to which the receiver is connected, and EARTH 2 a temporary connection for purposes of test.

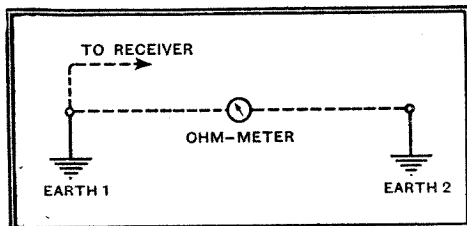


Fig. 1.—Inconclusive: the existence of a high resistance between the main earth No. 1 and the auxiliary earth No. 2 proves that one connection is defective. Query: which?

If an ohm-meter connected between these two points shows a resistance virtually no greater than that of the connecting wires, it is safe to assume that the earth is a good one. But the converse does not necessarily hold true; high resistance may obviously be due to a bad connection at either point 1 or 2.

These remarks are prompted by several letters received from readers lately; the writers all mention earth resistances running into dozens of ohms. All we can say is that "something is wrong somewhere," and the earth must be suspected. Another and less well-known way of making a test is to remove the earth connection entirely and to retrim and/or retune the receiver; if signals are then as strong as before, there is strong presumptive evidence that the connection is

not highly effective. Unfortunately, an increase in stray reaction effects due to the removal of the earth may tend to obscure results.

Unpleasant Shocks from 50 Volts

SUSCEPTIBILITY to electric shocks varies considerably, but few people would consider a 50-volt battery to be a source of unpleasant shocks. Commenting on this matter, a reader who is temporarily using a simple det.-LF headphone set under conditions of abnormal humidity, complains that the metal headphone shells have become "live," and that extremely unpleasant shocks result from touching them. He sends a circuit diagram of the receiver and asks us to say whether anything in this design could be responsible for abnormal surges of higher voltage than that of the 50-volt anode battery.

The existence of surge voltages seems to be quite impossible, and in any case it should be emphasised that under the conditions described a normally constituted person is liable to obtain quite violent shocks from a 50-volt source. What our contributor, "Free Grid," says is not always evidence, but he once maintained that even a 6-volt battery, properly (or improperly?) applied, might give a fatal shock.

Wireless receivers are used in all kinds of places nowadays, and we have had many letters bearing witness to the fact that in abnormally damp or salt-laden atmospheres the effect of a low voltage is quite different from that prevailing in ordinary domestic surroundings.

Cabinet Baffle

REFERRING to an article on the effects of loud-speaker baffles on response, which appeared in our issue of May 22nd, a correspondent asks for suggestions on the design of a cabinet-type baffle which will be free from troubles due to air column resonance. Naturally he desires to use the smallest size of cabinet commensurate with the reproduction of which his high-quality equipment is capable.

Air column resonance is not likely to give trouble if the depth (i.e., the back-to-front dimension) of the cabinet is small in relation to its width. To satisfy both requirements we suggest a baffle box measuring three feet square in front and one foot in depth. To avoid vibration of the wood, solid and heavy construction is essential.

A box baffle of the dimensions suggested would form a basis on which to carry out experiments with asymmetrical distribution of the baffle area on the lines suggested in the article referred to.

Visible Indicator

A CORRESPONDENT asks whether it would be possible to devise a simple means whereby "the incidence of sound waves on a microphone could be made to actuate some visible warning such as a lamp."

Thanks to the peculiar properties of the neon lamp, a visual alarm is easily arranged on the lines suggested in Fig. 2. The valve shown is the output valve of the microphone amplifier, but its grid is biased back so that in the quiescent state it takes practically no anode current.

Initial adjustment is made by reducing the voltage of the local 120-volt battery until the neon lamp just fails to glow.

When the microphone is energised the grid of the control valve will become less negative and anode current will flow. The

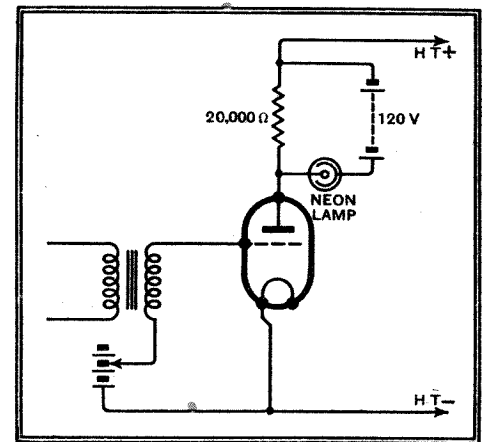


Fig. 2.—Noise made visible; a microphone-actuated warning signal.

voltage due to this current developed across the 20,000-ohm anode resistance will be additive to that of the local battery and the warning lamp will glow; due to the well-known "backlash" property of neon lamps, it will contrive to glow until the circuit is interrupted.

Two Kinds of Noise

TO judge from several letters received from querists, there is some confusion between the two kinds of background noise to which broadcast receivers are subject.

These noises may best be classified as internal and external. What is often described as background hiss is, in a highly sensitive receiver, largely inevitable, although the trouble may be aggravated by poor design. Noises due to defects in the receiver or to hum fall into subdivisions of the same category.

External noises due to local electrical interference and to atmospherics cannot be blamed on the receiver itself, although their effects may, to a greater or lesser extent, be mitigated by such adjuncts as screened aerial down-leads, etc.

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.

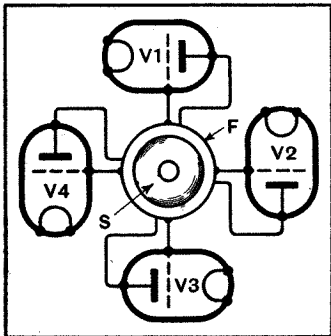
Recent Inventions

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

SHORT-WAVE OSCILLATORS

IN an arrangement for generating very short waves—of the order of one metre or less—four valve-oscillators V_1 - V_4 are coupled symmetrically to a common tuning-unit or "tank" circuit. This is shown in plan in the figure, and consists of two hemispherical "caps" of which only the upper one S is seen.

Each cap is formed with a flange F, and these are placed close together to form the tuning capacity of the system, the tuning inductance being equally distributed over the metal surface of the sphere. The plate and grid of each valve are connected respectively to a flange on each of the hemispheres, so that they all oscillate in phase. Owing to the equal spacing of the valves, parasitic oscillations, and harmonics of the



Micro-wave generator using four valves disposed symmetrically about a tuning system common to all.

fundamental frequency of the tuning-unit, are both ruled out.

Telefunken Ges für drahtlose Telegraphie m.b.h. Convention date (Germany) 15th September, 1934. No. 443693.

TELEVISION IN COLOUR

THE scanning current from three different photo-electric cells, each mainly sensitive to one of the three primary colours, is fed through separate amplifying-channels to three lamps, respectively screened by filters of red, green, and blue. The resulting rays are fed through lenses to a scanning-disc, which projects the picture in its natural colours on to a viewing-screen. The screen may be a finely-lenticulated sheet of celluloid.

H. E. Ives (Assignor to Bell Telephone Laboratories Inc.). No. 2017659. (U.S.A.)

CATHODE-RAY MICROSCOPE

CERTAIN minute objects, such as bacteria, cannot be seen even with the aid of a microscope, because they are so much smaller than the waves of ordinary light. It is, however, possible to photograph them by using ultra-violet light.

According to the invention, an ultra-violet light "image" of such an object is developed, and is then used to form a corresponding electron image on the fluorescent screen of a cathode-ray tube. In this way

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

it can be scanned and radiated as part of a television programme.

V. K. Zworykin (Assignor to Radio Corporation of America). No. 2021907. (U.S.A.)

TUNING COILS

WHEN a series of iron-cored tuning-coils are mounted side by side in the same receiver, one set for the long and the other for the short waves, it is desirable to design the windings so that the natural frequency of each is higher than the highest frequency to which the set is to be tuned. This minimises the absorption of energy by any coil which is, for the time being, short-circuited.

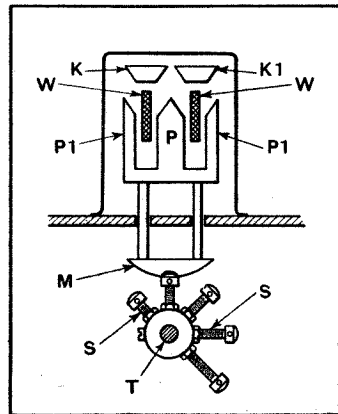
According to the invention the coil sections are wound in slots on a common former, which receives the movable iron core. The former is provided at one end with a small trimming-condenser, and also, at the same end, with a short-circuiting switch which is operated by a push-rod when the wave-band setting is changed.

W. J. Polydoroff and Aladdin Radio Patents, Ltd. Application date 5th July, 1934. No. 444013.

WAVE-CHANGE SWITCHES

IN order to avoid having movable contacts or tapping-points in the high-frequency circuits of a wireless receiver, the change-over from one wave-band to another is effected by the step-by-step movement of a powdered-iron core inside the tuning-inductance.

As shown in the figure, the yoke P and side-members P1 of the iron core are moved relatively to the windings W of an intervalve transformer, or other coupling,



Wave-band change effected by step-by-step movement of a powdered-iron core.

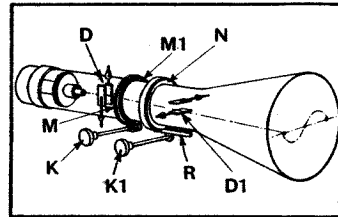
through the action by rotation of a number of screws S with hemispherical heads which fit into a recess in the base of a spring-pressed slider M. Several sets of screws are mounted at intervals along the same control shaft T in order to control the wave-band

setting of several tuned circuits in cascade. At the farthest point of penetration of the iron core, keepers K, K1, complete the magnetic circuit.

L. L. de Kramolin. Convention date (Germany) 22nd May, 1934. No. 443900.

CATHODE-RAY TUBES

IN order to focus the electron stream initially at a given point on the fluorescent screen, either at the centre or elsewhere, without interfering with its sub-



Electron stream focusing arrangement, using variable magnets.

sequent "sweep" under the influence of the control voltages applied to the deflecting-electrodes D, D1, a pair of C-shaped magnets M, M1 are mounted on a ring of non-magnetic material, such as brass, outside the glass tube, as shown. A knob K enables the flux from the gap between the pole-pieces (which are mounted like to like) to be centred in the direction necessary to displace the normal axis of the electron stream. In order to regulate the strength of the magnetic flux, a "shunting" ring N is mounted near the magnets, and at a distance which can be varied by the knob K1 and rack R.

British Thomson-Houston Co., Ltd. Convention date (U.S.A.) 12th July, 1934. No. 443682.

GRAMOPHONE PICK-UPS

A RAY of light from a lamp is focused on to a small mirror carried by the pick-up, so that the vibrations of the latter as it follows the sound track on a gramophone record, varies the incidence of the reflected ray of light on a pair of photo-electric cells arranged in push-pull. The resulting current-output from the cells is fed to a loud speaker.

In order to prevent distortion due to the curved characteristic of the P.E. cells, the light coming from the stylus is "split" by an interposed prism so that it reaches both cells simultaneously. The arrangement also allows the volume of reproduced sound to be controlled by varying the intensity of the light emitted from the lamp.

B. G. Johnson (communicated by E. N. Johnson). Application date 23rd October, 1934. No. 443981.

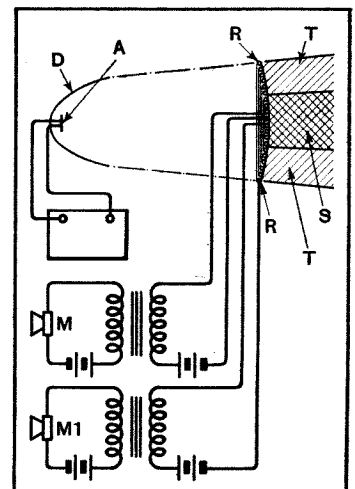
AUTOMATIC TUNING

A CHANGE in the direct current flowing through, say, the load resistance of an AVC valve is utilised to correct an initial mistuning of the set. The DC component is applied to release a brake magnet, which is normally closed, when the circuits are set "off-tune." As soon as the brake is released, the correcting-current operates a motor which rotates the main tuning-condenser until the circuits are brought into exact resonance with the incoming signal. The brake is then re-applied to hold the tuning adjustment at that point.

E. K. Cole, Ltd., and G. Bradfield. Application date 26th July, 1934. No. 443363.

SHORT-WAVE BEAMS

A SHORT-WAVE radio beam is modulated simultaneously with different signals in different sections by causing the beam to traverse an "array" of gas-filled tubes, the ionisation of which is differentially controlled. For instance, as shown in the figure, radiation from the dipole aerial A is concentrated by a parabolic reflector D so that the path of the beam intersects a lenticular surface R, built up of gas-filled tubes. The ionisation of these tubes is controlled separately in different sectors by signal



Beam transmitter modulated by two or more signals for navigational purposes.

voltages from the microphones M, M1, so that the emerging beam carries, say, one set of signals S along its central zone and another set of signals T in the area outside this zone.

The arrangement can be used for guiding aviators to ground, at night or in foggy weather, by modulating the beam differently in four quadrants so as to indicate at once to the aviator any departure from a predetermined central course which is calculated to bring the machine to earth at the correct landing angle.

Marconi's Wireless Telegraph Co., Ltd. (assignees of I. Wolff). Convention date (U.S.A.) 26th April, 1934. No. 443992.

The Wireless World

THE
PRACTICAL RADIO
JOURNAL
26th Year of Publication

No. 878.

FRIDAY, JUNE 26TH, 1936.

VOL. XXXVIII.

No. 26.

Proprietors : ILIFFE & SONS LTD.

Editor :
HUGH S. POCOCK.

Editorial,

Advertising and Publishing Offices :
DORSET HOUSE, STAMFORD STREET,
LONDON, S.E.1.

Telephone: Waterloo 3333 (50 lines).
Telegrams: "Ethaworld, Secist, London."

COVENTRY: Hertford Street.

Telegrams: "Autocar, Coventry." Telephone: 2510 Coventry.

BIRMINGHAM:

Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2971 Midland (4 lines).

MANCHESTER: 260, Deansgate, 3.

Telegrams: "Iliffe, Manchester." Telephone: Blackfriars 4412 (4 lines).

GLASGOW: 26B, Renfield Street, C.2.

Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

PUBLISHED WEEKLY. ENTERED AS SECOND
CLASS MATTER AT NEW YORK, N.Y.

Subscription Rates :

Home, £1 1s. 8d. ; Canada, £1 1s. 8d. ; other
countries, £1 3s. 10d. per annum.

*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

Place Names

B.B.C. Pronunciation

WHAT is the B.B.C. guiding rule to announcers regarding the pronunciation of place names? The answer must be that the Corporation has no rule, and the question is apparently left to the discretion of the individual announcer. Names with which the public is generally familiar may become unknown spots on the globe on the lips of an announcer who suddenly has the inclination to pronounce Hamburg, Berlin, Rome or Athens, as they are pronounced locally instead of as any ordinary listener would pronounce them and recognise them himself.

The disturbances in Palestine have recently brought that part of the world prominently into the news broadcasts, and the unhappy announcers have apparently worked hard to learn what they suppose to be the modern Arabic pronunciations of local place names. Biblical place names, of which an accepted pronunciation has been familiar to listeners here for generations, suddenly take on a complete disguise at the whim of a B.B.C. announcer, and Palestine becomes a strange and unknown land.

Lack of Uniformity

If the announcers would only agree amongst themselves we might be more inclined to excuse them, but when on the same night different announcers refer to what we believe to be the same place with widely different pronunciations it is time to protest.

In our view, "usage" should be the guiding rule in all matters of pronunciation by the B.B.C. If there is an

accepted pronunciation understood by the majority of listeners, there is surely no occasion for the B.B.C. to step in and devise some new one which, because it is not familiar, will only jar upon the ears of listeners.

The ideal literary style is one which conforms to "usage," and no better guide could be found in matters of pronunciation.

Whenever the B.B.C. is in doubt as to what is the recognised pronunciation, it should only be necessary to consult one or two regular travellers in the district in question, such as ship's pursers, and abide by their decision.

Broadcast Propaganda

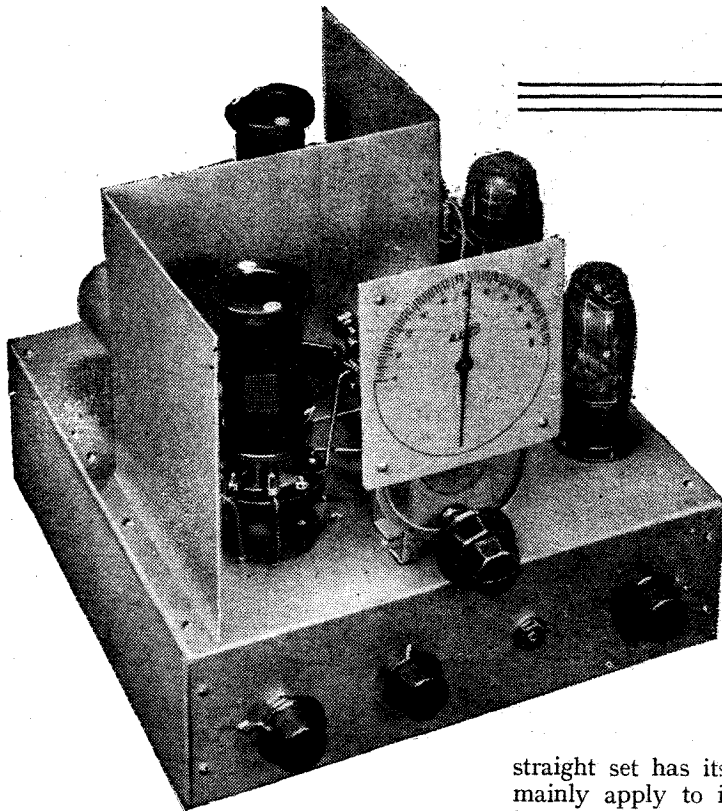
An Offensive Weapon

THERE are many who believe that wars of the future will be decided, not on battlefields, but through the agency of psychology, depending upon which nations best succeed in withstanding the effects of subtle enemy propaganda directed to undermining public morale at home until a state of panic results. The only instrument which could effectively put over propaganda of this kind to other nations is broadcasting. It would be possible, of course, to prohibit broadcast reception and confiscate receivers, but this would not be resorted to because the service of broadcasting at home would be too valuable an instrument to discard.

Perhaps the real solution would be that mutual jamming would be indulged in on such a scale that broadcasting as a means of communication would virtually cease to exist so long as hostilities continued.

Short-Wave

A VERSATILE RECEIVER COVERING A



THIS receiver has been designed to meet the requirements of all short-wave listeners and provision is made for CW as well as for telephony reception, also for the use of headphones or a loud speaker. The possibilities of being able to extend its usefulness to cover a part of the ultra-short-wave region will appeal to those listeners interested in the eight-to-ten-metre band.

By H. B. DENT

IF there is one field in which the straight set can still be said to be really worth while, it is on the short waves. Though it may lack the advantages of AVC and the high adjacent channel selectivity of the superheterodyne, it is far more flexible, for without elaboration it can be used either for CW or for telephony reception, as every set of the type will, as a matter of course, have reaction.

Its sensitivity, and incidentally its selectivity, is not easily measured, since by critical adjustment of the reaction very weak signals can be brought up to good audibility, while usually the signal-to-noise ratio is particularly good, a most valuable

feature if headphones are used more often than a loud speaker.

Of course, the straight set has its limitations, but these mainly apply to its performance on the loud speaker and for broadcast reception, for it is not practicable to employ AVC in a set with reaction and a leaky grid detector.

Although one of the advantages of this type of receiver is its comparative simplicity, the writer is definitely in favour of including an HF stage, even though this valve may not contribute much to the overall amplification, such as would be the case were an aperiodic HF amplifier with an untuned grid, or aerial, circuit adopted.

The inclusion of even an aperiodic HF stage considerably simplifies the handling of the set, as by interposing a buffer valve between the aerial and the detector circuit

reaction is much smoother, while hand-capacity effects are almost entirely absent, provided, of course, the usual precautions are taken to keep the HF currents from reaching the LF amplifiers. Quite simple filters, such as condensers and an HF choke, or a resistance, are usually quite efficacious, especially when a metal chassis and panel are employed.

While it is undoubtedly useful, an aperiodic HF stage is a wasteful way of employing a valve, so it was decided in this four-valve model to make the valve do more useful work apart from merely isolating the aerial from the detector stage.

Its contribution to the sensitivity is definitely worth having when it is operated in the customary manner with both input and output circuits tuned, and even on the ultra-short wavebands, or at least as far down into this region as the set extends, a useful gain is obtained.

This set was not designed primarily for ultra-short-wave reception, but for the

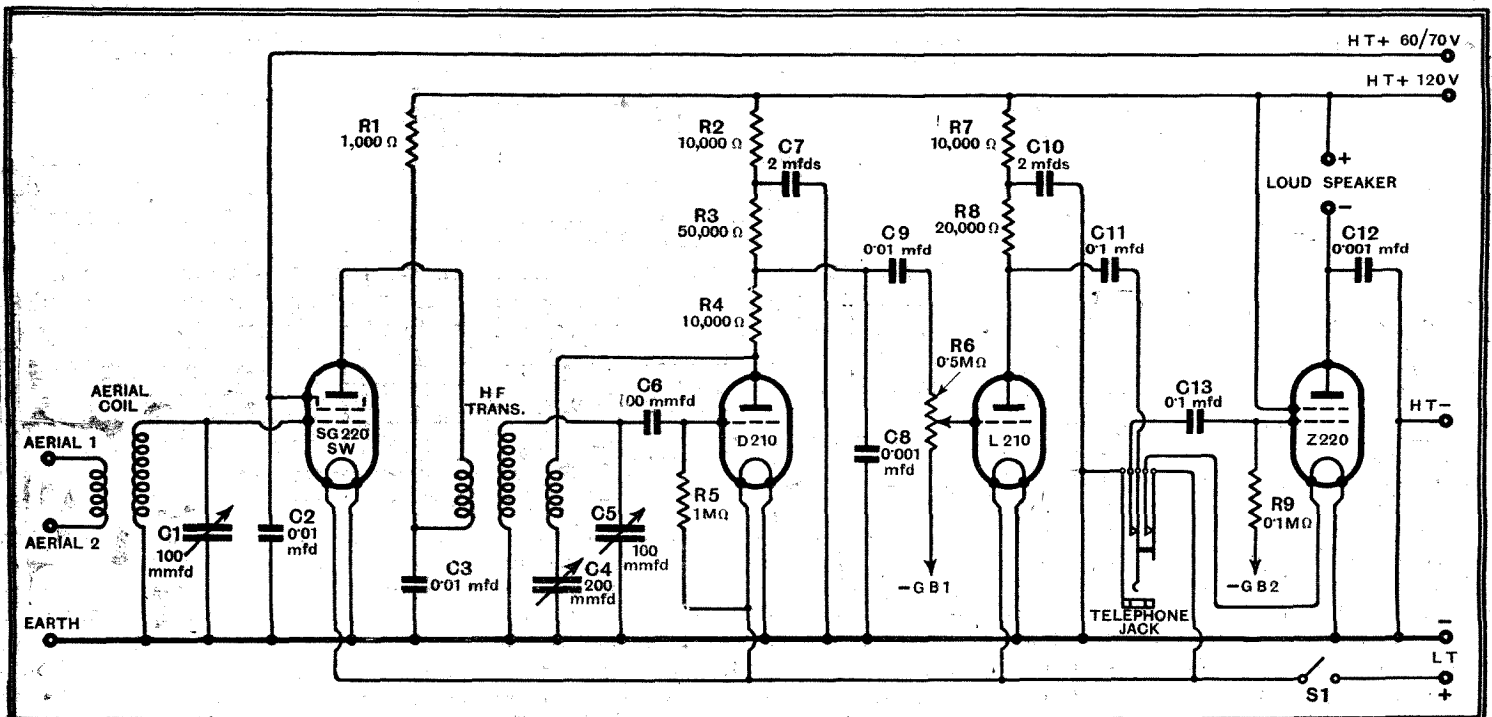


Fig. 1.—Theoretical circuit diagram of the receiver in which provision is made for the use of headphones or a loud speaker.

Battery Four

WIDE RANGE WITH PLUG-IN COILS

normal short-wave bands, though, while in the experimental state, care was given to the layout and the choice of the com-

tion on the lowest range. As it is, reaction is possible only by very tight coupling between the various windings, but this matter will be dealt with later. Tuning is not at all critical, and demands no more than the usual care in handling a short-wave set.

Now as regards the unusual features, the most prominent is the inclusion of an LF volume control. It may be thought a redundant fitting, since reaction mainly governs the sensitivity. On all but

phones, is such that many CW signals are overpoweringly strong; the writer has always made a point of including an LF volume control in all sets of this type used for DX listening, and has found it to be invaluable.

The other special feature is the provision of a jack-switch, which, when the telephone plug is withdrawn, brings an additional LF amplifier of the power type into circuit for operating a loud speaker. One LF stage is ample for headphone reception; furthermore, with two such amplifiers the receiver becomes very responsive to jolts and jars, and is by no means comfortable to handle.

Adequate Sensitivity

That three valves—HF, detector, and LF—are quite sufficient for this type of listening will be readily appreciated by the fact that during the maiden voyage of the *Queen Mary* the broadcast matter from the ship was followed clearly on all occasions on the 22-metre wavelength, and a very poor aerial was employed into the bargain.

No doubt the inclusion of two condensers, C11 and C13, in series in the grid circuit of the output valve would give rise to some comment were their functions not described. The telephone jack was connected in the manner shown to enable it to be fixed to a metal panel without the need for in-

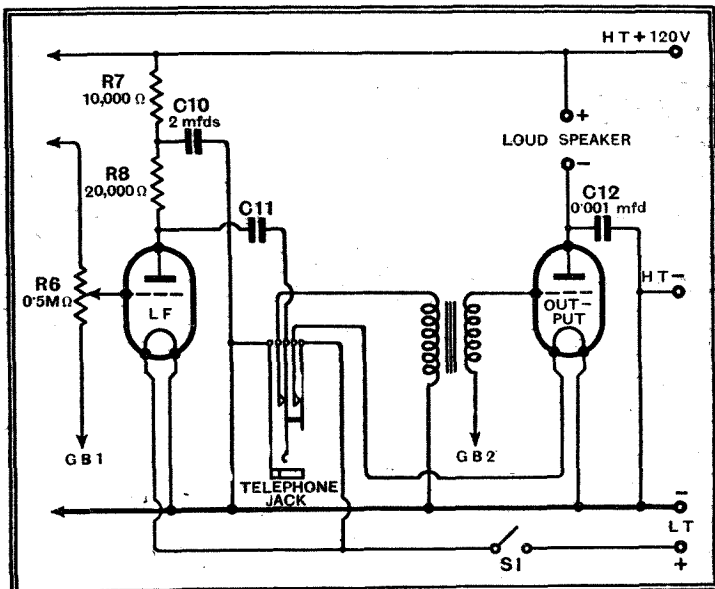


Fig. 2.—Suggested alterations in the circuit to include a triode output valve and a parallel-fed LF transformer.

ponents so that it could be brought down to below 8 metres, as there are several interesting signals in this region.

As a matter of fact, it was found subsequently that, having allowed a generous overlap on the lowest range of the commercially made plug-in coils, the pair made specially for this receiver took the tuning down to 7.4 metres.

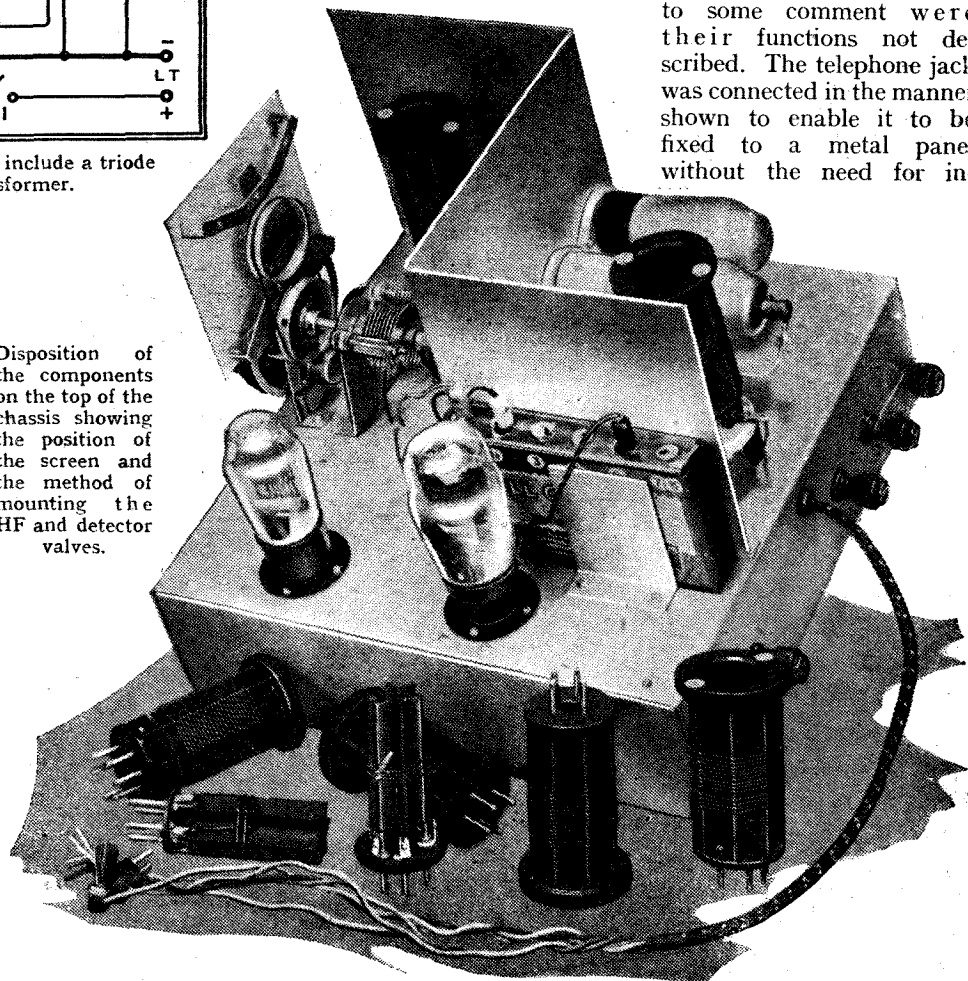
The Circuit

It might perhaps be best, before proceeding farther, to study for a moment the circuit diagram shown in Fig. 1, as there are a few features, not actually novel, but unusual in a set of this type, while some that one might expect to see are omitted.

Let us deal first with the omissions. Some may criticise the absence of band-spread tuning, but there are two reasons why it is not included in the set under discussion. First, the tuning condensers are only about two-thirds the usual capacity, i.e., 100 as compared with 150 or 160 mfd., and, secondly, the additional minimum capacity introduced by including band-spread units would have prevented extending the scope of the set to cover the ultra-high frequencies.

Even with the stray capacities pared down to the bone, each of the ultra-short-wave coils has only two and a half turns on a one-inch diameter former, and anything less than this would almost certainly preclude obtaining satisfactory regenera-

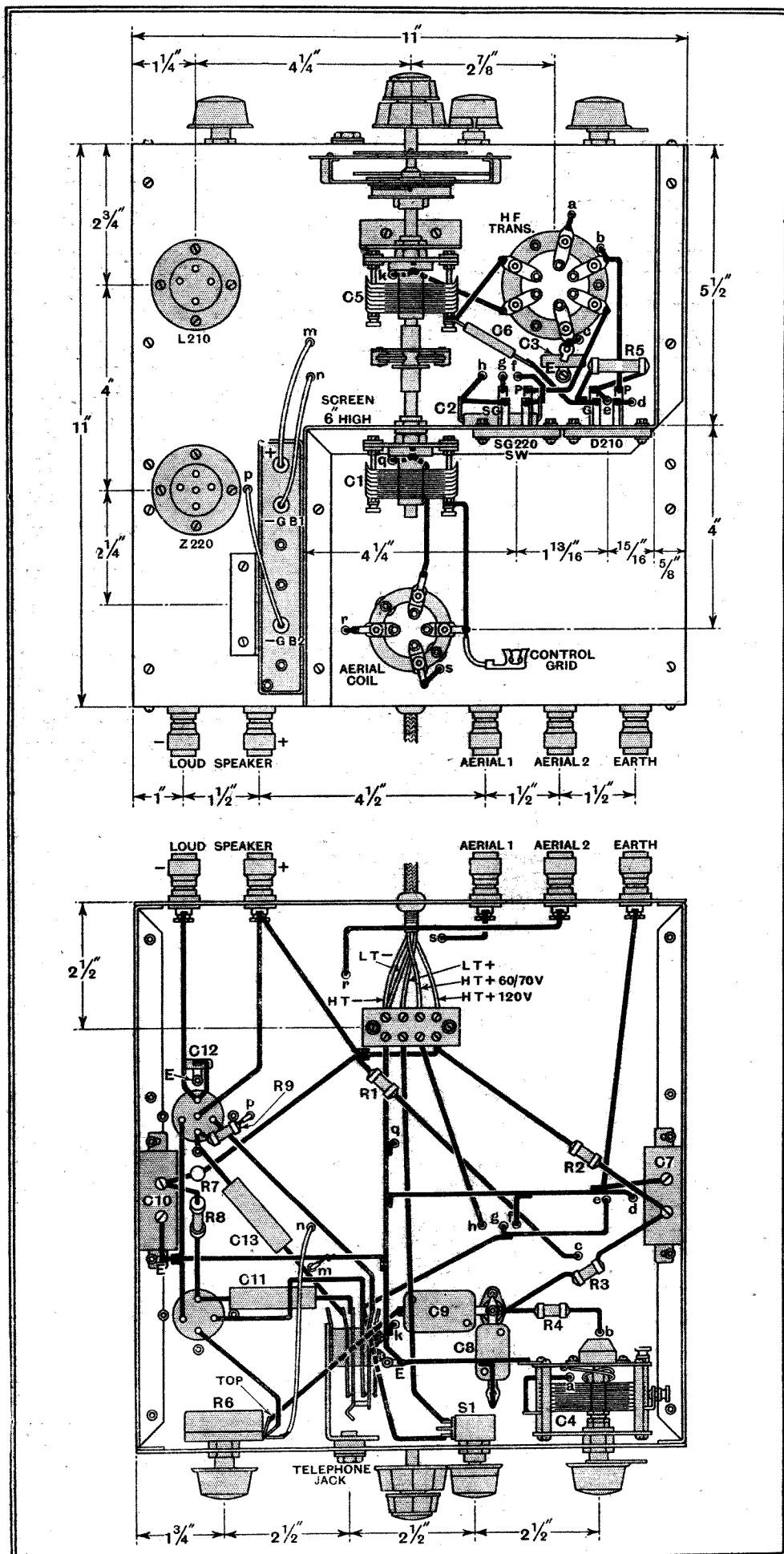
Disposition of the components on the top of the chassis showing the position of the screen and the method of mounting the HF and detector valves.



very strong telephony or broadcast signals, this is so, but as the set is designed for general use and for the DX enthusiast, as well as for the BCL (if we may be permitted to use this contraction for the broadcast listener), the receiver is going to be operated for much of its time in an oscillating state, and, when oscillating, the sensitivity, even on three valves and head-

ulating brushes. While in theory the idea is quite sound, in practice there is a momentarily earthing of the grid of the output valve as the plug is inserted and before the contacts separating C11 and R9 open. The grid battery is accordingly short-circuited for a moment and the output valve is operated without grid bias, and, as this might prove detrimental to

Short-Wave Battery Four—



Dimensional details for the layout of the components above and inside the chassis together with all the wiring connections.

the valve, and definitely harmful should the jack be left in so that it maintains the short circuit, condenser C13 has been introduced as a safeguard.

One other departure from accepted practice is the use of a 10,000-ohm resistance in place of the more orthodox HF choke in the anode circuit of the detector valve. This was found to be particularly effective on the short waves, being quite a good

LIST OF PARTS

- 2 Variable condensers, 100 mmfds. C1, C5.
Eddystone "Microdenser" 900/100
1 Flexible coupler Eddystone 1009
1 Condenser drive, two-ratio
B.T.S. Type TRA/WW.

- 1 Slow-motion reaction condenser, 0.0002 mfd. C4.
Polar "QJ"

(B.T.S., Eddystone)

Fixed condensers:

- 2 2 mfd., 300 volts DC working C7, C10
T.M.C. 30
2 0.1 mfd., tubular, 350 volts DC working C11, C13
T.C.C. 250
3 0.01 mfd. C2, C3, C9
T.C.C. "M"
2 0.001 mfd. C8, C12
T.C.C. "M"
1 0.0001 mfd. C6
T.C.C. "M"

(Dubilier)

Resistances, 1/2 watt (with wire ends)

- 1 1,000 ohms R1 Ferranti
3 10,000 ohms R2, R4, R7 Ferranti
1 20,000 ohms R8 Ferranti
1 50,000 ohms R3 Ferranti
1 100,000 ohms R9 Ferranti
1 1 megohm R5 Ferranti

(Bulgin, Erie)

- 1 Volume control, graded, 0.5 megohm (without switch) R6
Polar-N.S.F.V/4

(Bulgin; Erie, Ferranti)

- 1 Switch, rotary, single pole, on-off

Bulgin S91

- 2 Valve holders, 4-pin (without terminals)
Clix Short-wave Chassis Mounting Type V5

- 1 Valve holder, 4-pin (without terminals)
Clix Chassis Mounting Standard Type VI

- 1 Valve holder, 5-pin (without terminals)
Clix Chassis Mounting Standard Type VI

- 3 Plug-in coils, 6-pin B.T.S. S2, S3 and S4

- 3 Plug-in coils, 4-pin, 12 to 94 metres

B.T.S. Type E

- 1 Coil holder, 6-pin, baseboard type B.T.S.

- 1 Coil holder, 4-pin, baseboard type B.T.S.

(Eddystone)

- 1 Five-spring automatic jack B.T.S.

- 1 Universal plug B.T.S.

- 1 Connector, 4-way Bryce Light Pattern

- 1 Battery cable, 5-way, 30in. with wander plugs and spade ends
Belling-Lee

- 1 Grid bias battery, 9 volts

- 5 Ebonite shrouded terminals, A (2), E, LS+

- LS- Belling-Lee "B"

- 1 Midget stand-off insulator Eddystone 1019

- 3 Wander plugs Eelex

- Chassis, aluminium 11x11x3in. C.A.C.

- Screen, aluminium 18x6 1/2in. C.A.C.

- Brackets for condensers and bias battery

- C.A.C.

Miscellaneous:— Scientific Supply Stores

- 4 lengths systoflex, 2 ozs. No. 18 tinned copper wire. Ebonite pillars and 6BA studding for valve holder supports. Screws: 6 4BA 1/2in. r/hd., 2 4BA 3/4in. r/hd., 2 6BA 1/2in. r/hd., 42 6BA 1/4in. r/hd., all with nuts and washers.

(Peto-Scott)

Valves:—

- 1 Hivac SG 220 SW; 1 Hivac D 210 metallised; 1 Hivac L 210 plain, or Marconi or Osram L21, or Mazda L2, or Mullard PM2 DL; 1 Hivac Z 220 or Marconi or Osram PT2, or Mazda PM 220A, or Mullard PM22.

Short-Wave Battery Four—

HF filter, and as it has a practically constant HF impedance at all frequencies it makes for smooth reaction over the whole waveband.

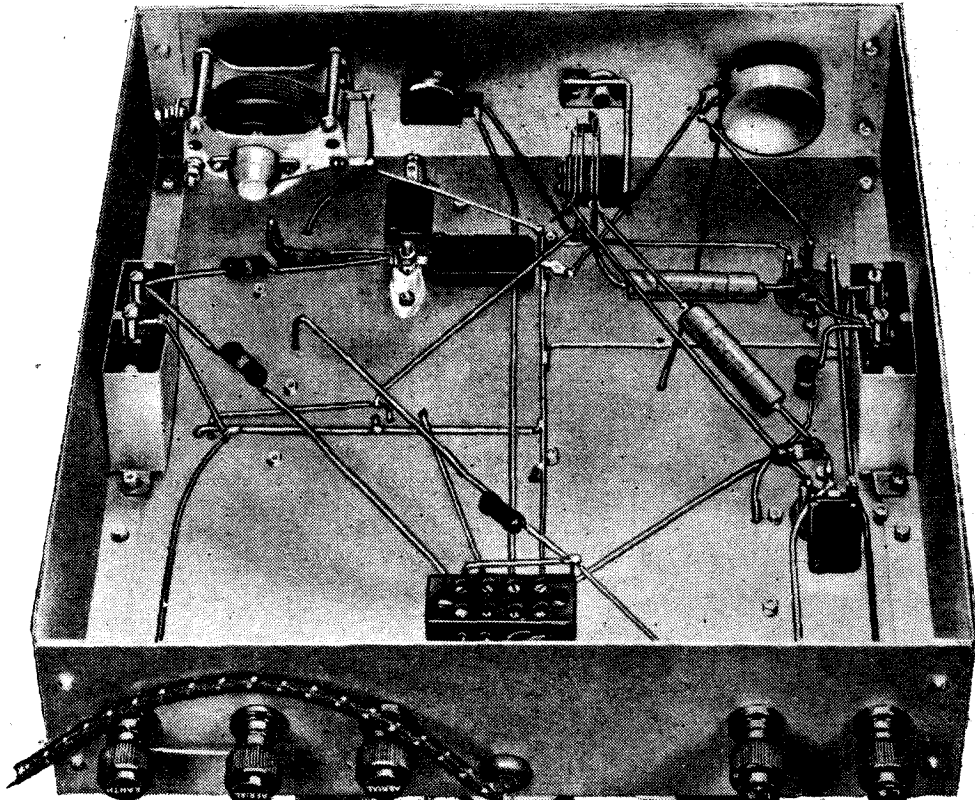
Referring to the circuit again, it will be observed that the output valve is shown by the symbol for a tetrode, or screen grid valve. The Hivac Z220, which was employed, is, indeed, a tetrode, but by critical spacing of the electrodes its characteristics resemble a pentode, but it also possesses some of the features of a triode. Of course, either a pentode or a triode could be employed in this position; with the former no alteration will be needed in the circuit, though an adjustment of its grid bias may be necessary. In the case of a triode, however, it will usually be found advisable to substitute an LF transformer—one with a 1:3 ratio will do—for the resistance-capacity coupling, and as this component should be parallel fed the only alterations necessary will be to rearrange that part of the circuit shown in Fig. 2. The extra grid condenser, C13, is now no longer required.

Aerial Circuit

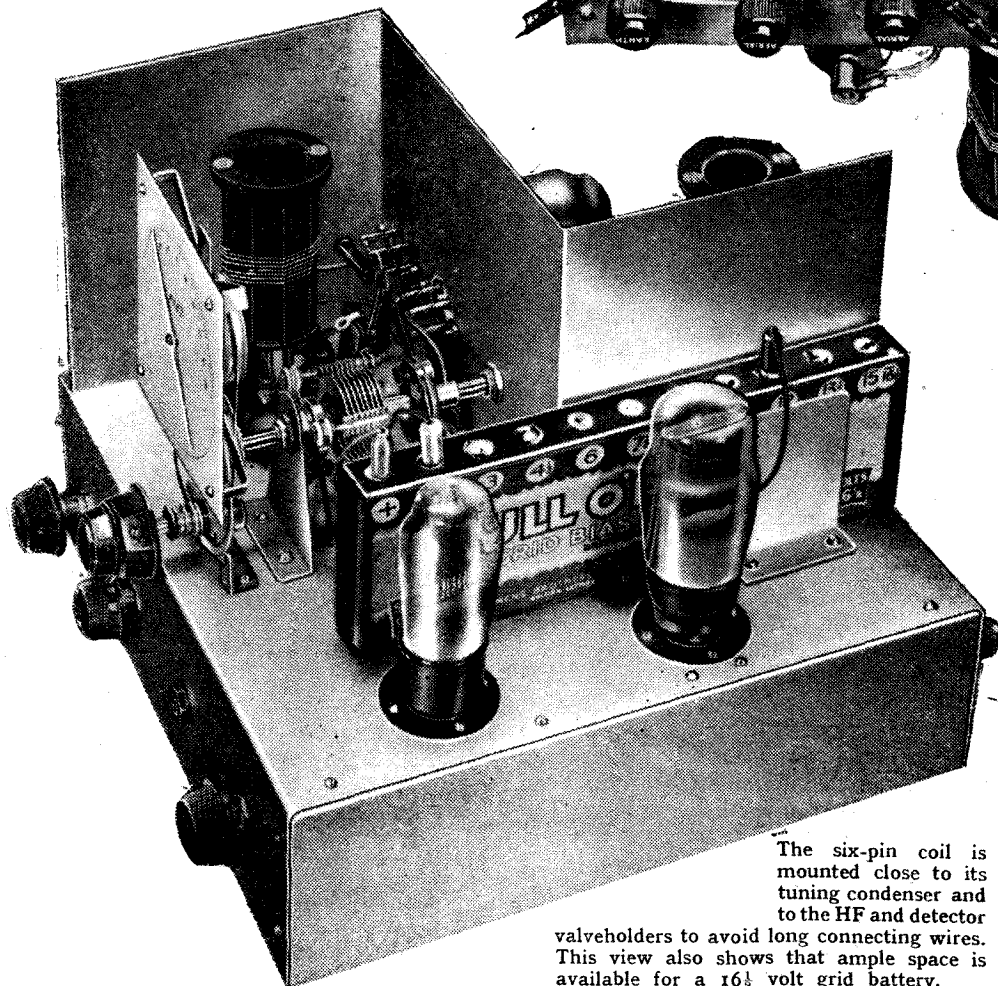
It will be noticed that two aerial terminals are provided, while neither end of the aerial winding is earthed. This is done to enable the receiver to be used, if desired, with an unearthed aerial of the

The layout of the HF and detector stages in this set has had to be arranged with some care, since it was proposed to include an ultra-short waverange. In order to keep the important leads short, the coil holders are mounted on short

A screen grid valve with a top grid connection, the Hivac SG220 SW, was chosen for the HF stage, and it is mounted horizontally to bring its grid and anode connections reasonably close to the coils. It was also found convenient to mount the



The underside of the chassis accommodates the reaction condenser, telephone jack, LF volume control and most of the smaller components, also the bulk of the wiring.



The six-pin coil is mounted close to its tuning condenser and to the HF and detector valveholders to avoid long connecting wires. This view also shows that ample space is available for a 16½ volt grid battery.

detector valve, a Hivac D210, in the same manner.

Special brackets are not required for the valve holders, as they are fixed to the vertical screen separating the aerial and HF circuits. This screen supports also the aerial circuit tuning condenser, C1, which is ganged by a flexible coupler to the HF circuit condenser, C5, the latter being mounted on a small aluminium bracket as shown in the illustrations.

The constructional work generally is quite straightforward and does not call for further comment; the drawings and illustrations show that every component is accessible, and the wiring is quite easily followed.

It might be of interest to mention, however, that ample space is allowed for either a 9- or a 16½-volt grid battery, and some of the illustrations show the one and some the other size, so that if an output valve requiring the higher value of grid bias is employed, the method of accommodating the larger battery will be understood.

If the layout and wiring of the receiver is closely followed, there should be no need to take any precautions in lining up the circuits, other than to make sure that

type that employs feeders. When used with an orthodox aerial the earth and the adjacent aerial terminal are joined together.

ebonite pillars; 7/8 in. in the case of the aerial coil, and 3/4 in. for the HF transformer, as their respective coil bases differ in height by about 1/4 in.

Short-wave Battery Four—

the flexible coupler is secured to both condensers and that at the maximum capacity setting both sets of moving vanes are fully and identically meshed with the fixed vanes of both condensers. It is advisable to examine the fixing of the dial to ensure that its full-scale position coincides with the maximum capacity of the condensers.

Initial tests should preferably be made with headphones, as the more intimate association that this gives with the set enables its handling and operation to be judged to the best advantage. Before switching on, however, it is essential to ensure that the LF volume control is at maximum, i.e., rotated as far as it will go in a clockwise direction, and that the reaction condenser — left-hand knob below the chassis—is set to minimum capacity, i.e., anti-clockwise rotation.

In tuning the set always advance the reaction condenser slowly, and oscillation will be indicated by a faint "plop" and a slight hiss. The most sensitive state is when the detector is feebly oscillating, so that the reaction control should always be adjusted accordingly when searching for stations.

The HF stage forms a sufficiently good buffer to prevent these oscillations being radiated from the aerial, and the set may therefore be operated in this state without interfering with other nearby short-wave listeners.

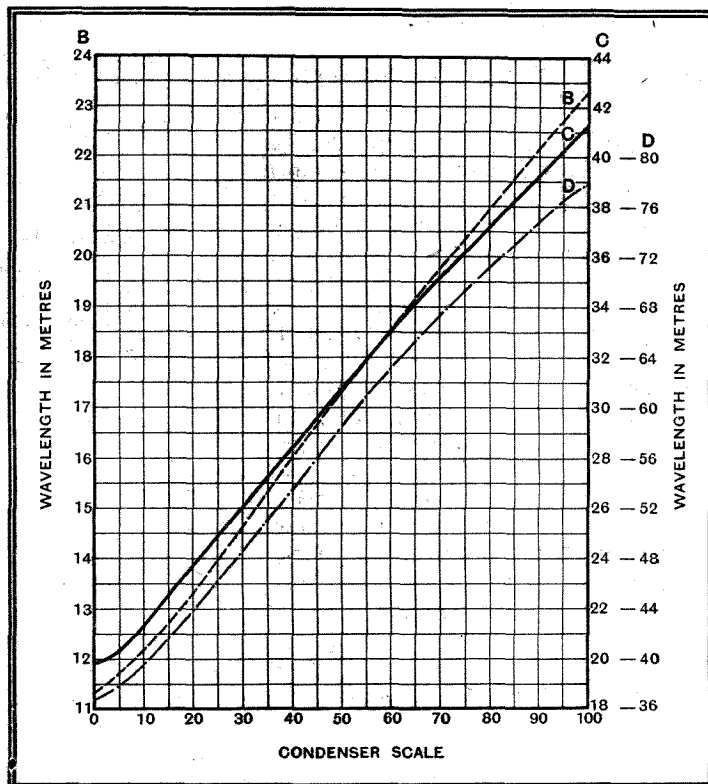
The set of B.T.S. coils used in the receiver gives a tuning range of from 11.3 metres to 77.8 metres, their respective coverages being 11.3 to 23.3, 19.8 to 41.2, and 36.6 to 77.8 metres, so that there is an adequate overlap between each range.

A set of curves has been prepared, and for convenience they are plotted on a single graph. It should be noted that the wavelength scales are different for each, so it might be advisable to replot them on separate sheets after a few tests have been made to verify the fact that the tuning of the set agrees with the curves.

Should any discrepancy be noticed, it will most likely be found to take the form of a constant error, the true calibration being either displaced to the right or to the left. However, the curves given here will serve as a useful guide and indicate where to set the condenser for any required station, so that only a small part of the scale will have to be explored to find that

station, assuming, of course, it happens to be working at the time.

Since plug-in coils are used, the scope of the receiver is not restricted to the wavebands already mentioned, but as coils for the higher bands are available the wave range of the set is considerably wider, though it is hardly to be expected that the performance on the broadcast bands will be entirely satisfactory, as such small tun-



Calibration curves for the three wavebands covered by the B.T.S. coils.

ing condensers are employed, and two tuned circuits are barely sufficient to cope with the conditions obtaining on these bands. Nevertheless, coils are available for those who require them.

If the suggested valves are used and operated correctly, incidentally the first LF stage will require $-1\frac{1}{2}$ volts grid bias, while the Z220 output valve with 120 volts HT should be given -6 volts; the total HT consumption will be 5.5 mA for headphone operation, i.e., with three valves, and 16 mA when the last stage is in circuit and a loud speaker is being used.

The total consumption on four valves can be brought down to about 10 mA or less if one of the economy-type pentodes or its equivalent is employed in the output stage.

Next week constructional details will be given of the ultra-short-wave coils, as these are not a standard size and have been designed especially for this receiver. The coverage on this range is 7.4 to 12.5 metres, thus overlapping the smallest of the B.T.S. coils used.

SOUND SALES TRANSFORMER

IN last week's issue the sub-title to the review of the Push-pull output transformer should have read 20-20,000 cycles response as given in the text of the test report.

Radio Interference**Measurements on Manufacturers' Products by the Post Office**

DURING the past few years a considerable amount of research work has been carried out by the Post Office Engineering Department into methods of suppressing radio interference caused by electrical machines and appliances. In addition, tests have been made on specimen machines, loaned by manufacturers, at the Post Office Research Laboratories and at the laboratories of the British Electrical and Allied Industries Research Association, and methods of elimination of radio interference have been devised and successfully applied. As a result of recent investigations, a remedy for interference caused by most types of apparatus can now be recommended.

The International Committee on Radio Interference has laid down certain standard values to which radio interference should be reduced. The Post Office, we are advised, are therefore desirous of recommending to owners and manufacturers of electrical products suppressors for general application to all types of apparatus, which will reduce the disturbance to the agreed value. With this end in view, manufacturers throughout the country are being approached by the Post Office for facilities to carry out tests on their products at their works.

The tests will be commenced shortly by a trained staff of the Post Office Engineering Department who will be equipped with the necessary measuring apparatus.

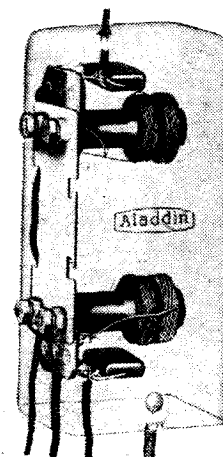
IF Transformers**American Development**

THE use of powdered-iron for the cores of IF transformers has long been common in this country, but it has not been at all widely applied in America. Iron cores are used in the new Aladdin transformers however, and instead of the usual trimming condensers the cores are made adjustable.

Efficient wave-wound coils are used and tuned by fixed mica condensers. Each core is, however, made adjustable by means of a screw so that exact trimming can be carried out. It is claimed that the elimination of the trimming condensers renders the characteristics of the transformer much more constant in that they are not affected by humidity, vibration or temperature.

In addition to the two-circuit transformer illustrated, a type embodying three coils is also available. The three-coil type has one coil movable by an external control for variable selectivity purposes. The three coils are contained in a single can, and a very compact design results.

In addition to the two-circuit transformer illustrated, a type embodying three coils is also available. The three-coil type has one coil movable by an external control for variable selectivity purposes. The three coils are contained in a single can, and a very compact design results.



Aladdin two-circuit IF transformer.

"Feelers" for Ships

NEW MICRO-WAVE EQUIPMENT DESCRIBED

ANY device which may serve to increase the security of ocean travel deserves special notice, and the micro-wave apparatus described here seems to offer great possibilities in this field. Information has only just been released regarding this new development.

WHEN the wireless equipment of the s.s. *Normandie* was first described, mention was made at the time of a special safety device which had been installed, which enabled the vessel to discover the presence of an obstacle in its path, such as an iceberg or another vessel which, by reason of fog or other obstruction to vision, might otherwise not be detected.

No particulars were disclosed as to the nature of this device, and only a bare reference to it could be made in *The Wireless World* of November 8th, 1935. We are now able, through the courtesy of the Société Française Radio - Electrique, who were responsible for the wireless equipment of the *Normandie*, to give an account of this "feeler" equipment which makes use of the properties of micro-waves in a novel manner, and is known as the S.F.R. obstacle detector.

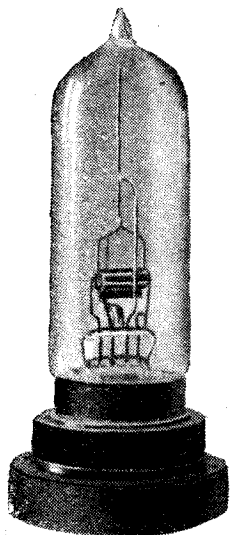


Fig. 1.—The special valve which incorporated the antenna within the glass container.

Principle of Detection

The device is dependent upon the property possessed by micro-waves that they are reflected from a solid object. The exact nature of the object, whether a conductor or an insulator, does not appear to matter. If, then, a micro-wave transmitter sends out a beam which strikes an obstacle, reflection of the beam takes place, so that it can be picked up by a receiver which may be located comparatively near the transmitter, provided that precautions have been taken to prevent any direct reception of the transmitter at the receiver. If there is no obstacle in the path of the transmitted beam no reception is obtained at the receiver, and it is only when some obstacle is encountered that the reflected energy is picked up at the receiver.

This explains very briefly the basic principle of the apparatus, but the next point

to be considered is how it is possible to locate the obstacle and estimate its distance from a ship. A wavelength of the order of 16 centimetres is used, giving the advantage that it is possible to concentrate a very sharp beam of only a few degrees with small-sized reflectors. This makes it possible to tell the direction of the obstacle to within a very few degrees. The distance of the object from the transmitter and receiver can be calculated by treating the line between the transmitter and receiver as a base and rotating the reflector at the receiver through a few degrees until maximum signals are obtained. Then, knowing the angle of the reflectors, both of the transmitter and receiver to the base line, lines drawn through these angles to form a triangle with the base will intersect at a point corresponding to the distance of the obstacle from the ship.

The Apparatus

The 16-centimetre waves generated at the transmitter are modulated at 7,500 cycles. The valve used as the source of oscillations is of a special type, and is

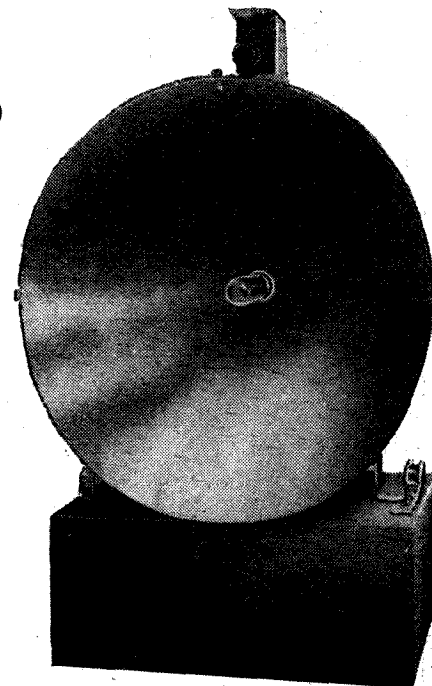


Fig. 2. The valve mounted within the reflector.

is transmitted to a quarter-wave antenna 4 centimetres in length, and this is tuned to the wavelength generated, and is located inside the glass bulb of the valve, as the illustration shows. This valve is placed inside a parabolic reflector 75 centimetres across. Fig. 2 indicates how the valve is mounted within the reflector.

The transmitted beams have been experimentally plotted, with the results shown in Fig. 3.

The receiver is placed as far as is conveniently possible from the transmitter, in order to have as long a base line as possible and to assist in preventing direct pick-up by the receiver. The receiver incorporates a similar valve to that of the transmitter, but in this case operating as a detector. The receiving antenna is placed as before, within the glass container of the valve, and the whole included in a similar parabolic reflector to that used in the case of the transmitter.

When a beam is reflected by an obstacle and reaches the receiver, the current detected is carried to an amplifier, and is received on earphones or on a visual indicator.

As soon as signals are detected, the reflectors, which are normally revolving automatically through about 40 degrees, are stopped and precisely directed for maximum received signals. It is then possible to make all

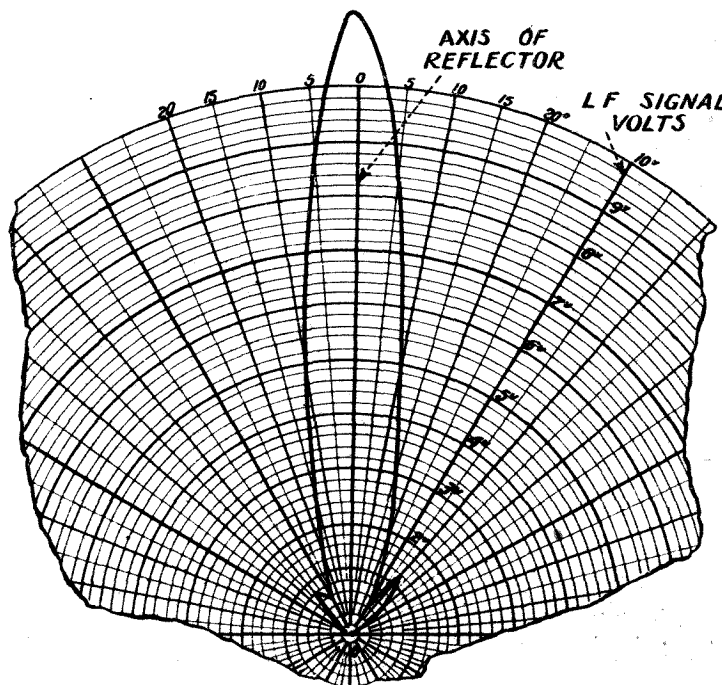


Fig. 3. Diagram indicating the nature of the radiated beam.

shown in Fig. 1. The grid is at a potential of 250 volts, and the plate is 70 volts negative in respect of the filament. The energy

"Feelers" for Ships—

the necessary calculations for obtaining bearings of the obstacle.

In some of the first tests carried out, the transmitter and receiver were placed on the side of a ship about 8 metres above the level of the sea, the distance between the transmitter and receiver being 6 metres. Tests along the coast enabled objects to be detected at a distance varying between 3 and 7 kms., the procedure being that the transmitted beams were

directed towards some point on the coast, and the reflector adjusted to maximum signals from the reflected beam. Later, distances up to 20 kms. were covered in this way, and reflections from passing ships were also obtained up to distances of the order of 7 kms.

The illustration, Fig. 4, shows the two reflectors of the obstacle detector mounted on the s.s. *Normandie*. The photograph was taken in New York outer harbour during tests.

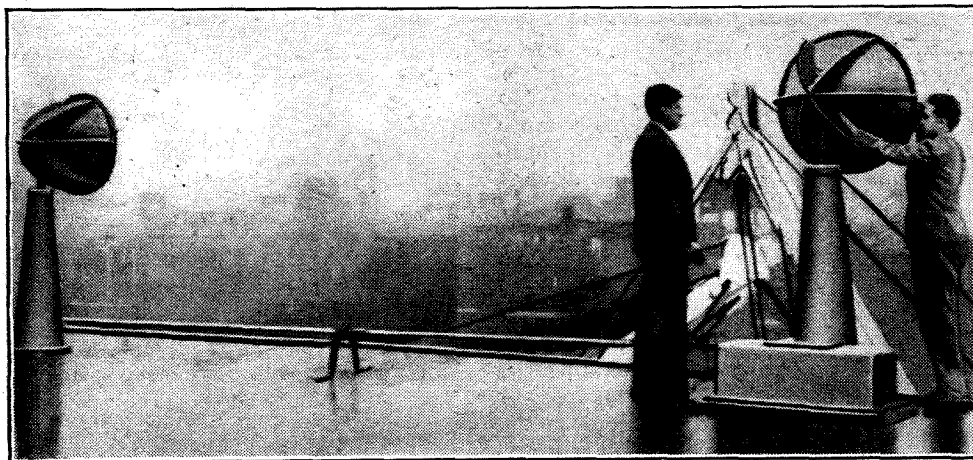


Fig. 4.—The transmitter and receiver mounted on the deck of the s.s. "Normandie."

SOUND DISTRIBUTION AT THE R.A.F. DISPLAY

New Public Address Equipment Installed at Hendon to Relay Operational Instructions to the Public

THIS year the sound-reproducing equipment at the Hendon Aerodrome for tomorrow's (Saturday) R.A.F. Pageant has been installed by The Marconiphone Co., Ltd., Radio House, Tottenham Court Road, London, W.C.1.

There is being used on this occasion a few new long-range loud speakers which are claimed to perform the function of three of the usual pattern, coupled with which particularly faithful reproduction has been secured.

A moving-coil unit with a permanent magnet fitted to a horn seven feet long is used, and in view of its special construction and characteristics the new model will be known as the Marconi Phase-corrected Sound Projector.

Very good reproduction is indeed obtained with the new model, for at a demonstration on the Aerodrome speech was clear and distinct some 600 yards away with about 5 watts of power in the speech coil. This by no means represents the limit of range which is stated to be about $1\frac{1}{2}$ miles.

We also noticed that the loud speaker had a very wide field of diffusion, and this should prove a valuable feature where a battery of these loud speakers are required to cover a wide area.

In addition to employing six of these new units, the Marconiphone Co. has installed a large number of their "short-horn" standard pattern at suitable vantage points.

This sound distribution system will be used to describe the principal points of each item on the programme, also to relay music

during the intervals as well as to distribute to all parts of the aerodrome the radio telephony transmissions between planes in the air and a ground station which this year is to be arranged in the form of a radio play, the movements of the five squadrons taking part being controlled by an Air Officer Commanding and his staff. The idea is to simulate in an interesting and novel manner the radio-telephony control of aircraft as it would be effected during actual operations.

H. B. D.

For Amateur and Professional

Wireless Servicing Manual. By W. T. Cocking. 213 pages, 90 photographs and diagrams. Iliffe and Sons Ltd., Dorset House, Stamford Street, London, S.E.1. Price 5s. net.

THE outstanding feature of this book is the very wide ground that it covers. The title might suggest that it was built up on the lines of some of the Service Manuals issued with commercial sets, and that it prescribed a series of routine tests with a view to the mechanical discovery of a fault. But the book is intended to provide guidance for fault-finding in sets of every type and class; such a method of approach would lead to impossibly complicated tables of tests, so that the writer has very wisely tackled his subject from quite a different angle.

Beginning with a description of the apparatus required for checking and adjusting a set—meters for currents and voltages and a test-oscillator are the chief—the book briefly, but very sufficiently covers the checking of voltages and anode currents, and points out very completely the deductions that can be made from these readings. The next chapter, on faults in valves, is the only one in the book that the reviewer feels in the least inclined to criticise; it is very brief, and suggests as the sole test the measurement of mutual conductance. But probably this is accounted for by the large amount of elaborate apparatus needed for a really complete series of tests on a valve, so that the serviceman would in any case have to fall back on the old and very effective trick of trying a new valve in the set.

All this is barely one-fifth of the book; the rest of it deals with the symptoms, cause, and cure of every kind of fault. It is particularly to be noticed that the treatment does not limit itself to finding the cause of breakdown in a set that has previously been satisfactory; the discussion is always broad enough to cover the localisation of a fault in a newly-built set, and to provide information as to the way in which the trouble can be overcome by a suitable modification in design. The book should, therefore, be every whit as valuable to the home-constructor and the amateur set-designer who tries to put his own ideas into practice as to the serviceman who knows the design to be sound, and has only to find which component has broken down. Even the professional designer will find within its covers a ready solution of many of his perplexities.

The treatment of the causes and cure of the various whistles likely to appear in a superheterodyne is particularly valuable, being both clear and comprehensive. The two tables which show the frequencies upon which each of the English stations can produce whistles should be extremely helpful in tracking down the mechanism by which such interference arises. Considerable attention is paid to the ill-effects of feed-back of IF harmonics from the second detector—a very important point that seldom gets the emphasis it deserves.

The difficult subject of ganging is dealt with in a particularly lucid and helpful way, every stage in the process of aligning a set, whether a "straight" set or a superheterodyne, being made clear in principle and explicit in practical detail. Though the serviceman is completely catered for here, the designer should note that little emphasis is laid on the possibility of incorrect coil-inductance, especially in connection with the superheterodyne.

Such obscure faults as modulation-hum, oscillation at a frequency controlled by a reaction winding instead of the tuned circuit, and the upsetting of ganging by wrong choice of value for a by-pass condenser are all discussed, together with their cures. There is, indeed, hardly any misbehaviour of a set, whether inherent in the original design or arising through the breakdown or deterioration of a component, the cause and cure for which cannot be found somewhere in the two hundred pages of this book.

The book winds up with three extremely useful appendices—a dozen pages of potted facts and figures—and an adequate index. Finally, it is to be hoped that the strictly professional implication of the title will not discourage the purchase of the book by the wide circle of amateur enthusiasts who would find it both interesting and useful.

A. L. M. S.

Current

Events of the Week

New Newspaper Transmitter

IN the various countries of America, including the U.S.A., several broadcasting stations are owned by prominent newspapers, and this practice appears to be growing. The latest addition to the ranks of newspapers which own broadcasting stations is the Brazilian evening paper, *A Noite*, which is reported to have placed an order with a prominent European firm for a high-powered transmitter.

Bulgaria on the Air

GREAT progress is being made in the construction of the new Bulgarian stations at Stara-Zagora and Varna, and even though the studios are not yet completed, listeners have already heard the natal cries of these transmitters. At present Bulgarian is the only language used by the announcers, but this is sufficiently akin to the tongues spoken in the neighbouring Slavonic countries to be understood over a wider area than Bulgaria itself. When the 100-kilowatt transmitter at Vakarel is built, probably French will be employed as an alternative language.

New French Television System

IN spite of the fact that it was turned down by M. Mandel, ex-P.M.G. of France, the direct television system of M. Henri de France is to have another chance for, according to reports received, the French Ministry of Marine has been greatly impressed by certain tests which have been made, and M. de France is now on board a cruiser making special experiments on behalf of the Ministry. He has for the time being apparently shelved his projected idea of taking his system to a foreign country.

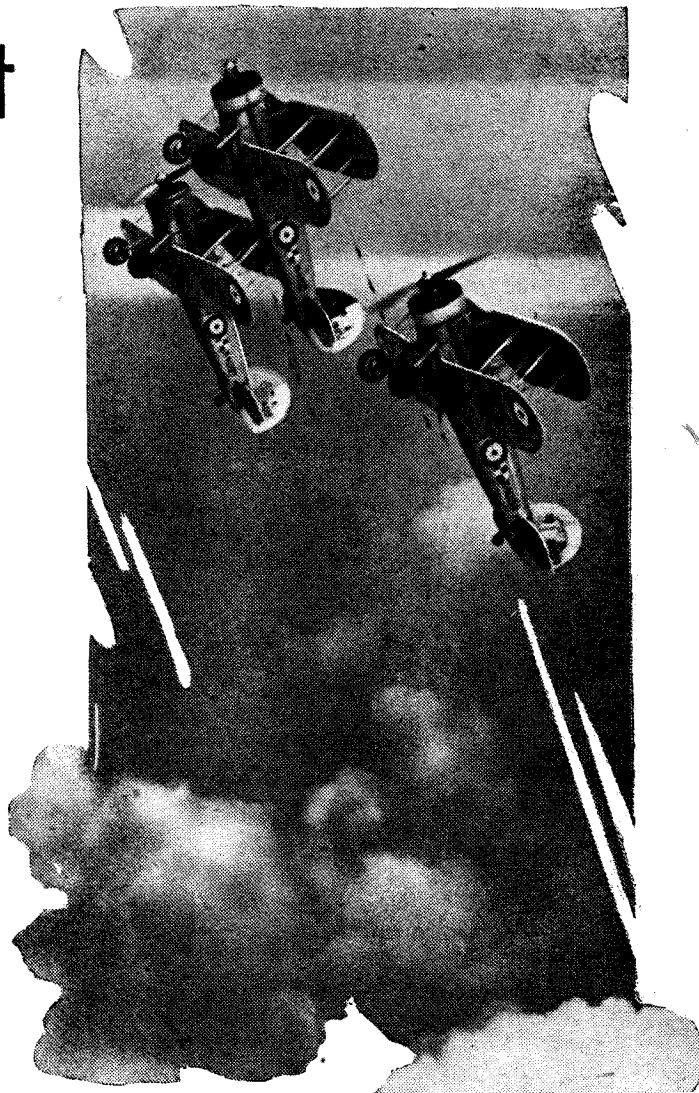
High Jinks in New York

TOWARDS the close of the present year the American N.B.C. will have been in existence for ten years, and we learn that already preparations are being made to celebrate the occasion in a befitting manner. It appears that special programmes have been arranged, both from home centres and from abroad. Comparatively few details are available at pre-

sent, however, but there is little doubt that, in the time-honoured words of the Mothers' Meeting report: "A good time will be had by all."

Special Radio Trains

THE French seem to have gone completely wireless mad as a result of the great revival of interest in broadcasting arising out of the reforms carried out by the Government. Several railways trains have now been completely equipped for the reception of broadcasting. In addition to the usual provision for reception in the compartments, it is reported that special coaches are to be attached to the trains for dancing purposes. These trains are to be mainly used for hiring by organised parties of excursionists. We cannot, however, imagine the most enthusiastic dancer wishing to indulge in his pastime in a swaying railway carriage. However, it takes all sorts to make a world.



Flight Photo.

"The flight will now make a half roll off the top of a loop." The public will hear the instructions of the Flight Commander to his co-pilots when they are rebroadcast on Saturday at the R.A.F. Display. The three Gauntlets of No. 19 (Fighter) Squadron seen in the photo appear to be heading straight for the Heavyside layer.

South African Wireless Receivers

A GREAT bid is to be made to popularise locally manufactured receivers, according to reports received from South Africa. A new receiver of home manufacture attracted a great deal of attention when exhibited recently in Johannesburg, and the radio manufacturing industry is expected eventually to take its place prominently among the commercial activities of the Union.

Moscow Television Service

GREAT activity in the matter of television is the order of the day in Moscow, and it is reported that Russian engineers are engaged in the erection of a high-definition television station designed to have a range of about twenty-five miles. This station is expected to be ready early next year, and will probably mark the commencement of a regular television service in the

Topics

in Brief Review

U.S.S.R. At present, as in many other countries, there are several transmitters working spasmodically, but there is apparently no really regular service.

Carthage Calling

THE voice of Carthage, which was so prominent among the nations of the world many centuries ago, will once more be heard, but in a different sense, if the project for building a high-power station near Tunis is carried into effect. Its opening will be a distinct challenge to the supremacy of its old rival which, from a wireless point of view, completely dominates that part of the Mediterranean at present, and may lead to a new Punic war of a type undreamt of by Hannibal and Fabius.

Worthy of Dickens

THE mentality associated with Government officials in France does not differ greatly from that of our own bureaucrats if a story concerning the French State Broadcasting Department is to be believed. According to this, a newly appointed director of a Government broadcasting station, finding his office cluttered up with a large number of useless documents, wrote to his chiefs in Paris asking if he could burn them. A few days afterwards the reply arrived: "Certainly burn them, but be sure to make copies of them first."

Who Invented the Superhet?

AS many people are aware, the superheterodyne principle of reception first made its appearance in 1917. For several years a fierce controversy raged concerning the identity of the inventor, rival claimants being the American, Armstrong, and the Frenchman, Lucien Levy.

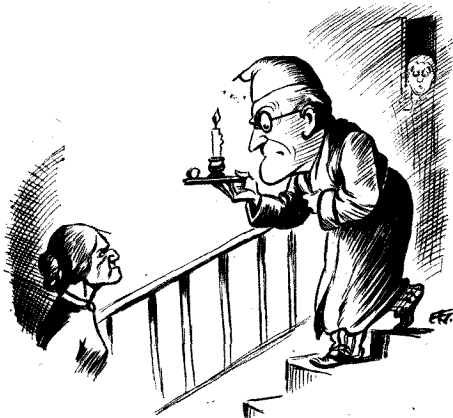
In some quarters the controversy still continues, although even the American authorities themselves long ago admitted the priority of Levy's claim. It appears from reports received from a French source that the American powers-that-be are, however, still reluctant to relinquish all the honours in this matter, for they have now announced that, as a result of investigations, it is clear that the invention was merely a practical development of the idea of heterodyne reception conceived by Fessenden ten years earlier.

UNBIASED

Trouble at Seaview

I SUPPOSE that at this time of the year many of you are engaged in delivering yourselves over to the rapacious hands of the seaside landlady. I should strongly advise those of you that can find room for it among the family luggage to take with you a good short-wave headphone portable set. It will at any rate help to pass away the weary night hours while you are tossing and turning on the hard and unaccustomed bed in the gloomy and morgue-like atmosphere of the average seaside bedroom.

Last year when, for the benefit of the younger members of my family, I did my annual penance away from home, and prepared to drink the waters of affliction for a couple of weeks, I was pleasantly surprised to find that over my bed hung a pair of phones. There was, I found, a pair of headphones and a volume control over each bed, these all being connected to a receiver in another part of the house. Before the shades of night fell on the first evening, however, I realised that the headphones would be of little practical use as the receiver did not cater for the short waves and, of course, the ordinary European stations have closed down long before I usually retire to rest when at the seaside.



Confronted by a grim face.

Even had the landlady's receiver catered for short waves, it would have been of little use as I discovered one evening when I retired early to rest owing to my foolishly ignoring my doctor's orders and indulging too freely in a whelk supper. Putting on the phones I whiled away the time by listening to the mournful strains of some wretched symphony orchestra when suddenly, at 10.30, the music ceased abruptly.

Hastily examining my phone-leads for a disconnection, and finding none, I emerged from the bedroom in order to go downstairs to see if a fault had developed

in the set. As I started to descend the stairs I found myself confronted by the grim face of the landlady coming up. In reply to a rather acid enquiry as to whether she could do anything for me, I stated my errand. To my surprise, she tartly informed me that I was a guest in a respectable household where the wireless was shut off promptly at 10.30. There was, of course, nothing for it but for me to retreat with as much dignity as I could command, and I flatter myself that I should have accomplished this without loss of prestige had I not had the misfortune to trip over the cord of my dressing gown and so precipitate myself suddenly and violently into the wrong bedroom.

By the time that I had been rescued by the scandalised landlady and my profuse



Well known at the bar.

of course, any of you who are well known at the Bar are willing to come to my aid.

My trouble is this. I have recently been assisting a young lady of my acquaintance to become familiar with the morse code in order that she may become a signals officer in some women's organisation which is apparently getting ready for the next war, although I should have

By FREE GRID

apologies accepted by an acidulous-looking fellow-boarder with her hair in curl papers, Mrs. Free Grid had arrived home and, in reply to the incredulous and enquiring raising of her eyebrows, explanations had to be begun all over again. Eventually heads began to appear in various bedroom doors and I finally retired in far greater confusion and disorder than that which fell to the lot of Mr. Pickwick in Ipswich without even having the comfort of the redoubtable and sympathetic Sam to see me safely abed again. And all this because I had neglected the elementary precaution of packing a short-wave portable.

A Delicate Situation

I HAVE been greatly disturbed in my mind since penning my remarks the other week in which I referred to the infringement of the Wireless Telegraphy Act by certain people on the promenades of our great seaside resorts who unwittingly make use of ether waves in the form of ocular oscillation in order to communicate their desire to become further acquainted.

The reason of my mental agitation is that I have, myself, I fear, been guilty of infringing the law in this manner, not, of course, by doing anything so vulgar as to interfere with the comfort of members of the opposite sex by winking at them. I have, however, I regret to say, been breaking not one but two fundamental laws of this realm, and I intend to take counsel's opinion upon the matter unless,

thought that it is an event for which women needed no preparation, as they always seem to be ready for it. As she lives across the valley I have found it very convenient to signal to her by morse lamp from my study window after dark, she being, of course, at the window of her bedroom.

Having read my remarks in *The Wireless World*, she is fearful that not only are we breaking the law by using ether waves for purposes of communication, but that in addition we are infringing the P.M.G.'s monopoly of message carrying, since we naturally do not confine ourselves to sending meaningless morse characters but are accustomed to eke out the tedium of the night by an exchange of social courtesies which we cannot very well send through the post owing to Mrs. Free Grid's regrettable habit of steaming open letters.

Being a great upholder of law and order and, at the same time, not being desirous of getting the young lady into the clutches of the law, my conscience is naturally very troubled over the matter, and that is why I am invoking the assistance of any of you who have legal knowledge. I trust that you will not fail me.

Thank You!

MANY thanks to those who sent me suggested solutions to the seaside mystery (June 19th, 1936). A "bandsman" signing himself "Fairplay to the Public" has, however, revealed the truth to me, and I hope to deal with it in an early issue.

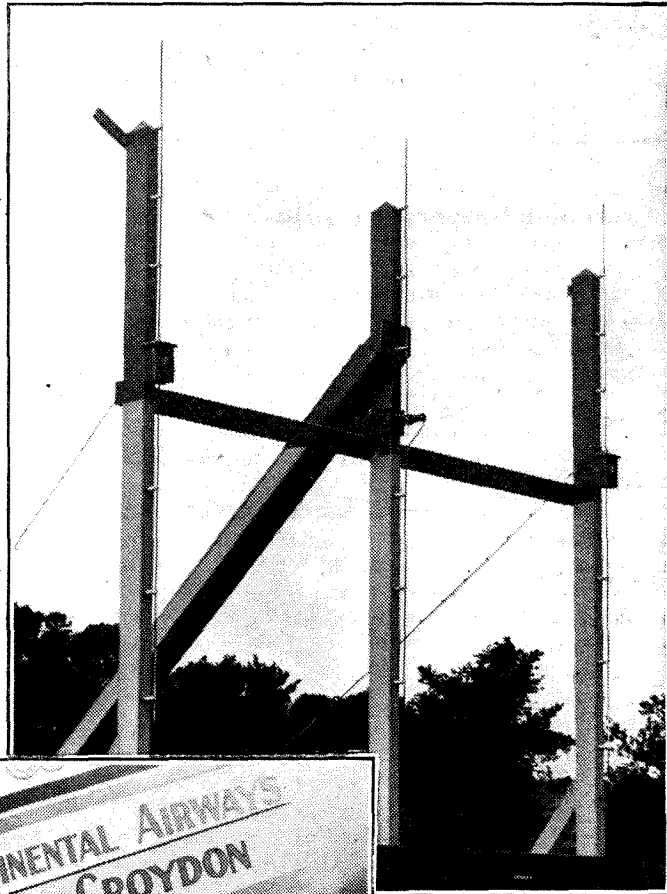
Landing Aircraft by Sound

A DEMONSTRATION
OF THE LORENZ
BLIND LANDING
SYSTEM

IN our issue of April 5th, 1935, we gave a full description of the Lorenz blind landing system for aircraft as installed at several Continental airports and for which ultra-short-wave beacon transmitters are employed. For the purpose of demonstrating the system in this country, a British Continental Airways D.H. 86A aeroplane was fitted with the receiving equipment while the ground transmitters were installed at the Heston airport.

On this occasion only the approach, or horizontal, navigation of the aeroplane on approaching the airport, and assuming bad visibility, was demonstrated since this can be effected by aural signals in headphones and lent itself best for this demonstration.

The machine was manoeuvred in the air to cross the approach path to the airport;



Arrangement of the aerials of the main beacon transmitter at the airport.

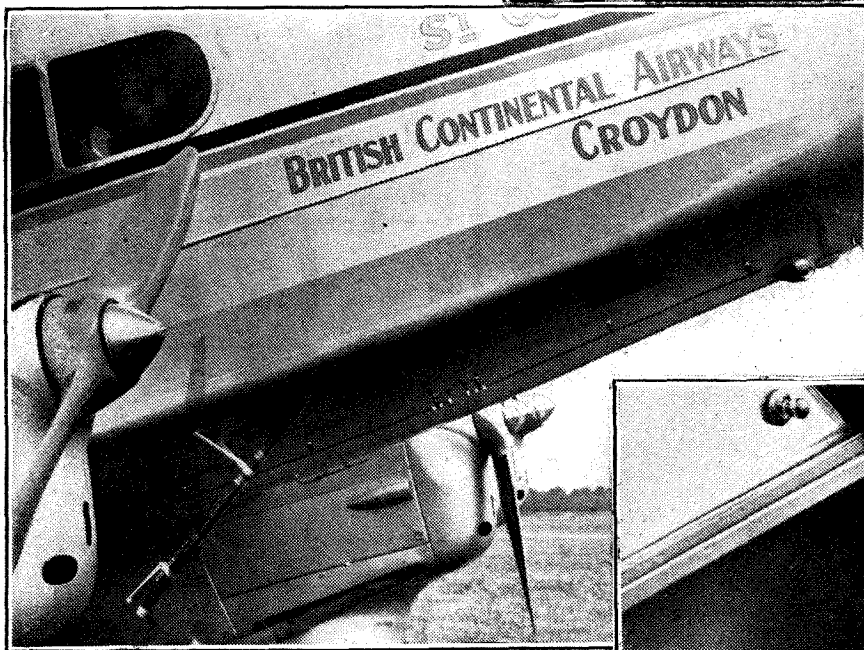
beacon is heard when about 450 yards from the landing ground and its signals are a series of high-pitched dots. They are of short duration only, the first marker beacon being audible for about six seconds and the final one for about eight seconds. They are heard superimposed on the guiding signal.

No account was taken on this occasion of the glide path for actually landing the machine, as visual indicators are relied on for this purpose.

Incidentally, in the Lorenz equipment visual indicators are included also as a check on the aural signals both for approaching the airport and on passing the two marker beacons.

The aeroplane was fitted with two aerials, one above the cabin and not shown in the illustrations, for receiving the main beacon, and one below adjusted for the marker beacons. Remote control of the receiver is provided, and the visual indicators are embodied in a single unit mounted on the instrument panel.

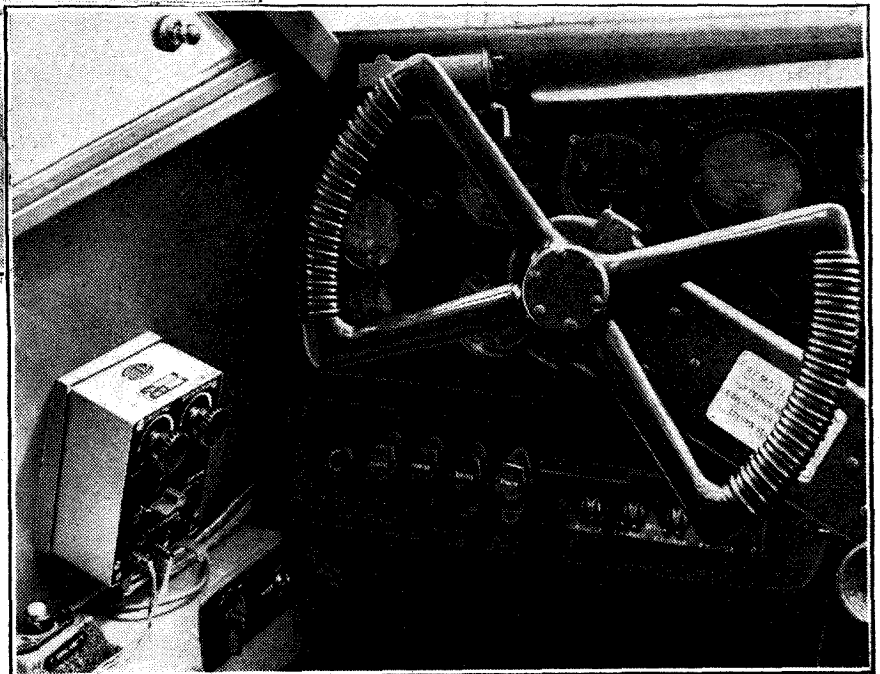
H. B. D.



On the aeroplane a di-pole aerial is mounted below the nose of the fuselage and the receiver is remote-controlled by the small unit seen on the left in the pilot's cockpit, while the visual indicators are mounted on the instrument panel to the left of the compass.

when on the right of this a series of dots were heard, then a continuous medium-pitched tone and, later, a series of dashes. The correct approach path is the central position where the dots and dashes merge into one continuous signal.

Approximately $2\frac{3}{4}$ miles from the boundary of the airport is the first marker beacon giving a vertical directive beam and a series of low-tone dashes. Continuing on the correct course, the final marker



High-pass and Low-pass

SIMPLIFYING
THE PROBLEM OF
DESIGN

HOW to design filters "with no more equipment than a knowledge of half-a-dozen technical terms, a grasp of the way in which the component parts of a filter fit together and a few very simple rules."

II.—Three-Element Cells

FROM the simple, or *prototype*, filter of Fig. 1, many more elaborate types can be evolved. Of these the most generally useful is that known as the "*m*-derived" filter—the name being due to the fact that "*m*" has been universally accepted as the letter to represent a particular constant relating the values of the various reactances.

In Fig. 5 *a* is shown, in the half-cell formation of Fig. 3, a π -cell of a prototype low-pass filter; below it, at *b*, is the corresponding *m*-derived cell. The change consists in first multiplying the original values of *L* and *C* by *m* to make L_1 and C_2 , and then adding in parallel with L_1 a new condenser C_1 of capacity *n* times *C*, thus making a rejector circuit in the series arm of the filter.

Corresponding changes are shown, in *c* and *d*, for the development of an *m*-

derived equivalent from a T-cell of the prototype. Again the original values of *L* and *C* are multiplied by *m* to make L_1 and C_2 , but in this case the extra component is a new coil L_2 , of inductance *n* times *L*, in series with C_2 . This provides an acceptor circuit in the parallel arm of the filter.

A corresponding development of the prototype high-pass filter into two equivalent *m*-derived cells is shown in Fig. 6; comparison with Fig. 5 shows that the process of conversion in the two cases is similar, division replacing multiplication, and *m* and *n* being interchanged. In both cases the factor *n* that appears depends only upon the value chosen for *m*, from which it can be calculated from the relation $n = \frac{1-m^2}{4m}$. To avoid calculation, a curve relating *m* and *n* (Fig. 9) will be given in the next instalment.

The "Frequency of Infinite Attenuation"

These *m*-derived filters differ in several ways from their prototypes. First, and most obviously, the presence of a series rejector or parallel acceptor circuit implies that they will especially bar the passage of one particular frequency. In a resistanceless version of Fig. 5 *b*, the rejector circuit $L_1 C_1$ would offer infinite resistance to currents of the frequency to which it is tuned; this frequency is therefore known as the "frequency of infinite attenuation," conveniently abbreviated to f_x . In practice, since resistance is always present, the attenuation is not infinite, but f_x remains the frequency at which attenuation is greatest. The parallel acceptor circuit $L_2 C_2$ in the equivalent filter of 5 *d* offers a nominal short-circuit, and an actual very low resistance, to earth for currents of frequency f_x .

Secondly, the attenuation of the highest frequencies by the *m*-derived cells of Fig. 5 is constant and moderately low. Imagine a current of frequency high enough to ensure that the current flowing through L_1 (Fig. 5 *b*) is negligible compared with that flowing through C_1 ; for this, and all higher frequencies, the cell becomes a simple network of three condensers, giving constant attenuation for all frequencies. By comparing voltages

across L_2 and C_2 in Fig. 5 *d*, and considering only frequencies high enough to make the voltage across C_2 negligible, the cell becomes a network of three coils—of very different impedance from *b*, but of identical constant attenuation. Fig. 7 gives a thumb-nail sketch of the type of response-curve given by (a) a prototype and (b) an *m*-derived cell. As we have just deduced, the characteristic of the latter is a sudden attenuation at f_x , fol-

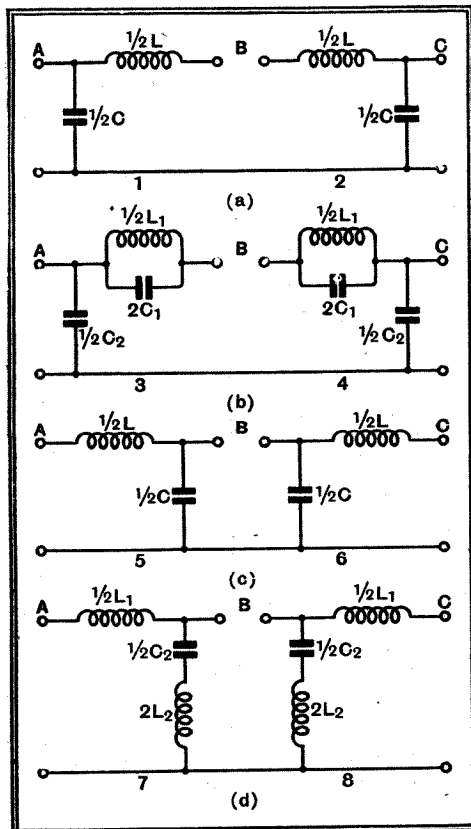


Fig. 5.—Low-pass filters. (a) π -prototype cell; (b) *m*-derived π -cell; (c) T-prototype cell; (d) *m*-derived T-cell. $L_1 = m \times L$, $L_2 = n \times L$, $C_1 = n \times C$, $C_2 = m \times C$.

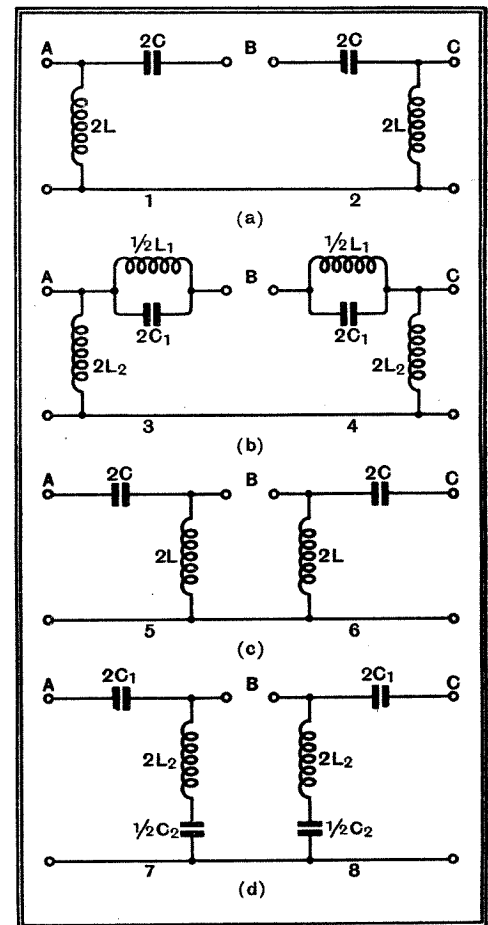


Fig. 6.—High-pass filters. (a) π -prototype cell; (b) *m*-derived π -cell; (c) T-prototype cell; (d) *m*-derived T-cell. $C_1 = C/m$, $C_2 = C/n$, $L_1 = L/n$, $L_2 = L/m$.

lowed at higher frequencies by a constant and moderately low attenuation in striking contrast to the continuously rising attenuation of the prototype. The exact figure for f_x , or, more correctly, its value as a multiple of the cut-off frequency f_c , is fixed, as we shall see later, by choice of the factor *m*.

No matter what value of *m* may be chosen, the derived π -cell at *b* in Fig. 5

Filters

By A. L. M. SOWERBY, M.Sc.

(or Fig. 6) has the same impedance at all frequencies as the parent π -cell at *a*. Similarly, the derived T-cell at *d* has the same impedance as the parent cell at *c*.

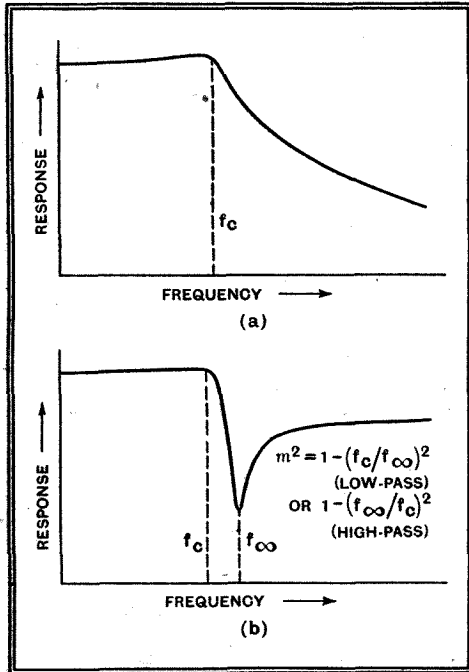


Fig. 7.—Typical response curves of (a), a prototype cell, and (b) an *m*-derived cell. Note that the relationship between *m* and the ratio f_c/f_∞ (or f_∞/f_c) is given as a curve in Fig. 9.

This similarity applies to the impedance across A or C and earth in each case. Across B and earth the two types of *m*-derived filters have impedances entirely different from that of either a π -terminated or a T-terminated prototype, and this impedance, especially if *m* is given the value 0.6 or thereabouts, is very reasonably constant over the range of frequencies that the filter is designed to pass.

These facts about impedances lead us to two conclusions. First, we are offered the opportunity of building up *composite filters* by joining cells of different filtering abilities but the same impedance. Secondly, by putting a half-cell of *m*-derived type (ending at B in any one of the four cases) at each end of a filter, we can terminate with a load-resistance without being let in for serious mis-matching at the ends.

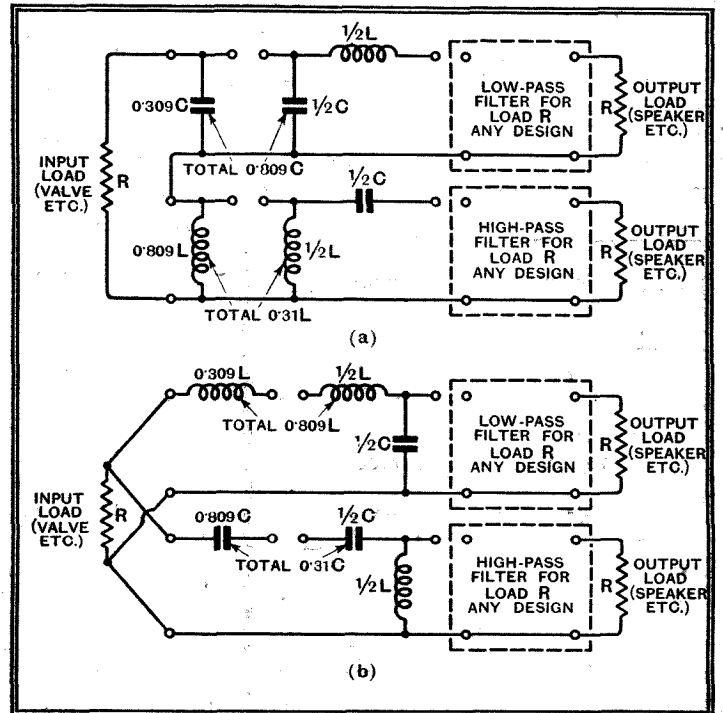
But there must be no mistake about the methods of joining together the various cells and half-cells. To save multiplication of diagrams, the half-cells in Figs. 5 and 6 have been numbered so that possible combinations can be expressed briefly.

4-1-2-3 or 8-5-6-7 will give us one *m*-derived cell for sharp cut-off, with one prototype cell to ensure attenuation at frequencies beyond the frequency of infi-

nite attenuation of the *m*-cell. The *m*-cell is cut in two, one-half being at each end of the composite filter for terminating. The two filters are electrically equivalent, and have the same average impedance over the pass-range, so that they will be terminated in the same resistance. Although either filter can be completely replaced by the other, so that it appears a matter of complete indifference which is chosen for a particular purpose, there is usually some reason for preferring the one to the other. Coils are usually more cumbersome than condensers, so that the π -filter would normally be chosen in the low-pass case, and the T-filter in the high-pass case. (Observe that the low-pass T and the high-pass π each contains one coil more, and one condenser less, than their alternatives.) But other reasons may come in; if it is undesirable to develop a high voltage at f_∞ across the input terminals of the filter, the combination of T-cells 8-5-6-7 will be preferred in both cases.

The following list gives all the possible combinations of half-cells up to a number of six in any one filter, in each case keeping an *m*-derived half-cell

Fig. 8.—Filters in combination: (a) two separate filters, inputs in series; (b) two separate filters, inputs in parallel. Note that an initial prototype half-cell of each filter is shown. Thus inductance and capacity in a full prototype cell are:—low-pass, L and C; high-pass, $\frac{1}{2}L$ and $\frac{1}{2}C$. This relationship between the filters ensures that they are complementary.



at each end of the filter for proper termination.

Combination.	Made up of:
4-1-7	1 <i>m</i> -cell + $\frac{1}{2}$ proto. cell
4-1-2-3 or 8-5-6-7	1 " " " "
4-1-2-1-7	1 " " " "
4-1-2-1-2-3 or 8-5-6-5-6-7	1 " " 2 " "
4-3-4-3 or 8-7-8-7	2 <i>m</i> -cells 0 " "
4-1-7-8-7 or 8-5-3-4-3	2 " " $\frac{1}{2}$ " "
4-3-4-1-2-3 or 8-7-8-5-6-7 or 4-1-7-8-5-3 or 8-5-3-4-1-7	2 " " 1 " "

Certain other combinations, at first sight different, but actually identical, can be

had by reversing those mentioned, e.g.: 8-7-8-5-3, which, read from right to left, is the same as 4-1-7-8-7 read from left to right.

As in joining half-cells of simple prototype filters, adjoining impedances are combined when a composite filter is put together. For example, at the junction 2-3 of Fig. 5, where $\frac{1}{2}C$ and $\frac{1}{2}C_2$ appear in parallel, they are replaced by a single condenser of capacity $(\frac{1}{2}C + \frac{1}{2}C_2)$. Similarly, at the junction 6-7, the inductances $\frac{1}{2}L$ and $\frac{1}{2}L_1$ are replaced by a single coil of inductance $(\frac{1}{2}L + \frac{1}{2}L_1)$. At corresponding junctions in Fig. 6 the single impedances used are respectively $2LL_2/(L+L_2)$ and $2CC_1/(C+C_1)$, applying in each case the usual "reciprocal rule" for inductances in parallel or condensers in series.

Prohibited Junctions

At the junctions 3-4 in either figure, the two separate closed circuits $(\frac{1}{2}L_1 + 2C_1)$ are replaced by a single circuit consisting of L_1 and C_1 in parallel. Similarly at the junctions 7-8, the combined parallel arm becomes L_2 and C_2 in series. Since the impedance across the centre-points of the *m*-cells is not a match for that of any other type of cell, junctions such as 7-6

or 1-4 are prohibited. The question of combining impedances of dissimilar character, as would occur at these illegal junctions, therefore does not arise. In fact, the appearance of such incompatibles in neighbouring half-cells of a filter-circuit is an absolutely infallible sign that the circuit is wrong, and that the half-cells making it up have been wrongly arranged.

The rule for combining cells can now be amplified a little, and becomes:—

" π may be joined to π , and T to T, provided that the arms so brought together are of like form." It goes without saying that the two half-cells to be joined must be designed for the same impedance,

High-pass and Low-pass Filters—

and must have the same frequency of cut-off.

Besides combining cells, there is the problem of combining filters. This is usually desired in order that currents of different frequencies, originating in a single source, should be shepherded down different paths. For example, one may wish to feed two speakers from a common output valve, allowing each speaker to receive only those frequencies with which it can best deal.

The input terminals of the two filters may be connected in series, as in Fig. 8 *a*, or in parallel, as at *b*. The cells next the junction of the two filters must in each case be of standard prototype form, a π -ending being used when the filters are to have their inputs in series (*a*) and a T-ending where inputs are to be in parallel (*b*). A "buffer impedance" is added to the input of each filter to enable them to be joined without upsetting their characteristics; with the aid of this addition, each filter serves as a correcting network to regularise the impedance of the other, so that an *m*-termination is not required. But, of course, it may still be used with advantage at the output ends of the pair of filters.

Complementary Filters

In nearly every case the filters are required to be *complementary*, one passing all frequencies above, and the other all frequencies below a common cut-off frequency. Thus (to take the case of two speakers) every frequency arrives at one speaker or the other, and none at both. The numerical values of Fig. 8, from which such a pair of filters can be designed, apply to complementary filters only; to cover other cases, in which transmission bands overlap, or do not touch, extra formulæ or curves are required to relate the width of the excluded or doubly passed band to the values of the filter components.

In designing such a pair of filters, it is only necessary to work out the values of *L* and *C* for the prototype low-pass filter that has the desired frequency of cut-off and that works into a load of the desired resistance; all other values follow at once from the diagrams. Note, however, that, in finding the values for an *m*-derived cell in the high-pass filter, $\frac{1}{4}L$ and $\frac{1}{4}C$ (the values of inductance and capacity in the high-pass prototype) must be taken as the basis to which to apply the conversion formulæ of Fig. 6.

Further, it should be noticed that in either circuit the input load for the two filters taken together is the same as the individual output load of each. This is so because at any one frequency only one of the two output loads is active.

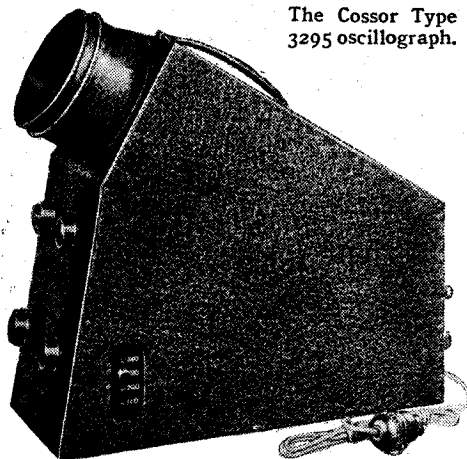
The next instalment will deal with the practical design of simple filters, the first example taken being an "HF stopper" for use instead of the usual haphazard choke-condenser combination in a detector anode circuit.

Cathode-Ray Oscillograph

A Completely Self-contained Equipment

ONE of the most modern tools available to the radio engineer and serviceman is the cathode-ray oscillograph, and it is one which is particularly attractive because it permits one to see what is happening in various parts of receiving and transmitting equipment. Until recently it has been expensive and troublesome, however, but it has now been tamed to such a degree that it can be handled without special precautions and it is no longer of prohibitive cost. So far as expense is concerned, there is now no reason why it should not form a part of the equipment of every service laboratory.

The Cossor Type 3295 oscillograph is particularly convenient in that it is completely self-contained and of quite small dimensions. The tube is of the gas-focused type with a sensitivity of about 0.75 mm. per volt, and has a screen of some 4in. diameter.



The Cossor Type 3295 oscillograph.

A linear time-base is included with a gas-filled triode in the discharge circuit, and there is a rectifier for the HT supply. The controls are four in number and consist of a combined on-off switch and focusing adjustment, a synchronising control, a frequency range-switch and a frequency control.

Terminals at the rear allow connection to be made to the apparatus, and the normal input connections are to one pair of plates via an isolating condenser with shunt resistance, so that an external circuit for the separation of AC and DC is unnecessary. When required, however, connection can be made directly to the deflecting plates. An internal AC supply of about 10 volts is also available for connection to the plates, so that voltage calibration is facilitated.

Extremely Sharp Focus

In operation, with no external voltage applied to the plates, a line appears on the screen when the focusing control is rotated. This line is due to the time-base, which is always operative, and can be used for the initial focusing. It may be remarked that the apparatus focuses extremely well, a very sharp, clear line being obtainable; the image is bright and of a blue colour. When the voltage it is desired to examine appears on the screen the straight line of the time-base dissolves into a pattern which can be varied by the frequency control. By setting this correctly one or more cycles of the

input wave appear, and when the best approach to a steady picture has been obtained the synchronising control is rotated and the picture locked. The synchronising is good, and in most cases a perfectly steady picture can be secured; this feature, together with the brilliance of the image, makes the equipment eminently suitable for photographic purposes.

The apparatus is intended for use at low frequencies and may be used for waveform examination at frequencies up to about 30,000 c/s or rather more. At very low frequencies the limit is set chiefly by flicker, since at frequencies lower than some 30 c/s the eye begins to detect the sequence of the images. This is, of course, inevitable unless the after-glow is made large, and the tube would then be unsuitable for use at high frequencies. It would seem, therefore, that the makers have adopted a very satisfactory compromise.

The uses to which the equipment may be put are obvious, and, apart from waveform examination, include the measurement of modulation depth. Complete with tube and valves, the apparatus is priced at £30, and its makers are A. C. Cossor, Ltd., of Cossor House, Highbury Grove, London, N.5.

THE NEW PYE SETS**Details of Five New Receivers Just Released**

THERE are three portables and two table model AC superhets in the latest issue of sets from the factory of Pye Radio, Ltd., Cambridge.

The new T.63 "straight" battery portable is similar in appearance to last year's T/9 and the price is the same, namely, £11. Superheterodyne circuits with a tuned var.mu. pentode HF stage, triode pentode frequency changer, var.mu. pentode IF amplifier, double-diode-triode detector and output valve are employed in the T.61 and T.20 portables. The former at 15 guineas is a battery receiver with a QPP output stage and the latter at 16 guineas is an AC receiver with a single pentode output stage and a neon tuning indicator.

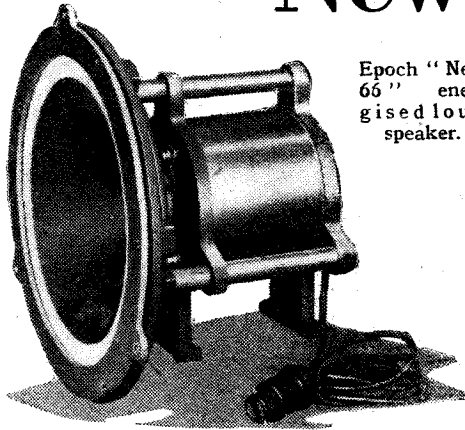
In the T.17 and T.18 table models a band-pass input circuit with provision for second channel suppression leads to an octode frequency changer. This is followed by a single IF stage and double-diode-triode second detector leading in the case of the T.17 to a pentode output valve, and in the case of the T.18 to a triode rated to give 2.8 watts undistorted. The model T.18 has a four-position tone control by means of which the selectivity of the IF stage, as well as the audio response, is varied. The prices of the T.17 and T.18 receivers are £11 15s. and 14 guineas respectively.

Special "Flight" Issues

TWO special issues of *Flight* will be published on June 25th and July 2nd, in which full details will be given of the R.A.F. Display at Hendon, and the British Aircraft Construction Exhibition at Hatfield. The issues, which will be fully illustrated, should prove of great interest to everybody interested in aviation.

New Apparatus Reviewed

Recent Products of the Manufacturers



Epoch "New 66" energised loud speaker.

EPOCH "NEW 66" LOUD SPEAKER

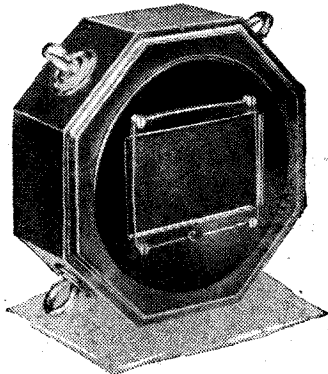
THIS massive unit is typical of the form of construction adopted by Epoch. Not only the field magnet and chassis, but the diaphragm and suspension are put together with a thoroughness which promises stamina over many years of hard use.

The 10-inch cone is made of a light, hard material and gives a particularly smooth response over the region from 2,000 to 5,000 cycles. On the debit side there are troughs at 500 and 1,500 cycles, and the stretched leather suspension causes some curtailment of output below 75 cycles. There is, however, ample bass response, for it is seldom that musical scores show notes going below the range of this instrument. The drop in output culminating at 1,500 cycles is less noticeable than the curve would lead one to expect, and after hearing the speaker most people will consider that the slight weakening of the middle register can be overlooked when the other qualities of the unit are taken into account.

The field winding takes 36 watts, and models are available of 12-volt, 200-240-volt DC, and 200-240-volt DC or AC supplies. The makers are the Radio Development Company, Aldwych House, Aldwych, London, W.C.2, and the price of the model tested (200-240-volt DC) is £4 12s. 6d.

Its performance is comparable in all respects with the earlier model reviewed, and on test no noticeable resonances could be detected. It has a wide frequency response, and although quite economical so far as polarising current is concerned, nevertheless gives an adequate output for satisfactory operation with standard PA amplifiers.

A very quiet background is an outstanding feature of this model, yet it is sensitive, and functions perfectly well with as little as three volts for polarising. The normal working potential need not exceed 6 volts provided the resistance of the primary on the transformer is not too high.



M.R. Model A transverse current carbon microphone.

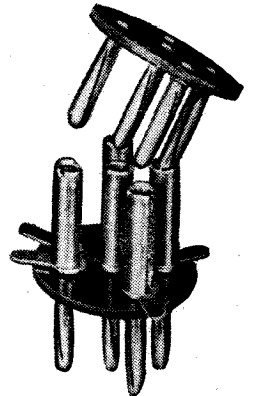
The resistance of the microphone is about 400 ohms, and the makers are M.R. Supplies, 11, New Oxford Street, London, W.C.1. The price is £2 15s.

CLIX TAPPING ADAPTOR AND MULTIPLUG

TWO new Clix components have recently become available. One is a valve adaptor on which tags are fitted to all sockets, and its purpose is twofold. It can be used with short-wave converters, where

and is. each respectively. It is described as a tapping adaptor.

The other new item is a skeleton-type plug to fit standard four-, five- or seven-pin valve holders. This is a useful accessory for loud speaker connections, extension cables and the like, and the prices are 4d., 5d., and 6d. for four-, five- and seven-pin models respectively.



Clix skeleton-type tapping adaptor and multi-plug.

BULGIN NEON LAMP AND TEST PROD

TWO useful accessories recently introduced by A. F. Bulgin and Co., Ltd., Abbey Road, Barking, Essex, are a miniature neon lamp and a test prod embodying the neon lamp.

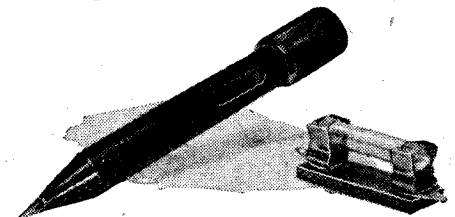
The lamp is assembled in a cylindrical glass tube and is fitted with end-caps, being very similar in appearance to a glass-encased fuse and does in fact fit the Bulgin 1 1/4 in. type fuseholder.

There are a variety of uses to which small neon lamps can be put: for example, they can be used for polarity tests and also they find application in test gear as LF oscillators for bridges and for modulating HF oscillators, etc.

The Bulgin model requires from 160 to 180 volts to operate it, and a series resistance of one megohm—a half-watt size will do—should be employed to limit the current. Without this resistance we found that the lamp passed about 6 mA at 160 volts—the striking potential. With the resistance this current is infinitesimal.

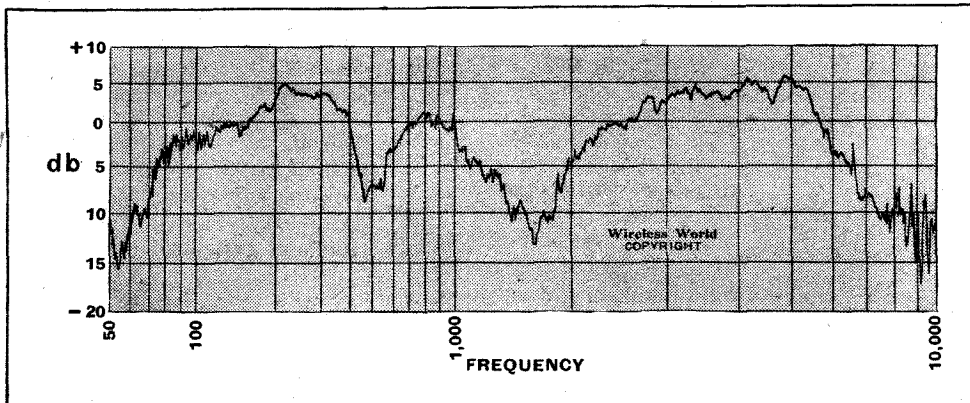
The small neon lamp is embodied in a test prod which can be used with or without a battery. For continuity tests a battery of 160 to 180 volts must be employed, but for testing the HT supply circuits the battery can be dispensed with. The prod can, of course, be used either on AC or DC.

The lamp, resistance, spring-loaded contact point and wire grip are all well-insulated, being enclosed in a bakelite tube with a small aperture in the side for viewing the neon lamp.



Bulgin small neon lamp mounted in fuseholder, type F17, and neon test prod, type T.P.5.

The neon lamp only costs 3s. 6d., and it has the list number N.L.1, while the insulated neon test prod complete costs 9s. 6d.



Axial response curve of Epoch "New 66" on irregular baffle (area approx. 22 sq. ft.). Microphone distance 4 ft., power input 1 watt.

M.R. SUPPLIES STANDARD MICROPHONE

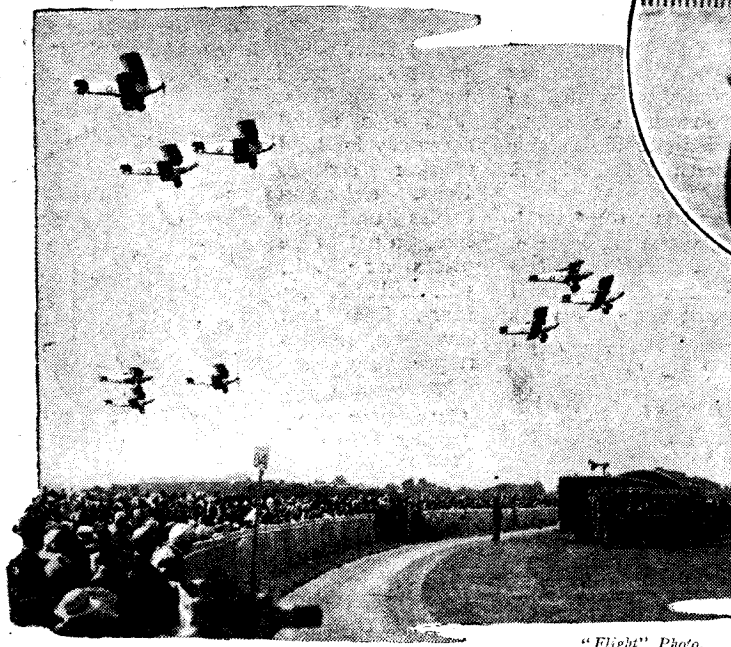
THIS is a transverse current carbon microphone similar in design to the hand model described in *The Wireless World* of September 27th last, but it is assembled in a massive chromium-plated metal case, the octagonal shape of which gives it a very attractive appearance.

power to operate the unit is taken from a valve socket in the broadcast receiver, or employed as a valve adaptor when making test measurements on receivers.

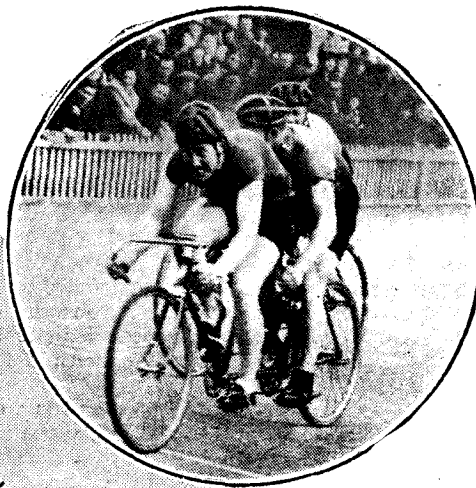
It does not enable a metre to be inserted in series with any of the circuits for current readings, and its usefulness in this field is to facilitate voltage measurements.

The adaptor is made in four-, five- and seven-pin types, and they cost 9d., 10d.,

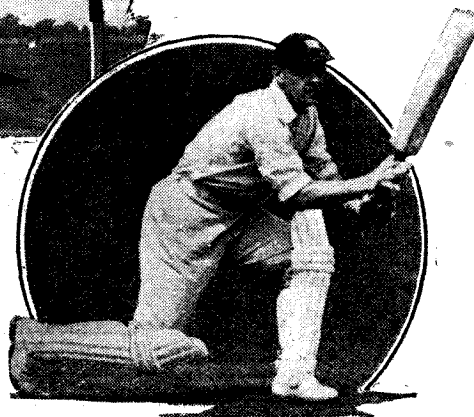
A POTPOURRI OF SPORTING EVENTS is included in Saturday afternoon's National programme from 2.0 to 5.15. Wimbledon and the R.A.F. pageant at Hendon will be visited. Such a close finish as that shown on the right should be exciting for those who listen to the commentaries from Herne Hill.



"Flight" Photo.



G. O. ALLEN, who will captain England against All-India at Lord's.



Listeners' Outstanding B

"THE VOICE OF ATLAS"

LISTENERS who have been on a Mediterranean cruise will undoubtedly be interested in the feature programme under the above heading by Philip Thornton at 8.30 on Thursday (Reg.). It will be a picture of Morocco as seen through the eyes of present-day tourists and of legendary figures of the past.

AN EMINENT CONDUCTOR

THE principal orchestral event of this week will be the occasion of Eugen Ormandy's first broadcast in this country, when he will be conducting the London Symphony Orchestra on Sunday at 9.30 (Reg.). Ormandy, who is of Hungarian origin but an American citizen, has succeeded Stokowski as conductor of the

famous Philadelphia Orchestra, and he is considered to be one of the most brilliant of the younger generation of conductors.

"COTTAGE LOAF"

THE scene of this rural divertissement by Ashley Sterne and A. A. Thomson is Marigold Cottage, near the village of Steeple Thatchby. Archie Campbell is the producer of this programme, which is to be given at 8 on Wednesday (Reg.) and 8.30 on Thursday (Nat.). The cast includes Priscilla Wills, Frank-

EVERY TOURIST who has visited Morocco will remember this view of Rabat harbour as seen from Hassan's Tower of the old ruined mosque (Thursday, 8.30, Reg.).



SATURDAY afternoon will be a busy time for the "O.B." department, four different venues being visited between 2 and 5.15 (Nat.). Listeners will be switched from one place to another and thereby kept in touch with the progress of the various events.

The first Test Match between All-India and England will be described from Lord's by Howard Marshall. From Hendon the R.A.F. Display will be commented upon by Wing-Commander W. Helmore, who has described every R.A.F. Display which has been broadcast. Colonel Brand and Captain Wakelam will give running commentaries on the play in the Lawn Tennis Championships at Wimbledon. The fourth event is somewhat unusual, descriptions of one-mile and fifty-mile Tandem Championship races at Herne Hill being given by an expert.

NO ALTERNATIVE

THE B.B.C. are this summer following the precedent of previous years by arranging for the Regional transmitter to take the National programme between 6.30 and 8 each evening, commencing on Monday. This will mean that many listeners will have no alternative programme during this period, which is quite a popular listening time.

TOC H

A PROGRAMME from the National transmitter at 5 on Sunday, under the heading, "Everyman's Club," to celebrate the coming-of-age of Toc H, will include a recording of a message from His Majesty the King spoken by His Royal Highness, the Duke of Kent, at the ceremony of the lighting of the Lamps of Maintenance at the Crystal Palace the day before. In this programme an effort will be made to represent dramatically the ideals for which Toc H stands, its history, and present activities. The spread of this movement is largely due to the indomitable energy of its founder, the Rev. P. T. B. Clayton.

FAMILY AFFAIRS

REMEMBERING Edna Best's magnificent performance in "A Bill of Divorcement," listeners will welcome the news that she is returning to the microphone in an adaptation for broadcasting of "The Silver Cord." This play by the well-known American dramatist, Sidney Howard, which was first produced at the St. Martin's Theatre in 1927 and had a run of nearly 200 performances, has been prepared for broadcasting by Barbara Burnham. It deals in a highly dramatic fashion with the conflict of wills between a highly possessive mother and her children. Gladys Young plays the part

of Mrs. Phelps, the mother, with Ronald Simpson as her son David and Edna Best as his wife, Christina. The rôle of the younger son, Robert, will be taken by Geoffrey Keen, and that of his fiancée, Hester, by Ann Todd. The production is in the hands of Val Gielgud, and will be broadcast Nationally at 8 on Monday and Regionally on Friday, July 3rd.

BELGIAN RELAYS

A CARILLON recital from Malines Cathedral is included in the Regional programme at 6 on Sunday. It will be given by Staf Nees, who is the official carillonneur of the cathedral.

Early Flemish music will be rendered by the Choir of St. Rombaut, with Flor. Peeters at the organ and Canon Van Nuffel conducting, and relayed by the National transmitter at 8 on Wednesday.

A. J. ALAN

THIS elusive broadcaster returns to the microphone on Wednesday at 9 in the Regional programme and again on Thursday at 10.20 (Nat.).

Guide for the Week

Broadcasts at Home and Abroad

lyn Bellamy, Patrick Waddington and Betty Huntley-Wright, with the Revue Chorus and Theatre Orchestra conducted by Mark H. Lubbock.

FROM GLYNDEBOURNE

THE second act of Mozart's "The Magic Flute," with Aulikki Rautawaara, the Finnish soprano, as Pamina, is to be relayed from Glyndebourne in the National programme at 9.35 on Tuesday. A five-minute introduction will be given at 9.30.

TO THE MEMORY OF QUEEN ASTRID

AN unusual and pathetic broadcast comes from Sottens on Sunday at 10.45 a.m. lasting until 12.15. The Chapel and Chimes erected at Küssnacht to the memory of Queen Astrid of the Belgians, who so tragically met her death last year, will be consecrated by Monseigneur Colle, Belgian Royal Chaplain. Music will be provided by the Royal Belgian Band and a panegyric will be given by the Reverend Father Henusse.

OLYMPIC GAMES

AT 7.45 on Wednesday all German stations will be relaying the ceremony at the official opening of the Olympic village which has been erected to accommodate the competitors during the period of the forthcoming Olympic Games.

OPERA ABROAD

As is usual during the summer months, there is comparatively little for the opera-lover. Bucharest, however,

does not disappoint her usual Friday audience at 7.35, for this station is transmitting recordings of a Paris Opéra performance of Massenet's five-act "Manon." Five minutes earlier this evening Leipzig relays from the Dresden Opera Weber's "Freischütz." This opera was so popular in this country in its early days (1824) that nine theatres were producing it at the same time.

From Turin at 8.45 on Saturday comes a studio performance of Luigi Trecate's three-act opéra-comique, "Le astuzie di Bertoldo." Lovers of good music well performed will not fail to tune in Vienna at 6.25



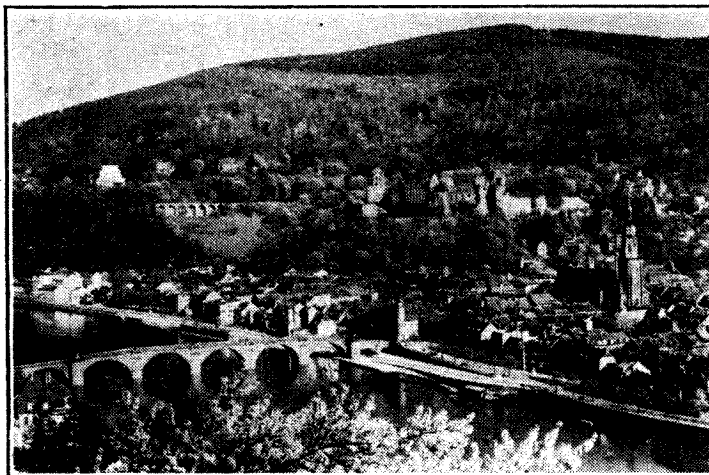
ERIC COATES, who conducts the B.B.C. Theatre Orchestra in a programme of his own works, with Jan van der Gucht as soloist, in the National programme at 6.30 on Sunday.

on Sunday when the State Opera Festival performance of Wagner's masterpiece, "The Mastersingers" will be given with Weingartner conducting.

Opera music is provided by Königsberg at 8.10 on Monday when Herr Brückner, the station musical director, conducts the Station Choir and Orchestra with vocal soloists.

"SALOME"

It is always pleasing to a nation's vanity to find that its own literary gems are appreciated abroad. For this reason Radio-Paris is certain to number many English listeners among its 8.45 audience on



THE STUDENTS' TOWN of Heidelberg, from which special programmes to celebrate the 550th anniversary of the University are to be relayed by Stuttgart on Monday at 7 and Tuesday at 10.20.

Saturday to hear Mariotte's music to Oscar Wilde's "Salome."

HILVERSUM'S BROADCASTING HOUSE

THE inauguration ceremony at the opening of the A.V.R.O. Broadcasting House will be

radiated by Hilversum No. 1 from 2.10 to 3.10 on Thursday. The actual inauguration ceremony will be performed by the Minister of the Interior at 2.30. At 8.30 a Cantata written and composed specially for this occasion will be broadcast. THE AUDITOR.

HIGHLIGHTS OF THE WEEK.

FRIDAY, JUNE 26th.
Nat., 7.30, Orchestre Raymonde, 8.15, Music from the Movies, 8.45, A Mozart Concert.
Reg., 7.25, "Fanfare" Concert Party from the Palace Court Theatre, Bournemouth; 8, Noel Coward's "Cavalcade."
Abroad.
Königsberg, 8.10, Light Classical Concert.

SATURDAY, JUNE 27th.
Nat., 2-5.15, "O.B.'s" from Wimbledon, Hendon, Herne Hill and Lord's. 7, The Arthur D'Almeida Quintet. 8.30, Music Hall.
Reg., 8.15, The B.B.C. Choral Society and Orchestra (B) with Joseph Hislop and Harold Williams. 9.30, London Zigeuner Orchestra.
Abroad.
Breslau, 8.10, Variety Concert from the Kurhaus, Bad Salzbrunn.

SUNDAY, JUNE 28th.
Nat., 5, "Everyman's Club." 7, Recital: The Kedroff Quartet and Helen Perkin (Pianoforte). [Albert Sandler and the Park Lane Hotel Orchestra.
Reg., 6, Relay from Malines Cathedral. 6.30, The Music of Eric Coates. 7.55, Service from St. Mark's, North Audley Street. 9.30, The London Symphony Orchestra, conductor, Eugen Ormandy.
Abroad.
Frankfurt, 8, Composers conducting their own new light music.

MONDAY, JUNE 29th.
Nat., Claude Hulbert and Bobbie Comber. 8, "The Silver Cord." [B.B.C. Theatre Orchestra, Frank Titterton (tenor).
Reg., "White Coons" Concert Party. 9, Pianoforte Recital: Harold Samuel.
Abroad.
Warsaw, 9, Finals of Singing Competition from the Philharmonic Hall.

TUESDAY, JUNE 30th.
Nat., "White Coons" Concert Party. 9.35, "The Magic Flute," (Act II) from Glyndebourne.
Reg., 8, Violin Recital: Jelly d'Aranyi.
Abroad.
Paris PTT, 8.30, Concert of "Music Inspired by Literature."

WEDNESDAY, JULY 1st.
Nat., The Bentley Colliery Silver Band. 8, Concert of Early Flemish Music from Belgium.
Reg., 8, "Cottage Loaf." 9, A. J. Alan.
Abroad.
Brussels II, 8, "Polenblut," Operetta (Nedbal).

THURSDAY, JULY 2nd.
Nat., 8.30, "Cottage Loaf." 10.20, A. J. Alan.
Reg., Carroll Gibbons and the Savoy Hotel Orpheans. 8.30, "The Voice of Atlas."
Abroad.
Leipzig, 8.10, "German Masters," a concert of Chamber Music.

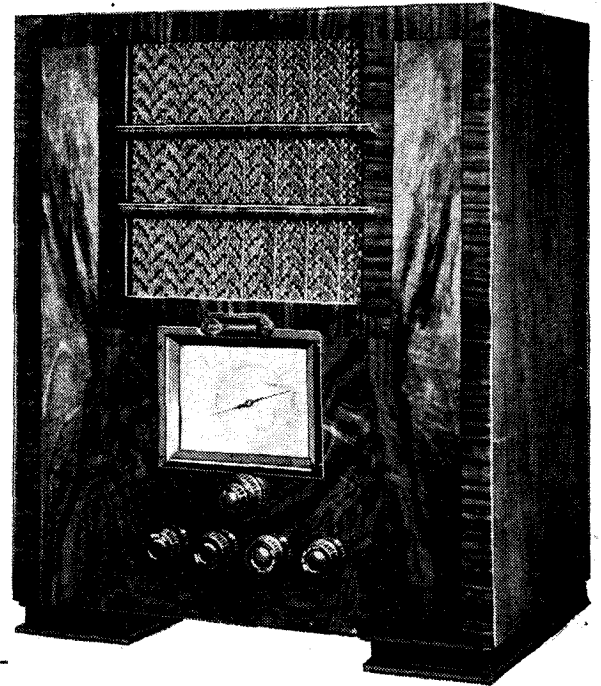


Hyvoltstar Eight

THIS receiver is essentially a simplified version of the "Hyvoltstar Ten" reviewed in our issue of December 13th, 1935. It will be remembered that the latter set was notable for the number and variety of its controls and the facility with which the high initial performance could be modified to existing receiving conditions. While the "Eight" is, perhaps, less flexible than its bigger brother and has one IF and one LF valve less in the circuit, it nevertheless shows its close relationship in the matter of performance, which is decidedly above that of the ordinary run of broadcast superheterodynes. As in other models in this series, universal valves with high-voltage heaters are employed. The filaments are rated at 190/210 volts and they are run in parallel from either DC or AC supplies with a series resistance to drop the small excess voltage of the majority of mains supplies in this country.

The circuit begins with a stage of HF amplification employing a variable-mu pentode. This stage is tuned on each of the four wavebands and the performance indicates that it is pulling its weight even at the highest frequencies. The frequency-changer is a heptode which is controlled from the AVC line on medium and long waves but not on the two short-wave ranges. The HF amplifier and the variable-mu pentode IF amplifier which follows the frequency-changer are, of course, controlled throughout the full range of the receiver. A double-diode follows the IF amplifier and supplies the AVC bias in addition to providing signal rectification. Special attention has been paid

AN AC/DC SUPERHETERO- DYNE OF HIGH SENSITIVITY



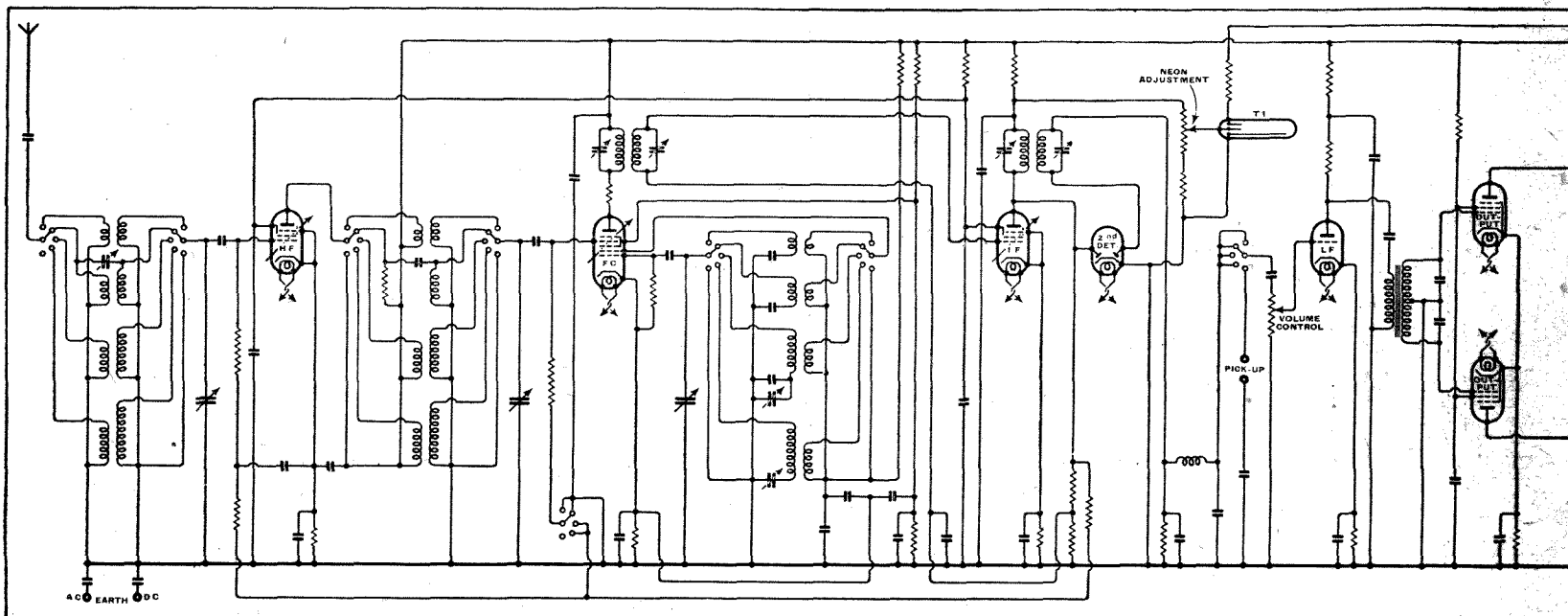
FEATURES. — *Type.* — Table model superheterodyne for AC or DC mains. **Wave ranges.**—(1) 13-33 metres. (2) 28-73 metres. (3) 200-560 metres. (4) 800-2,200 metres. **Circuit.**—Var. mu pentode HF amplifier—heptode frequency-changer—var. mu pentode IF amplifier—double-diode second detector—triode LF amplifier—push-pull pentode output valves. Half-wave valve rectifier. **Controls.**—(1) Tuning. (2) Volume and on-off switch. (3) Wave-range. (4) Tone. (5) Neon adjustment. **Price.**—30 guineas. **Makers.**—Universal High Voltage Radio Ltd., 28/29, Southampton Street, Strand, W.C.2

to be more prevalent at the higher frequencies. A separate triode valve is used for LF amplification following the diode second detector. This is coupled through a parallel-fed transformer to the push-pull pentode output valve. The tone control is applied across the anodes of these valves and a high-impedance feed for an external loud speaker is taken from the two anodes through two condensers of equal capacity. In this, as in the arrangement of the alternative earth connections, the makers have taken every precaution to render the set shock-proof.

A half-wave rectifier valve with two sections in parallel gives the low impedance which is essential in avoiding an excessive drop of volts. This point is of more than usual importance as the filament heater voltage is very little less than that of the supply mains. The rectified HT

the circuit constants of the AVC filters to ensure rapid action. This is essential in a receiver which goes lower in wave range than the majority of all-wave sets, as the occurrence of short period fading is likely

Complete circuit diagram. The range of the neon tuning indicator is adjustable by means of a potentiometer controlled from the front panel.



current is efficiently smoothed by a separate choke in conjunction with 16 mfd. condensers, and there is not the slightest trace of interference from mains ripple on either DC or AC supplies. The mains current before rectification also passes through a balanced HF filter which effectively suppresses HF interference which might otherwise enter the set at this point.

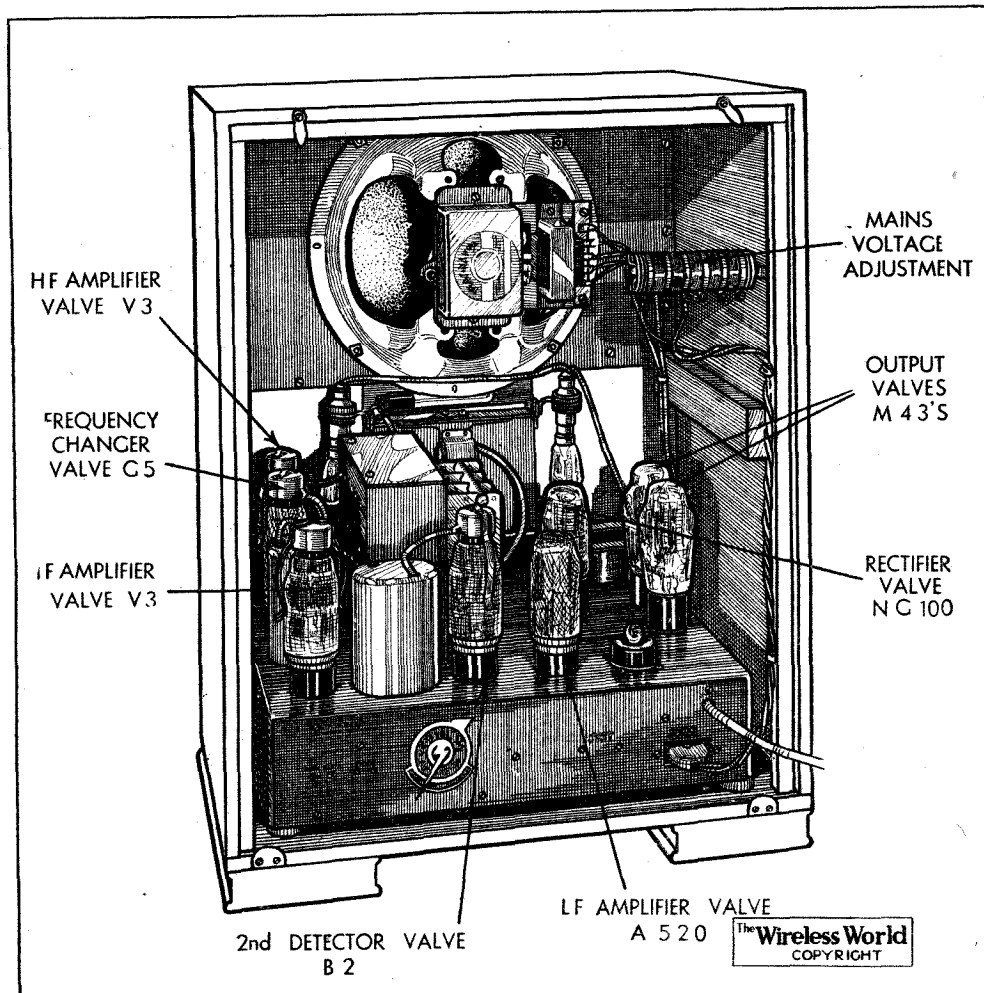
In our opinion the outstanding feature of the performance is the high sensitivity, particularly on the medium waveband. It is necessary to cut down the volume on the five or six continental stations which are comfortably receivable in daylight by the majority of broadcast superheterodynes, and the number of additional carrier waves revealed gives promise of a really remarkable performance in the matter of long-distance reception after sunset. High sensitivity is, however, of little use unless it is backed by a correspondingly high degree of selectivity, and this point has not been overlooked by the designers. It is possible to approach easily within one channel of either of the Brookmans Park transmitters when using the set in Central London, and at other parts of the medium-wave range the separation of stations on adjacent channels presents no difficulty. On the long waves the Deutschlandsender is not affected by interference from its two powerful neighbours if care is taken in tuning it accurately. Here one is able to rely on the assistance of the neon tuning indicator, which is more than usually sensitive owing to the fact that its range can be adjusted by means of a control on the front panel to cope with signals of widely different strength.

Two Short-wave Ranges

The short-wave ranges are no mere additions to the normal broadcast bands, and there is no diminution in the sense of range and power when the wave-range switch is turned to the short-wave bands after a spell of listening to ordinary broad-

casting. By dividing the short waves into two sections it has been found possible to go down well below 13 metres, and although a slight reduction in the level of background noise below 16 metres indi-

cast transmissions are indicated. The pointer is driven by a two-speed slow-motion dial with ratios of 15:1 and 100:1 respectively. The latter ratio may appear to be rather high, but experience will show



All HF coils are assembled in a subdivided screening box which forms the base for the ganged tuning condenser.

cates that the amplification has fallen off, the strength of two unidentified telephony transmissions on the uncalibrated portion of the dial below 14 metres showed that the extension of frequency range is already justified.

The quality of reproduction is clear cut and there is a useful reserve of volume between the level which would be normally required for a living room and the point at which harmonic distortion, due to overloading, sets in. The range of the tone control is much wider than is usually found in small commercial superheterodynes, and it is possible to adjust the audio-frequency response very accurately to the inevitable compromise between background noise and high-note response which must be found when listening to all but the most powerful short-wave stations.

The circular tuning scale is of rather small diameter, but room has been found for the names of all the principal medium- and long-wave stations. A few wavelength sub-divisions are also marked on these wavebands, but on the two short-wave ranges the calibration is more accurate and the segments of the dial which are likely to be productive of short-wave broad-

cast transmissions are indicated. The pointer is driven by a two-speed slow-motion dial with ratios of 15:1 and 100:1 respectively. The latter ratio may appear to be rather high, but experience will show

CLUB NEWS

The Radio, Physical and Television Society

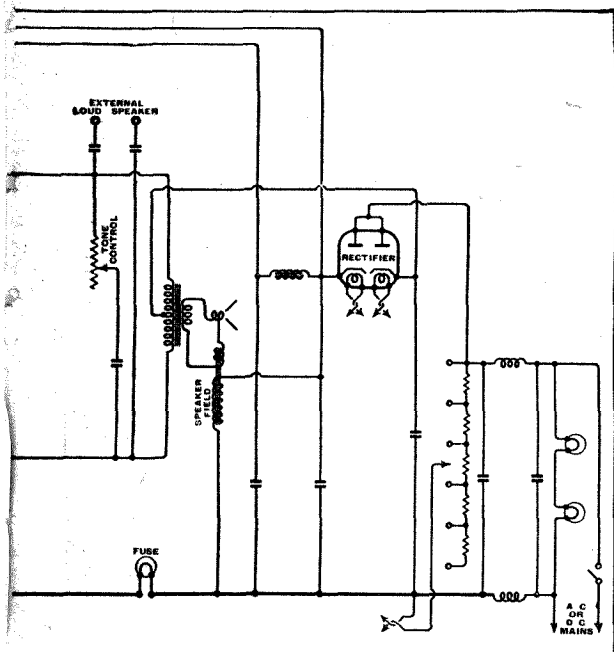
AN interesting lecture on "Field Measurements with a Superheterodyne Receiver" was recently given by Mr. E. M. Loveless. An informative visit has also been paid to the works of the Hivac Valve Co. Meetings of the Society are held every Friday at 72a, North End Road, West Kensington. Full particulars are obtainable from the Hon. Secretary at 12, Nassau Road, Barnes, S.W.13.

Smethwick Wireless Society

This Society is carrying out experimental 10-metre transmissions (G2GX) until the end of July on Friday evenings from 9 p.m. to 10 p.m. Further particulars can be obtained from the Hon Secretary at the New Talbot Inn, High Street, Smethwick.

Cambridge Short-Wave Club

A new Society has been formed at Cambridge to cater for short-wave listeners. Several active transmitters are included among the members. Novices are especially welcomed. A visit has been arranged to the G.P.O. receiving station at Baldock, Herts, for June 30th. Full particulars can be obtained from the Hon. Secretary at 19, Trafalgar Street, Cambridge.





Broadcasting

in the Cause of Peace

Discussion on a New International Agreement now in Draft Form

By "WANDERING WAVE"

PROPAGANDA broadcasts by Russian stations, friction between Hungary and Czechoslovakia regarding certain news broadcasts, diplomatic protests by Poland on the contents of German broadcasting programmes were among the first instances of so-called *propagande inadmissible* brought to the attention of members of the International Broadcasting Union. Within the Union a gentleman's agreement had existed under which infringement on another's territory by means of broadcasts of an unfriendly nature was "taboo." Even in those days, however, now over five years ago, the whole question was a very delicate one indeed.

More recently a protest by the Austrian Broadcasting Company placed the Union in a difficult situation, and the decision had to be taken whether to stand by the agreement and become mixed up in politics or to keep out once and for all. I think it must have been at the Amsterdam meeting in October, 1933, that the Union chose the latter course. This was a wise decision, since the U.I.R. is a private body, and as such could not have withstood pressure by a Government. But this decision also put an end to the first attempt to control unfriendly broadcasts directed to listeners in another country.

Following a suggestion by the Government of Poland regarding "moral disarmament," the League of Nations invited the International Committee on Intellectual Co-operation to study the possible uses of broadcasting in the cause of peace. These investigations led to the drafting of the text of an international convention which has since been modified in the light of suggestions received from various Governments to which it had been submitted. The draft will now be discussed at an international conference called for September 3rd in Geneva. The main contents of the convention are as follows:—

Article 1 binds the signatories to prohibit and, on occasion, to stop immediately, any transmission which might incite the population in another country to "acts incompatible with the internal peace or security of that territory."

Article 2. "Transmissions from stations . . . shall not constitute an incitement to war or provocative activities likely to lead to war."

Article 3 says that the High Contracting Parties undertake to prohibit "transmissions likely to prejudice good international understanding by statements the incorrectness of which is, or ought to be, known to the persons responsible for the broadcasts." A second paragraph in the article provides for the rectification of incorrect news.

Article 4 asks the signatories "to ensure especially in time of crisis the accuracy of the information concerning international relations broadcast within their respective territories."

Article 5 asks the contractors to help each other by an interchange of correct information and to provide ". . . items calculated to promote a better knowledge of the civilisation and the conditions of life in its own country," etc., etc.

Article 6 asks Governments to take the necessary measures to see that the broadcasting organisations will follow these prescriptions.

In article 7 the method is described for dealing with disputes arising out of the convention. If diplomatic negotiations fail there is right of appeal to the International Committee on Intellectual Co-operation, and finally the Permanent Court of International Justice.

The remaining seven articles are more or less of a legal nature and have to do with the putting into force of the Convention, adhesion to it, etc., etc. It is important to note that it only becomes valid when at least six countries have ratified it.

Views of Various Governments

The various observations which Governments have made in the course of the preliminary drafting are most interesting. In the minds of some of these Governments the efficacy of an international convention on this subject seems doubtful. The Government of India, for instance, criticises the draft by saying that it ". . . expresses only an ideal of international good manners which is not likely to be followed in times of international excitement." The Government of India goes on to state they "consider further that Article 5 cannot receive their approval in the light of experience that propaganda in a foreign country can be undertaken against the British Empire in the English language. While legitimate objection may be taken to propaganda against any foreign country in the language of the country from which it emanates, that objection becomes of far greater validity if the propaganda is deliberately conducted in the language of the country against which it is directed. . . ." The Government of India suggests that contracting parties should not use the language of others unless the matter for broadcasting has previously been submitted to them.

The Government of Poland, in an observation dated January 16th, 1936, voices the opinion that ". . . the sole object of the Convention being to promote a

rapprochement between nations. . . ." It seems unfortunate that this should be or seem so. But, then, it is an international Convention for the use of broadcasting in the cause of peace and not an international agreement restricting the use of broadcasting for moral aggression. This might seem to be one and the same thing, but in terms of a legal document it is not.

The Union of Soviet Socialist Republics states, in a note dated June 27th, 1935, that ". . . it will have certain suggestions to make as to the closer definition which, in its opinion, ought to be given to the messages that should, in the interest of international peace, be prohibited by the proposed agreement." One wonders what type of message Moscow will wish to prohibit.

The Belgian Government takes an entirely practical view of the whole matter. In a note dated July 6th, 1935, the Belgian Government states ". . . while paying a tribute to the commendable efforts of the committee of experts who were entrusted with the drawing up of this draft and who boldly faced the difficulties of a task that was unquestionably onerous, the Belgian Government feels compelled to express certain doubts as to the efficacy and practical character of the Convention envisaged. My Government will not refuse to subscribe to it, for it recognises that this Convention has, at least, the value of a manifestation of international goodwill, which, from the moral standpoint, is likely to produce beneficial results."

The Belgian Government ". . . declares that its signature will be contingent upon the recognition of the right to jam offensive foreign broadcasts, a right which, in its opinion, constitutes the sole means of efficacious defence."

And that, I think, puts the whole matter in a nutshell.

Past Experience

Let us review some recent practical cases. In Lithuania, when German stations broadcast what seemed, to the Lithuanian Government, messages which it thought unsuitable for the population of the Memel district to hear, a transmitter, said to be situated in the Memel harbour, periodically jammed these broadcasts, it is reported, by Morse interference. This jamming was so effective that the German National Transmitter, the *Deutschlandsender*, took over the special bulletins and broadcast them with an announcement stating that the Königsberg and Heilsberg transmissions were being jammed.

Broadcasting in the Cause of Peace—

Who is to decide where peaceful propaganda stops and aggressive propaganda starts? In the eyes of the German Government the so-called "Austrian" broadcasts from Munich in 1933 and 1934 were probably not regarded as aggressive. Yet Austria protested.

Then take the gigantic Italian campaign of propaganda broadcasting on the Abyssinian question. If our stations had attempted similar broadcasts in Italian, would Italy have allowed them to be clearly receivable in her country?

The task at present is to provide some kind of international agreement which, at least in times of peace, would free broadcasting from *propagande inadmissible*. There is, perhaps, a way out: It could be internationally illegal for broadcasting stations in a given country to directly address foreign listeners in their own

language without the sanction of the Government concerned. Any infringement would give the country to which the broadcasts were addressed the full right to interfere with these transmissions by every technical means in its possession. After all, it is not for an international body to decide what seems to be aggressive propaganda to the country against which it is directed. It is that country alone which can judge.

This basis would permit democratic and freedom-loving States to let their nationals listen to the other man's point of view, but would provide against the possibility of objectionable propaganda. As for *rap-prochement*, friendly exchange of politically harmless programmes has been handled admirably in the past by the U.I.R., which has all the machinery for maintaining this in the future. There is ample evidence that these broadcasts have been popular.

have his attention diverted from wondering why valves cost so much. There is room for a good side-show dealing with quality of reproduction; another demonstrating convincingly the most economical ways of running a battery set; a fourth proving that even the biggest mains set costs very little to operate; a fifth setting forth the ways of telling man-made from natural interference; a sixth making clear the whole subject, so perplexing to the man in the street, of ground waves, sky waves, fading and night distortion. I'll guarantee that demonstrations of that kind, if thoroughly well done, would attract a large public and be of much greater value to exhibitors than the most highly-paid tap dancers, crooners or comedians in the Exhibition theatre. It's worth thinking over.



Railway Television

TWO weeks ago I noticed a reference in "Broadcast Brevities" to the fact that several of the railway companies were thinking about entertaining those waiting for trains by television demonstrations. It now appears that both the Great Western and the Southern Railway are going to see what can be done about it. I am sure that to begin with it will be such an attraction that many trains will be missed. Why, I wonder, does the B.B.C. recommend so small a theatre for demonstrations? They are stated to have said that five rows of eight seats each is all that should be attempted. When I went to some of the Baird demonstrations in Wardour Street a while ago they were given to audiences of a much larger size than that, and I am sure that we sat more than eight in a row. The viewing screen wasn't very big, but I saw quite well even when sitting nine or ten rows back. If only forty people can be present at a time, the maximum number that can be accommodated in any one day is 120 since there are only going to be three programmes to begin with.



The Talks Problem

IN the old days of broadcasting what were then known as "Topical Talks" acquired rather a bad reputation amongst listeners. The speakers were often badly chosen; some of them could not make their subjects interesting, whilst the delivery of others was monotonous and dreary. So much, in fact, were talks disliked years ago that the announcement of one was sufficient to make the average listener's finger reach instantly and automatically for the switch. There are still many of those who don't care about talks, but I believe the number is diminishing. We get some first-rate people before the microphone nowadays; their subjects are carefully chosen and studio tests of delivery can be made before they are let loose on the air.

There may, too, be another factor in the increasing popularity of talks. If you cast your mind back a few years you will recall that receiving sets used to be pretty bad in their reproduction of speech. You have only to turn back the pages of wireless papers for those days to find frequent references to the half-swallowed potato with which speakers appeared to be struggling. Owing to defective reproduction talks certainly were rather a trial to listen to from sets that one came across in home after home. We have made a vast amount of progress since then, and speech is dealt with pretty well by most modern sets.

RANDOM RADIATIONS

By "DIALLIST"

The Voice of the Listener

IT is stated that in deference to the deluge of protests and pleas that have been received the B.B.C. is going to overhaul its programmes, making them altogether lighter. This may be a good move so long as it does not go too far. Broadcasting is an enormous factor in social life to-day, and one does not want to see the general standard of entertainment lowered to the level for which some sections of the listening public clamour. *Vox populi* is not always *vox Dei*. Frankly, I don't think there is any danger of a degradation of the programmes; listeners themselves will see to that. A joke in bad taste made before the microphone always evokes a huge volume of complaints.

Bright Without Being Vulgar

I do think, though, that our programmes, good as they are, can be very much brightened up if the whole business of programme revision is handled in the right way. There would be considerable difficulties if only a single programme were available to listeners. Except in areas where reception is phenomenally bad most valve users nowadays can receive both National and Regional programmes. There is therefore no reason why if you don't like the gravity of the one you shouldn't turn to the gaiety of t'other, and *vice versa*. My own view, for what it is worth, is that it is a great mistake to try to mix the very light-hearted with the rather serious in the same station's programmes. I'd much rather see the Regional programmes of a far more "popular" type than the Nationals. There is no doubt that though light programmes make a very wide appeal there is a big demand for others of what nowadays we call the more sophisticated kind. And it isn't only the highbrows who want these latter. Broadcasts such as the Queen's Hall concerts and Covent Garden opera have a huge army of supporters.



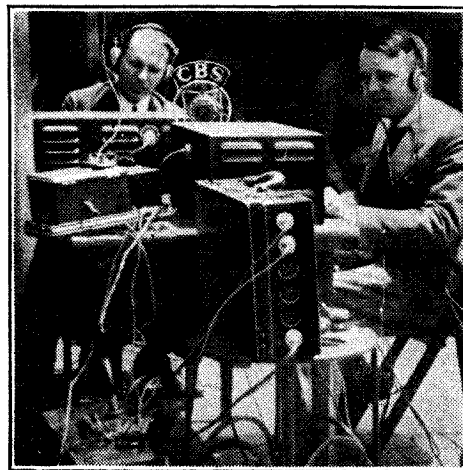
Olympia Variety

WHETHER the B.B.C. or the R.M.A. are to run "variety" shows at the Olympia Theatre, I do hope that too much attention will not be focused on these shows

when the Exhibition comes along. I am sure that it is quite wrong to make these performances the main attraction for a considerable part of those who attend, though this has been the case for some years past.

Side-Shows

I am all in favour of really good side-shows at the Olympia Exhibition, such things, I mean, as the Radio Weather House run by the N.P.L. the year before last and the G.P.O.'s extraordinarily good demonstrations of how interference can be caused by domestic electrical appliances and how they can be prevented from radiating. I should like, myself, to see a good many more side-shows of this practical kind. At present very little use is made at the Exhibition of the talking film. Why not half a dozen smallish film theatres, each showing something thoroughly interesting about wireless or the wireless industry? One, for example, might illustrate and describe the intricate processes of valve manufacture; if he could see for himself how a double-diode pentode is put together the man in the street might



A photograph received from America showing one of the O.B. squads of the Columbia Broadcasting Company with their portable outfit "doing their stuff" from a roof top during the commentary of the arrival of the *Queen Mary* on her maiden voyage

On the Short Waves

NOTES FROM A LISTENER'S LOG

CONDITIONS on the higher high frequencies, namely, above 20 mc/s, have been rather disappointing recently, although the "half-wave" of DGR, Nauen, was heard on 34.68 mc/s (8.65 m.) for quite a long period around 5 p.m. on Saturday afternoon, June 13th. The signals from this harmonic of the German transmitter, who, incidentally, was working HSP, Bangkok, were very strong and easily readable, with no appreciable fading. The "half-wave" of PPH, Rio, on 25 mc/s (12.5 m.) was also again heard at about R6/7 at 9 p.m. on Thursday evening, June 17th. It seems probable that long-distance reception on the ultra-high frequencies will now remain poor until about the end of August or the beginning of September, when conditions will improve and 28 mc/s signals from the west will again become audible until about one hour after sunset. It would appear that the open season for ultra-high frequency working is from autumn to spring of each year, except possibly during the sunspot minimum years.

A recent log of stations heard on 28 mc/s (10 m.) by Miss Nellie Corry, G2YL, published in QST for June, showed that during the period covered only one U.S. transmitter had been heard, the great majority intercepted being of European origin.

It would be very interesting to know exactly how these European ultra-high frequency signals are propagated; the skip-distance theory does not fit in here, as the waves seem to be incapable of making more than one hop (?) the signal disappearing after travelling a few hundred miles.

This improvement of ultra-high frequency conditions in the autumn is also noticed on frequencies lower than 28 mc/s (10 m.), and I am told that the performance of the Empire GSH on 21.47 mc/s (13.97 m.), although heard quite well in India at the moment, tends to be best near the Equinoxes, but what happens during the winter months is not yet known, except that Australia, which is at present in winter, appears at times to get even better signals on GSH during the Transmission 2 period (11.00-14.00 GMT) than on GSG, which uses the lower frequency of 17.79 mc/s (16.86 m.) and which radiates more energy in the direction of Australia than GSH!

It does seem a bit incredible to class GSH as a winter frequency, but this may well prove to be true.

It also has its uses as a summer frequency, however, for the latest bulletin of the Chicago Short-Wave Club, one of the best-known short-wave clubs in the world, states that "reception during the morning has been very poor—with the possible exception of GSH," which was given as QSA5, R8, on the two mornings monitored.

The report on short-wave conditions for the period normally covered by this log is curtailed a little owing to Ethacomber having been on holiday from June 1st-7th! Starting, therefore, with June 8th, one noted that W3XAL was rather better than usual at 7 p.m., being equal to the 'phone CGA, Drummondville, but not so good as

WLA, Lawrenceville, both on 18 mc/s (16 m.) approximately.

Only fair results were obtained from W8XK and W2XAD at this time on 15 mc/s (19 m.), but later, at 11 p.m., W1XAL, Boston, was good, marred, perhaps, by static, on 11.79 mc/s (25.45 m.); PRF5 was fair, but W8XK on 15.21 mc/s (19.72 m.) had improved to a good signal.

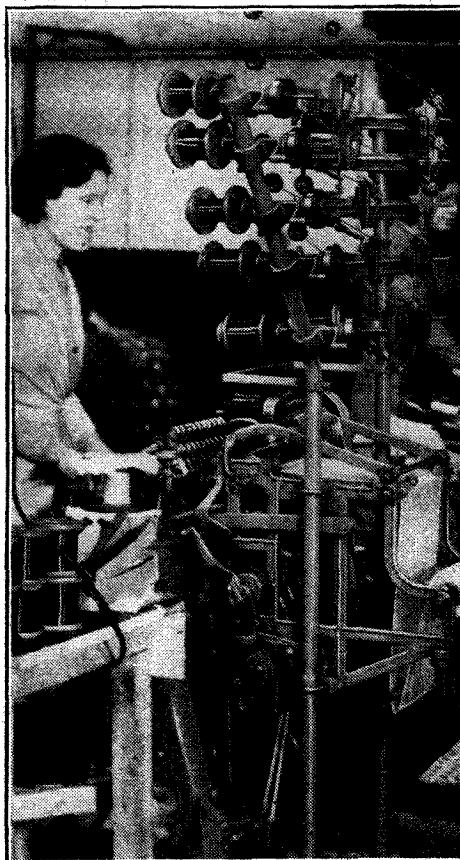
A station which was probably LRX was also quite a good signal on 9.64 mc/s (31.1 m.).

Really excellent signals were intercepted from W2XAD on 15.33 mc/s (19.56 m.) at 11 p.m. on Tuesday, June 9th, this station easily outperforming all the other U.S. broadcasters; undoubtedly W2XAD was using his European beam on this occasion, as was also the case on Wednesday evening during the relays of the speeches from the Republican Convention at Cleveland.

These relays continued until 7.30 p.m. on Friday, and during the closing broadcast it was stated that fifty-two microphones had been in use on the floor of the convention hall, the Cleveland Auditorium.

It was noted during these broadcasts that the field strength of W2XAD continued to increase during the evening—reaching

TEN TRANSFORMERS IN TWO MINUTES



One of the multiple transformer winding machines installed in the R & A speaker factory at Wolverhampton. The machine winds ten transformers at a time, interleaving each layer of wire with paper; operation is entirely automatic.

"local station" strength at midnight on June 11th.

On June 12th, however, W8XK, on 15.21 mc/s, at 7.30 p.m. was a rather better signal than W2XAD, due to a deeper modulation level, although the field strength of W2XAD was higher.

Later in the evening on the Friday six transmitters were logged at one time in the 15 mc/s band, namely, GSO, DJB, W8XK, W2XE, LRU, and W2XAD—this, in its way, is surely a record!

Finally, in closing, I should like to say that VK2ME, on 9.59 mc/s (31.28 m.), has been quite a good signal recently during his Sunday morning breakfast time (!) broadcasts from 6-8 a.m., at which time the noise level is often lower than in the afternoon.

ETHACOMBER.

Two New G.E.C. Sets

THE first of the new season's range of receivers are now available. One is a "straight" battery set, and the other an AC superheterodyne.

An 8in. moving-coil loud speaker with a nickel aluminium alloy magnet is included in the specification of the "Battery T.R.F.3," and the circuit comprises a variable- μ screen-grid HF amplifier, pentode detector, and high-efficiency pentode output valve. There is no grid-bias battery, as the bias is automatic. The price, complete with valves and batteries, is £7 19s. 6d.

The "AC Super 4" employs a triode-hexode frequency changer, variable- μ pentode IF amplifier, double-diode-triode second detector, and AVC valve and a high slope output pentode. The tuning dial, which is inclined from the front of the cabinet, is "floodlit," and carries a wave-range indicator, in addition to the names and settings of the principal European stations.

The standard 190-250-volt model costs 10½ guineas, and a special low-voltage model for 110-130 volts and 210-230 volts is available at 11 guineas.

THE RADIO INDUSTRY

ALIMITED edition of a technical bulletin describing the design and construction of the Goodman High Fidelity Auditorium Speaker has been printed by Goodmans (Clerkenwell), Ltd., Broad Yard Works, Turnmill Street, London, E.C.1. Readers may obtain copies for 3d. in stamps.

The combined station-name scale and tuning indicator described in our issue of June 12th was originated by H. Hacker and Sons, and is fitted to Dynatron receivers.

The latest issue of the *Bulgin Monthly Bulletin* announces the opening of the *Bulgin* experimental station G5BU, which works on 42.5 metres. The co-operation of amateurs is invited. A third revised edition of the *Bulgin* catalogue (price 3d.) has just been issued.

An important contract for the installation of public-address equipment at many points over an extensive area has been awarded by the Corporation of Southport to Ardent.

The overseas version of the new H.M.V. All-wave Autoradiogram has had a good reception abroad; according to the company, export figures for the last month showed a considerable increase.

BROADCAST BREVITIES

NEWS
FROM
PORTLAND
PLACE

New Studio Appointments

SEVERAL appointments which have been made recently by the B.B.C., while not affecting key positions, are nevertheless important as bearing upon the actual function of putting the programmes over. For instance, three new studio assistants have been appointed, one each for Birmingham (B. D. K. Lewis), Manchester (F. Rendall), and Bristol (L. G. Dennis). Mr. Lewis was a journalist in the south of England until he decided that music held a greater fascination than reporting; and so it came about that he entered the Royal Academy of Music, and became a singer, pianist and composer. Mr. Rendall has been a chorus singer at Glyndebourne Opera Festival and has toured with a marionette theatre; he graduated from the Royal College of Music. Mr. Dennis is an old hand in the broadcasting studio. He was first "on the air" in 1922, and subsequently served as principal 'cellist of the B.B.C. Midland Orchestra for ten years.

Journalist for Talks

Mr. R. F. Dunnett, who has joined the B.B.C. as Talks Assistant in Edinburgh, is another journalist whose experience should be an asset to broadcasting. His writings are very well known in Scotland, and he has broadcast the feature "New Books in Scotland" on several occasions.

A new Producers' Assistant in the Empire Department is E. St. C. Hobbins. He has been a teacher of the violin and viola and has taken an active part in the work of the Incorporated Society of Musicians.

How, Where and Why?

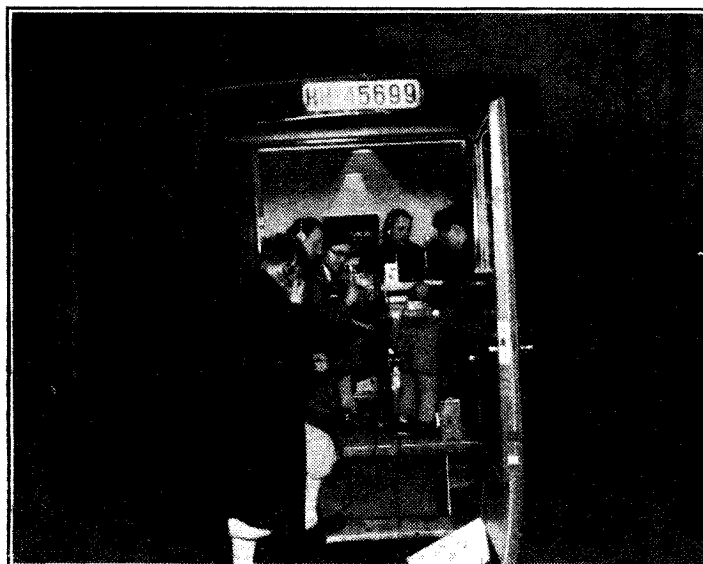
STRICTLY speaking, the B.B.C.'s responsibilities end when it has put out a good transmission of something worth listening to. How, where and why the listener picks up the said transmission is not the concern of the Corporation, which has enough troubles of its own. In practice, however, Portland Place is poignantly interested in who picks up the programmes, and how.

Baffle Boards Recommended

The first part of the question is answered in the case of transmissions to schools, and there should be no doubt about the second if the Central Council for

School Broadcasting realises its ideal in the matter of reception quality. In a special booklet for schools golden rules are laid down that might well be studied by common or garden listeners as well as the teachers for whom they are intended.

The Central Council is all for baffle-mounted speakers, urging teachers to avoid over-accentuated bass by mounting exten-



NOCTURNAL SONGSTERS are not only appreciated by English listeners, for above is shown some of the engineers of the Reichssender Hamburg in a special van listening to the songs of birds being picked up by microphones hidden in the woods.

sion speakers on a flat baffle-board of stout construction rather than in a cabinet. The importance of tuning-in "dead" on the transmission is also emphasised. "If the 's' sounds are blurred . . . care should be taken that the tone control is adjusted to the 'brilliant' position."

Rules for Testing

The Council is against the use of the school hall for broadcast lessons, the acoustics of large rooms usually being unsatisfactory if they are more than half empty; it is pointed out, moreover, that reception in the hall is likely to be frequently interrupted. This observation must certainly be based on bitter experience!

A final extract which may interest the home listener: "The quality should be tested particularly from the farthest desk and from the desks at the ends of the front row." Failure to test in this way has probably robbed some scholars of interesting "lessons" and led to many an undeserved spanking "for inattention."

Television "Begins"

"DOWN in the forest something stirred," and if, for "forest" we read "Alexandra Palace," we have a theme song for television. The first thing to stir is the television bus, which now leaves Broadcasting House daily at 2 p.m. with its human freight of television pioneers. At the Palace, too, things are stirring; a luncheon

mental basis before the end of August, and other test programme features will probably accompany it.

Sky Light

The steel tower of the television mast at Alexandra Palace has reached a height where it may be regarded as a possible danger to aircraft, and a warning red light now shines from the top after sunset.

"On the Carpet"

TO be "on the carpet" at Broadcasting House nowadays does not necessarily imply a visit to the "D.G.'s" room for chastisement or other form of correction. It may quite easily refer to something much more frightening—nothing less than broadcasting to the lurking and listening millions outside.

The "carpet" really is a carpet, circular in shape, which is now used in conjunction with ribbon microphones in drama studios.

Dead Spots

Instead of marking the floorboards with cabalistic signs, the producers now employ carpets in which the necessary directions to broadcasters are already woven in crimson on a grey background. The carpet, divided into numbered segments, is placed with its centre immediately under the mike, and the actors take up their stances on the appropriate numbers, as directed.

Although the ribbon mike is not markedly directional, there is a practically blind spot on each side of the instrument, and the corresponding segments in the carpet are marked "Dead." On seeing this, nervous newcomers invariably glance around for the body.

Less B.B.C. Building

FEW public organisations can rival the B.B.C. in the multiplicity of its building activities. At any given time one may expect to find a dozen or more constructional projects in hand, ranging from the erection of a valve-cooling tank to the building of a regional station.

It is not surprising, therefore, that a strict watch is being kept on building expenditure. Probably the next retrenchment measures at Broadcasting House will be in this direction.

Four Weeks Ahead

And while the engineers are busy the Programmes Branch is also getting down to brass tacks, for definite schedules must soon be prepared if present plans are to be adhered to. These plans provide for the general arrangement of television programmes a month ahead of transmission. Actually this time lapse must be regarded as short, considering that sound broadcast programmes are prepared six or even eight weeks in advance. Television should gain in topicality by the arrangement.

The Test Programmes

When will television possess entertainment value? is the question which everybody is asking, and the answer oscillates between mid-August and early September. In all probability a "Television Magazine"—not unlike its Saturday prototype in sound broadcasting—will be launched strictly on an experi-

Recent Inventions

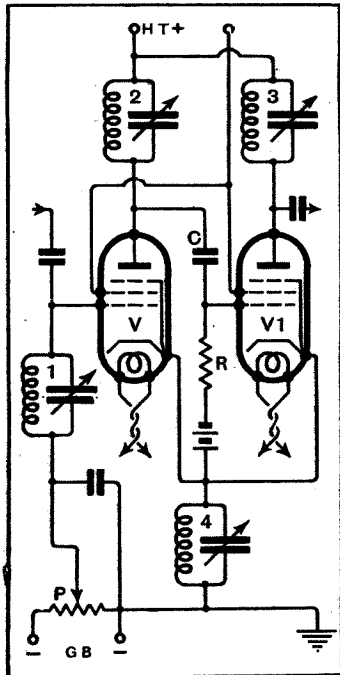
The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

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

VARIABLE SELECTIVITY

THE circuit shown in the figure is designed to give variable selectivity. The anode of the pentode V is coupled through a condenser C to the control grid of the pentode V1, the grid of which is anchored to the cathode by a resistance R.

A tuned circuit 1, in the grid circuit of V, is fed with IF current from a previous valve, and similarly tuned circuits 2 and 3 are included in the two output circuits of the pentodes. The two cathodes are joined together, and to one side of a fourth tuned circuit 4, which provides positive reaction between the two valves.



Arrangement of the variable selectivity circuit described in patent No. 444178.

In these circumstances a movement of the slider P in the input circuit of the first pentode varies both the selectivity and the overall gain of the circuit in the same direction. That is to say, when the gain is at a maximum (as it is when searching for a distant station), the selectivity is also high; but when a local station is being received, both the gain and selectivity of the set are reduced.

The circuit is particularly suitable for handling high intermediate-frequencies of the order of 1,000-2,000 k/cs. It will give two-channel separation under these conditions, even with a low value of inductance-to-capacity in the tuned circuits.

Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. Application date 15th August, 1934. No. 444178.

TELEVISION SYSTEMS

IN the Iconoscope type of cathode-ray tube, as used in television, an image of the picture to be transmitted is focused upon a "mosaic" surface of small photo-sensitive particles which, in effect, form an electrostatic facsimile of the picture. The static charges are subsequently discharged, line by line, by the electron stream from the "gun" part of the tube.

It is pointed out that the photo-sensitive "mosaic" is liable to suffer more or less rapid deterioration under continued bombardment by the electron stream, and the object of the invention is to prevent this by projecting the picture, in the first place, upon a photo-sensitive cathode. The resulting emission from the cathode is then focused upon an array of insulated electrodes placed in front of a "mosaic" surface of photo-sensitive particles. The resulting "electric image" is finally discharged by the electron stream from the "gun," which is located at the opposite end of the tube.

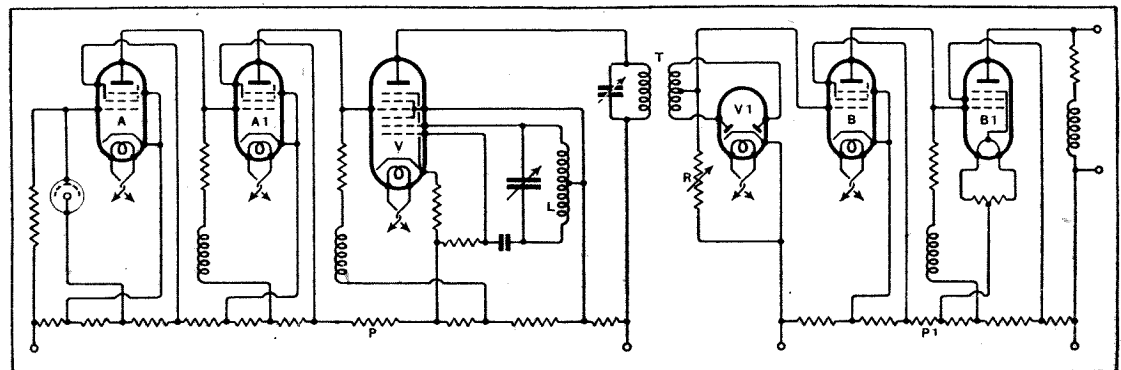
Telefunken Ges. für drahtlose Telegraphie m.b.h. Convention date (Germany) 14th July, 1934. No. 444151.

VALVE AMPLIFIERS

THE invention relates to amplifiers designed to handle a very wide band of frequencies, such as are used in television.

Direct-coupled amplifiers can of course be used for this purpose, but they suffer from the disadvantage of requiring a high-voltage source for the plate supply, particularly if a large number of stages are connected in cascade.

The figure shows two direct-coupled amplifiers A, A1 coupled to a second group B, B1 through



Wide-band direct-coupled amplifier for use in television.

an intermediate oscillator-modulator valve V, which generates a carrier-wave in the circuit L and modulates it with the amplified signals from A and A1. The coupling-transformer T (which may be replaced by a transmission line) feeds the modulated signals to a

double-diode rectifier V1, the demodulated signals then being passed through the second group B, B1 of direct-coupled amplifiers. The HT supply can then be drawn from two separate sources P, P1. Volume is controlled by varying either the load resistance, or the bias on the screen-grid of the valve V.

Scophony, Ltd.; G. Wikkenhauser; and J. Sieger. Application date November 25th, 1935. No. 444058.

REACTION IN CATHODE-RAY TUBES

AN initial deflection of the electron stream inside a cathode-ray tube, due to an applied impulse, causes the stream to fall upon an internal target or "collector electrode." The resulting current in the external circuit of that electrode passes through a coil which produces a magnetic field. This field is then applied to the stream in the correct sense to enhance the original deflection, thus increasing the overall sensitivity of the tube.

R. A. Watson Watt and L. H. Bainbridge Bell. Application date 12th July, 1934. No. 444173.

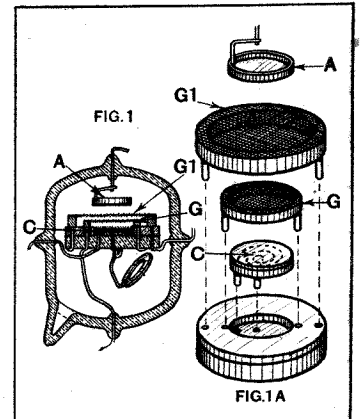
SCANNING SYSTEMS

IT is desirable to be able to alter the line-scanning frequency used in transmission, according to varying conditions. For instance, the line-frequency employed when televising a cinema film may not be the most suitable to use for an outdoor scene. In such circumstances it is of course necessary to make a corresponding alteration in the time-base circuit of the receiver.

According to the invention the necessary change-over is effected automatically. Two filter circuits are inserted in parallel between the input of the receiver and the "saw-tooth" oscillation-generator. One circuit is adjusted to "accept" a frequency corresponding to 180 lines at 25 frames, and the other a frequency corresponding to 240 lines at 25 frames. The

MIDGET VALVES

RELATES to "midget" valves suitable for handling waves of any length, more particularly ultra-short waves down to one metre or less. The glass bulb is made of two "hat-shaped" halves, each approximately three-quarters of an inch in diameter, which are fused together at the "brims," to produce a spherical or acorn-shaped container. There



Constructional details of the midget valve. An "exploded" drawing of the electrode assembly is shown in Fig. 1a.

is no "stub" in the ordinary sense of the term, the leads from the various electrodes being taken out at the top and bottom, and through the centre flange, as shown in Fig 1. The electrodes are very close-set, the spacing being of the order of a few thousandths of an inch. This is ensured by a method of mounting in cup-shaped holders which nest together on a centre base.

The electrodes are shown in "exploded" form in Fig. 1a, C being the cathode which is heated by an enclosed coil, G and G1 the control and screening grids, and A the anode. The valve can be used in an ordinary back-coupled circuit with inductances of copper

wire wound in a helix one-eighth of an inch diameter, to produce stable oscillations of about 30 cms.

Marconi's Wireless Telegraph Co., Ltd. (assignees of G. McN. Rose, Jr.) Convention date (U.S.A.) 24th June, 1933. No. 444567.

output current from each filter is then used to operate a switch which automatically inserts the appropriate condensers in the circuit of the time-base oscillator.

G. E. G. Graham. Application date 19th February, 1935. No. 444360.