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*As many of the circuits and apparatus described in these  
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making use of them, to satisfy themselves that they would  
not be infringing patents.*

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## EDITORIAL COMMENT

### The Gramophone Record

*Present Recording System  
Obsolete*

**A** REVOLUTION in the gramophone industry took place when electrical methods of recording and reproduction were introduced.

We are all of us familiar with the restrictions which purely mechanical means of reproducing from records imposed and the improvements which came within the reach of the general public at once when the modern electrical pick-up and valve amplifier superseded the sound box and the horn, and, startling as the effect on the reproducing side has been, the improvements brought about by the introduction of electrical methods to the original recording are even more remarkable.

The system of recording now in general use has been brought to such a state of perfection that it seems unlikely that any considerable further improvement can be expected ; yet it is common knowledge that the gramophone record to-day is a long way behind in quality the best results which can be received from broadcasting.

The reason for this state of affairs is that the present recording and reproducing system has inherent limitations and the quality of gramophone records must be expected to stand still unless another system is adopted. But the system need not be new—it can be a system introduced in the earliest days of recording but neglected because greater energy for cutting in the recording process was needed, and before the advent of the valve and amplifiers this consideration was so serious that the system had perforce to be shelved.

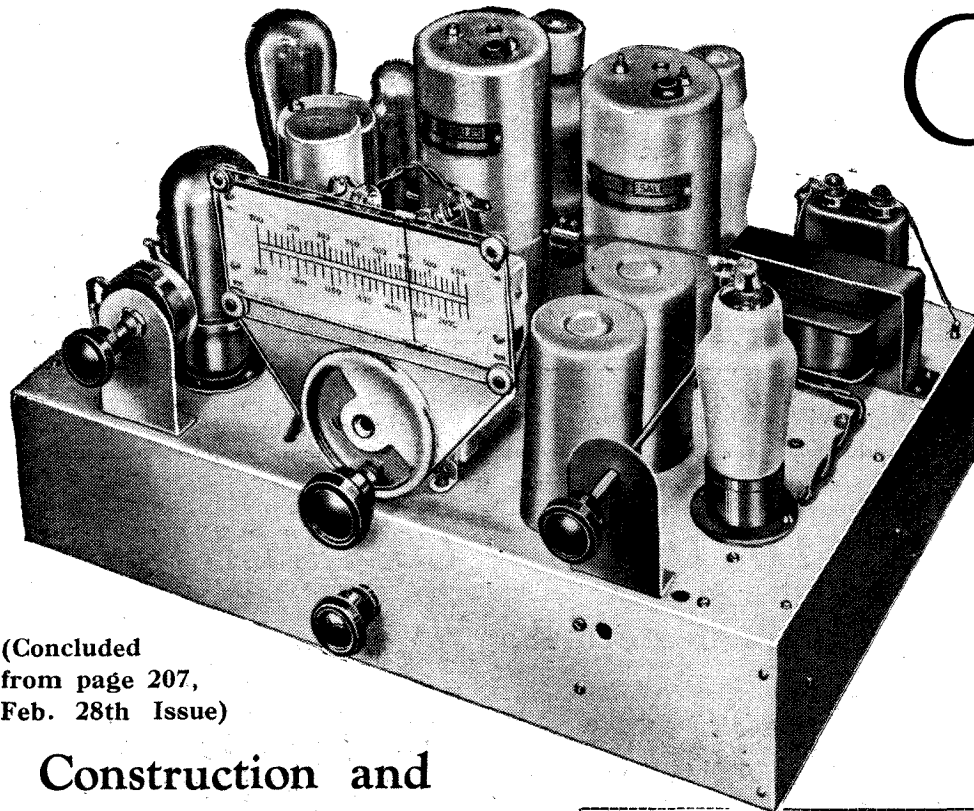
But the advantages of the "hill and

dale" system, as it is called, are so outstanding that it is probably safe to say that the present system would never have made progress except for this one objection. By the time the valve and amplifiers arrived the present types of records and gramophones were so universally distributed that no manufacturer had the courage to make the change-over. If a change-over to "hill and dale" recording on disc were made our new records would be capable of far greater contrast because at present the spacing of adjacent grooves limits the amplitude of the cut, and, therefore, correct proportioning of amplitudes is impossible ; needle scratch would practically disappear ; records would have a longer playing time because the width of grooves would be uniform and could, therefore, be brought closer together ; the moving-coil pick-up would become available for the first time, since pivoted pick-ups would no longer be necessary, and the reproducing needle could be permanent.

We have not, we believe, exhausted the advantages, but sufficient has been said to show that the change-over is prevented not by any technical considerations but solely because we are so committed to the present types of records and gramophones. For years now a perfected "hill and dale" system has been in existence and for special purposes this form of recording and reproduction is in use. It is regrettable that records on this principle should not yet be available to the public at a time when there is so much clamour for better quality. The question is now entirely a commercial one depending upon whether a sufficient increase in sales of records would result. We have to remember, of course, that the change would be most appreciated by a minority and not by the purchasers of the bulk of "popular" records.

# QA Super

By W. T. COCKING



(Concluded  
from page 207,  
Feb. 28th Issue)

## Construction and Operation

SEVERAL minor departures from the usual have been made in the constructional details of this receiver in order to obtain a more convenient assembly and a greater degree of uniformity between different receivers. The use of a metal chassis with all holes correctly drilled for mounting the components has for long ensured that variations due to changes in layout cannot accidentally occur. With modern screened components, however, their relative position is often quite unimportant as far as interaction between the components themselves is concerned, and their position is only of importance in so far as it determines the positions of the various connecting wires.

Most sets nowadays contain a large number of resistances and condensers which are so small that they are usually supported in the wiring. This course is entirely satisfactory electrically provided that they are placed with due regard to the possibilities of stray couplings, but there is no doubt that it leads to a considerable chance of error. To take only one example, resistances are commonly fitted with a lead of about  $1\frac{1}{2}$  in. for the connection; now a resistance is sometimes connected to the grid of an HF valve and the designer naturally intends the lead to be cut short to perhaps  $\frac{1}{4}$  in. so that the resistance can be soldered almost directly to the valve socket with the shortest possible lead. It is not uncommon, however, to find receivers in which the full length of wire is retained, and the constructor is surprised to find that instability is present!

In an endeavour to overcome possible troubles of this nature, therefore, definite mountings have been adopted for such

small components in cases where it is advantageous to do so. Paxolin boards carrying double-ended soldering tags are employed and each resistance or condenser is soldered to the appropriate pair of tags as shown in the constructional drawings. In most cases it is necessary to cut short the wire end or soldering tag fitted to the component.

### Mechanical Considerations

It is recommended that all the parts concerned be mounted on the boards before they are fixed to the chassis, and all the necessary cross-connections made. The tags which come next to the chassis should all be bent out to give a greater clearance from the chassis and to render them more readily accessible should it be necessary at any time to make a connection to them. Moreover, it is easiest to attach long leads to the appropriate tags for the connections to other parts before mounting them; this is advisable, of course, only in the case of those tags which come next to the chassis.

It will be observed that all resistances and condensers are not supported by these boards. In particular, C8, C9, R2, and R3 in the oscillator circuit are included in the wiring because the use of a board would here involve absurdly long leads. The components are, however, connected directly from point to point with the shortest possible leads.

The second departure from ordinary practice lies in the erection of screens around the valveholders of the two IF valves, and this has an important bearing not only upon the stability, but also upon the uniformity of different models. Stray couplings are greatly reduced because all leads carrying IF currents are screened from one another, including the so-called "dead" HT leads which are often nearly as live as anode leads. All by-pass and decoupling condensers are included within the screening, and all leads passing from one compartment to another do so through definitely placed holes in the screens which necessarily fix their positions.

The amount of screening incorporated

*PRECEDING issues of "The Wireless World" have contained full details of the theoretical considerations underlying the design of the QA Super as well as a complete description of the set. In this article, the construction and initial adjustments are dealt with and the performance described.*

has been found to be much greater than is necessary for the maintenance of stability, but in such an important item a large factor of safety is very desirable when it can be obtained. Even if actual oscillation does not occur, incipient instability usually spoils the performance, leading to excessive background noise and an unsymmetrical resonance curve.

The order in which the various components are assembled is not a matter of great importance, for none is difficult of access. When wiring, those leads which come nearest the chassis will naturally be placed in position first, and it is as well to start with the heater leads. To avoid an excessive voltage drop, No. 16 gauge wire must be used, and in view of the screening it is not feasible to use single lengths for joining together all valves. It is recommended that the frequency-changer be wired to the first IF valve; then straight lengths can be used and easily passed through the screening, for joining the two IF valves and the detector. The connections of this valve with the phase-changer and AVC valves are then quite straightforward. All wires are naturally sleeved to prevent short-circuits.

The inter-unit cable is of the five-way type, although only four wires are actually used. The heavy leads are for the heater connections, and those joined to the "cathode" and "anode" pins of the plug for negative and positive HT respectively. The cable is terminated by solder-

ing the leads to the appropriate points in the receiver, and the fifth lead, to the "grid" pin, should be cut short.

When the construction of the receiver is done there remain only the initial adjustments to perform. If a calibrated test oscillator is available, these can be done

frequency-changer, and the trimmers on T1 adjusted.

The IF amplifier is now approximately adjusted to 465 kc/s, but to ensure precise trimming it is necessary to go over it again and adjust each trimmer exactly for the maximum response. Unless the

a millimeter-type tuning indicator wired in the same position. The input must then be great enough for AVC to be operative, and maximum response coincides with a minimum indication on the meter.

Particular care should be taken to see that each trimmer is adjusted correctly, otherwise the adjacent channel selectivity will be below normal. It is just as important to make sure that the frequency to which the circuits are adjusted is the correct one, for although this will not affect the selectivity or amplification, it will have a large effect upon the accuracy of ganging of the signal and oscillator circuits. Should any difficulty be found in adjusting the ganging, an incorrect intermediate frequency is the most probable cause, and the calibration of the test oscillator should be checked. It may be remarked that difficulties of this sort are most probable when

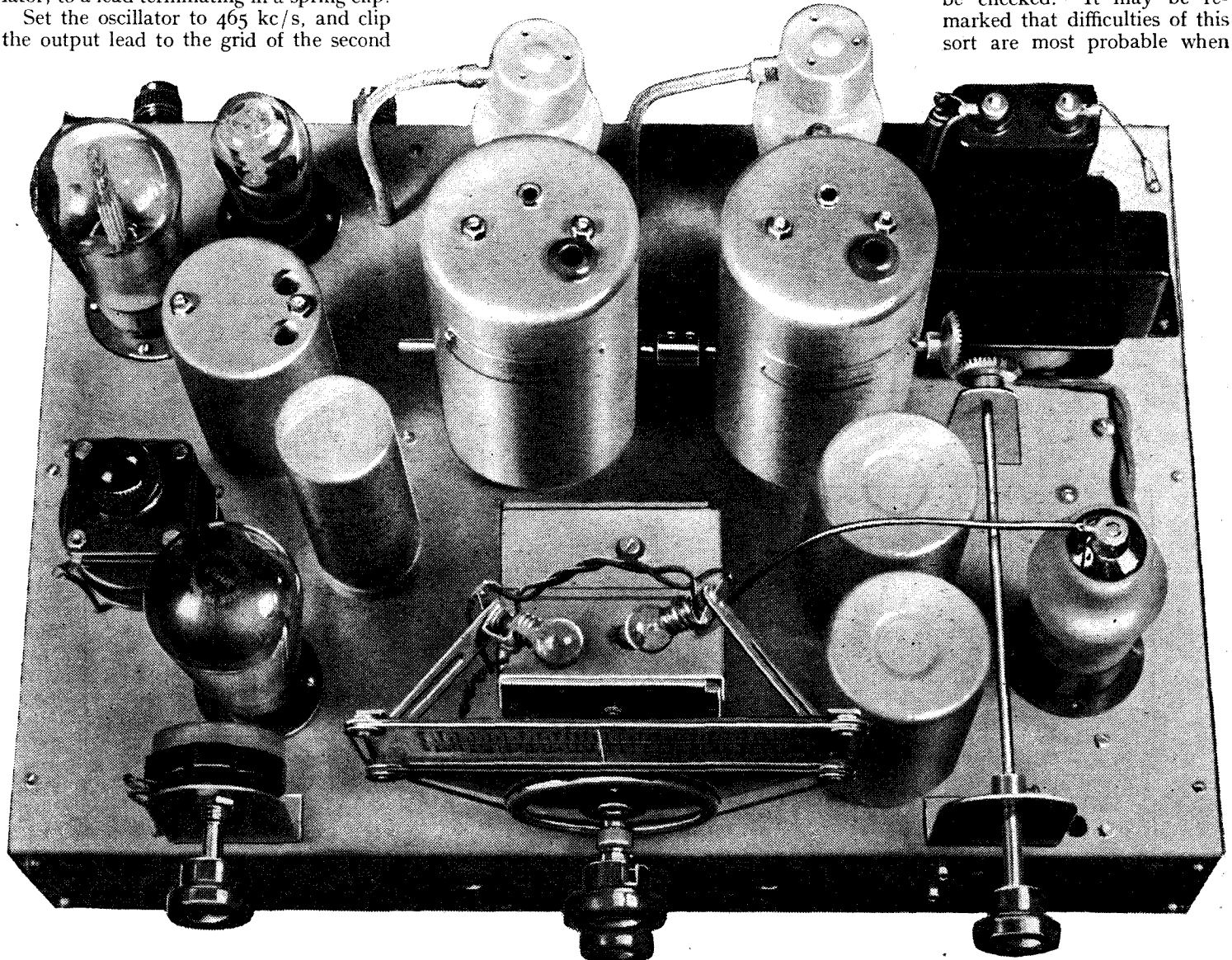
## A SPECIAL RECEIVER FOR THE PUSH-PULL QUALITY AMPLIFIER

very rapidly and certainly. The "earthy" side of the oscillator output should be joined to chassis, and the live output lead taken through an artificial aerial or a 0.0002 mfd. condenser, if this is not already incorporated in the oscillator, to a lead terminating in a spring clip.

Set the oscillator to 465 kc/s, and clip the output lead to the grid of the second

effect of AVC. This is so much more effective than usual that it is impossible to trim properly, using an output meter as an indicator, unless the detector input be kept small enough for AVC to be inoperative.

input be very small, it will be impossible to judge the optimum settings by ear, or even by means of an output meter owing to the



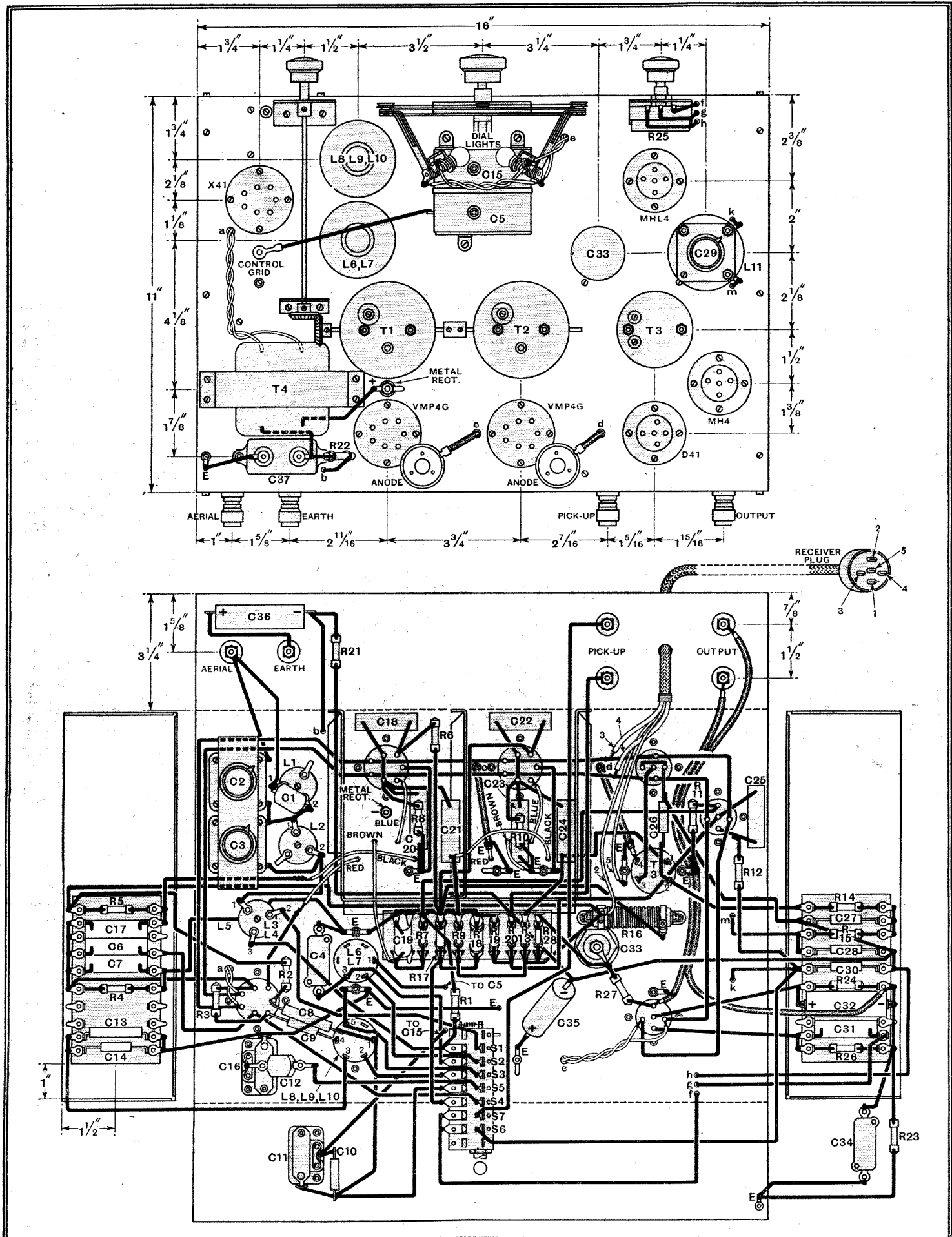
The layout of components is well shown in this illustration. The variable-selectivity IF transformers with their bevel-drive can be seen in the centre with the two IF valves behind them. The transformer for the AVC HT supply is on the extreme right at the rear.

IF valve, and adjust the trimmers on T3 for maximum response. Then transfer the oscillator lead to the grid of the first IF valve and adjust the two trimmers on T2 for maximum response, the selectivity control on the panel being fully rotated in an anti-clockwise direction (maximum selectivity). The oscillator output must next be connected to the grid of the fre-

An output meter is by no means necessary, however, and it is just as easy to employ a millimeter connected in the anode circuit of the first IF valve in series with R9 and on the HT side, or, alternatively, to use a voltmeter connected across R8. Incidentally, the milliammeter can be left in circuit permanently to act as a tuning indicator, if desired, or

the oscillator is of the type using harmonics for the IF range. Any error in the calibration is then multiplied by the degree of harmonic. Thus, suppose that the second harmonic is used, and the oscillator is accordingly adjusted to what is believed to be 232.5 kc/s, but that the fundamental is actually 242.5 kc/s—an error of 10 kc/s. The second harmonic will be 485 kc/s, and

PRACTICAL WIRING DIAGRAM



Complete details of the construction and wiring are given in these drawings. It should be noted that the wires shown as passing over the IF screen partition are actually bunched together between the screen and resistance board.



**QA Super—**

the IF amplifier will be adjusted to this frequency, and it will be in error by 20 kc/s. Some latitude in the exact frequency is naturally permissible, but the variations from 465 kc/s should be within  $\pm 10$  kc/s if possible.

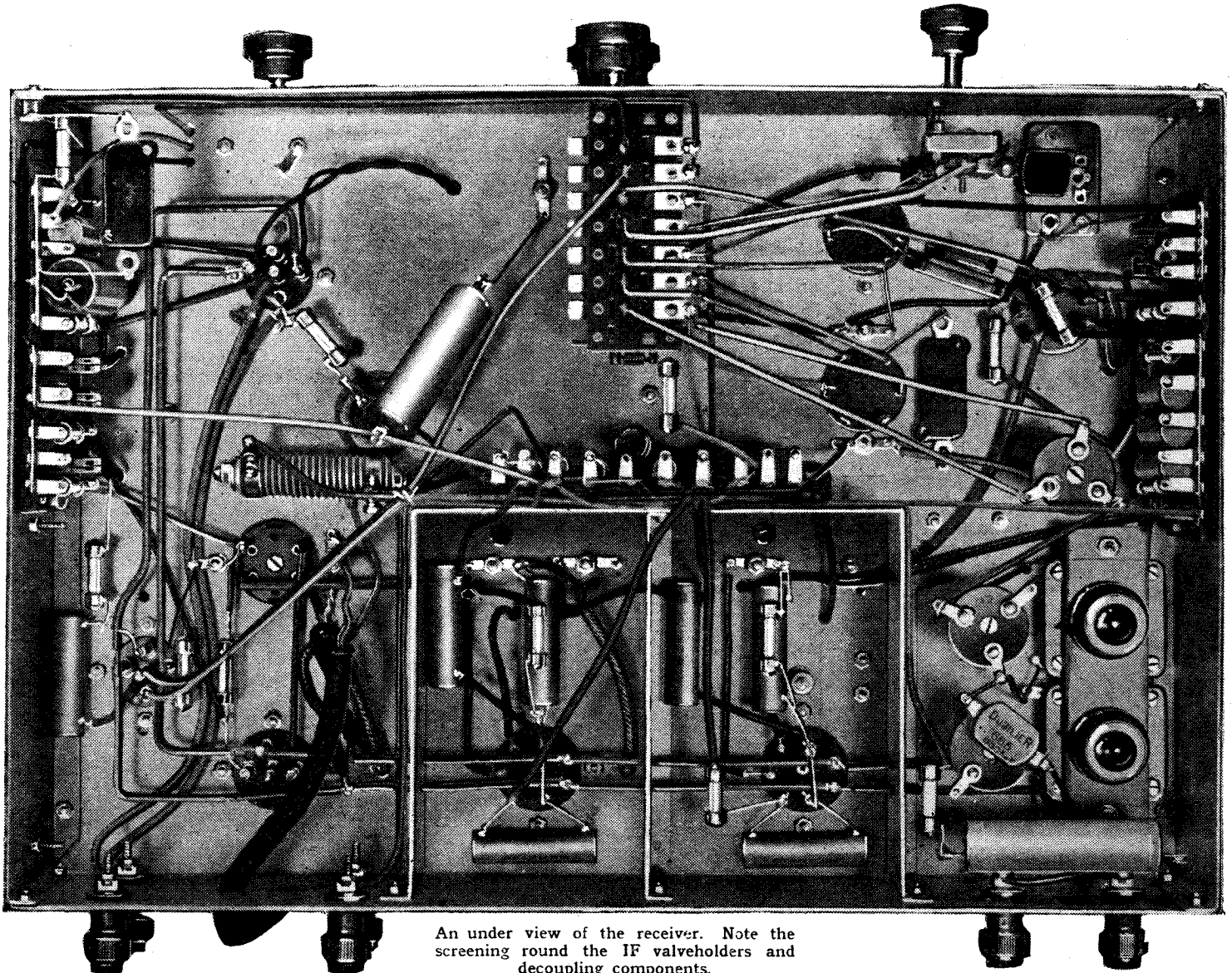
Having adjusted the IF amplifier, transfer the oscillator output to the aerial terminal and adjust the IF trap C2 for minimum output; that is to say, for minimum sound or reading on an output meter or maximum indication on a milliammeter or voltmeter connected to the first IF valve.

therefore, temporarily short-circuit R4; the reading of the indicating meter will change, of course, but ignore this and adjust the trimmer.

The next step is to set the oscillator to 1,400 kc/s and to tune the set to it by the main tuning control, again using the meter as an indicator. Then reduce the oscillator output considerably, remove the short-circuit from the set oscillator coil and also the short-circuit from R4 if this has been used. The oscillator trimmer on C15 can now be adjusted for maximum response. Its setting will be critical. Should more

can now be adjusted for maximum response. As both sides of this condenser are "live," an insulated screwdriver with a very small metal part is needed, otherwise the presence of the screwdriver will change the tuning of the circuit, and a certain amount of trial and error will be required to determine the best setting.

This completes the medium-wave ganging. On the long-wave band the process is similar, but only one trimmer needs adjustment. Apply the short-circuits previously described and set the test oscillator at full output at 300 kc/s, and tune the



An under view of the receiver. Note the screening round the IF valveholders and decoupling components.

The ganging must next be adjusted. Set the test oscillator to 1,500 kc/s and adjust it for maximum output. Short-circuit terminal (1) of the oscillator coil to the chassis by a lead terminating in crocodile clips, set the waveband switch to the medium waveband (fully anti-clockwise) and the tuning condenser at zero. Then adjust the trimmer on C5 for maximum response on a milliammeter or voltmeter joined to the first IF valve, *i.e.*, minimum reading. In some cases, it may be found that there is no response; this does not necessarily mean that there is anything wrong, merely that the oscillator output is insufficient to run the first valve into grid current. If no indication can be obtained,

than one point of response be found, the oscillator output is probably excessive and should be reduced.

The short-circuit to the set oscillator must now be reapplied, and also that to R4, if this was previously found to be necessary. Then set the test oscillator to full output and tune it to 600 kc/s. Now tune the set to it by the main tuning control, using the meter as an indicator. Reduce the output of the test oscillator, and remove the short-circuits; the trimmer C11

set to it. Then remove the short-circuits, reduce the oscillator output, and adjust C16.

The process of ganging is very much easier than it sounds, and is quite definite and free from any ambiguity. If everything is in order it can be done in a very short space of time, 10 minutes would be ample for anyone familiar with the process, but more time is naturally occupied if it is necessary to refer to the instructions at every step.

There remains only the trap circuit C3 to be adjusted, and this must be done on a signal; for the time being set C3 at maximum. Attach the aerial, and try out the receiver.

A full-size blue print of the wiring diagram is available from the Publishers, Dorset House, Stamford Street, London, S.E.1. Price 1s. 6d. post free.

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After dark there should be no dearth of stations; tuning should be quite sharp with selectivity at maximum, but will naturally be much flatter on the long than on the medium waveband. Save in the very worst locations there should be few, if any, whistles, the pitch of which varies with the setting of the tuning control. If whistles are found, determine which station on the medium waveband is the strongest by watching the meter joined to the IF valve, it will usually be the higher wavelength of the two local stations. Tune the set exactly to this station; then tune the trap to it by C<sub>3</sub>. As the circuit comes into resonance the meter needle will rise, indicating a smaller input to the first valve; set the condenser so that a maximum reading (minimum input) is secured. It should then be found that the whistles have disappeared.

**The Image Suppressor**

This trap circuit can be tuned to any station in the medium waveband, and, in general, this is all that is necessary. In a few districts, however, it may be better tuned to Droitwich, and it can be made to cover the long waveband by connecting to terminals (1) and (3) of L instead of to terminals (1) and (2).

No other adjustments are needed save to the whistle suppressor C<sub>29</sub> and to the second-channel suppressor L<sub>5</sub>. In general, it will suffice if C<sub>29</sub> is set at about 15 degrees less than maximum and L<sub>5</sub> in the position shown in the drawings. It must not be expected that the whistle suppressor will eliminate all inter-carrier heterodynes for some are to be found which are appreciably lower than 9,000 c/s. These are usually on the long waveband, and as they cannot be removed without restricting the upper frequency response unduly, it is better to reduce them by increasing the selectivity than by making the suppressor cover this range. If an attempt be made to adjust C<sub>29</sub> on a signal, selectivity should be low, and the station selected should be spaced by 9 kc/s from both its neighbours.

Turning now to L<sub>5</sub>, this will need adjustment only if second-channel interference is found on the medium waveband. Such interference will consist of CW morse, and the pitch of the note will change with the tuning. The set should be tuned to a signal upon which the interference is found, and the position of the single-turn L<sub>5</sub> which has been inserted in the wiring adjusted for minimum interference. If no minimum can be found, try reversing the direction in which the single turn is wound.

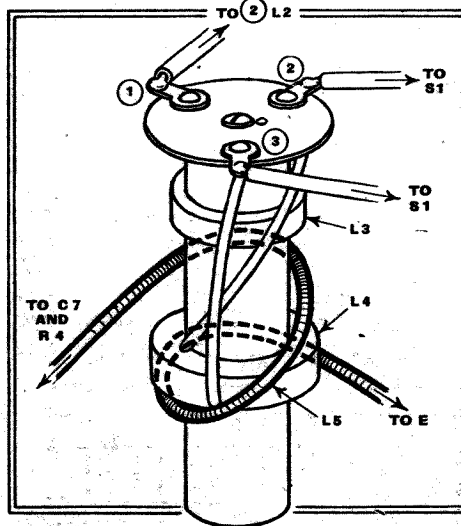
In most cases these adjustments are unnecessary, for the positions given in this article and in the drawings are sufficiently near the optimum for adequate rejection to be secured. It is only when interference is unusually severe, or the deviations from the normal in components unusually great, that adjustment will be needed.

So far nothing has been said about trimming the set when a calibrated test

VOLTAGES AND CURRENTS.					
Valve.	Anode Volts.	Screen Volts.	Cathode Volts.	Anode Current.	Screen Current.
FC. X41 hex. ...	240	67	2.8	m.A. 0.85	m.A. 1.2
osc. ...	84	—	—	2.3	—
1st IF VMP4G...	237	100	3.1	3.3	3.0
2nd IF VMP4G	235	100	1.9	7.05	5.85
Phase-changer					
MHL4 .....	115	—	50.0	1.1	—
AVC MH4 .....	60*	—	16*	—	—

\* Measured from junction of R20 and C35. All other voltages measured from chassis. Voltages and currents in the amplifier are normal for the Push-Pull Quality Amplifier.

oscillator is not available. This is quite possible but is much more difficult. Unscrew the two trimmers in T<sub>3</sub> nearly fully (until they are quite easy to turn) and the trimmers in T<sub>1</sub> and T<sub>2</sub> nearly half-way. Set the trimmer on C<sub>5</sub> about half-way, and that on C<sub>15</sub> about two-thirds unscrewed. Then, with the selectivity control at minimum (fully clockwise), try to find a signal. Having found a signal, adjust each IF trimmer roughly, then increase the selectivity, and readjust the trimmers. When the selectivity control is at maximum (fully anti-clockwise) adjust each IF trimmer accurately for maximum response, using a milliammeter or voltmeter connected to the first IF valve in the manner already described as an indicator of resonance.



The position of the single turn L<sub>5</sub> of the image suppressor is clearly shown in this drawing. The earthing lead of C<sub>7</sub> should be looped around L<sub>3</sub> L<sub>4</sub> in the manner indicated.

The IF circuits will then all be in line with one another and the trimming will be just as good as if an oscillator were used, but it will not be known whether they are tuned to the correct frequency or not. One can only judge this by estimating the accuracy of ganging, and this must next be carried out. No difficulty should be found in tuning in a very low wavelength station, and the trimmer on C<sub>5</sub> can be adjusted for maximum response; incidentally, both C<sub>2</sub> and C<sub>3</sub> should be at maximum. If C<sub>5</sub> requires much alteration, adjust C<sub>15</sub> in the opposite direction, and retune to the station, then readjust C<sub>5</sub>. In this way the circuits can easily be adjusted so that the trimmer on C<sub>5</sub> remains at approximately the half-way position.

Then tune in a station on about 600

kc/s (500 metres) and adjust C<sub>11</sub> while rocking the main control backwards and forwards over a few degrees until the optimum combination of settings is found. Now, unless the intermediate frequency is correct, it is possible that there may be no optimum setting for C<sub>11</sub>. The IF amplifier must then be readjusted to a different frequency and ganging attempted again. It is not difficult to deduce the direction in which it must be altered from the characteristics of the ganging. Thus, suppose that the adjustments show no optimum for C<sub>11</sub>, but that the response is greatest when it is fully screwed home. It is easy to see that as more capacity is needed for correct trimming the oscillator frequency is too high; the intermediate frequency is consequently too low, and all the IF trimmers should be unscrewed somewhat and the lining-up process repeated.

By trial and error it is possible in this way to arrive at settings for the trimmers which enable good results to be secured over the medium waveband, and the long waveband trimmer C<sub>16</sub> can then be adjusted. This is naturally done on the long waveband and at as low a wavelength as possible, C<sub>16</sub> being adjusted while rocking the main tuning control backwards and forwards over a few degrees until the optimum combination of settings is found.

In normal operation the receiver should be found to be sufficiently sensitive to permit any worth-while transmission to be well received when a good aerial is used, and the chief Continental transmissions even with quite a poor aerial. The selectivity is adequate for the degree of sensitivity, and tests have shown there to be no difficulty in receiving Deutschland-sender free from intelligible interference from either of the stronger transmissions on adjacent channels.

**The Performance**

Mains hum was found to be inaudible and set noise negligible on all but the weakest signals, which will not usually be required with a set of this character. The AVC system proved exceptionally good, having no adverse effect upon the quality, giving an unusually wide range of control, and keeping the detector input much more nearly constant than do conventional systems.

It was in the matter of quality, however, that the receiver proved on test to be outstanding. In local reception the reproduction proved in no way inferior to that given by a purely local station set designed for reception of the local only, and the same high standard was maintained on those more distant stations which were sufficiently free from interference for low selectivity to be used. An increase in the selectivity to reduce interference necessarily resulted in a deterioration of quality, but it still remained better than the average on account of the remarkably low level of amplitude distortion introduced by the equipment.

Before concluding, it may be as well to indicate the correct use of the selectivity control. While tuning, this should always

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be at maximum (fully anti-clockwise), or nearly so, the desired station should be tuned in accurately, and the selectivity then reduced to the required degree. Should this lead to the appearance of another station, as it may do sometimes, it should not be thought that the control is defective and affecting the tuning. This is not necessarily the case; more often the effect is due only to the opening out of

the resonance curve, so that the detector input resulting from a station on an adjacent channel is greater than that from the wanted signal. The latter is naturally swamped, and the indication is only that one is trying to use a lower degree of selectivity than is possible in the circumstances.

On gramophone, a pick-up having a large output is necessary if adequate volume is to be secured with the standard

connections; the piezo-electric type is recommended. It is possible, however, to increase the amplification on gramophone by altering the input circuit to the phase-changing valve, and satisfactory volume can then be secured from a pick-up having only a small output. It is hoped to indicate the nature of this change in a future article, and, needless to say, it is one which has no effect on the radio performance.

# CURRENT TOPICS

## Tank Pattern "O.B." Van

NORWAY'S latest "O.B." van is equipped with caterpillar drive in place of wheels for service in mountainous districts.

## Short-waves in Salisbury

SIR OLIVER LODGE, D.Sc., LL.D., F.R.S., is "Foundation Patron" of the newly-formed Salisbury and District Short-wave Club. The Hon. Secretary is Mr. C. A. Harley, 85, Fisherton Street, Salisbury.

## Air Ministry Radio Research

BAWDESEY MANOR, near Felixstowe, Suffolk, has been purchased by the Air Ministry for conversion into a radio research station. It is understood that the work of the station will be concerned with both civil and military aviation wireless. The property covers an area of 150,000 acres.

## "Not Cricket"

CRICKET commentaries caused such disturbances at the Australian National broadcasting station, 3AR, last week that it was necessary to close down three times. The "commentaries" came from black crickets, a plague of which is troubling the whole of Melbourne. The insects settled on the 10,000-volt conductor, short-circuiting the power supply.

## New York Television Tests

AMERICA may still beat the B.B.C. in the matter of television tests. Mr. David Sarnoff, President of the Radio Corporation of America, has announced that field tests of television will begin in a month or two. The transmitter will be situated on the Empire State Building, New York, and test receivers will be operated throughout the New York area. The television studio is now under construction in the N.B.C. plant, R.C.A. Building, Radio City.

The RCA uses 338-line definition.

## Microphone Manners Compared

IF a pleasing and persuasive microphone manner is a primary requisite in modern political campaigning there is no doubt (writes our Washington correspondent) that President Roosevelt will enter the Election lists this summer with a distinct advantage over anyone the Republicans may pick to oppose him. From a radio viewpoint not one of the potential Republican candidates compares with the President as a broadcast orator. Recent presidential talks have indicated that he is still the biggest audience-

voice sounds unnatural "on the air." Senator Arthur Vandenburg, although a good platform speaker, "needs lessons in microphone technique." Senator L. J. Dickinson, it is reported, has a booming, stentorian voice which the radio control engineers have to tone down too much for his own good.

## Mr. Hiram P. Maxim

THE amateur movement has suffered a severe loss by the death on February 10th at the age of sixty-seven of Mr. Hiram Percy Maxim, President of the American Radio Relay League.



TELEVISION OVER NEW YORK. The roof of the Empire State Building has been chosen by the Radio Corporation of America for transmitting aerials for the new high definition tests which are to begin within the next two months.

getter among political speakers.

Among his possible rivals the best orator is probably Senator Borah, but "he needs an audience to pep him up." Herbert Hoover, once notable for his dull speechmaking, is reported to have taken elocution lessons and to have become "definitely an interesting radio personality." Governor Alf Landon's speaking manner is described as being "as colourless as that of Coolidge," and Frank Knox is another whose

A son of the famous gun inventor, Mr. Maxim was himself an ardent research worker, and he devoted himself to maintaining the status of the radio amateur for many years. During the transatlantic amateur tests of 1923 Mr. Maxim came to England, visiting the offices of *The Wireless World*, and taking a keen interest in the activities of the British amateurs engaged in the tests.

Only a few days before Mr. Maxim died news came of the

## Events of the Week in Brief Review

death of Mr. Charles H. Stewart, Vice-President of the American Radio Relay League. He had been active in amateur affairs since 1908.

## Daily Television

EIFFEL TOWER television is now transmitted daily on 8 metres between 4 and 4.30 p.m.

## Police "Aerial Raid"

HELSINKI police conducted an "aerial raid" last week, cutting down 125 aerials attached to trees. An order forbidding the use of trees for this purpose was issued last autumn.

## The "Poor" Pirate

WHEN fines totalling £65 were imposed last week on fifty persons using wireless sets at Wealdstone without licences, the prosecution said that it was found in most instances that the people concerned owned expensive sets. One person who pleaded poverty owned a set worth 21 guineas.

## Pay Less, Listen More

WHILE Ravag—the Austrian Broadcasting Co.—is lamenting because "economic stress" is curbing the progress of broadcasting as reflected in the number of listeners, Czechoslovakia is taking the practical step of extending the listening clientele by reducing the licence fees. A start is being made by issuing specially cheap licences to crystal users.

## Photography : 760 Pages

NOW in its seventy-seventh year of publication, the British Journal Photographic Almanac for 1936 includes sixty-four gravure pictures exemplifying the latest practice in modern photographic art. The technical articles are well chosen, and a noteworthy feature this year is a survey of cinematograph film stocks and makers' approved processing formulæ. The book (760 pages) costs 2s., paper covers, or 3s. cloth bound, and is published by Henry Greenwood and Co., Ltd., 24, Wellington Street, W.C.2.

# Short-wave Interference

## IMAGE SIGNAL SUPPRESSION IN SUPERHETERODYNE RECEIVERS

**A GREAT** deal of interference from commercial telephone and telegraph stations which is sometimes superimposed upon a short-wave broadcast programme is wrongly ascribed to a thoughtless allocation of station frequencies resulting in insufficient channel separation. In a very few cases, where certain countries have not been represented at the Madrid Convention, this may be so, but it is almost certain that the greater part of the interference is due to the receiver itself if it operates by means of the superheterodyne principle.

IT is well known that the superhet is capable of receiving two stations simultaneously, although their frequency separation may be many hundreds of kc/s. Once the transference of the signals to a common intermediate frequency has been effected by the mixing or frequency-changing stage they are inseparable and no subsequent degree of selectivity will attenuate one signal more than the other. It can be shown theoretically that the undesired signal will always be spaced at a frequency separation of twice the intermediate frequency from the desired signal. As an example, a conventional superhet operating at an intermediate frequency of 100 kc/s will be capable of the simultaneous reception of signals at 1,000 and 1,200 kc/s. The undesired signal which is superimposed upon the desired signal is termed the *image* and creates *image interference*.

It is quite obvious that the elimination of the image signal must be carried out prior to frequency changing, and for this reason one introduces preselection, a self-explanatory term.

It is also obvious that the elimination of the image signal becomes more effective as:—

- (1) The preselection tuned circuits are made more selective.
- (2) The intermediate frequency is raised, thus increasing the percentage image detune.

On medium and long waves a pair of loosely coupled tuned circuits preceding the frequency-changer are usually sufficient to reduce image interference to a negligible value providing the tuned circuits are of good design and that the intermediate frequency is not materially less than 100 kc/s. An average figure for this type of receiver is 120 kc/s. It must be noted that the percentage detune of image to wanted signal is very important and plays a major part in determining the amount of image suppression possible. For example, with an IF frequency of 100 kc/s and a wanted signal of 1,000 kc/s the image is detuned by 20 per cent. of the wanted signal. Two carefully designed and loosely coupled tuned circuits are capable of suppressing the image signal by approximately 3,000

times, an amount which is acceptable for a receiver whose sensitivity is not higher than, say, 100  $\mu$ V absolute for 50 mW output.

### Short-wave Image Signals

Now consider the problem of image interference on the short waves from, say, 16-50 metres. With the same intermediate frequency of 100 kc/s the percentage detune of the image to a wanted signal at 19 metres (15,800 kc/s) is only 1.5 per cent. A pair of tuned circuits at this wavelength will, with the most careful design, only suppress the image signal by four times—nearly a thousand times less than on medium wavelength. It is now quite obvious why image interference is a prevalent nuisance on many short-wave broadcast programmes!

There is only one practical method whereby a higher degree of image suppression may be obtained, and that is by increasing the percentage image detune,

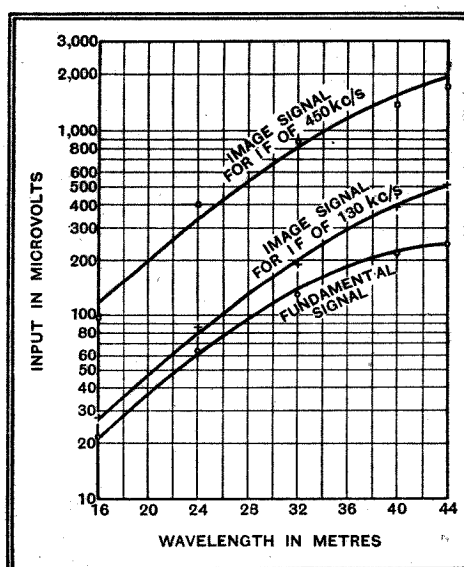


Fig. 1.—Image sensitivity relative to the fundamental for various IFs.

and this means that the intermediate frequency must be increased. The image suppression will improve rapidly as this is increased, but there is obviously a limit set when the intermediate frequency is

By "PRESELECTOR"

sufficiently high to produce other difficulties by way of low gain, instability, and poor IF selectivity. A value in the region of 450 kc/s appears to be satisfactory in practice, since it does not fall within the medium or long wave band and still permits of a high degree of stable and selective amplification.

If 450 kc/s is chosen, the percentage image detune from the wanted signal at 19 metres will increase from 1.5 per cent. to approximately 6 per cent. and suppress the image, under the same preselection condition, by some fifty times, which is more than ten times the value previously obtained with an IF frequency of 100 kc/s or thereabouts.

Naturally it is useless to attempt to use the high intermediate frequency if the only circuits preceding the frequency changer are aperiodic, since this will result in no suppression of the image interference whatever.

On the short waves the aerial also exercises considerable damping upon the first tuned circuit unless very loose coupling is employed, with subsequent serious loss of gain at certain frequencies corresponding to the voltage anti-nodes on the receiving aerial. Since two tuned circuits at least, and preferably three, are required in conjunction with an intermediate frequency of 450 kc/s to produce reasonable image suppression, it is desirable to use at least one stage of HF amplification in order to include the additional tuned circuit and decouple it from the direct influence of the aerial. Even though the stage does not materially contribute to the overall gain of the receiver, there is a great improvement in performance, due mainly to a fair degree of image suppression, and a very much improved signal to noise ratio, because of the reduction of the frequency band width of the thermal and other noises delivered from the aerial.

### Harmonic Interference

Another and rather less serious form of interference arises from the harmonics of the local oscillator beating with signals and transferring them to the intermediate frequency, together with the desired programme. The obvious cure is to eliminate the harmonics, but although this cannot be completely effected in practice they are kept at a minimum by careful design of the local oscillator—by avoiding excessive reaction coupling and losses in the oscillator coil circuit itself.

It is here, again, that preselection will



**Short-wave Interference—**

reduce the magnitude of this form of interference by decreasing the magnitude of unwanted components prior to the process of frequency changing.

Such components as will beat with the harmonics of the local oscillator are detuned from the fundamental by approximately  $N \times 100\%$  where "N" is the order of the local harmonics, so that the presence of a single tuned circuit will invariably remove this type of interference, or reduce it to negligible proportions. Aperiodic input circuits to the frequency-changer will, on the other hand, show this type of interference very strongly, even when elaborate care has been taken to reduce the oscillator harmonics to a minimum, and in such cases may prove to be more serious than image interference.

Reference may now be made to the curves depicted in Fig. 1 and Fig. 2. For the purpose of obtaining the necessary measurement a simple HF stage was set up and connected between modulator grid and cathode of the frequency-changer. The IF gain was made adjustable in order that it might be equalised for the two

radiation resistance from 50 to 2,500 ohms over the wavelength band used during the measurements.

Although the value of the resistance must be arbitrarily determined, it is fundamentally a better method of generator coupling than the normal artificial aerial employed on the medium and long-wave bands, and consisting of a combination of inductance, resistance, and capacity. The reason for this is that these values may only be regarded as lumped when the aerial is short compared with the wavelength to be received, and while this condition holds on medium and long waves it fails when the band from, say, 10-50 metres is used. The aerial hitherto represented by the lumped impedance of the artificial aerial now executes a series of nodal variations of impedance at the lead-in junction to the receiver, changing rapidly from capacitive to inductive reactance over a small critical waveband. Intermediate with these conditions it becomes a pure resistance, which latter condition obtains when the physical length of the aerial is any odd integral multiple of one quarter of the wavelength of the signal applied.

The replacement of the aerial by an artificial system comprising lumped reactances and resistances disfavours the shorter wavelength signals to a very considerable extent, and gives no indication of the comparative results which would be obtained between two different wavelengths in practice. It is better, therefore, to assume an input impedance which is independent of frequency, namely, a resistance, and choose a mean value which approximates to average input conditions.

A value of 400 ohms has therefore been used, and the coupling adjusted for optimum sensitivity at 16 metres. Fig. 1 shows the relationship between the fundamental and image sensitivity for two different intermediate frequencies of 130 and 450 kc/s respectively, and has been taken over a wavelength range of 16-44 metres.

The advantage of using 450 kc/s is apparent, particularly when the curves of Fig. 2 are examined, in which the ratios of fundamental to image signal are shown, and in which an average improvement of 12 decibels is noted when comparing the 450 kc. curve with that for 130 kc/s IF. This increase of 12 db by no means indi-

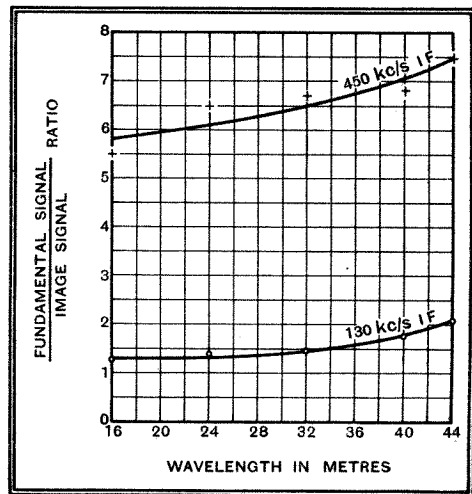


Fig. 2.—Ratio of fundamental to image signal amplitudes for different IFs.

intermediate frequencies, namely, 130 kc/s and 450 kc/s, whichever was used. The circuit arrangement is shown in Fig. 3, and is quite conventional. One or two points, however, must briefly be described before discussing the resultant measurements. The coils consisted of 5.5 turns of 22 SWG enamelled wire, space-wound upon a one-inch high - grade paxolin former. The coils were individually tuned by means of 0.0005 variable condensers of the conventional type, with the stator mounted on paxolin strip. It will thus be observed that no special precautions have been taken to obtain a generally improved performance by the use, for example, of ceramic coil formers, valve bases, and condenser mountings. The values in the curves, therefore, represent a low limit upon which a fair improvement might be made. The signal generator was coupled to the input via a 400-ohm non-inductive resistance, which more nearly simulates the normal 60ft. aerial under working conditions, which may exhibit variations in

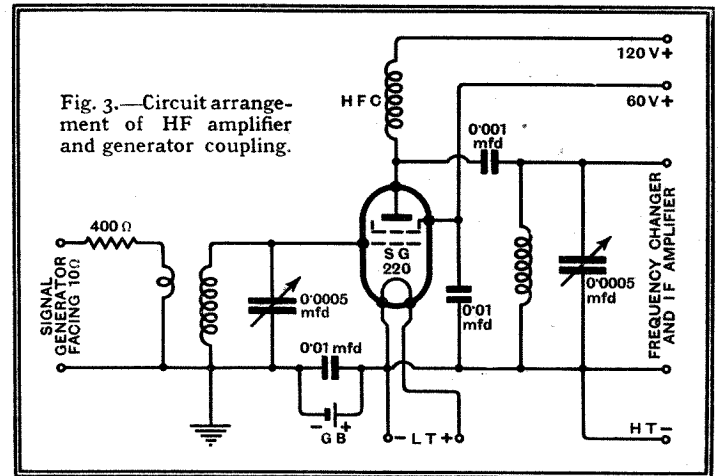


Fig. 3.—Circuit arrangement of HF amplifier and generator coupling.

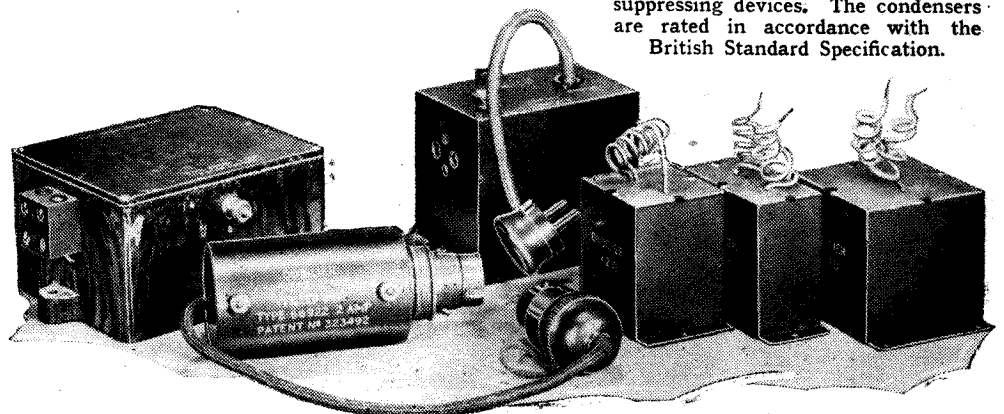
cates the best possible improvement in fundamental to image signal ratio, because of the low limit set by the mediocrity of the coils. By paying special attention to the elimination of major parallel losses, which means the use of ceramic mountings as previously mentioned, the improvement may be readily extended. An experimental arrangement comprising the same circuit as Fig. 3, but in which many precautionary measures had been taken to improve the short-wave gain and selectivity, gave the following figures for 19 metres:—

Wavelength in metres	19.0
Fundamental to image signal ratio for 130 kc/s IF	3.5/1
Fundamental to image signal ratio for 450 kc/s IF	40/1
Gain in ratio due to the use of 450 kc/s IF	11.5 or 21.0 db

An improvement of this magnitude, which gives a total image suppression in the above case of 32 db is very likely to reduce to a negligible value most of the annoying image interference which is inevitable when a low value of intermediate frequency is used, particularly with no HF stage preceding the frequency-changer.

**BANISHING ANOTHER KIND OF INTERFERENCE.**

A group of Dubilier disturbance-suppressing devices. The condensers are rated in accordance with the British Standard Specification.



# Castles in Spain



The Plaza Catalunya, Barcelona. This picture was taken from the Hotel Colon, in which the first broadcasting station was established, in 1924.

**B**ROADCASTING in Spain dates back to 1924, when No. 1 transmitter, call sign EAJ1, was opened on the roof of the Hotel Colon on the Plaza Catalunya, in the centre of Barcelona.

From that day until now Spain, and with it Spanish broadcasting, has gone through a long period of political unrest. Consequently the Government was not given time to realise its plans for a public broadcasting service—a state of affairs which fostered the growth of innumerable low-power publicity stations, now numbering sixty-eight.

Some years ago, if I remember rightly, under that kind-hearted though stern ruler Primo de Rivera, the Spanish Government decided to provide listeners with a national broadcasting service with a revenue from listeners' licences. But since that time much has happened, and the Government has been preoccupied with other matters, so that, although decrees and laws were passed and plans prepared and wavelengths reserved, nothing

Senor Toresky, the ventriloquist announcer at Union Radio, Barcelona, in a microphone interview with Senorita Carmen Soriano, woman swimming champion.



*WHY is it so difficult to tune in a worthwhile Spanish programme at satisfying signal strength? The answer is given in this entertaining account of a visit to Barcelona, where our contributor made some revealing discoveries concerning programme policy and the official attitude towards the projected development of the service. Under the Lucerne plan, Spain is entitled to a 150-kilowatt transmitter. At the moment her most powerful station works on seven-and-a-half kilowatts!*

further has been done. Most of the private stations whose ten-year concessions expired in 1934 and 1935 have now been given provisional concessions until such a time as the State proceeds to organise the suggested public service. On a recent visit to Spain I found that experts and officials alike were very sceptical of such a development.

It will be remembered that at the Lucerne Conference in 1933 Spain obtained the right to use a long wavelength (to be shared with Turkey and Iceland) for a 150-kW transmitter near Madrid. This transmitter belongs to the airy future when the State broadcasting service is established;

at the time of writing, the highest power station in Spain is our old friend EAJ1 with 7.5 kW-in-aerial, which has been in operation with that power since 1929!

I have already mentioned that in Spain there are laws which provide for the payment of licence fees by listeners. One law in force requires every owner of a broadcasting receiver to pay a State tax of 5 pesetas per annum. If he does not do so his apparatus is liable to confiscation and he may be fined anything from 100 to 500 pesetas. To enforce this law the Spanish Post Office Telegraph Service has inspectors who bring "pirates" to book. Either there are very few inspectors, or their activities are the opposite of efficient, for I was told that only about one Spanish listener in ten pays this annual tax. An experience I had illustrates the difficulties which lie in the way of the eager would-be licensee. Anxious to investigate matters for myself, I entered the central Post Office in Spain's largest city, and, seeing an arrow pointing to where one could obtain licences, I went up to the window marked and found that it was only open for four hours in the morning (9.00-1.00). It happened to be noon, so that I was at the right

time. After much knocking at the window an official from a neighbouring counter told me that the window was closed; if I wanted to enquire about radio licences I must go upstairs. However, I refrained, and I am sure listeners have done the

same, especially as another notice indicated that, unless proof were forthcoming that the person desiring a licence had bought his first set within the preceding month, he would have to pay double tax—10 pesetas.

Restaurants and cafés have to pay 50 pesetas per annum listening tax.

Another Spanish custom provides that persons owning receivers with three or more

valves must pay a tax of 2 pesetas a month; those with crystal sets, less. But this law will not be applied in 1936. It might be in 1937, but also it might not, my informant told me with a dry smile.

## Five Audible Stations

Sixty-eight stations seem to be quite a lot for a country like Spain. But a glance at any reliable list of wavelengths and stations will show that Spain has, at the present moment, only about five stations which might possibly be audible in other countries. These are: **Barcelona**, EAJ1, 377.4 metres with 7.5 kW, which can be heard quite well in Central Europe, in spite of the fact that it shares its wavelength with Lwow; **Madrid**, EAJ7, 274 metres, 3 kW (shared with a Russian); **Radio Associacio de Catalunya, Barcelona**, EAJ15, 293.5 metres, 3 kW (this transmitter shares its wave with EAJ19 at Oviedo (3 kW) and with Cracow); **San Sebastian** (which used to be a good signal with its 2.5 kW-in-aerial; now it shares the 238.5 metre wave with Swedish and Latvian transmitters and with Rome III); **Madrid**, EAJ2, with its 3 kW (Radio Espania), which operates together with **Radio Sevilla** (2.5 kW) on 410.4 metres; probably can only be



Senorita Francina Boris, aged 19, is second announcer at Radio Catalunya. (EAJ15).

# IBERIAN BROADCASTING TO-DAY —AND “TO-MORROW”

By “WANDERING WAVE”

heard when one of them is not operating; Tallinn also uses this wavelength.

The remaining sixty-one stations operate on national or international common waves of 200 and 201.1 metres, and their power is limited by the Lucerne Plan to 200 watts.

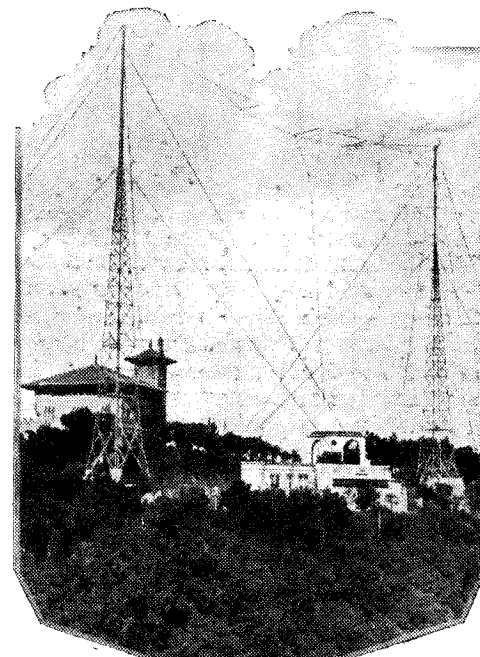
This would seem rather a sad state of affairs from the point of view of the foreign listener who would like to tune-in the Spanish stations. But the local listener is really quite well catered for, as a 200-watt transmitter in the centre of a small town has quite a good range. Of course, some of these sixty-odd stations do not operate regularly. A large number of them are “one-man stations,” and their programmes are limited to the broadcasting of gramophone records and to such talks as the owner, or perhaps his friends, like to broadcast.

Except for occasional voluntary donations by kind-hearted listeners, Spanish stations at the present moment are entirely dependant on publicity broadcasts for their source of income.

The State, apart from the 5 pesetas tax which it ought to receive from Spanish

Some of the Spanish broadcasting stations are grouped together, the most important grouping being the Union Radio Company, the share capital of which, I was told, is owned by three big European firms. Union Radio operates seven stations: Union Radio Barcelona, Union Radio Madrid, the stations at Sevilla, San Sebastian, and Valencia, and two smaller transmitters. Union Radio is the sole member of the International Broadcasting Union, a sore point with a grouping of great importance in Catalunya. I refer to the Catalan Radio Association at Barcelona, which operates the EAJ 15 station and three other transmitters in near-by towns. This company is a direct competitor to the Barcelona Union Radio station. To the foreign observer it seemed most amusing to hear that Radio Associacio has ordered a 7-kW transmitter from Telefunken, which will be completed early this year. The well-known German company is, I was told, an important shareholder in Union Radio!

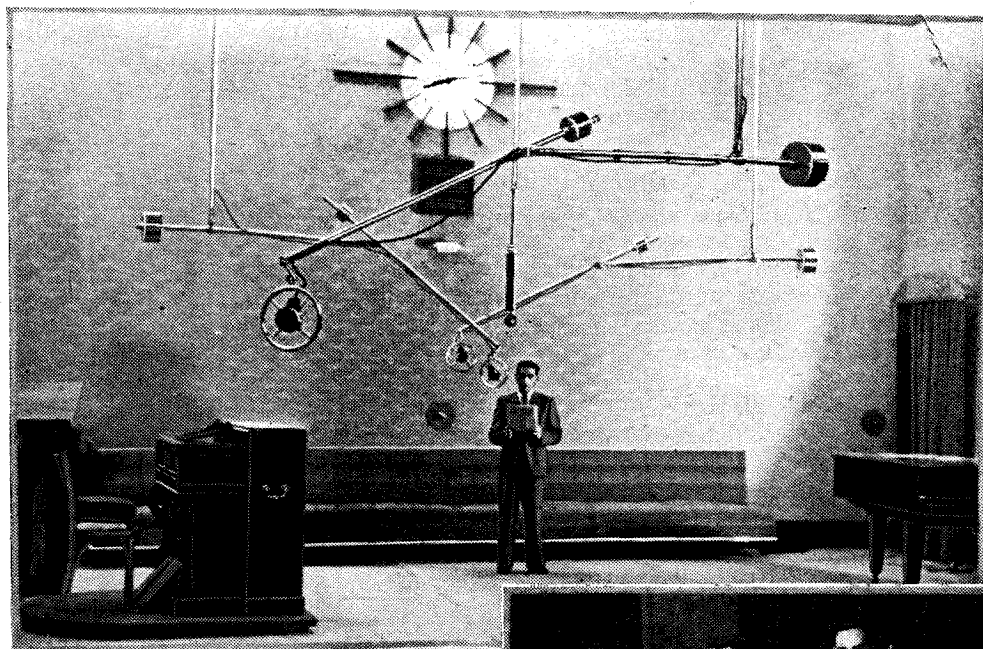
From a programme point of view the



Although permitted a 150-kW. transmitter under the Lucerne Plan, Spain's most powerful station is Union Radio Barcelona (EAJ 1), working on 7.5 kW. It is situated on the summit of the Tibidabo mountain.

Spanish listener is well catered for, even though he has to submit to many hundreds of advertising announcements every day. The most difficult task of all is to get the advertising matter over without annoying the listener or driving him to switch off. Radio Associacio in Barcelona employs two charming woman announcers who alternate at the microphone. Union Radio Barcelona has a ventriloquist, Senor Toresky, and his imaginary little boy, “Miliu”; sometimes there are even two announcers and “Miliu,” and the tediousness of the advertisement announcements is occasionally broken by “Miliu” and Toresky having “words.”

To the foreign observer the state of affairs in Spanish broadcasting does not seem ideal. Unlike the Italian, the average Spaniard likes listening, and as long as he gets his concerts churned out to him at the right moment, he really does not mind whether Spain fulfils its cultural mission in broadcasting or not, or whether listeners from afar can hear the “Spanish point of view.”



Barcelona's biggest studio contains intricate suspension gear for its four microphones. (Right): A typical Spanish Sardanias orchestra which broadcasts national folk dances on Sundays.

listeners (whose total number is at present accepted to be in the neighbourhood of 2 million, but of which only about 10 per cent.—i.e., 200,000—actually pay the tax), demands a tax from the transmitters in exchange for the permission to operate. This amounts to 20 per cent. of the total revenue from publicity. The bigger stations have procured a reduction since September 15th, 1935, and only pay 5 per cent.



# UNBIASED

## Ultra Short Scarecrows

THE ingenuity of our big wireless manufacturers has often struck me very forcibly, particularly at exhibition time, when their inventive genius rises to heights to which Poe never attained even in his most inspired moments.

Apart from exhibitions, there is nothing which acts so much as a spur to inventive genius as being left high and dry with a vast quantity of unsaleable goods. Thus it is rumoured (although I personally don't believe it for a moment) that high definition television was invented solely because it was a necessity. Certain manufacturers, so I learn, had been working day and night on the production of vast quantities of ultra-short-wave components under the mistaken belief that an ultra-short-wave



"... a startling effect on the birds ..."

boom was coming. Unfortunately, the boom did not materialise to the extent that they had hoped, and so they had vast quantities of surplus gear on their hands. What was to be done about it? Obviously something must be invented to make use of the gear, and in double-quick time too! The result was high definition television.

Unfortunately, they reckoned without the Government's Circumlocution Department, and by the time an official committee had sat on the question of television, in more senses than one, bankruptcy was likely to ensue. Fortunately there was America, the inhabitants of which, like the Athenians of old, were for ever running after some new thing. And so all the spare ultra-short wave coils were shipped to that great country and soon put to a noble use. For how else are we to account for the presence of the ultra-short scarecrows which have appeared on the farms of the great Middle West? These, an American journal tells me, "were originated in the mind of a great British radio manufacturer."

According to my source of information, the highly sophisticated American crows are thoroughly blasé in the matter of scarecrows, the good old-fashioned devices boring them to tears. Something had to be done about it, and as the Small Boys'

Union in America was demanding fabulous sums for the services of its members science had to be called in, with the result that scarecrows have appeared which are fitted with simple "toobless" ultra-short wave radio receivers and superannuated loud speakers. At the old farmstead is situated a low-power transmitter and a "British-made automatically operated electric phonograph," by which I presume they mean a radio gramophone fitted with an automatic record changer.

Certain types of music apparently have a startling effect on the birds. Unfortunately, the journal from which I get my information omits to state exactly what sort of music this is, or I would try it out on the starlings which have nested outside my bedroom window. I should have thought that the average American programme would have had a quite sufficiently startling effect on any bird with sensitive nerves, but apparently American crows are hardened to it.

Common sense would suggest that it would have been far cheaper to have wired up the scarecrows to the farmhouse and to have cut out the wireless business altogether, especially as it must be an exhausting business (as well as an expensive one) to keep on lugging round fresh LT and HT batteries to the individual scarecrows.

## 3 a.m. Adventure

A PART from its uses in connection with television, the cathode-ray tube seems to be giving as much impetus to the science of wireless as did the invention of the thermionic amplifier, and its latest application threatens to render signposts obsolete.

It was demonstrated to me in a rather mysterious manner. I received an anonymous invitation to be present at 3 a.m. last Sunday outside the railway station of a certain provincial city in the North of England where, it was stated, I should see something to interest me. I nearly consigned the letter to the wastepaper basket which I reserve for all anonymous communications, but the ineradicable trace of the feminine which is present in all men owing to their unavoidable semi-female ancestry got the better of me, and 3 a.m. on Sunday morning found me at the appointed place after an uncomfortable night journey in a milk train.

After a brief interval, what the lady novelists call "a powerful black car of

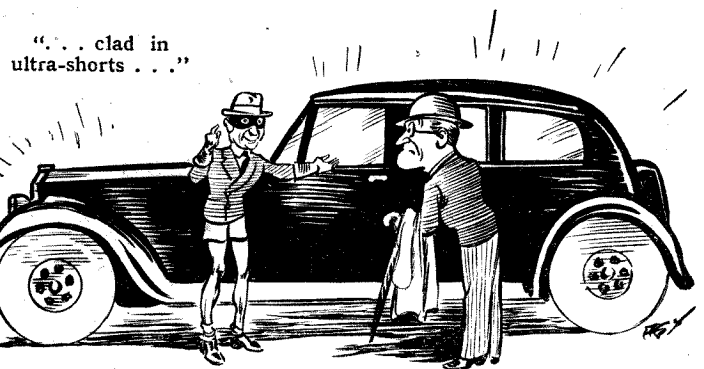
sinister appearance" drew up to the kerb and a well-dressed individual, clad in ultra-shorts and a black silk mask, motioned me to take the vacant front seat. My companion was either deaf and dumb or unfamiliar with the Southern accent, as he paid not the slightest heed to my questions. I was, in fact, beginning to feel just a trifle uneasy when a voice, coming apparently from the roof, began to address me.

## By FREE GRID

This I found came from a loud speaker attached to a wireless receiver, but I had little time for investigation, as my interest was aroused by the information imparted by my unseen mentor, who directed my attention to a pane of translucent glass, rather like the ground-glass screen of a stand camera, which was let into the dashboard. This, I was informed, was the business end of a large cathode-ray tube, and on it was projected a street-plan of the city I was in. There was nothing very remarkable in this, as the street-plan was actually made on a sheet of transparent celluloid, which slid into a frame so that it was readily interchangeable.

The interesting part of the whole business, however, was a spot of light which was projected on to the map from within the cathode-ray tube. This spot was, I observed, moving along a street on the map, and the unseen voice told me it was keeping track of the movements of the car.

I was told that the spot was operated automatically by the intersection of two ultra-short wave beams emanating from two transmitters situated in different parts of the town, and was, in fact, a development of the cathode-ray DF system which certain ships employ in order to avoid col-



liding with each other when navigating in congested waters in thick fog.

My unseen informant told me that the whole scheme is to be marketed in this country as soon as the necessary financial backing is available. I was finally driven back to the station, where I had to cool my heels until the first train left for civilisation.



# The Magnavox "Duode" Speaker

*THE principle of operation of a new wide-range single diaphragm loud speaker is described, and details are given of its design and performance in commercial form.*

FOR true fidelity of reproduction, judged by absolute standards, all frequencies audible to the human ear would have to be equally rendered. The upper limit varies with different individuals but is generally agreed to be about 15,000 cycles. To set any lower standard means that the harmonics of certain musical instruments are lost and many sounds, while recognisable, no longer seem natural.

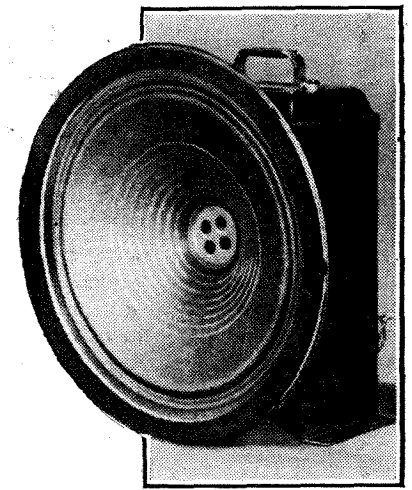
To obtain natural "effects," an extended frequency range is absolutely necessary. Even the most unmusical can distinguish between the ring of a hammer on an anvil and a reproduction which sounds more like a brick striking a piece of wood.

Where musical instruments are concerned it is the harmonic content and not

of 10,000 cycles to 15,000 cycles is not so great. One is considering, of course, the effect on average individuals of listening to a variety of different kinds of sound.

At the present time the B.B.C. are transmitting frequencies up to at least 10,000 cycles on studio programmes without appreciable attenuation. Presumably sound broadcasts in connection with television will go up much higher, and eventually no doubt both broadcast transmissions and reproduction by ordinary receivers will include the entire frequency range.

Very few present-day radio sets deliver to the loud speaker frequencies above 6,000 cycles, but there are no serious practical difficulties in extending the range. Designers have not commonly gone further because of the limitation imposed by the loud speaker. For reception of distant stations it is desirable to limit the response and increase selectivity, otherwise whistles and interference become too prominent. For listening to the local



By **BURGESS DEMPSTER**

*Chief Engineer for the Magnavox Speaker Section of the Benjamin Electric, Ltd.*

stations there is everything to be said for going up to 10,000 or 15,000 cycles.

The overall response of a modern set with a single moving-coil loud speaker generally has a pronounced rise in response between 2,500 and 4,000 cycles, with a cut-off at 6,000 cycles. If the hump is removed, without extending the cut-off point, the set appears to be totally lacking in top.

Many efforts have been made to build reproducers for high-quality reception, generally by using a moving-coil loud speaker in conjunction with a "tweeter" or speaker for reproducing the upper frequencies only. In practice the device is usually unsuccessful and gives an unpleasant effect. When listening to such combinations one is generally conscious all the time that a special effort has been made to include the top. True quality sounds natural and not forced. The desire to use a tone control does not arise when listening to the original sounds, and if a reproduction seems to demand it, it is a reasonable assumption that the reproduction is bad.

## Advantages of Single Speaker

The reasons for this unnatural effect when listening to a moving-coil speaker with a "tweeter" are sometimes due to the "tweeter" merely emphasising a narrow band of frequencies. Sometimes it may be due to difficulties in coupling and matching, with trouble in dealing with the overlap between the two units.

Obviously the ideal is one speaker to reproduce the whole frequency range, and continual attempts have been made to achieve this ideal. In 1933 Ringel produced a design using two voice coils coupled to a single diaphragm. One voice coil (fastened to the apex of the cone) was extremely light and therefore efficient at the higher frequencies. More recently Olson has designed a unit with a long voice coil having two windings in series separated by a compliance. At low frequencies both windings furnish the driving force, and at high frequencies one winding only is supplied with current.

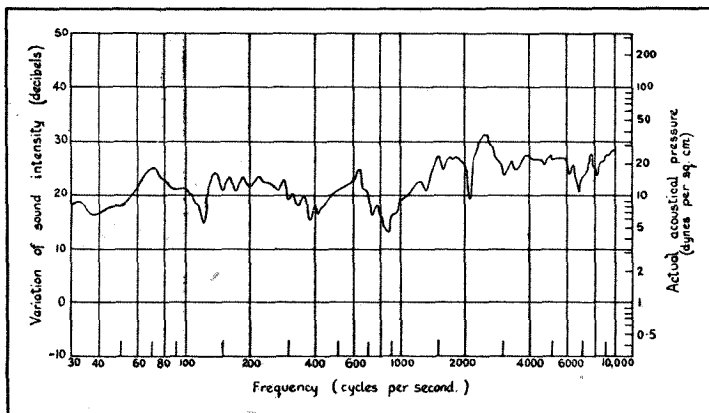


Fig. 1.—Copy of N.P.L. curve of Magnavox "Duode" taken on the forward axis. Microphone distance, 6ft.

the pitch which determines the frequency range necessary for true reproduction. For example, the piccolo needs an upper limit of only 8,000 to 9,000 cycles, whereas for an oboe the range must be extended to nearly 15,000. Of the two instruments the fundamental notes are higher from the piccolo, but the notes of the oboe have harmonics much higher in frequency than those from the piccolo.

The effect of cutting off the upper frequencies at various points has been the subject of a good deal of study, and complete statistical data have been published from various sources, notably by the Bell Telephone Laboratories.

It is generally accepted that the gain in quality by raising the limit from, say, 6,000 cycles to 10,000 cycles is very considerable, and that the gain obtained by extending the range from an upper limit

Extract from Report Ref. S.288 dated 25th July, received from the National Physical Laboratory on Measurements of the Acoustical Output of a Moving Coil Cone-Type Loudspeaker Mounted in a Baffle.

"The loudspeaker submitted for measurement of the acoustical output consisted of a Magnavox Model "33" moving coil cone-type unit, bearing the number 2156/39. A rectangular wooden baffle of dimensions 48 inches by 53 inches was supplied for use with the unit. The centre of the aperture mentioned was not at the mid point of the baffle, but was situated midway between the two shorter edges, and 17 inches from one of the longer edges.

#### Method of Test.

For the purpose of the test the loudspeaker was mounted above the edge of a high roof and pointing away from the mass of the building. The shorter edges of the baffle, of length 48 inches, were horizontal. A low wall 7 feet behind the loudspeaker and a subsidiary flat roof 18 feet below it were each covered by sloping sound reflectors with the object of projecting reflected sound away from the loudspeaker and from the region of measurement. . . .

#### Field Windings.

The field winding was supplied with 10 watts electrical power by a direct current of 59 milliamperes at 170 volts.

#### Results of Test.

The results of the test are exhibited in the figure. For a driving e.m.f. of 2 volts r.m.s. across the combination of the speech coil of the loudspeaker in series with a 1 ohm resistance, the results show the relation between the intensity of the sound as measured by the microphone and the frequency of the note. In the scale to the left of the diagram the variation of sound pressure is expressed in decibels with reference to an arbitrary zero level corresponding to an acoustical pressure of 1 dyne per sq. cm. The actual acoustical pressures are shown on a corresponding scale on the right-hand side of the figure.

**The Magnavox "Duode"—**

As mentioned above, a great deal of thought has been devoted to the subject, and many designs have been produced as a result. None of them has achieved any wide measure of popularity, and the best reproducers to-day are highly developed moving coil loud speakers, identical in principle with those made many years ago and still suffering from the same limitations imposed by the basic design.

A fundamentally new design is now to be described (patents applied for by A. Cecil Barker), which is simple and effective, besides giving a vast improvement in the uniformity of its acoustic response and the width of its frequency range.

A frequency response curve of a commercial double voice coil or "Duode" speaker, taken by the National Physical Laboratory, is shown in Fig. 1. Tests in another laboratory show that the response rises slightly from 10,000 to 15,000 cycles. The existing N.P.L. equipment will not measure above 10,000 cycles.

**Voice Coil Construction**

The "Duode" speaker has a normal cone and suspension, the special feature being the construction and design of the voice coil, the latter consisting of two coils one within the other, separated by a resilient material.

Fig. 2 shows the general arrangement. The outer tube is a conventional voice coil wound with copper wire and connected through a transformer to the output stage of the set or amplifier. The inner tube, which is of thin aluminium, is rigidly cemented to the cone. The coupling between these two tubes is both mechanical and inductive, while the action of this double voice coil varies with frequency.

In the case of low frequencies the copper-wound voice coil drives the cone through the resilient material, and the

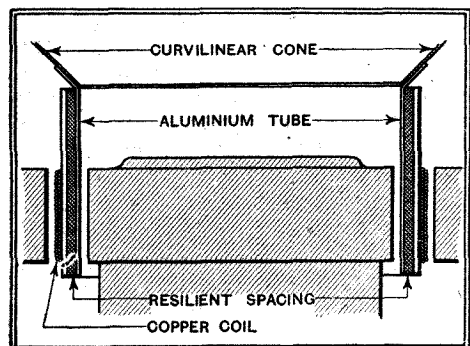


Fig. 2.—Section of "Duode" voice coil assembly.

degree of resilience is small enough to have no appreciable effect on overall efficiency. This can be seen by reference to the lower end of the response curve. At low frequencies, also, no appreciable current is induced in the aluminium tube.

At high frequencies (above about 5,000

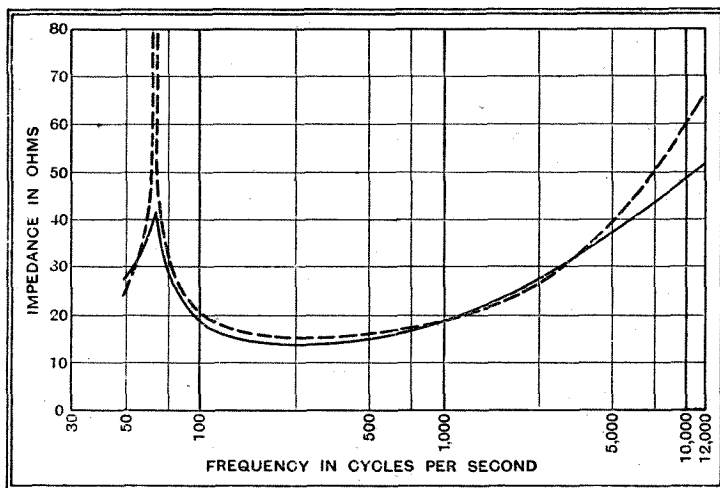


Fig. 3.—Impedance variation of voice coil in the "Duode" (full curve) and the standard Magnavox Model 33 (dotted curve).

cycles) this mechanical driving force provided by the copper-wound coil becomes progressively less, and at the highest frequencies the copper coil is practically stationary. Current is, however, induced in the aluminium tube with increasing transfer efficiency, and the resilient coupling permits the necessary relative motion between the two coils.

The theory underlying this form of construction is easy to appreciate, and to obtain the required results it is only necessary to proportion correctly the weights of the two tubes, the stiffness of the compliance, and the design of the cone.

The general requirements are strong driving force for reproduction of the low frequencies, when the double coil must move as a whole, and a light moving system for the upper frequencies. It is on account of its weight that a conventional speech coil fails to reproduce the upper frequencies.

The following table compares the weights of the moving parts of a "Duode" speaker with one of conventional design, where the higher frequencies are concerned, say, above 5,000 cycles.

The benefits derived from the "Duode" form of construction are not only mechanical; there are other important advantages as well. The level response, as shown in the frequency response curve, would not be predicted merely from consideration of the mechanical functioning of the parts as described above.

	Conventional.	"Duode."
Cone apex (the only part moving at high frequencies) ..	0.25 g	0.25 g
Copper-wound voice coil .. ..	1.89 g	Stationary
Bakelite spider (moving part) ..	0.30 g	Stationary
Aluminium tube ..	—	0.45 g
	2.44 grams	0.70 grams

Actually, the impedance curve of the "Duode" differs from that of a conventional speech coil (see Fig. 3).

At the main resonance frequency the aluminium tube has a damping effect which reduces the height of the impedance peak. The copper coil does not induce any appreciable current in the aluminium tube, but the movement of the latter cuts the magnetic flux so that a current is induced in the aluminium tube which is directly proportional to cone velocity. This type of damping will be recognised as being the same as that used in many electrical measuring instruments.

At the high-frequency end of the impedance curve, the comparative decrease is due to the low resistance of the aluminium tube. The flattening of the curve indicates the improved power transfer as well as better matching to the output stage of the amplifier.

The output transformer required to couple the "Duode" speaker to the am-

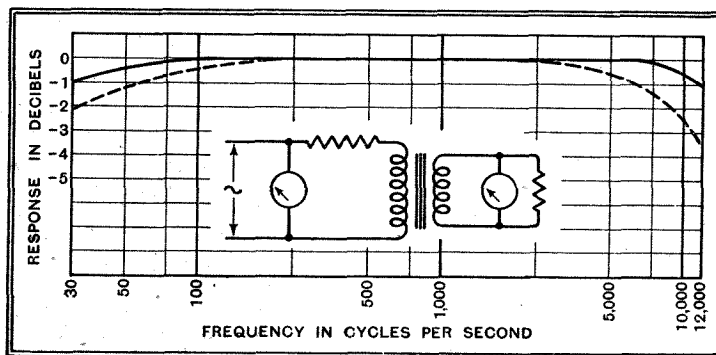


Fig. 4.—Output transformer characteristics with sectionalised windings and lapped laminations (full curve) and normal commercial construction (dotted curve).

plifier, preserving the advantages of the increased frequency range, might at first be expected to prove somewhat costly. Two curves (Fig. 4) have therefore been prepared to show the difference in results between a transformer of special construction and a normal commercial product. The former has interleaved laminations and sectionalised windings. Even so, the difference at 10,000 cycles is only 2 db, which is difficult to detect aurally.

The full advantage of the "Duode" speaker is only obtainable with a set which passes a wider frequency band than usual, but even with a comparatively selective set some improvement is derived from the absence of peaks in the frequency response curve. The speaker is definitely unsuitable for a set which is so selective that a peak at 4,000 or 5,000 cycles is required

**The Magnavox "Duode"—**

in order to give a spurious brilliance to the tone.

Distortion due to overloading or other causes becomes more noticeable as the frequency range is extended. A pentode output valve might be expected to be quite unsuitable with the speaker, but in actual

practice, as long as overloading is avoided, this is not the case. The high anode resistance of a pentode makes it particularly desirable that a speaker associated with it should have good damping, which is characteristic of the "Duode" construction. In speakers lacking this damping, the resonance will be unduly emphasised.

swop jobs with Howard Marshall when a couple of stonewalling batsmen have dug themselves firmly in at the wickets?



**European Stations in the U.S.A.**

RECENTLY I mentioned some of the European stations that were well received in the United States by enthusiasts (and they seem almost innumerable) who don't mind either sitting up very late at night or getting up very early in the morning. The list that I then gave consisted mainly of big stations; I have since heard from American friends and from readers in this country that many of the smaller 'ry are quite regularly received in many parts of the United States. A recently published list of "best bets" for American long-distance enthusiasts includes no less than 66 European medium-wave stations—which means that you can hear just about as many of them in America as you can in this country! From the "North-Eastern I.D.A. News," the official organ of the Seventh District of the International DX'ers' Alliance, I learn that the North Regional, the Scottish Regional, the London Regional, the Midland Regional, the Scottish National, the synchronised London, North and West Nationals (I wonder what they sound like as a trio at long range?) and Aberdeen have all been logged in Nova Scotia, or the parts adjacent. But much more surprising is it to find that stations such as Pecs (1.25 kilowatt), Ile-de-France (0.7 kilowatt), Zagreb (0.7 kilowatt), Cork (1 kilowatt), and Berne (0.5 kilowatt) appear in the record. I should mention that no station is regarded as verified by members of the I.D.A. unless and until a reply has been received from it that it was transmitting the items heard by the listener on the date and at the hour that he gives. These are remarkable feats.

# Random Radiations

**The King's Broadcast**

IN selecting 4 o'clock in the afternoon for his first message to the Empire, the King chose probably the best of all times for an Empire-wide broadcast. No hour could have been found which would have been convenient for this country and for all Dominions and Colonies—the time difference of ten to twelve hours between London and places in Australia and New Zealand settles that. But 4 p.m. was probably as nearly ideal as any hour could be. It allowed dwellers in Canada to hear it at local times between 9 a.m. and 11 a.m.; in Africa the hour was 4 p.m. to 6 p.m.; in India, where the whole sub-continent uses a standard time 5½ hours ahead of Greenwich, 9.30 p.m.

Listeners in Australia and New Zealand were naturally the worst off; they could hear the direct transmissions only by sitting up till the small hours or getting up with (or before!) the lark. But for those for whom this kind of thing was, for one reason or another, ruled out, there were the blattnerphoned transmissions at more reasonable hours.



**Another Fine Old-stager**

MY paragraph about a very old set which was still giving a good account of itself brought me an interesting letter from a Harrow reader. He has in use a receiver, built in 1925, which began with a neutralised triode HF stage (do you remember fiddling with those neutralising condensers?), an anode-bend detector and a small power valve. The HF stage has been brought more or less up to date (though ancient plug-in coils are still in use); the detector is now a diode and the output stage contains two triodes in push-pull.

The way in which this set has been altered step by step to keep pace with advancing standards of quality in reproduction is a pretty good proof of how well it pays to build your own apparatus. There has never been any question of scrapping it and now my correspondent tells me that though it can't compare for selectivity and sensitiveness with a modern AC/DC superhet that he has (he is on 230 volt DC mains) it has the latter beaten handsomely when it comes to quality.



**Wireless versus Crime**

SCOTLAND YARD now possesses some 300 cars fitted with wireless, and by the end of the year the number will be considerably increased. So well does wireless serve as a connecting link between the control room at the Yard and the patrol car moving about the streets that the "time-lag" between the reception of a telephone message saying that there is trouble afoot and the arrival of a police car on the scene is seldom more than two or three minutes. Radio has already played an important part in checking certain kinds of crime, and it will be

**By "DIALLIST"**

even more useful in the future as the number of wireless-equipped cars increases and the police are able to pounce yet more quickly.

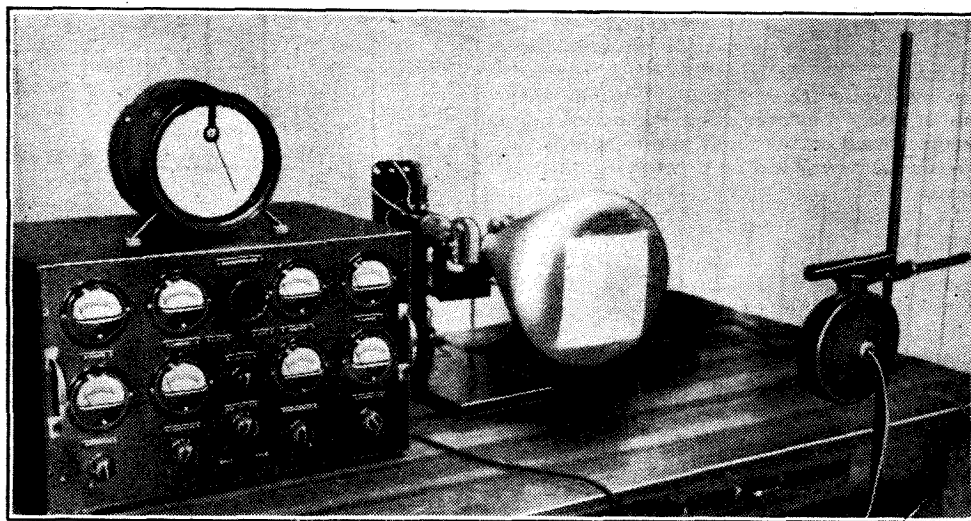


**Sporting Commentators**

AS one who heard the whole of Bob Bowman's commentary on the Olympic ice-hockey match between Great Britain and the U.S.A., I find it rather hard to understand why some listeners should have become almost hysterical about his gift for graphic description. He was good; he was, in fact, quite first-rate. But I really can't see that he has made all the other sporting commentators look like amateurs, or struck out an entirely new line in running commentaries.

We are perhaps apt to lose sight of the fact that ice-hockey is the fastest and most breathless game in the world. Hence it isn't difficult to make a commentary on it sound exciting. I can think of several regular commentators who would have kept us just as much keyed up with excitement had they been called upon to describe the match. I wonder how Bob Bowman would like to

## An Equipment for Testing Cathode-ray Tubes for Television or Measuring Purposes



THE above photograph illustrates an interesting equipment, developed in the Manfred von Ardenne laboratories, in Berlin. All the important properties of a cathode-ray tube can be measured in a few minutes by means of this apparatus. With the help of the barrier-layer photocell seen on the right-facing the screen of the tube under test—the characteristic curve of fluorescence-intensity can be plotted for all values

of anode voltage likely to be met with. Simultaneously, measurements can be taken of the ray current and the current passing to the focusing electrode, showing their variations as the control-electrode potential is varied. In addition, spot brightness, the corresponding focusing-electrode potential, the deflection sensitivity, the vacuum factor, and the saturation effects at the screen can all be determined.

# Below 100 Metres

## Notes from a Listener's Log Book

**I**N connection with my last notes, in which you will remember I classified ultra-short wave conditions into two types, "A" and "B," an interesting letter has been received from G5AM.

It was pointed out then that good ultra-short wave conditions (with abnormally low skip distance on 10 metres) in the afternoons and very poor 30-50-metre results later in the evening were typical of type "B" conditions, and that this could be accounted for by Intense E region ionisation in the afternoon and abnormally low ionisation later in the evening.

My correspondent, however, whilst accepting the Intense E explanation for the 10-metre results, does not agree that the poor evening results were due to low ionisation or lack of bending of the rays earthwards, but would account for the weak 44-metre signals (see example given in last notes) rather by attenuation due to a still abnormally high E region ionisation.

This attenuation would be caused by heat losses in the E region and is proportional to the square of the working wavelength ( $\lambda^2$ )\* or, as my correspondent ably puts it, "is due to the factor of 'collisional friction,' i.e. the oscillating electrons make frequent collisions with air molecules, thus losing energy."

This loss or attenuation may also be said to be a function of the "mean free time or path" of an electron, and it is of interest to note that, for average E layer ionisation, the attenuation is a maximum at 1,400 kc/s (214 metres), because at this frequency the "mean free time" and "half-period time" of the HF oscillation coincide, and there is thus a resonance effect and the maximum energy is absorbed by the layer.

Returning, however, to our point, one feels that the objection to the attenuation hypothesis is this: if the attenuation in E region remains high—equivalent to a summer daytime value—such as would produce weak 44-metre signals and no indirect ray medium wave reception, then why was indirect ray medium-wave reception perfectly normal on the night in question, with no—or at the best only weak—44-metre signals?

In fact, there is some reason to believe that the "Intense E" region is a non-attenuating sharply defined reflecting lower limiting stratum of the normal E region and is called by the Americans "sporadic E."

This propagation study would not now be complete, I feel, without further reference to the fifty-four day cycle of radio fade-outs, mentioned in previous notes. Following a well-defined fade-out on Friday afternoon, February 14th, between 3.15-3.35 p.m. on practically all short-wave channels, it now seems practically certain that the cause of these fade-outs is the ejection of hydrogen by the sun. This seems first to have been demonstrated by the U.S. Bureau of Standards, with the co-operation of the Mt. Wilson Observatory (see "Electronics," pages 25 and 34, January, 1936, and "QST," pages 8 and 79, January, 1936), and a statement on page 311 in the English scientific weekly *Nature*, February 22nd, is of great interest.

Referring to an active group of sunspots, it is stated, "Most of the eruptions (hydrogen) were of minor importance, but on February 14th (the central meridian passage) one of appreciable extent and involving large radial velocities of accompanying dark clouds of hydrogen was fortunately observed in its entirety. This eruption, which occurred within a few degrees of longitude of the central meridian, began within a minute or two of 12h. 39m. and lasted until 13h. 27m. U.T.

"Since the active area on February 14th was favourably, but not ideally, placed on the disc for corpuscular streams to reach the earth, reports on the disturbances of the earth's magnetic field and on radio reception will be of special interest."

It seems now that it only remains to be established whether this phenomenon is really a fifty-four day one, or whether it actually occurs more frequently, but no doubt these fade-outs will not escape notice so easily in the future as they must have done in the past, if indeed they did.

I had originally intended to refer in my notes this week to the programme value aspect of short-wave reception, a side which must be of more than passing interest to both the manufacturer of all-wave sets and to the listener, but in view of the foregoing dissertation I think it would be better to postpone this till next time.

### Fortnight's Review

Conditions in the daylight bands were still good at 8 p.m. on Wednesday evening, February 12th. W3XAL on 16.87 metres was very strong at this time, and it was noted that Montreal CGA was also on his 16-metre wave at 8.20 p.m., presumably for the first time this year. This transmitter is particularly interesting in view of the fact that it operates on telephone and telegraph simultaneously, on 16, 23 or 32 metres, with a keyed tone (9,000 cycles) for telegraphy, and a possible frequency range of approximately 50-6,000 cycles for telephony.

Similar systems are in use on the Paris-Algiers and Amsterdam-Bandoeng circuits.

Conditions were similar on Thursday evening, and W3XAL was again good—in particular a male voice quartet singing "Drink to me only"—and so were the U.S. amateurs in the 20-metre band.

It was noted that there was no heterodyne on GSL this evening, so apparently the Halifax transmitter CJHX (VE9HX) has now ceased operation on this frequency (6,110 kc/s) or has altered its transmitting times. It certainly could not have been heard in this country while GSL was in operation, i.e. from 7.30 to 10.45 p.m., or, after February 26th, to 9 p.m. only.

In spite of the 54-day fade-out on Friday afternoon, February 14th, conditions were good in the evening, and at 10.20 p.m. both W1XAL and W8XK were good in the 25-metre band, and W2XAF was excellent on 31.48 metres, although earlier it had been worried by a heterodyne from LKJ1, Jelöy.

Ten-metre conditions were fair on Saturday afternoon, and W2XEM was heard calling Cars 13 and 16—"look over vacant property, etc., etc.—this concludes reminders"!

The American quintet W3XAL, W2XAD, W1XAL, W8XK, W2XAF continued to perform well until Tuesday, February 18th, when conditions became distinctly poorer and the South Americans on 49 metres leapt into prominence.

Some sixteen of these stations were logged this evening, starting at 45.9 metres and slowly working upwards, as below:—

	m.	Station	Strength.	Merit.
(1)	46.0	YV6RV Valencia	R 6.7	M3+
(2)	46.52	HJ1ABB Barranquilla	R 7.8	M4
				Morse interference.
(3)	46.7	HI1S Puerto Plata?	R 3	M2
(4)	47.05	YV4RC Caracas	R 2	M1
(5)	47.5	HIZ Trujillo City	R 5.6	M2
(6)	47.7	YV12RM Maracay?	R 1.2	M0
(7)	48.4	CTIGO?	R 3	M2+
(8)	48.4-48.8	Several very weak stations.		
(9)	48.92	COCD Havana?	R 7	M3+
(10)	49.75	HP5B Panama City	R 7.8	M3+
				Good (slight band interference).
(11)	50.5	TG2X Guatemala?	R 6	M2+
(12)	50.6	HJ4ABE Medellin?	R 6.7	M2+
(13)	50.7	HH2S Pont-au-Prince?	R 6.7	M3
(14)	50.8	HCK Quito?	R 8	M3+
(15)	51.2	HRN Tequiguilpa?	R 6.7	M2+
(16)	51.7	YV2RC Caracas	R 7	M2+
				Echoey.

Ten-metre conditions over the week-end February 22nd-23rd were definitely poor, but W2EUG distinguished himself by coming through O.K. on 'phone, practically a solitary U.S. 'phone signal. Otherwise, CP1AC on c.w. and OA4B on 'phone were the only outstanding signals. The Heston airport beacon on 8.5 metres was, however, a strong signal.

There seem to be increasing signs of activity on the 5-metre band, and at about 1 p.m. on Sunday, February 23rd, G5LB was read at R4, working G2AW on T9 c.w. (a distance of ten miles, mainly houses and railway lines). G2AW, I believe, is much nearer than this to G5LB. (G2AW works only on 5 and 2½ metres.)

Finally, did you hear the YL operator on VP3BG Georgetown calling "CQ 20 metre 'phone'" at 10.40 p.m. on Sunday—a "fb" signal, too! "ETHACOMBER."



### FOUR SETS A MINUTE

Assembling Philco receivers on the moving production line at the new Perivale Works of the Philco Radio and Television Corp. of Gt. Britain, Ltd. The present output schedule is for four sets per minute, and plans are already in hand for doubling the capacity of the factory.

\* For Short Waves



# New Apparatus Reviewed

## Recent Products of the Manufacturers

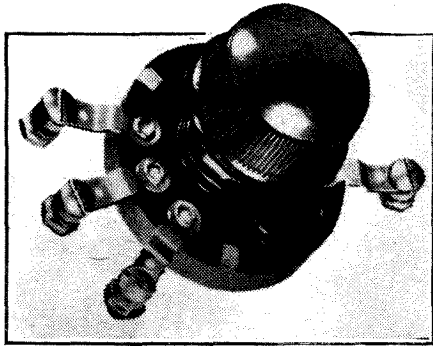
### DUBILIER FADOVER

THIS interesting Dubilier product is a potentiometer-type volume control having a connection brought out from the centre of the resistance which, in this case, is a synthetic element stated to be of the metallised type.

Its function is a dual volume control for use in amplifiers where it is required to have a smooth and continuous change-over from one source of input to another; for example, from gramophone to microphone, or from one gramophone unit to another, or maybe, from one microphone to another.

One input can be gradually faded out and the other slowly brought up to full volume merely by rotating the Fadover knob. The mid-way, or zero input position is made definite by a spring stop that engages with a hole in the moving contact at this point.

This contact is of special interest, as apart from the fact that it is entirely insulated from the spindle, it is provided with a three-prong finger that bears lightly but firmly on the resistance element. Having three separate contact points, the risk of failure is very remote; furthermore, it enables the contact arm to adjust itself easily to slight inequalities in the element and precludes momentary changes in contact resistance, thus making for silent operation. The Fadover was certainly found to be very satisfactory in this respect.



Dubilier Fadover, a dual-volume control with two graded resistances of 0.25 megohm each.

Each half of the resistance element is suitably graded for even control of volume and has a resistance of 0.25 megohm. The price is 6s. 6d.

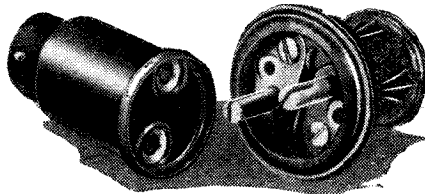
### HOOVER ADJUSTABLE PLUG

THIS new electrical fitting recently introduced by Hoover, Ltd., possesses many novel and interesting features. In the first case it can be readily adapted to fit 3-, 5-, 10- or 15-amp. sockets by changing the pins which are screwed into threaded sockets, and, furthermore, two sets of sockets differently spaced are included. Secondly, as the body of the plug is made of rubber, it will fit any socket merely by squeezing it, either to increase the spacing of the pins or to lessen it.

Other features include accessible terminals, and it does not require taking apart when fitting the flex. Normally the plug is supplied fitted with 5-amp. pins, but if the larger size wall sockets are to be used,

then the correct pins should be obtained. On the other hand, if the 3- and 5-amp. fittings are occasionally used, the former being now generally found on most wireless apparatus, it might be best to fit the smaller size and rely on its adjustable feature to accommodate itself to the larger.

There is also available an adaptor to enable the plug to be fitted into a lamp holder. Since provision is made to fit different size pins on the plug, the adaptor, which is made of bakelite, has interchangeable sockets and any size from 3- to 15-amp. is available. The plug and adaptor interlock when fitted together, a rubber skirt on the former engaging with a flange on the latter. The rubber adjustable plug alone costs 1s. 6d., or complete with adaptor 2s. 3d.



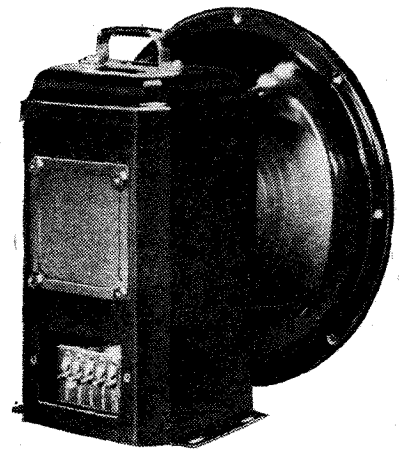
Hoover rubber adjustable plug and lamp-holder adaptor.

### MAGNAVOX MODEL 33 "DUODE"

THE constructional features of this new loud speaker are dealt with in detail in another part of this issue. Here we are concerned more with its performance under ordinary receiving conditions.

There can be no doubt that as far as the high-frequency response is concerned, the "Duode" marks a very distinct advance. The reproduction is quite free from the peaky quality which often attends the strengthening of the upper register, and it is possible fully to appreciate the increased clarity and fidelity of sounds rich in harmonics. The extended frequency range in conjunction with the increased eddy current damping at low frequencies also results in exceptionally good transient response.

The latter quality is not predictable from

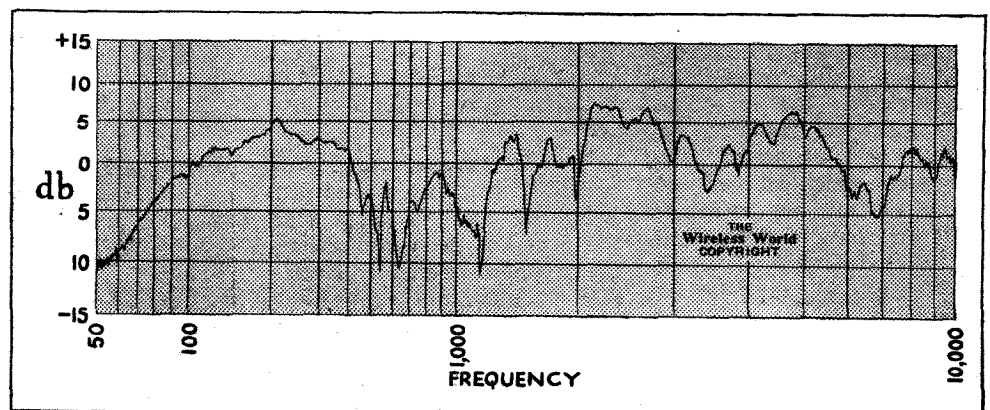


Magnavox Model 33 "Duode" loud speaker with single diaphragm and composite voice coil.

treme bass the droop is due primarily to the limitations of baffle area and not to the loud speaker itself. The absence of the resonance peak at 70 cycles shown in the N.P.L. curve on another page is probably accounted for by the fact that the field energy, and consequently the damping, was higher (21 watts). It should be borne in mind also that no correction is made in *Wireless World* tests for the characteristics of the output transformer, nor is any account taken of other factors such as change of impedance which might tend to cause a variation from constant current in the speech coil with frequency. The speaker is matched according to the makers' instructions, and constant volts are then maintained on the grids of the output valves.

Whatever the method of test, however, the "Duode" is revealed as a loud speaker of outstanding merit, and one which is pre-eminently suited for use in equipments designed for the quality reception of the local station or in sets with variable selectivity which provide the necessary frequency range when conditions permit its use.

The price of the Magnavox 33 "Duode" is five guineas including transformer, and models are available with 2,500- or 1,250-ohm fields.



Axial response curve of Model 33 "Duode." Microphone distance 4ft., power input 1 watt.

the frequency response curve, but in other respects the curve confirms the good impression made by listening tests. Except for a few narrow dips in the 1,000-cycle region the output is within  $\pm 5$  or 6 db. throughout the greater part of its range. In the ex-

### Shaftesbury Microphones

PRODUCTS of the new factory of Shaftesbury Microphones, Ltd., include a mobile amplifier operating from a car battery, a 10-watt horn speaker, and a velocity microphone.



**DOROTHY DICKSON**, star of musical comedy, is commère in a "Dorothy Dickson" programme devised by James Dyrenforth which National listeners will hear at 10.15 on Wednesday.

# Listeners' Guide

## Outstanding Broadcasts at Home and Abroad

**GHOSTS** have been pitifully neglected in recent years, thanks to the spread of free education and such rival entertainments as broadcasting and the cinema, but Mr. Harry Price, hon. secretary of the University of London Council for Psychical Investigation, is determined that at least one ghost shall have a chance to prove that he is more than an old wives' tale. All the machinery of modern broadcasting is to be set in motion to enable National listeners on Tuesday next to eavesdrop on an alleged ghost in a Twelfth Century manor house. Mr. Freddie Grisewood, B.B.C. announcer, will accompany Mr. Price to the house at 8 o'clock to watch the fastening and sealing of the doors and windows, and the spreading of powdered graphite to develop any finger prints which may appear during the investigation. Electrical contacts, we are told, will be attached to those doors which are believed to open of their own volition.

The first part of the broadcast concludes at 8.20 p.m.; from 11.45 to midnight National listeners will be switched in again to overhear the supposed manifestations.

**WHEN THE WIND BLOWS**  
"GALE WARNING," which is to be revived on Wednesday (Reg., 7.30), was the first feature programme prepared with the assistance of the B.B.C. Mobile Recording Unit, and it will be interesting to

compare its twelve-months-old technique with that of its successors, "Cable Ship," "Dinner is Served," and "Fog." "Gale Warning" traces in sound the drama of the men and organisation behind the public services affected by a gale. Battersea Power Station, Ramsgate Coastguard Station, a liner in mid-ocean, a light-house and a lightship, the London Fire Brigade—these are some of the sources from which the programme was built up.

### "DISHONESTY IS THE BEST POLICY"

**DISHONESTY**, in certain circumstances, is not only the best but the only possible policy; at least, this is the thesis of "The Voysey Inheritance," Granville Barker's famous comedy, which will be heard in a radio version on Monday (Nat. 8) and Tuesday (Reg. 8.20). Edward Voysey, heir to an old-established firm of family solicitors, learns just before his father's death that the firm has been embezzling the capital of its clients. Horrified, he determines to give himself up to the police. The firm's wealthiest client discovers the secret but decides to take no action so long as his income is, as formerly, paid in full, and the stolen capital is eventually replaced. Edward realises that the firm's clients would be worse off if he told the truth than if, like his father, he shouldered the Voysey inheritance and attempted gradually

to make good the defalcations. So he determines, like his predecessor, to protect his clients by continuing to make use of their money.

### BOLERO AT LEICESTER

**LEICESTER** leaps into the limelight this week, the de Montford Hall being the scene of two important broadcasts. To-morrow night at 7.20 Regional listeners will hear the Leicester Brass Band Festival, while on Wednesday the B.B.C. National Orchestra of 119 players, conducted by Adrian Boult, will broadcast from the same platform (Nat. 8). The programme includes Beethoven's 6th Symphony and Ravel's intoxicating "Bolero."

### "THE GYPSY PRINCESS"

**MARIA ELSNER**, the Viennese opera star, who appears in Gordon McConnel's production of "The Gypsy Princess" (Kalman) on Thursday (Nat. 8.30) and Friday (Reg.), is young and charming, representing a new generation of

opera singers no longer doomed to enormous proportions. She was one of the most interesting "discoveries" of British radio in 1935, when she appeared in the first "Band Box" programme last autumn. She is an international singer with the technique of the German opera school.

This beautiful operetta was first broadcast in 1932, and Jan van der Gucht will again appear as Prince Ronald.

### JUVENILE TALENT

**MAE WEST'S** classic invitation to "Come up and see me sometime" is to be echoed by a young person of fourteen—Doreen Williamson—one of the child *protégés* whom Philip Ridgeway is bringing to the microphone on Wednesday (Reg. 9.40). We are told that her rendering of this turn lacks little of the robust sophistication of the original. With her will be a number of child performers, as well as Ridgeway's partner, "Irene," who, although only fifteen years old, is an expert variety artist.



**HAUNTED HOUSE.** We hope the above scene will not be re-enacted by Messrs. Harry Price and Freddie Grisewood when they take the microphone to a twelfth-century haunted house at 11.45 on Tuesday for the benefit of National listeners.

## for the

## Week



SIR THOMAS BEECHAM in characteristic pose at a rehearsal. He conducts the Royal Philharmonic Orchestra on Thursday next (Reg. 8.15) in a concert of works by Mozart, Mackenzie and de Falla.

## HEADLIGHTS OF THE WEEK

## FRIDAY, MARCH 6th.

Nat., 8, Music from the Movies.  
Reg., 8, "Men and the Land," a discussion (from Midland). 8.30, B.B.C. Military Band.

## Abroad.

Leipzig, 7.50, Dresden Philharmonic Orchestra.

## SATURDAY, MARCH 7th.

Nat., 7, "Saturday Magazine."  
"Band Box."  
Reg., 8.20, Act II. "La Bohème" (from Scottish). "Ambrose and his Embassy Club Orchestra.

## Abroad.

Hilversum (1,875 metres), 7.50, Opera: "Il Seraglio" (Mozart).

## SUNDAY, MARCH 8th.

Nat., 1.30, Medvedeff's Balalaika Orchestra. 5.20, "King Henry VIII" (Shakespeare). 9, Leslie Jeffries and Orchestra, Grand Hotel, Eastbourne.

Reg., 4.30, Frank Biffo's Brass Quintet. 9.20, Bantock's "Pagan Symphony" (Sunday Orchestral Concert).

## Abroad.

Deutschlandsender, 8, Symphony Concert of works by Hans Bullerian and Kurt Thomas, the composers conducting.

## MONDAY, MARCH 9th.

Nat., 8, Radio Play: "The Voysey Inheritance" (Granville Barker). "Grosvenor House Dance Band."  
Reg., 8, "Variety of Music"—Compère: Brian Michie. "Comfortable Words"—oratorio programme.

## Abroad.

Munich, 7.10, "Hand on Your Heart, Dear Friend!"—a humorous programme.

## TUESDAY, MARCH 10th.

Nat., 8, Visit to Haunted House. "Geraldo and Band: "Romance in Rhythm." 11.45, Haunted House Revisited.

Reg., 8.20, "The Voysey Inheritance." "Joe Loss and his Band.

## Abroad.

Strasbourg, 8.30, Concert by Metz Municipal Theatre Artistes.

## WEDNESDAY, MARCH 11th.

Nat., 8, B.B.C. Orchestra visits Leicester. 10.15, Dorothy Dickson in "Twinkle, Twinkle."

Reg., 7.30, "Gale Warning." "Lou Preager and his Band.

## Abroad.

Berlin, 8, Berlin Philharmonic Orchestra.

## THURSDAY, MARCH 12th.

Nat., 8.30, "The Gypsy Princess." 10, Mid-Week Service from St. Michael's, Chester Square.

Reg., 8.15, Sir Thomas Beecham conducts Royal Philharmonic Orchestra.

## Abroad.

Kalundborg, 7.10, Twentieth Thursday Concert by Radio Symphony Orchestra. Conductor: Fritz Busch.

## SHAKESPEARE "ON THE AIR"

"KING HENRY VIII" is Sunday's Shakespeare play in a radio version by Howard Rose (Nat., 5.20). Ruthless cuts are necessary for these microphone versions, and it requires legerdemain as well as mental concentration to attempt to follow the plays from the printed book.

The part of the King will be taken by Frederick W. Lloyd, and Queen Katherine by Marie Ney. Malcolm Keen appears as Cardinal Wolsey.

## DR. BLOW, HIS MUSIC

ROBUST old-English fare is being offered in the "Foundations of Music" next week. It consists of dramatic music of the Restoration period, the most notable item, which extends over several days, being Dr. John Blow's "Music for a Royal Masque." The B.B.C. Singers with Ernest Lush at the harpsichord will be supported by a section of the Boyd Neel String Orchestra.

## MID-EVENING DANCE MUSIC

ANTICIPATING the forthcoming changes in the arrangement of the broadcast dance sessions, there are to be two important mid-evening dance programmes next week.

At 8.30 on Tuesday (Nat.) Geraldo and his Band will give another "Romance in Rhythm" feature, and on Wednesday Carroll Gibbons and the Savoy Orpheans are presenting a special programme at 8, with Brian Lawrence and the Three Ginx.

## "TOP HAT" BY WIRELESS

WHY not listen to Fred Astaire? He is to broadcast from Kalundborg on Monday at 7—not in person, but in the shape of an excerpt from the film, "Top Hat," relayed from the Metropolitan Picture Palace, Copenhagen.

Incidentally, the Danish programme list gives the title of

one of the songs as "Top Hat, White Tie and Tales," the last named evidently being what is handed out to the enraged spouse on one's return to the home battlefield.

## WHEN THE SCENERY FELL

CARUSO's fatal illness is said to have begun during his last performance of the leading role in Saint-Saëns' famous opera, "Samson and Delilah," for as he seized the pillars of the temple a heavy piece of scenery fell on him and he was seriously injured. The rare treat of a relay of the opera from the Scala, Milan, is offered to us by Rome at 7.45 to-morrow evening (Saturday).



RICHARD CREAN conducts the London Palladium Orchestra in a popular programme on Sunday evening (Reg. 6.45).

Another notable operatic event to-morrow is a relay by Brussels No. II of Borodin's "Prince Igor," from the Royal Flemish Opera, Antwerp, at 2.30. This opera, being in-

tensely national, is full of excitement and optimism, giving the lie to the accepted conception of pessimism inherent in the Russian character.

Deutschlandsender reflects the spirit of Germany's National Day of Remembrance with its 7.15 o'clock transmission on Sunday—a Tügel ballad opera entitled "Die Treue" ("The Faithful One"), with music by Steinkopf.

## A LEHAR DEBUT

LEHAR's "Merry Widow" now has a little sister, "Eva," who is to make her bow on the Brussels No. II wavelength at 8 o'clock to-morrow evening. This is an event which no Lehar disciple can miss.

## CLASSICAL GEMS

LOVERS of classical music have a good choice in the Continental programmes during the next seven days. Reger's Quartet in E flat is being broadcast by the Oslo Philharmonic String Quartet at 9.15 this evening from the local station, and to-morrow Quartets by Beethoven and Martini come from Brussels No. II at 10.10. Eighteenth-century Chamber music comes from Kalundborg at 9.40 on Sunday, and Brahms' pianoforte music, played by Walter Rehberg, comes from Leipzig at 9.20 on Thursday.

## IN PRAISE OF BEER

"BEER, glorious beer," is the title of Munich's programme about beer in general and Munich beer in particular, to be broadcast at 8 on Thursday next. Other National transmissions of local interest include Silesian and Moravian folk songs by a children's choir, which can be enjoyed at 6.20 to-night by those who can tune in Moravska-Ostrava. Vienna offers at 7.5 a folk play, "Nur keck," with incidental music and songs.

Contemporary German music is not everybody's meat, but those who will "try anything once" might tune in Breslau at 7.45 on Wednesday, when compositions will be heard of such modern writers as Edward Behm, Josef Suder, Walter Cropp, and Cäsar Bresgen.

THE AUDITOR.

# Readers' Problems

## "Add-on" Volume Control Unit

A QUERIST, who proposes to modify a somewhat out-of-date 2 HF-det.-LF set for mainly single-station reception, intends to provide a pre-detection volume control (originally lacking) by replacing the SG valves by variable-mu types with appropriate control of grid bias.

It is asked whether the whole volume control unit might be external to the receiver, and mounted at a distance of some twenty feet from it. The set is battery operated.

There is no objection to this plan, but it will be wise to see that the grid circuits of the controlled HF valves are thoroughly decoupled. The circuit diagram of a suitable

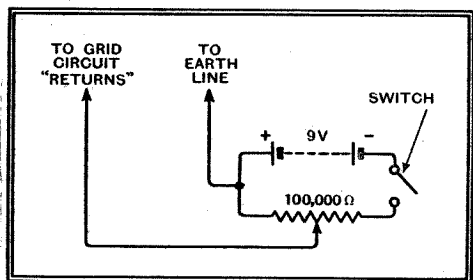


Fig. 1.—Remote volume control: an external unit for adding to an "HF" receiver.

controlling unit is given in Fig. 1; the two leads connected to the receiver may, if desired, be in the form of twisted flexible wire, as capacity between them will not be harmful.

## Volume Expansion

A QUERIST who wishes to experiment with volume expansion is unable to obtain special valves for the purpose, and asks us whether it should be possible to obtain reasonably good results with ordinary variable-mu pentodes.

These valves should be reasonably suitable, but we are inclined to think that variable-mu triodes would provide better quality. It is therefore suggested that ordinary variable-mu pentodes or tetrodes should be converted into variable-mu triodes by the simple expedient of strapping together the screening grids and anodes. The valve will then have characteristics similar to those of the ordinary low-impedance triode, and it would be advisable to restrict the anode voltage to that normally recommended for the screening grid.

## Increasing Selectivity

WITH the object of obtaining the maximum possible selectivity to satisfy special receiving conditions, a reader asks us to criticise the various alterations he proposes to make to his superheterodyne receiver.

The alterations suggested should all help towards the attainment of his aim, but, of course, at the expense of quality—that, presumably, is accepted as inevitable in this particular case. The only additional measure that we can suggest is that the load resistance of the diode detector should be increased from the conventional value of

about 50,000 ohms to  $\frac{1}{4}$  or  $\frac{1}{2}$  megohm. This should help selectivity appreciably and will not have any noticeable effect on quality as compared with the other proposed alterations.

## Reverse the Mains Plug

THE expedient of connecting a small condenser (0.001 mfd. or more) between one side of the mains input to the receiver and earth is often effective in curing modulation hum. When fitting the condenser it is necessary to ascertain by trial to which side of the mains it should be joined.

A reader who has hitherto been using this simple hum-stopper with complete success finds that it is ineffective now that the set has been transferred to another room. We gather from his letter that he has overlooked the fact that, in moving the set, the polarity of the mains connection has possibly been reversed, and so we suggest that, before trying a more elaborate suppression device, he should try the effect of reversing the mains plug through which the set is supplied with current.

## Wiring the Short-wave Two

SEVERAL constructors of the Short-Wave Two, described in November last year, have suggested that the process of wiring might be simplified by joining some of the "earthy" leads directly to the aluminium chassis instead of to the points shown on the wiring plan.

In a short-wave receiver it is often undesirable to employ the chassis indiscriminately as a common earth connection. By doing so hand-capacity effects are sometimes provoked and the performance may be adversely affected in other ways. It is therefore safest to follow the run of the original wiring as closely as possible. This applies to all short-wave sets.

$$2+2+2=2(?)$$

A SOMEWHAT puzzling question is posed by a correspondent who uses a 6-volt accumulator battery for charging an HT unit. When the battery was recently returned from the charging station, a voltmeter test showed the total voltage to be only 2 instead of 6 volts, but each of the three individual cells showed 2 volts.

The only plausible explanation seems to

## 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.

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.

be that the connections of one of the cells (probably the middle one) have been reversed. The voltage of this cell will then neutralise that of one of the others, leaving an effective pressure of 2 volts only.

## Mounting IF Transformers

ALL constructors of receivers employing a variable selectivity should pay attention to the mechanism whereby the coupling of the various IF transformers is controlled. Matters should be so arranged that all transformers are mounted the same way round; otherwise it may happen that, by operation of the control knob, the coupling in one transformer is increased while that in another is decreased.

Neglect of this precaution is clearly responsible for a few failures by correspondents to obtain proper control of selectivity.

## The Simplest Battery Set

SOME weeks ago we published a brief description of the simplest possible single-valve receiver for DC mains operation. A reader now asks us to suggest a cir-

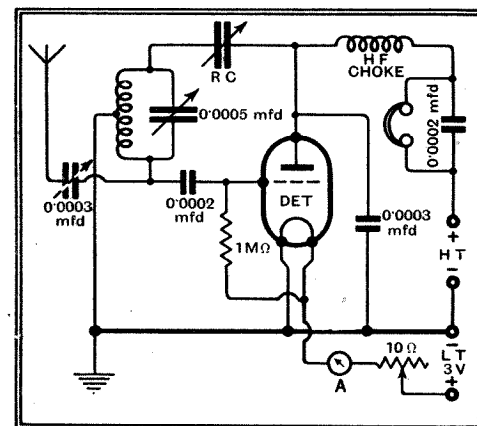


Fig. 2.—Almost the irreducible minimum: a "stand-by" headphone set with dry-cell LT.

cuit for a similar battery operated receiver which can be worked with an improvised aerial for short-distance reception.

We doubt whether it would be possible to find anything simpler than the arrangement shown in Fig. 2. This single-valve detector set employs a "Hartley" circuit requiring only one centre-tapped coil which combines the functions of tuning inductance and reaction winding. Reaction is controlled by the condenser RC, which should be extremely small—20 or 30 m.-mfd. maximum.

A 3-volt dry-cell LT battery is suggested because a set of this nature is generally used intermittently and in such circumstances an accumulator is often neglected. The use of a dry battery introduces the need for a rheostat and makes the insertion of a filament current meter (A) extremely desirable. But there is, of course, no reason why an accumulator should not be used if preferred.



# Alternative Programmes

## II.—A Regional Scheme Up to Date

An alternative programme has to be . . . . .

By P. P. ECKERSLEY, M.I.E.E.



**I** CONCLUDED my last article with the question, "What modifications of the regional scheme are therefore advisable?" The "therefore" in this quotation implied an introduction of two new factors since the original conception of the twin-wave alternative service was made, namely, a great increase of power of foreign stations without a corresponding increase of channel separation, and, secondly, the universal adoption of autogain in the receiver.

Before proceeding to answer this question let us all at least agree on one fundamental. The Regional scheme has never been properly used; this is no fault of its technical conception but rather a lack of courage and imagination on the part of those responsible for programme policy. It seems to most of us inconceivable, given the technical facility of the provision of a second channel, that, at any but obviously exceptional periods, it should not be used to radiate an alternative programme. The glaring example of the news period when the prices of dead animals are laboriously radiated on both wavelengths has been so often quoted as to make its repetition tedious, but surely, in any discussion of principle, necessary. Nor is this the sole example. The thing seems to me so lamentable that I cannot be eloquent in its condemnation; I am merely amazed at its ineptitude. In passing, however, it is as well to point out that it is really impossible to get true alternatives, so long as one organisation is responsible for both transmissions. You can contrast jazz with talk, symphony with drama, children's programmes with those of interest to adults (believing that the adults will listen to the former, hoping that children will listen to the latter), but you can never contrast the spirit, the presentation, ideology if you will, of two programmes if the same type of mentality is responsible for both. This does not imply any specific criticism of the B.B.C. programmes, which, of their kind, are exactly what the British public enjoys and appreciates. Nevertheless, it is a fact that unless completely autonomous bodies are responsible for the different programmes you will never have programmes of contrasted character.

The ideal of two alternatives would be, in existing circumstances, most nearly approached if the alternatives, radiated by regions, should always be different from one another and different from the National programme. Actually it was the basis of my idea that "regions" should be largely autonomous. There would thus be a national programme and a regional programme. The national programme was to be London made and London conceived, the framing of the regional programmes was to be left to the skill and personality of a regional director. There are, according to authorities, two difficulties which make a full realisation of this scheme impossible; first, the London headquarters are reluctant to put the heavy responsibility of autonomy on to the shoulders of their regional directors; secondly, the money available has been limited. It is and always has been my sincere hope that the former policy may be modified, and, so far as can be gathered from the inspired forecasts of the Ullswater Report, finance will be given to the B.B.C. to make such modification possible. It is to be hoped, however, that if the Treasury is more generous the B.B.C. will present a more accurate record of how its money is spent than they have done heretofore.

### Regionals as Alternatives to Foreign Stations?

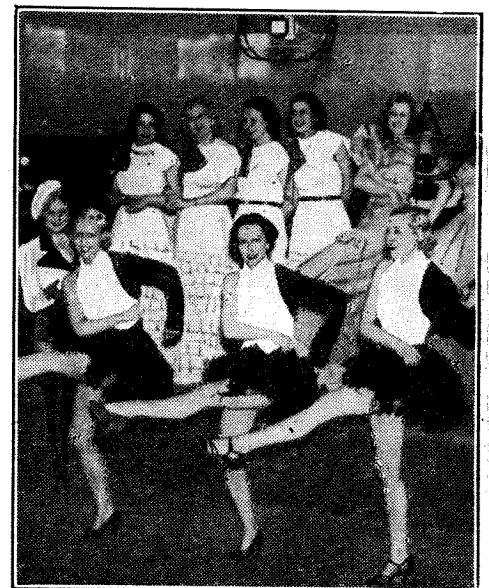
Although I am inclined to believe that listening to music can only have cultural significance if the quality is really good and free from background noise, I must appreciate that the usually harsh sounds emanating from a typical set picking up a distant transmission does give pleasure to a large number of persons. Thus, while an orthodox technician may feel that the benefits of the varied regional programmes cannot be fully appreciated, the public may take the opposite view.

It would seem to me, therefore, that the first modification of the regional scheme is to do what has been previously suggested, namely, to give regions their autonomy and count them somewhat as the listener counts foreign stations as a contrasted source of entertainment. The local listener is not in any sense penalised by

such a policy, and the original conception of the regional scheme would be fulfilled.

But can we, in view of the great improvement in wireless sets, go a step farther? Can we wholly abandon the original technical conception of the regional scheme and use only single wavelength transmitters at each region, counting the long-wave transmission as the sole alternative? The advantages of such a scheme are that it frees a large number of wavelengths so that areas originally enjoying good service but now jammed by foreign stations can be served from new transmitters. The disadvantages of such a scheme are that the service from the new long-wave transmitter at Droitwich which substitutes Daventry is not so good, in spite of its higher power, its higher masts, etc., as to constitute, over a large part of the country, a good service of what is probably counted by the average listener as the most important programme, i.e., the National.

I am somewhat out of touch with the B.B.C. plans, but it seems that they are attempting both to open more and more stations to "fill up the holes" in the regional scheme, and yet to preserve the



. . . . . an alternative programme.

**Alternative Programmes—**

alternative programme service. Is this not impossible? Or only possible by adopting synchronisation of National transmitters?

**Synchronising Snags**

This latter scheme has the disadvantage that where the field created by two stations radiating the same programme is comparable the quality is bad, and the listener located in such an area gets a poor service. For instance, if you were to synchronise Scottish National with Northern, London, and West National, and unless something can be done to construct aerials to give less indirect ray field at night, Glasgow and Edinburgh would have to rely upon Droitwich for its National service, and Droitwich in these regions does occasionally fade, and gets interrupted by atmospherics a certain percentage of the (summer) time. But it appears that the "half-wave" aerial does really considerably diminish the indirect ray field, and it may be possible, if these taller masts are used, to synchronise more stations than appeared possible when I was designing the Regional scheme.

The issue is one which can only be decided by a study of quantities. The prime factor is the lack of a sufficient number of wavelengths, and the forcing up of power in an attempt to get better range, with the only result of jamming one's neighbours and being jammed by them. Increase of power is not a permanent solution. The half-wave aerial and synchronisation points a hopeful way out of the difficulty.

**The Choice to be Made**

The authorities will, I think, be faced with the decision as to how far a minority is to be sacrificed in the interests of the provision for greater facilities for the majority. It seems that there must be a choice between a partial abandonment of the ideals of the regional scheme or a greater denial of facilities for a minority. Either we must see the spread of the service in terms of more and more stations giving facilities to remote parts unserved by Droitwich and the giving up for their use wavelengths now used for alternatives at twin-wave stations or the abandonment of any idea of serving these remote areas by robust signals in the belief that the modern set is quite capable of picking up stations outside what I still maintain is their true service area.

It would be extremely interesting to me, and I daresay to others, to know the opinions of readers of this journal as to whether or not they believe that the public in general would be sufficiently served if they had to rely upon listening to stations one hundred or more miles away using medium waves. If such a service is "good enough," then the old regional scheme is sufficient in itself; if not, then the alternative service may have to be partly abandoned. On one thing we all, I think, agree, that if the alternative service is to go on, let it be truly alternative!

# Letters to the Editor

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

**Transmission Quality**

IT was interesting to read Mr. Moscrop's recent letter on the quality of transmissions of the B.B.C. Dance Orchestra. As his remarks are on a par with those expressed by myself to the B.B.C. concerning this orchestra he may be interested to read their reply.

"Your criticisms have been noticed with interest, and as these relate primarily to the balance of the orchestra they have been communicated to those primarily responsible for these broadcasts. We would, however, remind you that it very often takes a matter of weeks for an orchestra to adapt itself to conditions in a new studio, and in this particular case finally in the matter of balance has not yet been by any means reached.

"The broadcasts take place from No. 4 studio (Maida Vale), and the microphones used are of ribbon type." (Dated November 18th, 1935.)

Weeks have passed, yet the consistently bass-less transmissions of this orchestra prevail. Maurice Winnick and Carroll Gibbons, at times, have had some flawless broadcasts from BA studio, yet Henry Hall for some mysterious reason never gives us a broadcast from this studio. Why? Mr. Moscrop writes that doubtless the weak bass is accidental, as Ambrose and Hylton always give us even bass; perhaps this is concurrent with the rumour that Henry Hall is in charge of his own balance and control when he is on the air.

Bradford.

W. McNICHOLAS.

**Alternatives and SW Broadcasting**

I AM amazed at your Editorial Comment in this week's *Wireless World*. How can you suggest that continuous sound transmissions should be made from the Alexandra Palace because of the outstanding improvement in quality that would be possible, and on the same page suggest that listeners should rely on the more distant B.B.C. stations as alternatives to the local?

In this part of the world not one of the more distant stations can give a service in any way comparable to the two "locals"—i.e., London Regional and Droitwich. Curiously enough, the next nearest to London Regional—namely, Midland Regional—is the worst, and the farthest away, Scottish Regional, is the best. Any of them, at their strongest, can come in as strongly as London, but fading is continuous and violent, so that a degree of selectivity suitable for the "locals" is quite inadequate for the rest, which, of course, means that quality cannot be so good as on the locals. In daylight, moreover, a receiver has to work nearly "all out" to receive West, North, and Scottish, so that even a slight amount of atmospherics rules them out altogether.

I would suggest also that there must be millions of licence holders who cannot afford the £10 or £12 for a superhet with AVC which is necessary to obtain any sort of entertainment value from the more distant stations. I know several personally.

No, for goodness' sake let us have our full variety of programmes from our two local stations. I quite agree, however, that at present the "alternative" programmes are frequently much too nearly alike, and I have never been able to see any justification for not giving an alternative to the first news bulletin. Even for those of us

who do not get an evening paper, the first news is largely a rehash of the morning's news, and what is not a rehash of the morning's news we get again in the second bulletin!

A. K. GORDON.

Crowborough.

**Operators' Status**

I SHOULD very much like to reply to a paragraph in "Current Topics" in *The Wireless World* of January 10th entitled, "Operators Losing Caste?"

To suggest that the present-day radio operator is in the same class as a typist evidences lack of knowledge of present-day conditions.

In the old days, with a magnetic detector and 1½ kW. "stonecrusher," as you say, considerable skill and dexterity were necessary for the handling of traffic.

To-day the operator needs far more skill, as he now has to deal with direction finders, long-wave CW/ICW, short-wave CW/ICW, and 600 to 800 ICW transmitters. In lots of cases he must also cope with automatic alarms, band repeaters, and echo meters.

The mention of the telewriter being responsible for the reduction in status is completely out of the question, as 99½ per cent. of our work is still received in Morse, and translated into plain language.

I am an operator of many years' standing, and have had experience in some of the largest liners, but have never yet seen a telewriter in use at sea.

Admittedly the present-day instruments are more reliable than in the old days, but the operator has had more put on to him, which also necessitates some knowledge of the gear he is using.

Rather than suggest the operator is losing caste, it would be more correct to say that he has a more responsible job requiring greater skill.

"SEA GULL."

London, E.6.

[The paragraph referred to quoted a statement in a Ministry of Labour pamphlet. At the present time telewriters are used only at land stations.—Ed.]

**Nomenclature**

THERE is a danger that in wireless nomenclature, so many conventions are used that we are making things very difficult for the next generation of engineers who may have to learn that a thing is sometimes what it is and at others the reverse of what it appears to be.

To take a particular example: "Sensitivity." It might seem that this definition would be better expressed as  $\frac{I}{E}$  where E is a ratio of field strength in microvolts per standard 50 milliwatt output; or, alternatively, to find a word (e.g., "dullness") which is the reciprocal of "sensitivity" when  $\frac{I}{\text{sensitivity}} = E$  expressed as a ratio. "So many microvolts" has about as much real meaning as "so much plum jam."

GERALD SAYERS.

Ware.

# BROADCAST BREVITIES

By Our  
Special  
Correspondent

## The Ullswater Report

ON Monday next a great field of speculation will be closed, for the public will know the best and the worst about the future of British broadcasting.

I understand that the Postmaster-General will present the Report to Parliament on Monday afternoon.

## No Hurry

This does not mean that the Report will come up for immediate discussion in the House. Nearly ten years ago, when the Crawford Committee presented its draft Charter for the present Corporation, the publication of the Charter preceded the Parliamentary discussion by several months.

As the existing Charter runs till the end of the year, Parliament will probably show no violent desire to discuss broadcasting for some time to come.

## What of John Watt?

JOHN WATT was to have roamed the Royal Albert Hall with a ribbon mike and one of the coat lapel variety on March 20th, on the occasion of the great Film Carnival Ball, but for some recondite reason his name has been struck off, which is a pity.

People said unkind things about that "first night" broadcast from the Adelphi Theatre last month, but the fault was not John Watt's, and I defy anyone to coax more than he did from a crowd of well-fed individuals much more concerned in finding the right seat numbers than in speaking sweet nothings to the thought-hungry millions outside.

## Film Stars at the Mike

March 20th should be an interesting night, however, for the Film Ball will, I think, be the first occasion on which Henry Hall, Geraldo, Jack Jackson, Lew Stone, and Joe Loss have conducted the same orchestra or, indeed, appeared in public together. They will take it in turn to direct Louis Levy's film orchestra of sixty musicians. The changes will be rung at frequent intervals, listeners being informed which conductor is in charge at any particular moment. Comparisons will be odious, but inevitable.

It is hoped that international film celebrities will address the microphone during the evening.

## A Shock for Clapham

THE B.B.C.'s Research Department at Clapham sat up and took notice last week when details and photographs were published of the American

N.B.C.'s new pocket 5-metre transmitter for "O.B." men.

Nothing of the sort is available to B.B.C. commentators, who would often say hard words—but for the presence of the microphone—when unwrapping yards of cable from nether extremities in the midst of a fast-running commentary.

"Ultra-short" research is now starting in Clapham's converted nunnery.

## In Passing

AMONG thirty composers and authors just elected to membership of the Performing Right Society are Mr. Eric Maschwitz, Mr. Jack Payne, and Mr. Gerald Bright, *alias* Geraldo.

## Lighthouse Comments

FRANK radio criticism goes out daily from the 'phone transmitters used by lighthouse-men off the West Highland coast. Every morning the shore station calls all lighthouses to see that all is in order and at the same time to tell the men of any interesting items in the day's broadcast programmes. The fun begins when the lighthouse keepers offer their own comments, which are often warranted to give the B.B.C. Programme Directors sleepless nights. It would be violating official regulations to state the wavelength—but if you come across a strrring of virrrulent

rrremarrrrks not far below the medium waveband, that's it.

## Val Gielgud in Person

THE dramatic atmosphere of the B.B.C. Press Conference on Tuesday next will be heightened by the presence of Mr. Val Gielgud, the Drama Director, who is to face a barrage of questions on the why and wherefore of radio plays.

## New Microphone Plays

The Drama Director has lately been carrying on an intensive personal campaign among distinguished authors and dramatists in order to obtain original works for the microphone. As a result a new series of radio plays has been planned for the autumn, all of which have been specially written for the microphone.

Among those contributors to the series who have already produced original material in the radio dramatic field are L. du Garde Peach, Horton Giddy, Anthony Ellis, and Norman Edwards.

## New Deal for the Provinces

SINCE his official tour of the provinces, Mr. Charles Siepmann, B.B.C. Regional Relations Officer, has changed his mind. In the old days he was one of the staunch supporters of centralisation, *i.e.*, tying the provincial stations to the apron

strings of Portland Place, but now that he has studied the problem at first hand he has had the courage to say that the old idea was all wrong.

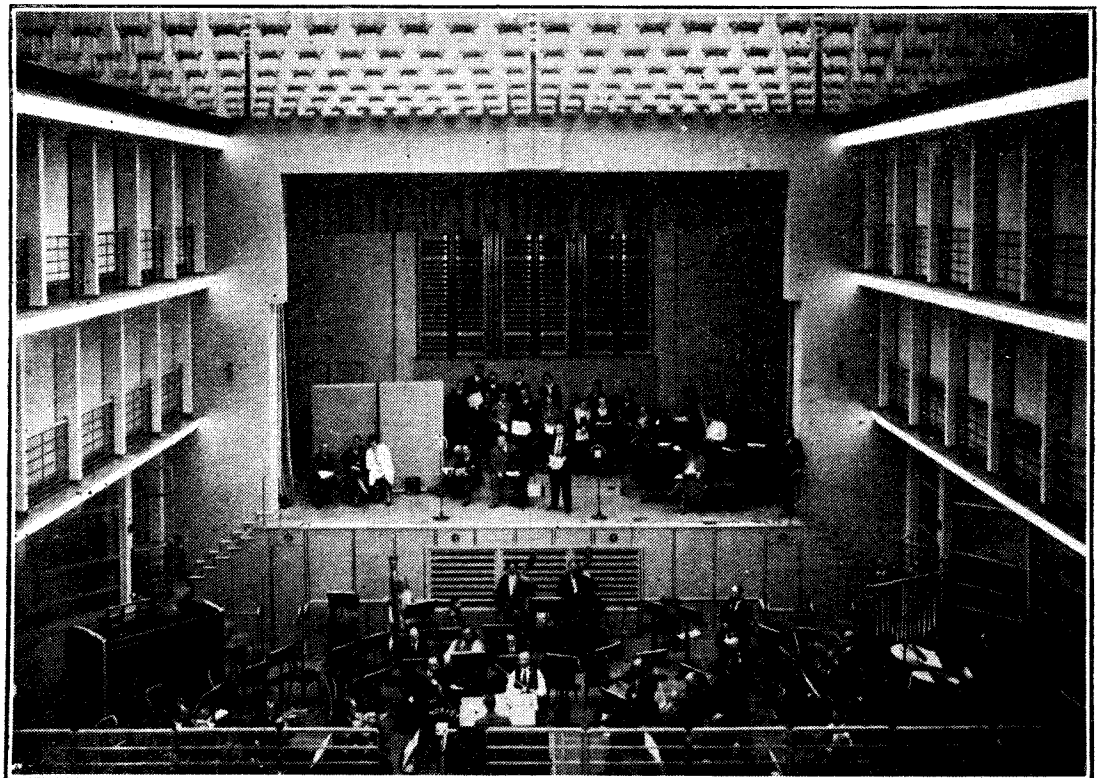
## Portland Place Has the Money

Mr. Siepmann has now devised a scheme which would put each Region on its feet as a more or less independent unit; but the extent to which Portland Place will follow his advice is controlled by the amount of money which Sir John Reith and the Governing Board are prepared to allot to each Region.

## Too Deep for Words

MR. BUTLER, of Leeds, will probably never be "In Town To-night." Indeed, it was while the *Evening Standard* radio critic was away from London for the week-end that he met this extraordinary person. "He sings down to 'deep' F, and when the B.B.C. tried him out they found his voice was so low-pitched that there were many notes in his register that the microphone could not transmit."

It is possible that Mr. Butler will be employed as a human interval sign.



**VARIABLE ACOUSTICS.** In the large orchestral studio at Hamburg provision is made for an almost infinite number of architectural adjustments to vary the acoustic response. Note the serrated ceiling, the movable "galleries," and the portable sound screen behind the announcer's microphone.

# PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

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

Station.	kc/s.	Tuning Positions.	Metres.	kW.	Station.	kc/s.	Tuning Positions.	Metres.	kW.
Kaunas (Lithuania)	155		1935	7	<b>London Regional (Brookmans Park)</b>	877		342.1	50
Brazov (Romania)	160		1875	150	Graz (Austria). ( <i>Relays Vienna</i> )	886		338.6	7
<b>Kootwijk (Holland) (<i>Relays Hilversum</i>) (10 kW. till 2.40 p.m.)</b>	160		1875	100	Helsinki (Finland)	895		335.2	10
Lahti (Finland)	166		1807	40	<b>Hamburg (Germany)</b>	904		331.9	100
<b>Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)</b>	174		1724	500	Toulouse (Radio Toulouse) (France)	913		328.6	60
Paris (Radio Paris) (France)	182		1648	80	Brno (Czechoslovakia)	922		325.4	32
Istanbul (Turkey)	187.5		1600	5	Brussels, No. 2 (Belgium). ( <i>Flemish Prog'mme</i> )	932		321.9	15
<b>Deutschlandsender Zeesen (Germany)</b>	191		1571	60	Algiers, P.T.T. (Radio Alger) (Algeria)	941		318.8	12
<b>Droitwich</b>	200		1500	150	Göteborg (Sweden). ( <i>Relays Stockholm</i> )	941		318.8	10
Minsk, RW10 (U.S.S.R.)	208		1442	35	<b>Breslau (Germany)</b>	950		315.8	100
Reykjavik (Iceland)	208		1442	16	Paris (Poste Parisien) (France)	959		312.3	60
<b>Motala (Sweden). (<i>Relays Stockholm</i>)</b>	216		1389	150	Odessa (U.S.S.R.)	968		309.9	10
<b>Novosibirsk, RW76 (U.S.S.R.)</b>	217.5		1379	100	Belfast	977		307.1	1
<b>Warsaw, No. 1 (Raszyn) (Poland)</b>	224		1339	120	Genoa (Italy). ( <i>Relays Milan</i> )	986		304.3	10
<b>Luxembourg</b>	230		1304	150	Torun (Poland)	986		304.3	24
Ankara (Turkey)	230		1304	7	<b>Hilversum (Holland). (15 kW. till 4.40 p.m.)</b>	995		301.5	60
Kharkov, RW20 (U.S.S.R.)	232		1293	20	Bratislava (Czechoslovakia)	1004		298.8	13.5
<b>Kalundborg (Denmark)</b>	238		1261	60	<b>Midland Regional (Droitwich)</b>	1013		296.2	50
<b>Leningrad, RW53 (Kolpino) (U.S.S.R.)</b>	245		1224	100	Chernigov (U.S.S.R.)	1013		296.2	5
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25	Barcelona, EAJ15 (Radio Asociación) (Spain)	1022		293.5	3
<b>Oslo (Norway)</b>	260		1153.8	60	Cracow (Poland)	1022		293.5	2
<b>Moscow, No. 2, RW49 (Stchelkovo) (U.S.S.R.)</b>	271		1107	100	<b>Königsberg No. 1 (Heilsberg) (Germany)</b>	1031		291	100
Tiflis, RW7 (U.S.S.R.)	280		1071.4	35	Pareda (Radio Club Português) (Portugal)	1031		291	5
Finmark (Norway)	355		845.1	10	Leningrad, No. 2, RW70 (U.S.S.R.)	1040		288.5	10
Rostov-on-Don, RW12 (U.S.S.R.)	355		845.1	20	Rennes-Bretagne, P.T.T. (Thourie) (France)	1040		288.5	120
Budapest, No. 2 (Hungary)	359.5		834.5	20	<b>Scottish National (Falkirk)</b>	1050		285.7	50
Sverdlovsk, RW5 (U.S.S.R.)	375		800	50	Bari (Italy)	1059		283.3	20
Banska-Bystrica (Czechoslovakia)	392		765	30	Paris (Radio Cité) (France)	1068		280.9	0.8
Geneva (Switzerland). ( <i>Relays Sottens</i> )	401		748	1.3	Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
<b>Moscow, No. 3 (RCZ) (U.S.S.R.)</b>	401		748	100	<b>Bordeaux, P.T.T. (Lafayette) (France)</b>	1077		278.6	50
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 (Union Radio) (Spain)	1095		274	10
Tartu (Estonia)	517		580	0.5	<b>Madona (Latvia)</b>	1104		271.7	50
Hamar (Norway). ( <i>Relays Oslo</i> )	519		578	0.7	Naples (Italy). ( <i>Relays Rome</i> )	1104		271.7	1.5
Innsbruck (Austria). ( <i>Relays Vienna</i> )	519		578	1	Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Ljubljana (Yugoslavia)	527		569.3	5	Fécamp (Radio Normandie) (France)	1113		269.5	5
Viipuri (Finland)	527		569.3	10	Alexandria (Egypt)	1122		267.4	0.25
Bolzano (Italy)	536		559.7	1	Newcastle	1122		267.4	1
Wilno (Poland)	536		559.7	16	Nyiregyhaza (Hungary)	1122		267.4	6.2
<b>Budapest, No. 1 (Hungary)</b>	546		549.5	120	Hörby (Sweden). ( <i>Relays Stockholm</i> )	1131		265.3	10
<b>Beromünster (Switzerland)</b>	556		539.6	100	Turin, No. 1 (Italy). ( <i>Relays Milan</i> )	1140		263.2	7
<b>Athlone (Irish Free State)</b>	565		531	60	London National (Brookmans Park)	1149		261.1	20
Palermo (Italy)	565		531	4	North National (Slaithwaite)	1149		261.1	20
<b>Stuttgart (Mühlacker) (Germany)</b>	574		522.6	100	West National (Washford Cross)	1149		261.1	20
Grenoble, P.T.T. (France)	583		514.6	15	Kosice (Czechoslovakia). ( <i>Relays Prague</i> )	1158		259.1	2.6
Riga (Latvia)	583		514.6	15	Monte Ceneri (Switzerland)	1167		257.1	15
<b>Vienna (Bisamberg) (Austria)</b>	592		506.8	100	Copenhagen (Denmark). ( <i>Relays Kalundborg</i> )	1176		255.1	10
Rabat (Radio Maroc) (Morocco)	601		499.2	25	Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Sundsvall (Sweden). ( <i>Relays Stockholm</i> )	601		499.2	10	<b>Nice (La Brague) (France)</b>	1185		253.2	60
Florence (Italy). ( <i>Relays Milan</i> )	610		491.8	20	Frankfurt (Germany)	1195		251	25
Cairo (Abu Zabal) (Egypt)	620		483.9	20	Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Brussels, No. 1 (Belgium). ( <i>French Programme</i> )	620		483.9	15	Lille, P.T.T. (Camphin) (France)	1213		247.3	60
Lisbon (Bacarena) (Portugal)	629		476.9	20	Trieste (Italy)	1222		245.5	10
Trøndelag (Norway)	629		476.9	20	Gleitwitz (Germany). ( <i>Relays Breslau</i> )	1231		243.7	5
<b>Prague, No. 1 (Czechoslovakia)</b>	638		470.2	120	Cork (Irish Free State). ( <i>Relays Athlone</i> )	1240		241.9	1
<b>Lyons, P.T.T. (La Doua Tramoyes) (France)</b>	648		463	90	Swedish Relay Stations	1240		241.9	1
<b>Cologne (Langenberg) (Germany)</b>	658		455.9	100	Saarbrücken (Germany)	1249		240.2	17
<b>North Regional (Slaithwaite)</b>	668		449.1	50	Kuldiga (Latvia)	1258		238.5	10
Sottens (Radio Suisse Romande) (Switzerland)	677		443.1	25	Rome, No. 3 (Italy)	1258		238.5	1
Belgrade (Yugoslavia)	686		437.3	2.5	San Sebastian (Spain)	1258		238.5	1
<b>Paris, P.T.T. (Palaiseau Villebon) (France)</b>	695		431.7	120	Nürnberg (Germany). ( <i>Relays Munich</i> )	1267		236.8	2
<b>Stockholm (Sweden)</b>	704		426.1	55	Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	0.8
<b>Rome, No. 1 (Italy)</b>	713		420.8	50	Christiansand and Stavanger (Norway)	1276		235.1	0.5
Kiev, RW9 (U.S.S.R.)	722		415.5	36	Dresden (Germany). ( <i>Relays Leipzig</i> )	1285		233.5	0.25
Tallinn (Estonia)	731		410.4	20	Aberdeen	1285		233.5	1
Madrid, EAJ2 (Radio España) (Spain)	731		410.4	3	Austrian Relay Stations	1294		231.8	0.5
Seville (Spain)	731		410.4	5.5	Danzig. ( <i>Relays Königsberg</i> )	1303		230.2	0.5
<b>Munich (Germany)</b>	740		405.4	100	Swedish Relay Stations	1312		228.7	1.25
Marseilles, P.T.T. (Realtor) (France)	749		400.5	90	Magyarovar (Hungary)	1321		227.1	1.25
Katowice (Poland)	758		395.8	12	German Relay Stations	1330		225.6	2
<b>Scottish Regional (Falkirk)</b>	767		391.1	50	Montpellier, P.T.T. (France)	1339		224	0.8
Stalino (U.S.S.R.)	776		386.6	10	Lodz (Poland)	1339		224	1.7
<b>Toulouse, P.T.T. (Muret) (France)</b>	776		386.6	120	Dublin (Irish Free State). ( <i>Relays Athlone</i> )	1348		222.6	0.5
<b>Leipzig (Germany)</b>	785		382.2	120	Milan, No. 2 (Italy). ( <i>Relays Rome</i> )	1357		221.1	4
Barcelona, EAJ1 (Spain)	795		377.4	7.5	Turin, No. 2 (Italy). ( <i>Relays Rome</i> )	1357		221.1	0.2
Lwow (Poland)	795		377.4	16	Basle and Berne (Switzerland)	1375		218.2	0.5
<b>West Regional (Washford Cross)</b>	804		373.1	50	Warsaw, No. 2 (Poland)	1384		216.8	2
<b>Milan (Italy)</b>	814		368.6	50	Lyons (Radio Lyons) (France)	1393		215.4	25
Bucharest (Romania)	823		364.5	12	Tampere (Finland)	1420		211.3	0.7
<b>Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)</b>	832		360.6	100	International Common Wave	1492		209.9	0.5
<b>Berlin (Germany)</b>	841		356.7	100	Miskolc (Hungary)	1438		208.6	1.25
Bergen (Norway)	850		352.9	1	Paris (Eiffel Tower) (France)	1456		206	20
Sofia (Bulgaria)	850		352.9	50	Pecs (Hungary)	1465		204.8	1.25
Valencia (Spain)	850		352.9	3	Antwerp and Courtrai (Belgium)	1465		204.8	0.1
Simferopol, RW52 (U.S.S.R.)	859		349.2	10	Bournemouth	1474		203.5	1
<b>Strasbourg, P.T.T. (France)</b>	859		349.2	100	Plymouth	1474		203.5	0.3
Poznan (Poland)	868		345.6	16	International Common Wave	1492		201.1	0.5
					International Common Wave	1500		200	0.25
					Liepāja (Latvia)	1737		173	0.1

NOTE.—Since the publication of the previous list alterations have been made to the following stations: Saarbrücken (Germany), Juan-les-Pins (France).



# 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.)	37.33 36.5	8,035 8,214	CNR HCJB	Rabat (Morocco). (Sun. 20.00 to 22.30)... Quito (Ecuador). (Daily ex. Sun., Mon. 00.45 to 04.45, Sun. 21.45 to 04.15.)		
70.2	4,273	RV15	Kharbarovsk (U.S.S.R.). (Daily 06.00 to 14.00.)	34.29	8,750	ZCK	Hong Kong (China). (Daily 10.00 to 14.00.)		
67.11	4,470	YDB	Sourabaya (Java). (Daily 03.30 to 06.30)	32.88	9,125	HAT4	Budapest (Hungary). (Sat. 23.00 to 24.00)		
58.31	5,145	OK1MPT	Prague (Czechoslovakia). (Experimental)	31.8	9,428	COCH	Havana (Cuba) (Daily 16.00 to 17.00, 22.00 to 23.00, 01.00 to 02.00.)		
51.28	5,850	YV5RMO	Maracaibo (Venezuela). (Daily, 22.00 to 02.00.)	31.58	9,500	PRF5	Rio de Janeiro (Brazil). (Daily 22.30 to 23.15.)		
50.60	5,930	HJ4ABE	Medellin (Colombia). (Daily, 16.30 to 18.30, Sun., Thurs., 23.30 to 03.00 also.)	31.55 31.54	9,510 9,518	GSB VK3ME	Empire Broadcasting Melbourne (Australia). (Wed. 10.00 to 11.30, Sat. 10.00 to 12.00.)		
50.26	5,969	HVJ	Vatican City. (Daily 19.00 to 19.15, Sun. 10.00 also.)	31.48	9,530	LKJ1	Jeløy (Norway). (Relays Oslo.) (Daily 10.00 to 13.00.)		
50.16	5,980	HIX	Santa Domingo (W. Indies). (Daily, 12.00 Sun. 00.38 also.)	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.)		
50.00	6,000	XEFT	Mexico City (Mexico). (Daily 00.00 to 09.00.)	31.45	9,540	DJN	Zeesen (Germany). (Daily 08.45 to 12.15, 13.00 to 16.30, 22.15 to 03.30.)		
50.00	6,000	RW59	Moscow (U.S.S.R.). (Relays No. 1 Stn.) (Daily 20.00 to 23.00.)	31.38	9,560	DJA	Zeesen (Germany). (Daily 13.00 to 16.30, 22.15 to 02.00.)		
49.95	6,005	VE9DN	Montreal (Canada). (Daily 04.30 to 05.00)	31.36	9,565	VUB	Bombay (India). (Sun. 13.30 to 15.30, Wed., Thurs., Sat. 16.30 to 17.30, irregular Mon.)		
49.95	6,005	HJ3ABH	Bogota (Colombia)	31.35	9,570	W1XK	Millis, Mass. (U.S.A.). (Relays WBZ.) (Daily 12.00 to 05.00.)		
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	GSC	Empire Broadcasting		
49.85	6,018	ZHI	Singapore (Malaya). (Mon., Wed., Thurs. 23.00 to 01.30, Sun. 03.40 to 05.10.)	31.32	9,580	VK3LR	Lyadhurst (Australia). (Daily ex. Sun. 08.15 to 12.30.)		
49.83	6,020	DJC	Zeesen (Germany). (Daily 22.30 to 03.30, 17.00 to 21.30.)	31.28	9,590	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 17.00 to 24.00.)		
49.75	6,030	HP5B	Panama City (Central America). (Daily 17.00 to 18.00, 01.00 to 03.30.)	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	VE9CA	Calgary (Canada). (Thurs. 14.00 to 07.00, Sun. 17.00 to 05.00.)	31.27	9,595	HLB	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.)	31.01	9,675	DJI	Zeesen (Germany)		
49.59	6,050	GSA	Empire Broadcasting	31.0	9,677	CTICT	Lisbon (Portugal). (Thurs. 21.00 to 23.00, Sun. 12.00 to 14.00.)		
49.5	6,060	W8XAL	Cincinnati, Ohio (U.S.A.). (Daily 12.00 to 01.00, 04.00 to 06.00.)	30.43	9,860	EAQ	Madrid (Spain). (Daily 22.15 to 00.30, Sat. 18.00 to 20.00 also.)		
49.5	6,060	W3XAU	Philadelphia, Pa. (U.S.A.). (Relays WCAU.) (Daily 01.00 to 04.00.)	29.24	10,260	PMN	Bandoeng (Java). (Sun., 12.00 to 15.00)		
49.5	6,060	OXY	Skamlebaek (Denmark). (Relays Kalundborg.) (Daily 18.00 to 24.00, Sun. 16.00 also.)	29.04	10,330	ORK	Ruyssetede (Belgium). (Daily 18.30 to 20.30.)		
49.42	6,070	OER2	Vienna Experimental. (Daily 14.00 to 22.00.)	28.01	10,710	JVM	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)		
49.4	6,072	CT1AA	Lisbon (Portugal). (Tues., Thurs., Sat. 21.30 to 24.00.)	27.93	10,740	JVM	Tokio (Japan). (Tues., Fri. 19.00 to 20.00.)		
49.35	6,079	DJM	Zeesen (Germany)	25.65	11,695	YB3RC	Caracas (Venezuela)		
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	FYA	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 WCLE.) (Sun. 19.00 to 20.30.)	25.6	11,720	CJRX	Winnipeg (Canada). (Daily 00.00 to 05.00, Sat. 21.00 to 06.00 also, Sun. 22.00 to 03.30 also.)		
49.33	6,080	CP5	La Paz (Bolivia). (Daily 00.45 to 02.15)	25.57	11,730	PH1	Huizen (Holland). (Daily ex. Tues., Wed. 13.00 to 15.30, Sun., Sat. to 16.30.)		
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.)	25.53	11,750	GSD	Empire Broadcasting		
49.3	6,085	2RO	Rome (Italy). (Mon., Wed., Fri. 23.00 to 00.30.)	25.49	11,770	DJD	Zeesen (Germany). (Daily 17.00 to 21.30)		
49.26	6,090	VE9BJ	St. John (N.B.). (Daily 00.00 to 01.30)	25.45	11,790	W1XAL	Boston, Mass. (U.S.A.). (Daily 23.00 to 00.30.)		
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.)	25.40	11,810	2RO	Rome (Italy). (Mon., Wed., Fri. 23.00)		
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.)	25.38	11,830	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 20.00 to 03.00.)		
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.)	25.29	11,860	GSE	Empire Broadcasting		
49.18	6,100	W9XF	Chicago, Ill. (U.S.A.). (Daily ex. Mon., Wed., Sun. 21.00 to 07.00.)	25.27	11,870	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 03.00.)		
49.1	6,110	GSL	Empire Broadcasting	25.23	11,880	FYA	Paris, Radio Coloniale (France). (Colonial Stn. N-S.) (Daily 16.15 to 19.15, 20.00 to 23.00.)		
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.)	25.09	11,955	ETA	Addis Ababa (Abyssinia)		
49.08	6,112	YV2RC	Caracas (Venezuela). (Daily ex. Sun. 15.30 to 17.30, 21.00 to 03.00, Sun. 14.30 to 15.30.)	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.)		
49.02	6,120	YDA	Bandoeng (Java). (Daily 10.30 to 15.00)	24.83	12,082	CTICT	Lisbon (Portugal). (Sun. 14.00 to 16.00, Thurs. 20.00 to 21.00.)		
49.02	6,120	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 03.00 to 04.00.)	24.52	12,235	TFJ	Reykjavik (Iceland). (Sun. 18.40 to 19.00.)		
48.92	6,130	ZGE	Kuala Lumpur (Malaya). (Sun., Tues., Fri. 11.40 to 13.40.)	24.2	12,396	CTIGO	Paredo (Portugal). (Sun. 15.00 to 16.30, Tues., Thurs., Fri. 18.00 to 19.15.)		
48.92	6,132	COCD	Havana (Cuba) (Daily 23.00 to 05.00.)	23.39	12,830	CNR	Rabat (Morocco). (Sun. 12.30 to 14.00)		
48.86	6,140	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 21.30 to 06.00.)	22.94	13,075	VPI	Suva (Fiji). (Daily ex. Sun. 05.30 to 03.60)		
48.78	6,150	CSL	Lisbon (Portugal). (Daily 11.00 to 12.30, 18.00 to 22.00.)	22.00	13,635	SPW	Warsaw (Poland). (Daily 16.30 to 17.30.)		
48.78	6,150	YV3RC	Caracas (Venezuela). (Daily 20.30 to 01.30.)	21.42	14,005		Band of wavelengths allotted to amateur transmitters.		
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.)	20.84	14,395	JVH	Nasaki (Japan). (Tues., Fri., 19.00 to 20.00.)		
48.4	6,198	CT1GO	Paredo (Portugal). (Daily ex. Tues. 00.20 to 01.30, Sun. 16.30 to 18.00 also.)	20.55	14,600	HVJ	Vatican City. (Daily 10.00, 15.30 to 15.45)		
47.50	6,316	HIZ	Santo Domingo (W. Indies). (Daily 21.40 to 22.40, Sun. 16.00 to 17.30 also.)	19.84	15,123	GSF	Empire Broadcasting		
47.05	6,375	YV4RC	Caracas (Venezuela). (Daily 21.30 to 03.30.)	19.82	15,140	DJB	Zeesen (Germany). (Daily 08.45 to 12.15)		
46.69	6,425	W3XL	Bound Brook, N.J. (U.S.A.). (Experimental)	19.74	15,200	W8XK	Pittsburg, Pa. (U.S.A.). (Relays KDKA.) (Daily 13.00 to 21.15.)		
46.52	6,447	HJ1ABB	Barranquilla (Colombia). (Daily 21.30 to 03.30.)	19.72	15,210		Eindhoven (Holland). (Experimental)		
46.21	6,490	HJ5ABD	Cal (Colombia). (Daily 00.00 to 03.00)	19.71	15,220	PCJ	Paris, Radio Coloniale (France). (Colonial Stn. E-W.) (Daily 12.00 to 16.00.)		
46.0	6,520	YV6RV	Valencia (Venezuela). (Daily 17.00 to 18.00, 23.00 to 03.00.)	19.68	15,243	FYA	Boston, Mass. (U.S.A.). (Daily 15.50 to 18.30.)		
45.31	6,620	PRADO	Riobamba (Ecuador). (Fri. 02.00 to 03.40)	19.66	15,260	GSI	Empire Broadcasting		
45.0	6,667	HC2RL	Guayaquil (Ecuador). (Sun. 22.45 to 12.45, Wed. 02.15 to 04.15.)	19.64	15,270	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 18.00 to 20.00.)		
42.86	7,000		Band of wavelengths allotted to amateur transmitters.	19.63	15,280	DJQ	Zeesen (Germany). (Daily 04.30 to 06.00)		
41.10	7,300			19.6	15,300	CP7	La Paz (Bolivia)		
42.02	7,140	HJ4ABB	Manizales (Colombia)	19.56	15,330	W2XAD	Schenectady, N.Y. (U.S.A.). (Daily 19.30 to 20.30.)		
41.8	7,177	CR6AA	Lobito (Angola). (Wed., Sat. 19.30 to 21.30.)	19.52	15,370	HAS3	Budapest (Hungary). (Sun. 13.00 to 14.00.)		
39.95	7,510	JVP	Tokio (Japan). (Tues., Fri., 19.00 to 20.00)	17.33	17,310	W3XL	Bound Brook, N.J. (U.S.A.). (Daily 16.00 to 22.00.)		
39.37	7,620	ETA	Addis Ababa (Abyssinia)	16.89	17,760	DJE	Zeesen (Germany). (Daily 13.00 to 16.30)		
38.48	7,797	HBP	Radio Nations, Prangins (Switzerland). (Sat. 22.30 to 23.15.)	13.89	17,760	W2XE	Wayne, N.J. (U.S.A.). (Relays WABC.) (Daily 16.00 to 18.00.)		
				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.)		
				16.66	17,790	GSG	Empire Broadcasting		
				16.42	18,270	ETA	Addis Ababa (Abyssinia)		
				15.93	18,830	PLE	Bandoeng (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 16.00.)		
				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

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

## CATHODE-RAY TUBE

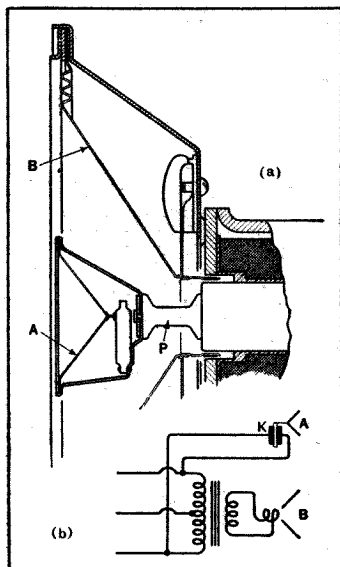
THE electron stream is passed through at least two electrostatic lens systems, the first being located close to the cathode, whilst the second comes just in front of the scanning-electrodes. Apertured diaphragms are used in both cases, as an additional control on the cross-section of the beam.

When the cut-off method of modulation is employed, the angular movement of the beam sometimes gives rise to "false" modulation, caused by some of the electrons striking the diaphragms under the influence of the voltages applied to the scanning-electrodes. This source of disturbance may be minimised by inserting a third electrostatic lens between the first two.

*Fernseh Akt. Convention date (Germany) 13th June, 1934. No. 439414.*

## LOUD-SPEAKERS

A HIGH-NOTE speaker is nested inside a low-note speaker so that when both are used for dual operation the sound appears to originate from a common point. To allow the manufacturer to offer the choice of a set fitted with only one or both speakers, the high-note instrument is detachably mounted on the central core of the low-note instrument, so that it can be removed as a unit.



Normal and high note speaker combination.

As shown in Fig. (a), the high-note speaker A is of the piezo-crystal type, and is protected by an insulating post P against the heat generated in the field-structure of the low-note instrument B. The circuit connections are shown in Fig. (b), in which K represents the piezo-electric drive.

*W. J. Tennant (communicated by the Rola Co.). Application date 5th October, 1934. No. 438824.*

## MULTI-GRID AMPLIFIER

INCOMING signals are applied between the cathode and the first grid of a four-grid valve. The second grid is anchored to a fixed voltage. The third grid serves as an anode for the radio-frequency output, and is coupled to a separate diode rectifier. The rectified signal voltage developed across the load resistance of the diode is fed back to the fourth grid and is amplified between that electrode and the anode proper. The advantage of the arrangement is that the voltage on the fourth grid can be adjusted at will.

*K. Steimel and E. Klotz (assignors to the Telefunken Co.). No. 2006969. (U.S.A.)*

## AUTOMATIC TUNING CONTROL

A WIRELESS receiver is provided with a clockwork drive, and with a number of pre-set contact discs, so arranged that selected items from the same or different broadcast programmes can be tuned in from time to time. The change-over is usually made every quarter of an hour, but longer listening-periods can be arranged for if desired.

*C. Petersen. No. 2008108. (U.S.A.)*

## SHORT-WAVE RECEIVERS

CONTINUOUS-WAVE reception on ultra-short waves of the order of a metre or less is handicapped by the difficulty of adjusting the frequency of the local oscillator so exactly as to ensure a steady "beat" note. To overcome this difficulty a compact, lightweight receiver is fitted with a local oscillator of the Barkhausen-Kurz type which is coupled to the main dipole aerial by a tuned Lecher-wire system. The latter includes a "rejector" circuit for undesired signals. The Barkhausen-Kurz oscillator is stabilised by adjusting (a) the filament current, (b) the grid and anode potentials, and (c) the tuning of the Lecher-wire coupling. The resulting beat frequency, say, of 3 megacycles is fed to a pair of valves which are arranged to act alternately as super-regenerative amplifiers.

*R. W. George (assignor to Radio Corporation of America). No. 2011942. (U.S.A.)*

## PHOTO-ELECTRIC CELL

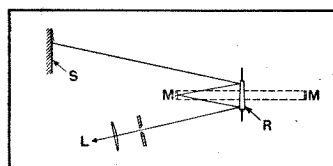
A GAS-FILLED photo-electric cell operates at maximum efficiency when the voltage across anode and cathode is made as high as possible, short of causing the tube to "glow." The danger of using such a high biasing voltage lies, however, in the fact that, as the exciting ray of light falls off the internal resistance of the cell rises, so that the potential across the cell may then exceed the safety limit.

According to the invention, the cell is operated at maximum anode-cathode voltage but is coupled to a valve amplifier which is so arranged that, as the output from the cell falls off, a compensating grid current flows through the load resistance. This creates a counter-E.M.F. which offsets the natural rise in voltage across the cell-electrodes.

*F. H. Shepard (assignor to Radio Corporation of America). No. 2014786. (U.S.A.)*

## INTERLEAVED SCANNING

THE use of "interleaved" scanning is stated to give a reduction in "flicker" for a given number of pictures per second, and for a given spread of the side-band frequencies in the ether.



Scanning device.

In the mirror-drum system shown, a ray of light from a source L is thrown on to a rotating double-sided mirror R, from which it is reflected on to one of a series of fixed mirrors M set around the inner periphery of a drum. From each of the fixed mirrors the ray is reflected back on to the rotating mirror R and then swept over one line of the screen S. The fixed mirrors M are so arranged that successive scanning-lines are spaced apart by the width of one line. In addition, the two opposite faces of the rotating mirror R are so inclined that when the first complete frame has been scanned the second set of lines are slightly displaced from and interleaved with the first as the mirror rotates through 180°. The number of fixed mirrors in the drum is 84, a gap being left in equal to 3 1/2 mirrors, so as to allow for the line displacement required to "interleave" the screen completely in 168 lines.

*C. O. Browne. Application date 29th May, 1934. No. 439121.*

IN interleaved scanning, it is necessary to make the line-scanning frequency a whole multiple plus a fraction of the picture-repetition frequency, so that one set of lines is displaced relatively to the next, instead of occupying identical positions on the screen.

According to the invention, the necessary displacement is secured by applying a biasing-voltage to the condenser which supplies the scanning voltages to the framing-electrodes of the cathode-ray tube. The condenser discharge is regulated by two triggered valves, which act during alternate framing periods. During the scanning of one frame the condenser is completely discharged, but during the next it is left with a residual voltage which "shifts" the position of the lines of that frame by the amount necessary to interleave the two pictures on the screen. Each

of the two control valves is impulsed at a frequency which is an exact sub-multiple of the line frequency, thus simplifying the time-base circuits.

*Electrical Research Products Inc. (assignees of F. Gray). Convention date (U.S.A.) 19th May, 1934. No. 439225.*

## GAS-FILLED AMPLIFIERS

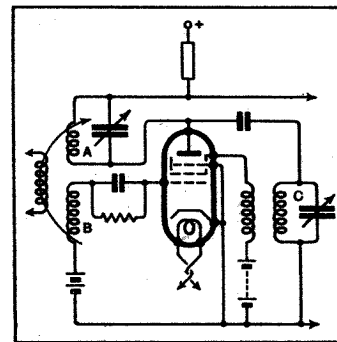
THE usual gas-filled valve is of the "trigger" type which spills-over on the application of an impulse to the control grid. It can therefore be used as a relay, but does not produce an output current strictly proportional to the input. The invention is designed to give a valve of this type a straight-line relation between input and output, so that it can be used either as a high- or low-frequency amplifier.

This result is secured by interposing, between the control grid and anode, a screening-electrode which prevents the grid from acquiring a positive layer of ions, and also prevents any ionisation from taking place between it and the grid. Mercury vapour is used as the filling, and it is stated that the power output is about tenfold that obtainable from the ordinary type of valve. Since the valve also acts as a rectifier, it can be used to work a loud-speaker without any low-frequency stage.

*S. Rubens. Convention date (U.S.A.) 5th May, 1933. No. 438961.*

## SUPER-REGENERATIVE CIRCUIT

A MULTIGRID valve is arranged to provide an easily handled receiver of the super-regenerative type. The anode circuit A is tuned to the signal frequency, and is back-coupled as shown to the grid circuit B. A separate branch C of the same anode circuit is tuned to a suitable "quenching" frequency, and is back-coupled to the circuit of a second



Circuit arrangement for super-regeneration.

grid, so as to generate that frequency. Owing to the fact that the coils A, B are coupled to the control grid and anode, respectively, the full amplification factor of the valve is utilised, whilst the "quenching" control applied to the second grid is found to be particularly effective.

*D. W. Pugh and Baird Television, Ltd. Application date, 31st August, 1934. No. 439103.*

# The Wireless World

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

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## EDITORIAL COMMENT

### Co-ordinating Radio Research

#### Part of the National Defence Plan

**W**E have on many occasions drawn attention in *The Wireless World* to the multiplicity of Government Departments engaged in radio research and development and the apparent lack of centralisation and co-ordination of the work undertaken.

The Government is at the present time committed to a very full consideration of the whole question of national defence, and we would submit that wireless communication cannot be regarded as anything but a very important part of any national defence organisation.

The Navy, the Army, the Air Force and the Post Office, all maintain laboratories and considerable research staffs engaged on radio development work, and in addition we have the Radio Research Board and the various commercial companies who undertake research and manufacture for the Services. It is only natural to assume that a very considerable amount of overlapping must occur, and what is more serious still, the benefit of knowledge and experience gained in the separate spheres of activity is not pooled for the common good.

For obvious reasons much of this work does not receive publication, and although we are aware that there are appointments of liaison officers who are doing excellent work, their positions are not, we suggest, vested with sufficient authority to perform their tasks to the best advantage.

We are afraid that far too often development work is carried out independently by two or more Government

departments where overlapping occurs in all but the final form which the practical apparatus takes, so that the development work could all have been done by one authority.

The Radio Research Board was originally set up to collate the results of research in various Government departments and to carry out special investigation work on their behalf. How far the Board has failed, through no fault of its own, to achieve the original purpose for which it was constituted can be gathered from the fact that the Board has at times had to "invent" work to be done, presumably because the Government departments have not fed the Board with their requirements but have preferred to do their own work each in their own way.

#### What is Needed

From what knowledge is available there seems to be sufficient evidence to believe that for purposes of defence, our wireless equipment is a long way behind that of other countries, and we would urge that the present opportunity should be taken, when the question of national defence is being so fully investigated, to consider the whole matter of Government radio research.

To bring this about would probably involve less drastic reorganisation than at first might seem to be the case. Scattered personnel would be brought together and a large and flexible staff would thus come into being almost at once to deal with the new and urgent problems which the National Defence Scheme demands. Such an organisation would be responsible for supplying all departments with technical information and designs to meet their requirements. Present arrangements for actual manufacture of wireless equipment need not be disturbed.

# Acoustic "Scenery" in



This staircase has been built up in a Berlin studio to accommodate speaking choirs or to reproduce conversations of the "balcony scene" type.

**I**N the early days of German broadcasting, drama, like concerts, was transmitted from a medium-sized studio.

The only technical means for making clear the action of the play, apart from changes in the loudness of the voices, was the variation of the distance between the speaker and the microphone. The chief difference between a small distance and a great distance is that when the speaker is close to the microphone the main transmission is that due to the direct sound-rays, whereas when the speaker is farther away the acoustics of the studio enter into the effect. In relying on this phenomenon, however, only the particular acoustic properties of the one room are available. This limitation soon led to the adoption—for the sake of clearer definition of the acoustic conditions of individual scenes—of a number of small auxiliary "rooms" built into the main studio in the form of tents of cloth or wood-fibre sheets, and to the ever-increasing use of adjoining halls and corridors.

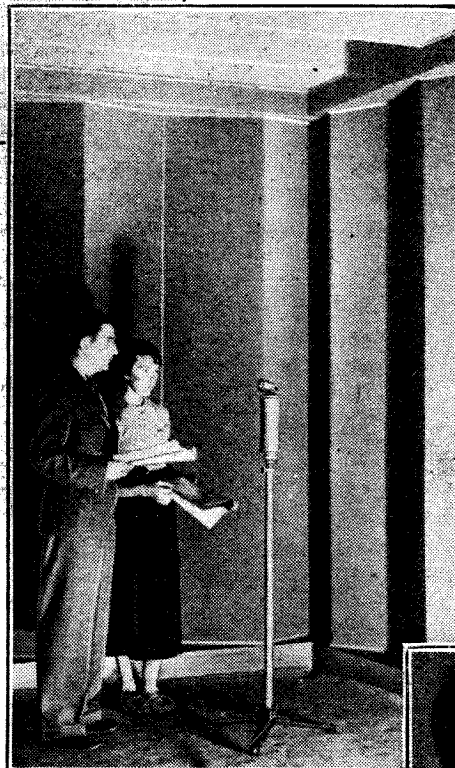
This development, arising spontaneously from actual practice, showed clearly that the acoustic "atmosphere" of the various scenes was of great importance for dramatic purposes. Meanwhile, another important factor came into being—the improvement of general broadcasting technique, and, in particular, the employment of high-fidelity microphones free from background noise and distortion. As a result, the demand arose for a technically flawless solution of the acoustic problem as regards the radio play. Physically, this solution consists in playing each scene in a studio of the correct acoustic properties for that scene. But beyond this it is permissible to exaggerate—within certain limits—the characteristic acoustic properties of the studio,

**A** SYSTEM of small studios with variable reverberation period is entirely superseding the primitive single-studio principle upon which German radio drama has been conducted until quite recently. Dr. Braunnühl, who has himself designed the new dramatic studios in Broadcasting House, Berlin, here describes how the frequency characteristics of the studios are adjusted to suit the mood of atmosphere of each episode in a radio play

provided with echo. Such extreme conditions do not, of course, always occur, but the technical solution must allow for them; for it is easy to make a reverberant room less reverberant by the introduction of damping materials. On the other hand, a highly damped room can be provided with additional echo by the well-known device of the echo-chamber.

## Making a "Sound-Dead" Room

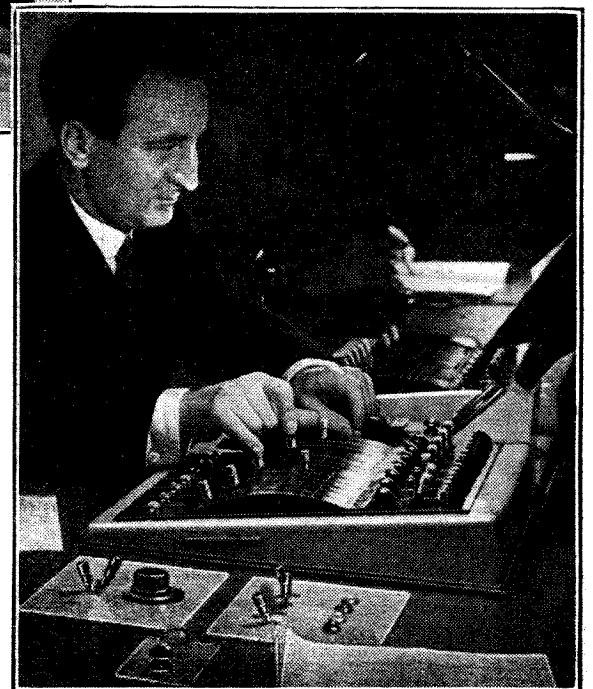
The most important component of the new radio-dramatic studio system is the acoustically dead room. Requirements of medium or great reverberation can be satisfied more or less by the older methods, but the transmission of a scene from a large studio presents very great difficulty if all echo is to be avoided. The "sound-dead" room is obtained by lining walls and ceiling with thick coatings (up to 20 cm. in thickness) of slag-wool held by wire gauze with a holding-layer of thin material. In some cases these coatings are given a serrated or fluted surface, as seen in the right-hand illustration on the next page, which has the effect of diffusing, on reflection, whatever small amount of sound energy may escape absorption by the highly effective damping materials.



Dialogue in a completely "dead" studio. Slag-wool absorbs sound and the angular wall surfaces break up major reflections.

in order to make the "acoustic situation" as vivid as possible; for in a broadcast play this is the only way of indicating the surroundings in which the action occurs. Thus, for the sake of contrast, a scene occurring in the open air may well be rendered as acoustically "dead" as possible, while an event in a reverberant room may well be richly

Six or more gain controls can be handled simultaneously by one operator, using this new DC panel in Broadcasting House, Berlin.





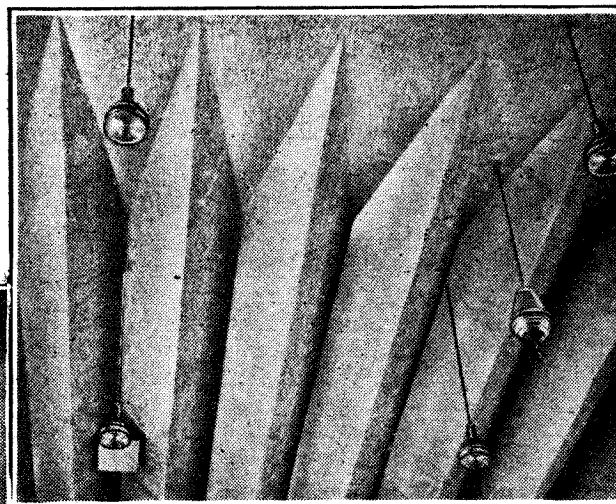
# Radio Drama

By Dr. HANS J. von BRAUNMÜHL

## Germany Adopts New Studio Methods

In addition to the "dead" room there is, in every radio-play studio system, a larger room of medium reverberation time, primarily for the accompanying musical programme but used also for scenes in large apartments. Further, several small studios are provided, to which the acoustic properties of living-rooms are given. Much use is made of slag-wool, often enclosed in half-pillar-shaped perforated containers, a form which is satisfactory both acoustically and architecturally. Wide use is also made of vibration-capable plywood or wood-fibre sheets (similar to Celotex).

The mere alteration of the general level of reverberation time is, however, rather a primitive method of indicating the varying acoustic situation, and cannot convey the niceties of such variations. More important is it to be able also to influence the frequency characteristic of the reverberation time. A room with a falling



This fluted ceiling in one of the larger Berlin dramatic studios gives little or no direct sound reflection. A rough coating of plaster assists the effect.

records of natural sounds are used as well as artificially produced sound effects. For variation of the character of the noises the gramophone pick-ups and the sound-effects studios can be combined with the echo-chambers; each of the other studios, moreover, can be connected with the echo installation.

All the studios belonging to a radio-play system are connected to the "mixing room," where they are mixed, controlled and monitored at the control desk. A point worth noticing is that the controls for the various studios are not, as usual, provided with rotating knobs, but with edge-on handles moving over an arc ("profile"-type regulators). Thanks to this compressed design it is possible to adjust several controls simultaneously with one hand. The control desk also carries the necessary signalling apparatus and switch-gear for the monitoring loud speakers, etc.

On the above principles various German State stations have been provided with radio-play systems of varying sizes, some of which are already in service.



As the producer sees it: a picture taken from the producer's silence cabinet during a musical broadcast. The sound monitor and his assistant are at work in the foreground.

characteristic gives a muffled, deep effect, while one with a rising characteristic sounds sharp and bright, although the mean reverberation time may be the same in the two cases.

From the early days of broadcasting the stuff-damped room with hanging curtains, padded furniture, and so on, giving a falling characteristic, has been thoroughly studied, and for contrast's sake it became of great importance to

obtain, as well, rooms with rising characteristics. This problem has been completely solved by providing the slag-wool packing round the walls of the room with membrane-like coatings. Finally, small studios have been constructed with variable reverberation times, in which, by opening or shutting wall-coverings hinged like doors, not only the level but also the frequency-characteristic of the reverberation can be varied. In contrast to earlier attempts in this direction, this type of studio allows a very successful control of the acoustic conditions to be obtained. The sound-effects necessary for radio-play transmissions are sent out from special studios; gramophone

A high-pitched "tragic" scene being enacted in a small studio with a rising sound characteristic. High notes are reflected from the walls at exaggerated intensity.

### PA ISSUE

NEXT WEEK'S NUMBER OF  
*The Wireless World*  
will be devoted principally to  
the subject of Public Address  
Equipment.

PA apparatus is to-day so important a subject and it is so closely allied to wireless that there seems to be every reason for devoting a special number to describing some of the equipments at present available.

In addition to a general review of PA apparatus special articles will be included dealing with applications or special problems associated with PA installations.

# Rectifying Valves—GLASS

## Theory of Operation and Practical Circuits

**S**INCE a wireless set is a device for amplifying and reproducing, via a loud speaker, alternating currents of all audible frequencies, we must not allow any alternating currents other than those associated with the received signals to enter the amplifying circuits of the set. If we do, sounds corresponding to the additional currents will appear in the speaker—giving rise, if the intruding currents have the frequency of ordinary AC supply mains, to the well-known phenomenon of *hum*.

If, therefore, we wish to operate our set with power drawn from AC mains, it first becomes necessary to convert the original to-and-fro current into one that flows in one direction only by the process of *rectification*. This, by itself, results in a unidirectional current that proceeds in a series of pulses, these pulses occurring at the instants of maximum voltage of the original supply. A current such as this could be built up from, and is therefore equivalent to, a suitably chosen alternating current superposed on a steady current drawn from a battery; rectification by itself, therefore, is insufficient to ensure freedom from hum. There must be a second stage—that of *smoothing*, in which the irregularities of the original current are ironed out, leaving a current that is not

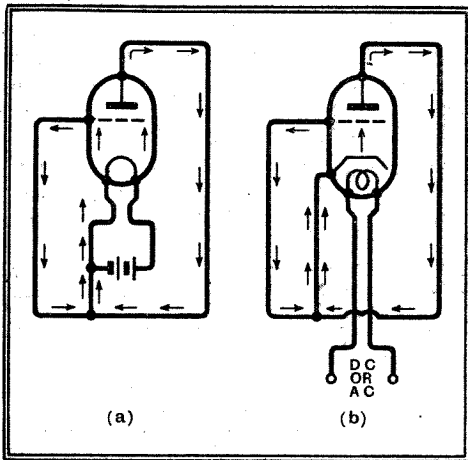


Fig. 1.—Paths of anode and grid currents. In a directly heated valve (a) the filament is part of the amplifying circuits, but the heater of an indirectly heated valve (b) is completely independent.

only unidirectional but also *constant*. If the smoothing is adequately carried out, hum need be no more noticeable in a speaker worked by a mains-driven set than in one attached to a set operated from batteries.

In a battery set the sources of energy are usually three: Filament accumulator, anode or HT battery, and grid-bias battery. Of these three the filament accumulator is the only one not directly concerned with amplification; its duty is simply to

heat the filaments so as to cause them to emit the electrons necessary for the functioning of the valves. The emitting filaments themselves, however, do form part of the amplifying circuits. In valves designed for operation from the mains, the

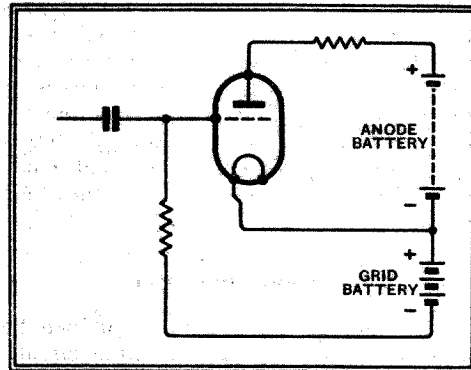


Fig. 2.—Showing that anode and grid voltages are in series, and so may be obtained from a single source with a tap for the cathode connection.

functions of heating and emitting are separated. The emitting surface, known as the *cathode*, is in the form of a tube, and within this runs a filament of wire, known as the *heater*, which is completely insulated from it. By passing current through the heater it can be raised to a high temperature, and so caused to heat the cathode surrounding it sufficiently to provoke emission. As the heater is now completely outside the amplifying circuits it can be run just as well from alternating as from direct currents, as Fig. 1 shows.

There remain grid and anode circuits to

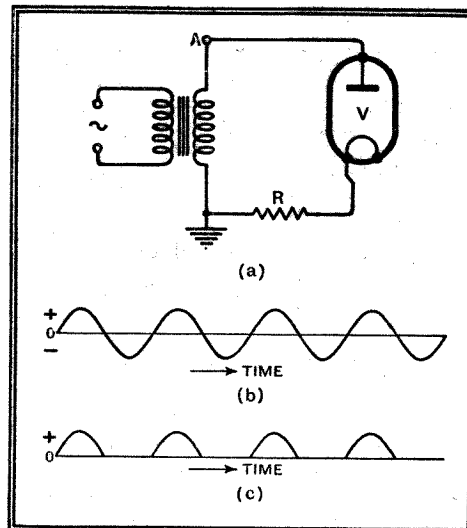


Fig. 3.—Circuit of half-wave rectifier, and (dia. b) voltage at A; alternately positive and negative. Dia. c represents intermittent but unidirectional current through R.

supply. As Fig. 2 shows, these two are in series, and can consequently be supplied from one source—and are so supplied in all mains and some battery sets. The three sources of power can therefore be reduced to one unrectified, and a second rectified and smoothed.

### Unidirectional Current

In a valve, electrons can flow only from cathode (or filament) to plate, and not in the reverse direction. We can make use of this fundamental property for deriving a unidirectional current from an alternating voltage. If, as in Fig. 3a, we put a two-electrode valve in series with a source of alternating voltage and a resistance, the voltage at A will be alternately positive and negative, varying with time, as in the curve at 3b. Owing to the one-way conductivity of V, the current through R will vary as at 3c, and will consist of a series of unidirectional pulses with intervals between them.

The gaps can be filled up by the arrangement of Fig. 4a. Here two trans-

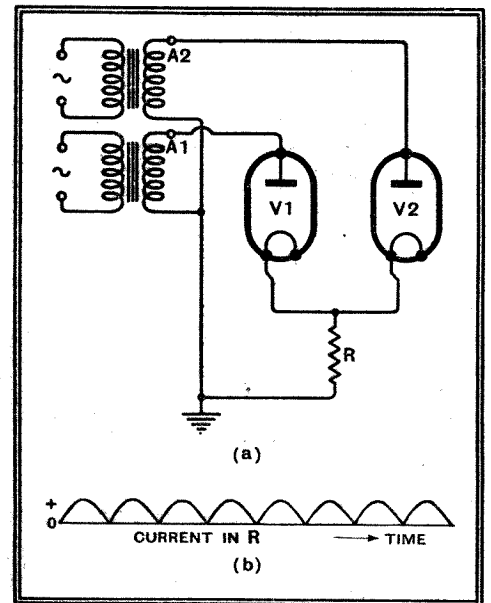


Fig. 4.—By using two rectifiers and two transformers so connected that when A1 is negative A2 is positive, the gaps in Fig. 3c can be filled up, making the current through R non-intermittent.

formers are used, so connected that at the instant when A1 is negative, and no current is passing through V1, A2 is positive and driving a pulse of current through V2. Both sets of pulses converge on R; the current through it is therefore as shown at 4b.

The circuit can be simplified. In place of two transformers, a single one with a

# AND METAL

centre-tapped secondary winding can be used, while the two rectifiers, since their filaments are joined, may conveniently be

**A CLEAR explanation of the functioning of HT supply systems in AC mains receivers. The two types of rectifier—thermionic valve and Westinghouse copper oxide—in most common use are discussed, and the action of the associated smoothing equipment is described.**

made up in one bulb. We thus arrive at the circuit of Fig. 5, in which, for easy comparison, the lettering of Fig. 4 is retained.

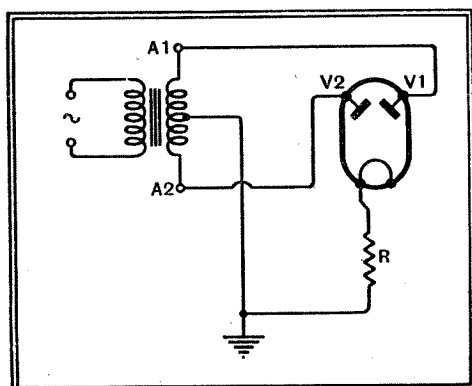


Fig. 5.—Practical form of Fig. 4a, with a single transformer and a "full-wave" rectifying valve with two anodes and a common filament.

Where only one-half of the original voltage-wave is rectified, giving a current as at 3c, the process is called "half-wave rectification," as opposed to the "full-wave rectification" of Figs. 4 and 5.

### Copper Oxide Type

In place of a thermionic valve, a metal rectifier is often used. This consists of a series of discs of copper and copper oxide, and possesses, like a valve, the property of allowing a current to flow through it in one direction only. It will be clear that metal rectifiers may be substituted for the valve or valves in the circuits of Figs. 3 to 5 without alteration. Since a metal rectifier has no filament it is more adaptable than

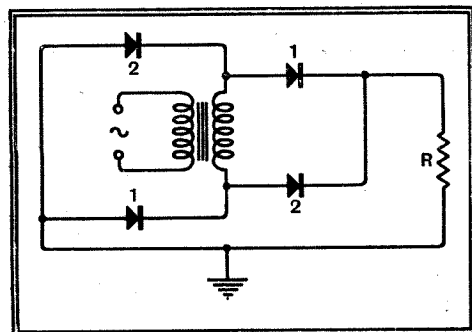


Fig. 6.—Four-unit metal rectifier, giving full-wave rectification and a DC output voltage equal to the AC voltage of the whole transformer secondary.

a valve, and lends itself better to more complex circuits. In Fig. 6, for example, we have an arrangement of four metal rectifiers (normally built up, of course, as one unit), making a full-wave rectifier in which the DC output voltage is approximately equal to the AC voltage supplied instead of being, as in Fig. 5, only half the over-all voltage of the transformer.

During one half-cycle the current flows through rectifiers 1, 1, and during the other through rectifiers 2, 2; in both cases the driving voltage is that across the one transformer winding. Compare the action with that of Fig. 5, where the halves of the tapped secondary are only active for alternate half-cycles. To duplicate Fig 6 with valves, three separate filament windings would be necessary for the four rectifiers.

### Voltage-doubling

An even more attractive result can be obtained with a *voltage-doubling* circuit, which gives full-wave rectification and an output voltage approaching double the AC voltage across the transformer secondary. For this only two rectifiers are needed, as Fig. 7 shows. The condensers C<sub>1</sub> and C<sub>2</sub> are placed in series across the HT terminals of the set. On

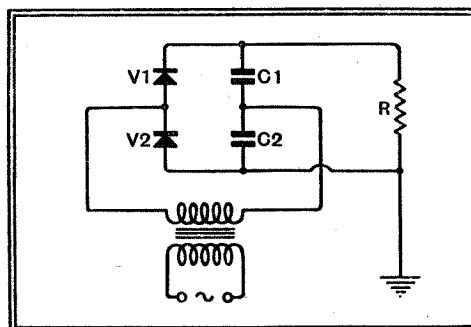


Fig. 7.—Voltage-doubling circuit, with metal rectifiers. C<sub>1</sub> and C<sub>2</sub> are charged, on alternate half-cycles, to the full voltage across the transformer. The sum of the two rectified voltages is applied to R.

one half-cycle C<sub>1</sub> is charged through V<sub>1</sub>, and on the next C<sub>2</sub> is charged through V<sub>2</sub>. These two recurrent charges, in series, make up the DC voltage across the load. Two filament windings would be necessary to duplicate this performance with valve rectifiers.

In the circuit of Fig. 5 the voltage across R rises to a maximum and falls away again to zero once every half-cycle of the original alternating supply, so that the mean voltage is low. Let us see what happens if R is replaced by a condenser of large capacity, known as a *reservoir* condenser. The first pulse of current into it will charge it up to some voltage or other, and in the absence of any path through which this charge can be dissi-

pated the voltage reached will be retained. As soon as the voltage at the output of the rectifier falls below that across the condenser, the flow of current will cease, and will not re-start until, on the next pulse, the voltage has again risen to that left on the condenser. At that point the condenser will again take current, and the voltage across it will rise further. This process is pictured in Fig. 8, where the dotted line shows the driving voltage derived from the rectifier (as in Fig. 4 b) and the full line the voltage across the condenser. The shaded areas indicate the

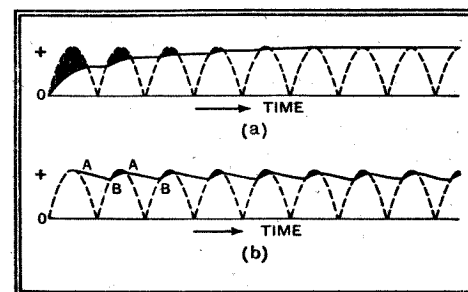


Fig. 8.—Action of reservoir condenser. At a is shown the effect of substituting a condenser in place of R in Fig. 5. The charge on it rises eventually to the peak voltage of the applied A.C. Dia. b shows that by connecting the condenser in parallel with R, discharge from A to B is followed by recharge from B to A, and so on continuously. Fluctuations are less, and mean voltage greater, than in Fig. 4b, where no condenser was used.

portions of the successive waves during which current flows through the rectifier into the condenser. It is quite evident that this will eventually charge up to the peak value of the pulsating voltage from the rectifier. The number of half-cycles that will be required to reach this voltage will depend on the capacity of the condenser and on the resistance offered by the transformer windings and the rectifier itself to the flow of the charging current.

Now, leaving the fully-charged condenser in position, let us replace the load resistance R into which the rectifying device delivers its current. Fig. 8 b shows quite graphically the result. On first connecting R across the condenser (at A) the voltage falls as the condenser slowly discharges, until at B the falling voltage meets the swift uprush of rectified voltage on the next half-cycle, and is carried up towards the peak-value again. Once more a fall, arrested again before it has gone far—and a continuous repetition of this, cycle after cycle.

The magnitude of the drop from A to B depends, as a moment's consideration will show, on the capacity of the condenser and the current drawn by the load resistance. Clearly, high values of C and R make AB flat, and low values make it steep; have we not seen that in the absence of any condenser the voltage-level follows the dotted curve right down to zero?

The effect of the reservoir condenser, as Fig. 8 shows, is two-fold; it raises the mean voltage across R towards the peak voltage as theoretical limit, and it

**Rectifying Valves—Glass and Metal—**

smooths out fluctuations in the voltage, thereby reducing the hum that is introduced into the set by way of the HT line. In the average case both functions are sufficiently fulfilled by a capacity of some 4 to 8 microfarads, though it must be noted that the larger capacity allows rather a large alternating current to flow through the rectifier.

It is not found practical so to increase this condenser as to provide smoothing enough to remove all hum from the receiver, for this would require some hundreds of microfarads in the average case. It is found cheaper to use a second condenser C<sub>2</sub> (in Fig. 9) and a choke L to provide further smoothing. If the inductance of L were negligibly small, the

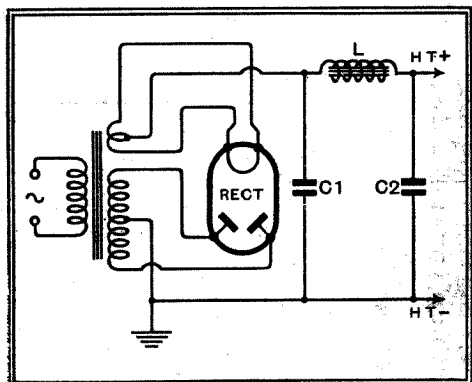


Fig. 9.—Complete HT supply system for AC mains. C<sub>1</sub> is the reservoir condenser, L and C<sub>2</sub> are smoothing components. Usual values: C<sub>1</sub>, 4 mfd.; C<sub>2</sub>, 8 mfd.; L, 20 to 50 henrys.

changes in voltage across C<sub>1</sub> would result in a flow of current in and out of C<sub>2</sub>, thus keeping it always charged to the voltage that might at any moment exist across C<sub>1</sub>. By giving L a high inductance (20 to 50 henrys) it is made to oppose these fluctuations in current, and so prevents C<sub>2</sub> from charging and discharging fast enough to follow the voltage changes on C<sub>1</sub>. Thus the voltage on C<sub>2</sub>, which is that actually applied to the set, is very much more steady—i.e., nearer to pure DC—than that on C<sub>1</sub>.

If, in a set rather susceptible to hum, the addition of L and C<sub>2</sub> to the rectifier and reservoir condenser does not suffice to give the smoothing required, a second choke-condenser pair may be added in the

same way. In the majority of commercial sets the circuit of Fig. 9, with one choke and two condensers following a full-wave rectifier, is found adequate for satisfactory smoothing. In place of a special choke it is customary to use at L the field-winding of the moving-coil loud speaker, which has an inductance suitable for smoothing, this arrangement having the particular advantage that the whole current of the set, in passing through the speaker, is used as energising current for the field.

While the circuit of Fig. 9 is almost invariably used in sets intended to work off AC mains only, another arrangement involving the same principles is used for "universal" sets that are designed to be operated indifferently by alternating or direct current. The use of a transformer being impossible on DC mains, the filament of the rectifier, like those of the other valves, has to be heated by direct connection (through a suitable resistance, of course) to the mains. So connected, the filament cannot conveniently be used as the "HT+" point; an *indirectly heated* rectifier is therefore employed. Half-wave

rectification is used, the cathode-anode space of the valve being placed in series with the anode-current supply to the valves, and suitable smoothing added. Study of the circuit of Fig. 10, which shows the arrangements for power supply in such a set, will make clear the necessity for separating the cathode from the filament.

Owing to the limited voltage available, it is not usual to energise the speaker-field by making it do duty for the smoothing choke; sometimes a permanent-magnet speaker is used, and sometimes the field is connected across the reservoir condenser. In either case the choke in Fig. 10 will have an inductance of some 20 to 50 henrys and the lowest practicable resistance. On direct current mains, of course, there is no rectification to be done; the rectifier of Fig. 10 then becomes a "passenger," doing no more than reduce the anode voltage a little. If desired, it could be removed, replacing its filament with a resistance of equivalent value and joining together anode and cathode sockets of the valve-holder normally occupied by the rectifier.

## DISTANT RECEPTION NOTES

SEVERAL readers have been kind enough to write to me about the reception of Lahti. I mentioned recently that this was a station of which I had never been able to make very much, and suggested that the position of my house in one of the deep, narrow Chiltern valleys might possibly be responsible for my failure to hear it better. These valleys, as readers probably know, run almost parallel with one another in a direction which is approximately from south-east to north-west. As Lahti lies almost exactly north-east from me I am pretty well blanketed by several ranges of not very high hills. One reader from Essex tells me that he receives Lahti at very fair strength even in daylight, there being a distinct deflection on the tuning meter of his set, a *Wireless World* new Monodial Superhet. He classes the signal strength as about equal to that of the Deutschlandsender. Another, who hails from Bristol, reports fair daylight volume and respectable volume at night. He puts it in the same class as Warsaw, so far as signal strength is concerned.

I think that my theory of the "wireless shadow" cast by the hills to the north-east

of my aerial must be correct, for Rainham is at least as far as I am from Lahti and Bristol is a good deal farther.

At the same time I can't quite understand how it is that I obtain such good reception of American medium-wave stations if the blanketing theory holds good. To the south-west of my house I have at least four ranges of hills, which run almost at right angles to a line between my aerial and any part of the United States. Yet I have received over thirty U.S.A. stations on a single night in August with a three-valve straight set and nothing better in the way of a collector than an indoor aerial slung round three sides of a ground-floor room. And that is not all: On particularly good nights I have more than once heard U.S.A. stations quite well with a battery portable fitted with a frame aerial about ten inches square.

I wonder if any readers listened to Breslau, Berlin or Königsberg during the first week of March? If anyone did so and happened to make a note of the way in which any of these stations was received I shall be glad to have a report. I couldn't do so myself since influenza had me in its horrid grip. The three stations were then conducting synchronised working on 356.7 metres, and it would be interesting to know what the result was at a distance of 700 miles.

I have had several reports of good reception of Banska Bystrica, the 30-kilowatt Czechoslovakian station which works on 765 metres. Unfortunately I have no set at present which will tune up to this wavelength on the one range or down to it on the other, but reception should be good for those who can manage it. The power, by the way, is reduced to 15 kilowatts after five o'clock in the evening. Czechoslovakia is pretty well off in the way of stations now, for, in addition to Banska Bystrica, she has the 120-kilowatt Prague No. 1, the 32-kilowatt Brno, the 13.5-kilowatt Bratislava, the 11.2-kilowatt Moravska-Ostrava, the 2.6-kilowatt Kosice, and the 5-kilowatt Prague No. 2, none of them with a wavelength shorter than 249.2 metres. D. EXER.

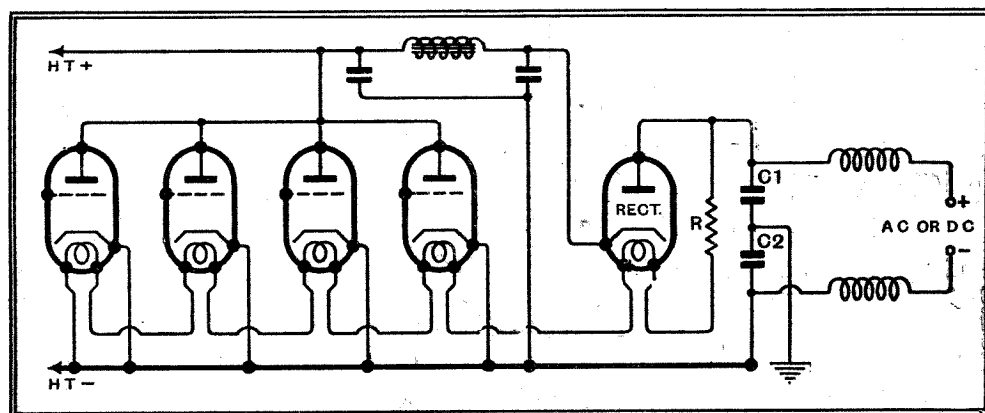


Fig. 10.—Power supply circuit of a typical "universal mains" set. C<sub>1</sub>, C<sub>2</sub> and the associated HF chokes form an anti-interference filter.



EVENTS OF THE  
WEEK IN  
BRIEF REVIEW

## Current Topics

**Nothing Doing!**

FRENCH listeners are bemoaning the fact that radio licence fees may not be deducted from income-tax payments. An effort was recently made to obtain a favourable ruling on this point, but the *Direction des Contributions Directes* has definitely ruled against the concession.

**Screening the Railway**

THAT special care must be taken to avoid interference with broadcast reception was a prominent clause in the Swedish Government's grant of extensive railway electrification concessions last week. It is estimated that screening will cost the contracting firms  $\frac{1}{2}$  million kroner.

**Home, Sweet Home**

WARDEN E. LAWES, of Sing Sing Prison, has informed the National Broadcasting Co. that convicts listening to radio on headphones in their cells, like best those programmes dealing with home and family life.

Gangster plays are obviously *demodé*.

**Mexican Station "Answers Back"**

A NEW Mexican station, XBA, working on 43 metres (6,976.64 kilocycles) is now providing weather forecasts and gale warnings for the benefit of farmers.

An interesting feature of the service is the answering of weather questions put by the farmers themselves.

**German Radio Conductor for Tokio**

JAPAN is enlisting European radio talent. Herr Walter Herbert, musical director of the Vienna State Opera, has been appointed music controller of the Tokio radio station, where he will conduct the large symphony orchestra composed of Japanese musicians with European training.

**Prizes for Radio Inventions**

PRIZES totalling nearly 12,000 francs are being offered in the inventions competition which is being staged at the Paris International Trade Fair running from May 16th to June 2nd. Wireless inventions will be included under Section B, Group I, which also deals with electricity, photography and the cinema. Full details can be obtained from the London office of the Foire de Paris, 17, Tothill Street, S.W.1.

**5-Metre Tests at Portsmouth**

EVERY Wednesday morning at 10.30 station G6PU (Municipal College, Portsmouth) transmits 5-metre tests. The co-operation of *Wireless World* readers is welcomed.

**Shunting with "Ultra-Shorts"**

ULTRA-SHORT waves are being used at the Rouen railway station for shunting purposes. It is stated that a single despatcher, having before him a plan of the sidings, can carry out the marshalling of trains on a scale which previously demanded the services of a large staff. The news has created anxiety in shunting circles.

**The Television - Telephone**

"YOU can take your seat in a comfortable armchair," writes our Berlin correspondent, "resting your head on a pillow, converse between Berlin and Leipzig, and see, and be seen by, the speaker at the other end." The new public television-telephone system between Berlin and Leipzig is operated by over 100-miles length of co-axial cable. It employs mechanical scanning with 180-line definition at 25 frames per second. Two

Come," at the Leicester Square Theatre, can communicate their request to the booking clerk upstairs while watching him on the cathode ray tube television screen. The apparatus, which has been installed by Mr. J. H. Reyner, employs mechanical scanning with 90-line definition and, considering the low definition, the results are extremely good.

It is hoped, however, that the public will realise that the results are not comparable with those to be expected when the Alexandra Palace tests begin.

**Paris Television**

THE Paris television timetable for March is as follows:—

*Eiffel Tower*.—4-4.30 p.m. (G.M.T.) on Mondays, Wednesdays and Thursdays.

4.30-5.0 on Tuesdays, Fridays and Saturdays.

*Paris PTT*.—4.30-5.0 on Mondays, Wednesdays and Thursdays.

4-4.30 on Tuesdays, Fridays and Saturdays.

**That Last Instalment**

THE latest sales promotion scheme of a big New York store is to offer to cancel the final hire-purchase payment on a radio set if the user will provide the names of five friends who will agree to home demonstrations of new sets.

New Yorkers are alleged to be showing a sudden and unprecedented genius for developing the social instinct!

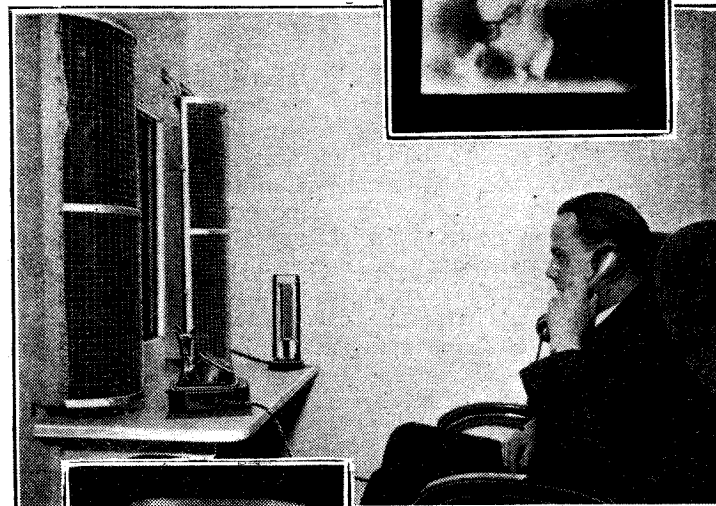
**Praise for M. Mandel**

HIGH praise for M. Mandel, the French Postmaster-General, was forthcoming at the opening of the International Broadcasting Conference in Paris last week. A statement by the International Broadcasting Union referred to the "energetic impulse given to French radio by M. Mandel's Ministry and the rapid technical and artistic advances in French broadcasting due to the Minister's untiring efforts."

M. Mandel accepted the invitation to preside over the work of the Inter-Continental Broadcasting Conference.

**Armstrong Said It**

MAJORE H. ARMSTRONG, eminent inventor of the famous radio circuit bearing his name, has forecast that within two years all U.S. automobile manufacturers will fit factory built-in suppressors as standard equipment, due to the immense growth of car radio.



"YOU'RE LOOKING WELL!" The new German television-telephone in use. (Inset) Typical images produced by the 180-line scanning system.

**Radio v. Films in India**

MR. LIONEL FIELDING, late of the B.B.C., who is now organising the Indian broadcasting service, is deploring the fact that the film and gramophone trades are stealing all the best artists, the I.B.C. having insufficient funds to tempt them to the broadcast microphone.

Fortunately the Standing Finance Committee of the Indian Legislative Assembly has approved an annual increase of 479,751 rupees towards the maintenance of the existing stations in Bombay, Delhi, and Calcutta, and for the provision of better programmes.

public television-telephone offices have been provided in each city and the three minutes connection costs 3.5 marks.

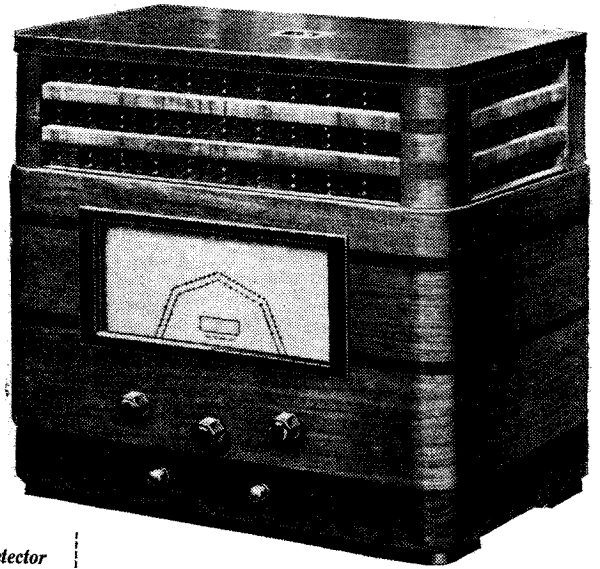
The quality of the picture is remarkable, every detail, including rings on the fingers, being clearly discernible. The service, which is experimental, is being closed down this week for a short period to permit of technical improvements and further laboratory tests.

**"Television" in Oxford Street**

SOME inkling of what British television will be like can be obtained by the public at the theatre booking offices at Selfridges, Oxford Street. A television-telephone booth has been installed on the third floor and persons booking seats for the H. G. Wells film, "Things to

# H.M.V. MODEL 445

## An AC Superheterodyne Incorporating a Novel Tuning Scale



**A**LTHOUGH the circuit of this receiver is based on well-tried practice, the form in which it is presented has many attractive features which should make a strong appeal to those who will be making daily use of the set.

Foremost among these features is the new "Station Selector Ray" tuning dial. This is an optical device which, in addition to throwing a narrow slit of light on to the calibrated wavelength scales, causes a spot of light to appear near the appropriate station name to which the receiver is tuned. One great advantage of this design is that the station names can be distributed over a considerable area, which obviates the necessity of peering closely into the dial as is necessary with some types of station identification. The long-wave station names are situated inside, and the more numerous medium-wave stations outside, the wavelength scale. The H.M.V. system of fluid-light tuning indication is also included on the dial and takes the form of two illuminated arrows the length of which varies according to the strength of the incoming signal.

The mechanism associated with the selector ray is enclosed in a "box of

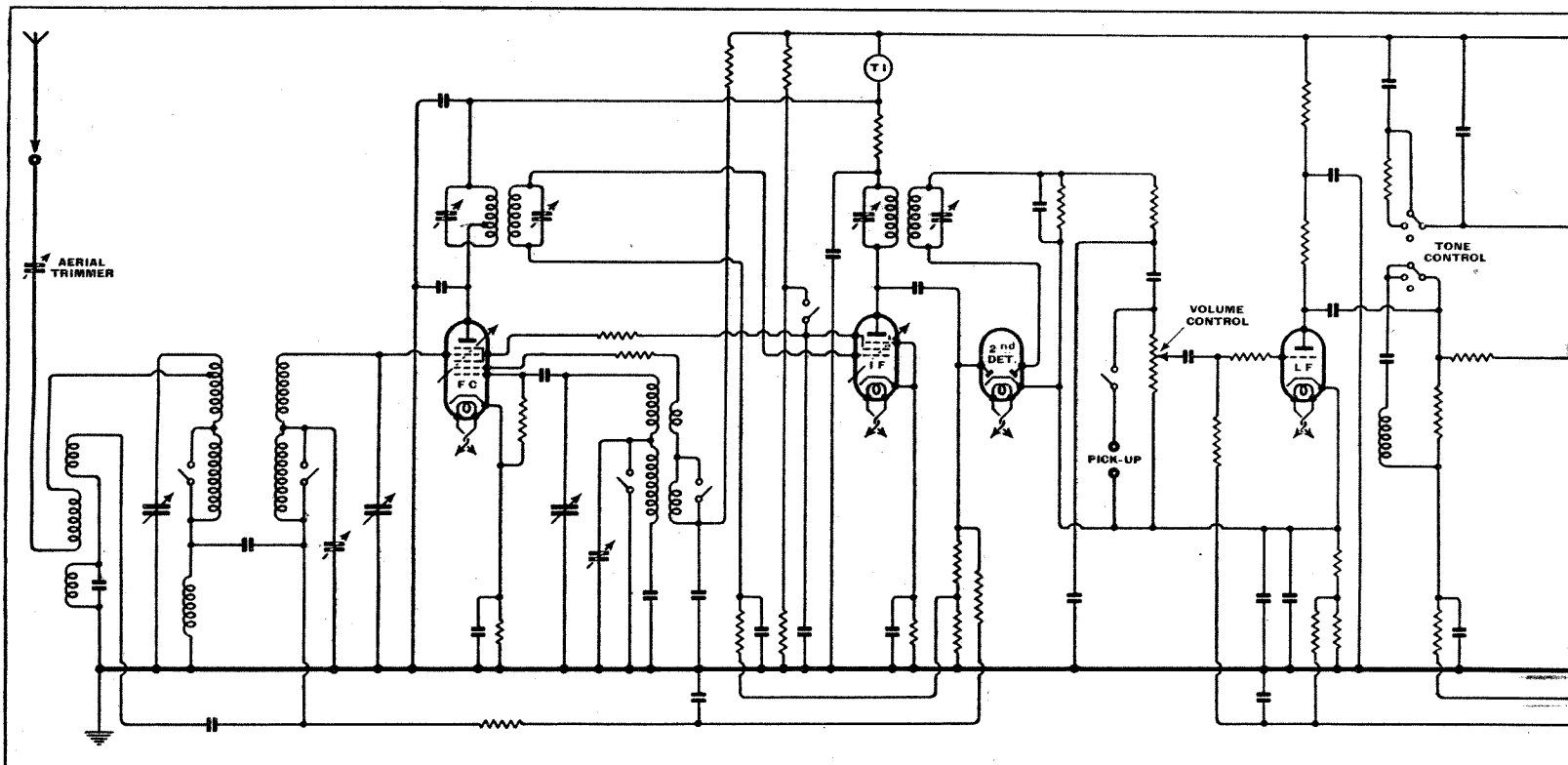
**FEATURES.** — *Type.* — Table model superheterodyne for AC Mains. **Circuit.** — Heptode frequency-changer — var.-mu pentode IF amplifier — double-diode second detector — triode LF amplifier — pentode output valve. **Full-wave valve rectifier.** **Controls.** — (1) Tuning. (2) Waverange. (3) Volume. (4) Tone. (5) Silent Tuning. (6) On-off Switch. **Price.** — 13 guineas. **Makers.** — The Gramophone Co., Ltd.

mystery" immediately behind the dial, and the moving parts are necessarily of greater weight than is usually found in slow-motion tuning mechanisms. This imparts what might be described as a fly-wheel action to the tuning control, and advantage has been taken of this to design a small-diameter knob which can be rapidly rotated with the finger tip to move from one part of the scale to another. This is an attractive innovation, which is at the

same time quite sound from a utilitarian standpoint.

Another interesting feature of the tuning system, which is, however, not apparent to the eye, is the friction-operated quiet-tuning switch. The function of this switch is to mute the receiver while changing from one station to the next. As soon as the tuning control is moved the station to which the set was tuned is immediately cut off, and when the next station has been found and accurately tuned by means of the tuning indicator, a period of between one and two seconds elapses after the hand has been withdrawn from the tuning control before that station is heard. A small switch on the front panel is provided so that this delayed action and quiet tuning can be cut out if desired. Those who have

Complete circuit diagram. A whistle filter is included in the tone-control circuits, and the silent tuning control is operated by a mechanical switch associated with the tuning control spindle.



had experience with ordinary sets will no doubt find this of advantage during the first few days of their acquaintance with the Model 445, but we feel confident that the attractive features of the mechanical quiet-tuning device will soon be appreciated and that this action will then be left permanently in circuit.

The tone control which has been provided in this receiver shows a distinct advantage over the usual type. It is provided with three positions, and in the medium and low settings of the control a filter circuit is brought into action which cuts out heterodyne whistles between stations and considerably reduces sideband interference.

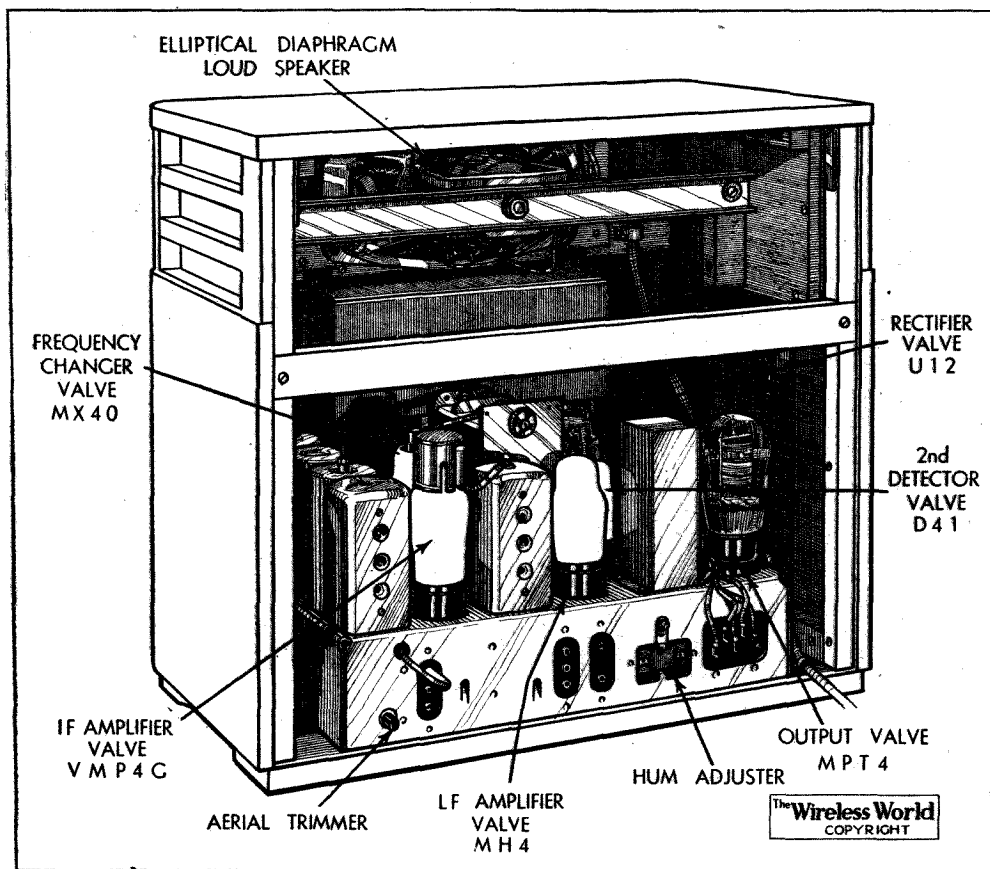
### Wide-angle Sound Distribution

Last but not least among the leading features of this receiver is the new type of loud speaker which has been incorporated. This is a small edition of the elliptical diaphragm unit which has already made its appearance in some H.M.V. radio-gramophones, and not the least important of its advantages is the wide-angle distribution of sound—particularly in the high frequencies. This is not mere talking point, and in walking round the front of the set at a distance of only two or three feet it would take a very experienced ear to detect any change in the balance of tone throughout the whole of the 180 degrees. The makers claim that the frequency response of this new reproducer is from 50 to 7,000 cycles, and judging from the quality of tone we are confident that this claim is fully substantiated. In spite of the comparatively small dimensions of the diaphragm the bass response is extremely good, and there is not the slightest trace of unnatural boom. The mounting of the loud speaker on a rigid channel-section

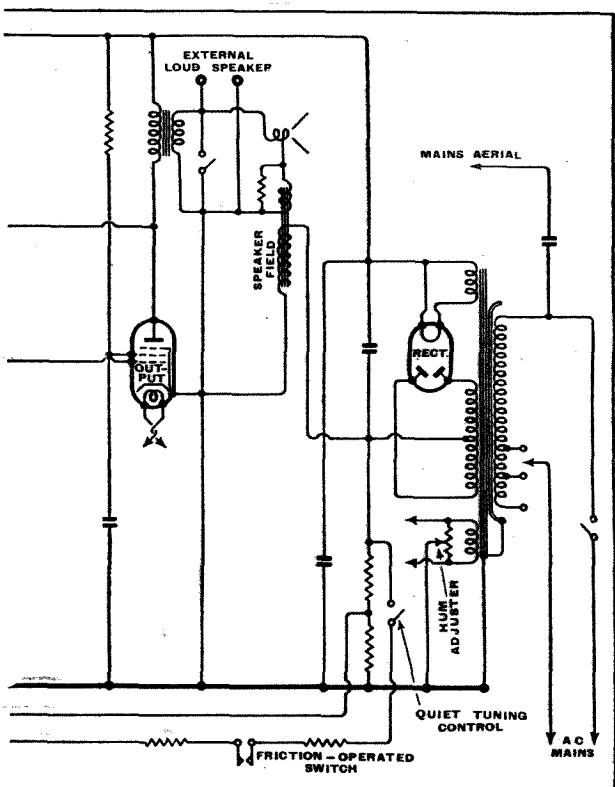
metal bar and the addition of a solid wooden strut across the back of the cabinet are, no doubt, contributing factors.

The volume available is fully adequate, and if the commencement of harmonic distortion in the output stage is noticeable just before the volume control reaches the maximum position, this, at any rate, is an

This should be adjusted when the set is installed and will then require no further attention. The single IF stage, which, like the frequency-changer, is AVC controlled, also performs the function of operating the fluid-light tuning indicator. It is interesting to note that the triode first LF amplifier, which is usually included in



The rigid mounting of the elliptical-diaphragm loud speaker and the solidity of the cabinet construction contribute to a clean bass response.



indication that the set is not being starved, at any rate as far as the input to the last valve is concerned.

The sensitivity is such that many more stations will normally be received than are indicated on the station selector dial. The Deutschlandsender between Droitwich and Radio-Paris is one of these, and with the efficient form of tone control provided this is a programme well worth listening to, particularly when one or other of its neighbours in wavelength is silent.

### Selectivity

The medium-wave selectivity is such that the local Brookmans Park transmitters can be approached within one and a half to two channels without experiencing interference when the set is used in Central London. Both wavebands are free from objectionable self-generated whistles, and there is no sideband shriek as a station is brought into or out of tune with the silent-tuning device out of action.

The circuit comprises five valves, the first of which is a heptode frequency-changer. This valve is preceded by a band-pass filter, the first circuit of which is provided with an accessible trimming control mounted at the back of the chassis.

the same valve as the diode rectifiers, is in this receiver treated as a separate stage. It is here that the quiet-tuning control takes effect, the method being the application of an excessive negative bias to the grid taken from the output-valve bias resistance through decoupling filters with a suitable time constant. There are two switches in this circuit, one of which is mechanically operated from the tuning spindle and the other manually to eliminate the quiet-tuning effect if desired.

The mains transformer is screened internally to prevent interference from entering the set through the mains leads. There is also a hum control, though the hum level is in any case so low that its adjustment is not likely to be critical.

The cabinet design is attractive and is executed with the customary H.M.V. attention to solidity and good finish. In order to take full advantage of the wide-angle sound distribution from the loud speaker, a special type of narrow fret running completely round the top of the cabinet has been adopted.

From every point of view this is a highly original set, and is a welcome indication that the design of table-model receivers is far from entering upon a period of stagnation.

# Listeners' Guide for the



IT would be so easy to get into the humdrum rut where music is concerned that Dr. Adrian Boult is to be congratulated on the vigorous policy which still governs his department. Musical surprises blossom forth week by week, full use being made of the B.B.C.'s magnificent resources in instruments and personnel. Last week the microphones were overloaded with orchestras and voices performing the Berlioz' Funeral Symphony, and on Wednesday next we are to have the first performance in England of the Russian opera by Shostakovitch, "Lady Macbeth of Mtensk."

Although the lady in question is no relative of her Shakespearean namesake, she partakes of the same nature, for in Leskov's story, written in 1864, on which the opera is based, Katerina Ismailova, the heroine or villainess, kills her father-in-law, her husband, her rival, and then herself. The composer, we are told, has treated this sordid theme in lyrical style. The final scene in this picturesque opera, which will be broadcast in two parts in the National programme, beginning at 8, leaves us at a convict station on the road to Siberia.

The chief rôles will be sung by Harold Williams, Parry

[Photo by courtesy of "The Picturegoer."]  
**"THE GREEN GODDESS."** Cyril Maude will take the part of the Rajah of Rukh in the thrilling stage play, to be heard in a broadcast version at 7.45 on Thursday (Reg.). The picture shows an exciting episode in the film version of the play in which George Arliss (seen in the background) took the leading part.

Jones, Oda Slobodskaya, Enid Cruikshank, and other artists. The B.B.C. Chorus and Symphony Orchestra will be conducted by Albert Coates.

#### "NO SAE BAD"

ENGLAND'S greatest tragic actress, Mrs. Siddons, had a thoroughly bad reception on her tour of Scotland, until at Edinburgh a small reward came her way. At the end of a great scene there was silence except for one voice in the gallery saying: "No sae bad!" The owner of this voice has been chosen by Mr. James Agate for his "Imaginary Biography" on Sunday (Nat., 6.45).

#### GARDENS OF SPAIN

"PICTURE" music is ideal for broadcasting. Few examples could excel de Falla's "Nights in Gardens of Spain," the beautiful work which the B.B.C. Orchestra is performing on Sunday evening (Reg., 9.20) under the direction of Dr. Boult, with Irene Kohler taking the solo pianist's part. The piece is fully as poetical and lyrical as its name suggests.

#### VENUS AND ADONIS

MRS. MARY DAVIS, a mistress of King Charles II and rival to Nell Gwyn, took the part of Venus in the first performance of "Venus and Adonis" by Dr. John Blow, which the B.B.C. Chorus and the Boyd Neel String Orchestra are broadcasting at 8.45 (Reg.) on Monday. Dr. Blow, born in 1648, was one of the outstanding figures in English music of the Restoration period. The part of Venus is to be taken by Nora Gruhn and that of Adonis by Henry Cummings, and there will be a background of little Cupids and shepherdesses. Incidentally, the broadcast version is based on the original MS in the British Museum.

#### CORPSES AND COMEDY

Two corpses form a sinister background to the musical comedy *motif* which Max Kester offers us in "Death in the Dressing Room" on Monday (Nat., 8.30) and Tuesday (Reg., 7.45). This musical thriller takes us behind the scenes during the performance of "Follies of 1936." The mystery concerns the murder

of a wealthy widow whose body is discovered in the dressing room of the actress, Gita Walenska, played by Tessa Deane. Just as the musical comedy reaches its height a second body is discovered.

Two outstanding numbers to be heard will be "Climbing Up the Golden Stairs" and "Old King Cotton."

#### WALES v. IRELAND

WALES meets Ireland tomorrow at Cardiff Arms Park in the International Rugby Union match, and once more Captain H. B. T. Wakelam will give a running commentary (Nat., 3.20). Of the forty-five matches played Wales has won twenty-six and Ireland seventeen. After the runaway victory of Wales over Scotland it is expected that Wales will be at the top of her form on her own ground at Cardiff.

#### A JOHNSON EVENING

DR. SAMUEL JOHNSON, the most compelling personality in the history of English letters, comes to the microphone in a feature programme on Wednesday (Reg., 9). The rôle of the "Great Cham" will be taken by Mr. S. C. Roberts, a past-president of the Johnson Society, who will give us episodes in Dr. Johnson's life, including his first dreary days as a hack writer



"THE GREAT CHAM." The Johnson statue at Lichfield, the lexicographer's birthplace. Episodes in the life of Johnson will be re-enacted in a feature programme on Wednesday (Reg. 9.)



# Week

## HIGHLIGHTS OF THE WEEK

FRIDAY, MARCH 13th.

Nat., 8, "Here's George" (George Robey Programme). 10, Transatlantic Bulletin.

Reg., 9, "The Gypsy Princess." 10.25, Billy Cotton and his Band.

Abroad.

Warsaw, 7.10, 4-Act Opera: "Carmen" (Bizet), from the State Opera.

SATURDAY, MARCH 14th.

Nat., 8.30, "Music Hall." 11, Henry Hall's Hour.

Reg., 4.15, "Here's George." 8.30, Griller String Quartet.

Abroad.

Luxembourg, 9.5, Symphony Concert of Polish Music.

SUNDAY, MARCH 15th.

Nat., 2.30, L.N.E.R. Concert from Harrogate. ♪Kutcher String Quartet. 9, B.B.C. Theatre Orchestra.

Reg., 6.45, Commodore Grand Orchestra. 9, G. K. Chesterton: "The Spice of Life." ♪Sunday Orchestral Concert.

Abroad.

Strasbourg, 8.15, Cherubini Anniversary Concert and Waldteufel Waltzes.

MONDAY, MARCH 16th.

Nat., 8, Louis Levy and his Symphony (Music from the Movies). 8.30, "Death in the Dressing Room."

Reg., 8, B.B.C. Organ Recital by Fernando Germani. ♪"Venus and Adonis," by Dr. Blow.

Abroad.

Hamburg, 7.10, Max Reger Concert.

TUESDAY, MARCH 17th.

Nat., 8, "Orchestre Raymonde." 8.45, St. Patrick's Day programme. ♪Brig.-Gen. P. R. C. Groves: "Conquest of the Air."

Reg., 7.45, "Death in the Dressing Room." ♪Lou Preager and his Band.

Abroad.

Warsaw, 7.10, Three-Act Operetta: "The Charm of Uniform" (Swierzyński).

WEDNESDAY, MARCH 18th.

Nat., 8, "Lady Macbeth of Mtsensk," Queen's Hall Concert. ♪Jack Jackson and his Band.

Reg., 8, Will Fyffe in Variety. ♪"Dr. Johnson," a feature programme.

Abroad.

Leipzig, 7.45, "Kreisler, Conductor's Joy and Sorrow"—a Kreisler Fantasia.

THURSDAY, MARCH 19th.

Nat., 8, "Fol-de-Rols"—a Seaside Summer Show. ♪Violin Recital by Emil Telmanyi.

Reg., 7.45, "The Green Goddess." 9, "Camp Fire on the Karroo." ♪Harry Leader and his Band.

Abroad.

Kalundborg, 7.10, Twenty-first Thursday Concert. Guest Conductor: Fritz Busch.



"THE SPICE OF LIFE." Mr. G. K. Chesterton contributes to this popular series at 9 o'clock on Sunday. (Reg.)

in Grub Street, the compilation of the famous dictionary, and the journey with Boswell to the Hebrides. The programme has been devised by Moray McLaren.

### ON THE KARROO

DURING the last few months listeners have enjoyed broadcasts by the Rocky Mountaineers, the Canadian concert party with the atmosphere of the prairie and the lumber camp. Succeeding them on Thursday next (Reg., 9) will be a South African concert party in a programme entitled "Camp Fire on the Karroo." Josef Marais and his band will be supporting a programme inspired by the vast South African plains—the Karroo—and will reproduce the atmosphere of the farms and camps inhabited by Dutch settlers and the coloured people of the Cape.

Some of the songs will be sung in Afrikaans, and others under the general title "Bushveld Songs" will include "When the Jackal Keeps a'howlin' all Night," and "Boo-Boo, the Baby Baboon." This is the first time South African farming life has been featured in a British broadcast.

### OPERA ABROAD

It is odd to think that Bizet's "Carmen" was not a success until its production in this country. It is associated with many illustrious names in the title rôle, and it will be interesting to hear how Polish artists interpret the opera tonight (Friday), when Warsaw relays "Carmen" from the State Opera at 7.10. The big operatic event to-morrow is Milan's relay from the Scala

## Outstanding Broadcasts at Home and Abroad

at 7.45 of Richard Strauss' newest opera, "The Silent Woman." Another interesting Opera House relay to-morrow is that of Gounod's "Faust," relayed by Paris PTT from the Opéra.

The only other operatic "highlight" is a Verdi Opera Gala in the Munich studio at 7.10 on Tuesday.

### OPERETTA

SOME sparkling operetta music comes from the Continent this week. To-night Radio-Paris has "Madelmoiselle Prudhomme" (Koechlin-Barlow) at 8.45, and to-morrow there are two Millöcker gems. Vienna presents the composer's "Enchanted Castle" at 6.45, and Berlin (Funkstunde) his "Gasparone" at 7.10. Leo Fall's operettas are of such a quality as to place him on a level with Lehar, with whom he vies in popularity. His "Madame Pompadour" is in the Saturday night programme of Brussels No. II at 8. On the same evening a musical play with the intriguing title

3.10 Hilversum will be relaying the Rotterdam Philharmonic Orchestra. Luxembourg, at 9.5 on the same day, gives a symphony concert of Polish music.

The Berlin (Funkstunde) station orchestra is one of the best of its kind in Europe. It will be heard at 7 on Sunday.

The great musical treat of the week, however, will be the Leipzig broadcast at 7.10 on Monday of Bach's "Art of Fugue," given by the Leipzig Symphony Orchestra; conducted by Dr. Weisbach, with Gunther Ramin playing organ and harpsichord.

### BASIC ENGLISH

BASIC English is the subject of a talk from Oslo to-day at 4.45, the speaker being Miss Kathinka Welhaven.

### BALLAD OF WHISKY AND GIN

ACCORDING to overwhelming requests from listeners Hamburg is repeating the "Ballad of Whisky and Gin" (Kuhner-Kusche) at 7.10 on Tuesday.



"CAMP FIRE ON THE KARROO" is the title of a South African feature in which Josef Marais and his Band take part on Thursday (Reg. 9). Above is the market place in a typical township in the Karroo Plateau.

"The Music Hater" comes from Berlin (Deutschlandsender) at 8.

### CONTINENTAL CONCERTS

If the B.B.C. closed down for a week the musical listener would still have a fine feast of concerts from the Continent during the next seven days. To-night Hilversum brings the Haarlem Symphony Orchestra to the microphone at 7.55, while Vienna features the famous Vienna Symphony Orchestra in a Bruckner concert on behalf of the Winter Relief Fund. There will be a choir and soloists.

To-morrow afternoon at

### A MUSIC CONTEST

EITHER one enjoys music contests or detests them. To-night at 7.15 the Deutschlandsender is broadcasting the finals in the German Dance Band Competition relayed from the Zoological Gardens.

### LIGHTNING MUSIC

A "LIGHTNING composer" comes to the Copenhagen microphone at 9.35 to-night during a "Whoopie Night" programme. He is Mr. E. J. Lehmann, who produces impromptu compositions in a few minutes from themes provided by members of the audience.

THE AUDITOR.

# Plan for Listening

## HOW TO ENJOY THE PROGRAMMES

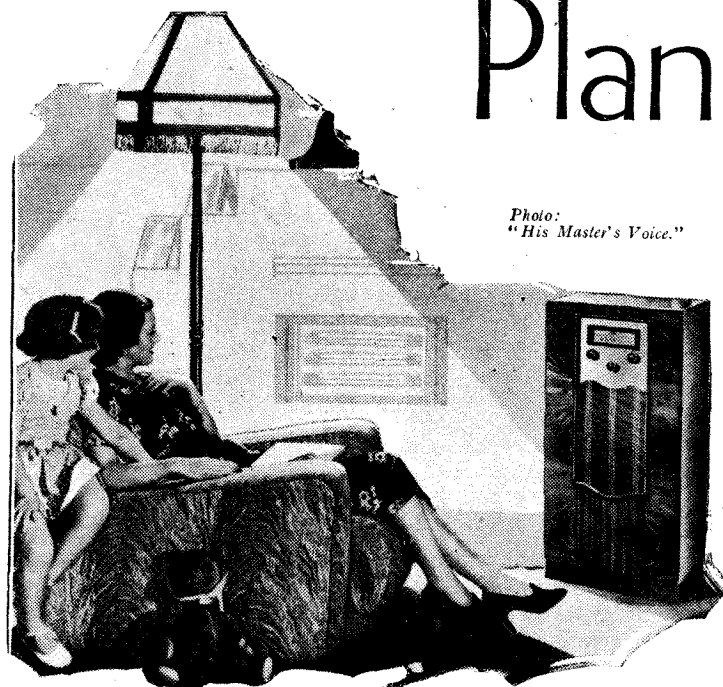


Photo:  
"His Master's Voice."

OF all the various enthusiasms through which we pass in our radio activities, that of the "High-Quality" stage is probably the one which proves the most lasting in its interest—especially to those musically inclined—and the one which finally gets us busy in designing and building that "last word" in High-Fidelity receivers.

But, having built it, it does not necessarily follow that the resulting superlative reproduction will yield that full appreciation of the B.B.C.'s transmissions which they usually deserve unless a little thought and discrimination are exercised in the use of the receiver.

These notes on listening, having been compiled from the writer's experience over a long period, are offered not so much as hard-and-fast rules as general recommendations, and may be of interest and of some practical assistance to those who wish to ensure the maximum enjoyment and appreciation of the varied entertainment offered.

No design data is given for a receiver as we are concerned with the *use* of it rather than how to make it, but, as a matter of interest, the writer's own local-station set consists basically of a high-frequency amplifier, diode rectifier, and resistance-coupled amplifier. Three tuned circuits of mediocre "goodness," two of which are used as a tightly coupled input filter and the other as transformer coupling to the diode, provide adequate selectivity without noticeable side-band cutting.

Automatic-volume-control is considered undesirable and unnecessary as every effort is made to work valves on the straightest part of their characteristics. The low-frequency amplifier consists of two resistance-capacity coupled stages of low gain—to minimise Miller effect—feeding a pair of neutralised P.X.4's in push-pull, a phasing valve being used as in the well-known "Paraphase" system to provide the necessary reversal.

Theoretically, the main advantages are the larger radiating areas and the smaller power each reproducer is called upon to handle to create the required noise, and although these reasons may not seem sufficiently strong to warrant the additional cost, a practical test is very satisfying and convincing.

### Correctly Phased Speakers

Music, in particular, acquires a much greater depth and body—not to be confused with boomy resonances—and it is not difficult to fill a large room with each speaker working at quite a medium level and without the harshness and peakiness which often goes with a single cone worked at high volume.

An analogy that might be drawn is that of a room illuminated, in one case, with a number of softly shaded lamps of medium candle-power as against a single unshaded bulb of much higher consumption.

It is essential that the speakers are correctly phased, i.e., all the diaphragms move in and out together, and a simple listening test on music will clear up this point satisfactorily, particularly if the speakers are close together—as they should be—as, when out of phase, the bass practically disappears and reproduction becomes reminiscent of the old trumpet days. A reversal is obtained, of course, by changing over the speech-coil connections of one cone.

The listening room is important, a fact which may prove unfortunate, because if one is not lucky enough to possess a suitable room, there is usually not much to be done about it. And the same with

furnishings. If the room in question is acoustically bad or suffers from some other defect, it is not usually within the scope of the average man to alter it appreciably beyond slight modifications such as the draping of a large area of glass to avoid unpleasant sound reflections.

When some degree of selection is available, however, a fairly large room should be chosen so that one avoids the necessity of having to sit too close to the speakers—a state of affairs it is usually difficult to avoid in a small room, with the result that one is never far enough away from the concentrated high-frequency beam which, in cases where a "tweeter" is used, is anything but pleasant. The actual distance can be varied within fairly wide limits and will depend upon a large number of factors, but, as a suggestion, something between five and fifteen feet should suit the majority of cases. In the writer's case it is twelve feet.

The subject of volume level is open to a good deal of controversy and, although one should simulate *as far as possible* the degree of loudness obtaining at the transmitting end, it is obvious that this cannot be the rule, the actual setting depending upon one's comfort and the type of transmission coming through. It is suggested that the best level is approached when the volume of sound reaching the ears is of the same order as it would be if one were present at the actual performance; which is not quite the same thing as reproducing it at the original volume.

Talks and plays with musical effects are often disconcerting because, compared with the music, the speech is far too loud and one is compelled to choose between good speech and weak music or bellowing speech and good music.

As, however, "the play's the thing"—a phrase which may have been used before—the music must go by the board and the volume control adjusted for good speech.

And, further, on this subject of speech, most people seem to keep the level far too high: a fault which largely destroys any illusion of realism and merely produces a feeling of irritation.

***B**ELIEVING that the possession of a "High-Quality" receiver does not guarantee complete enjoyment of the B.B.C. programmes, the writer gives some helpful advice, born of personal experience, on how the listening room, as well as the receiver, can be adapted to provide the nearest approach to a true reproduction of the original performance.*

**Plan for Listening—**

If you listen to plays or talks at all, try LISTENING, and adjust the level to something approaching that of a human speaking voice. Actually, it will have to be a little higher than this for comfort because a certain amount of intelligibility is lost due to the imperfections of the system, but be sure it is only a little higher.

At these low-volume settings the overall balance usually requires some adjustment to compensate for the ear characteristic, and in the writer's case, this is accomplished by the use of a condenser shunted across the top of the volume control. This attenuates the bass and cleans up speech considerably, leaving it largely free of "middle" boominess.

The cabinet question is a difficult one, for the apparatus must be accommodated *somewhere*, and even if we tuck the receiver and amplifier away in some dark corner, it still remains to dispose of the speakers—a task that is by no means simple when there are several of them. Things being what they are, most of us will have to fall back on a cabinet of sorts as a general "hold-all" which, provided

it is solidly constructed and not too small, is probably the best solution in view of the relative unsightliness and limited accommodation of a baffle.

It is often maintained that loud speakers should never occupy the same cabinet that contains the rest of the apparatus, but with a set of this description there seems to be no valid reason why they should not do so. This, however, may make it difficult to avoid mounting the speakers near the floor—a practice to be avoided—but if they can be kept about eighteen inches above it and tilted backwards slightly reproduction should not suffer in any way as one's effective height is considerably reduced when sitting down and the sound source is then more or less at ear level.

So far as gramophone reproduction is concerned the writer has little to say, for it is definitely a very expensive business to get real quality from a record, *vide* the elaborate equipment used on the H.M.V. "high-fidelity" radio-gramophone, and until such equipment is available at a popular price the writer, for one, will be satisfied with the broadcast material.

"TUNE."

under some such title as "American Half-Hour." In this way, at least, two birds could be killed with one and the same stone. Listeners in this country would hear what the big American broadcasting chains can do in the way of programmes, and would therefore obtain a much more correct idea of what our transatlantic cousins hear when they sit down to their *evening* wireless.

Not less important, a carefully edited Blattnerphone tape would eliminate any items spoilt by fading or other forms of distortion. I can't help thinking that at the moment the B.B.C. is unwittingly hindering short-wave listening from becoming more popular by these relays. At this time of year 5.30 p.m. is not an ideal time for west-to-east transmission on the short waves, and the man in the street, hearing the extraordinary sounds that sometimes come through, may conclude that short-wave reception is not for him if that is the best that can be done by the B.B.C. with its almost unlimited resources.



**Clearing the Ether**

IT is reported that Captain P. P. Eckersley has laid before the B.B.C. a new system of transmission which he has worked out. His object is to reduce interference between stations on the medium- and long-wave bands, which under present conditions are very much overcrowded. Captain Eckersley calls his new system Assymmetric-Sideband broadcasting. He maintains that were it brought into use it would be possible to have the existing number of stations working on the wavebands devoted to broadcasting with far less mutual interference and far better quality in reproduction. Or, alternatively, twenty to thirty per cent. more stations could be fitted in with a reduction of interference but no improvement upon present quality. The scheme is at present being tried out by the B.B.C. research staff. Let's hope that it may be found as good as its author believes it to be, for there is no question that anything which would provide more elbow-room on the ether would be a boon and a blessing.

# Random Radiations

By "DIALLIST"

**Well Done, G.P.O.**

IN the past the Post Office authorities have put in a great deal of good work in helping listeners to get rid of interference troubles. The latest move by the authorities is the issue of a pamphlet, "Good Wireless Reception," which can be obtained free at any post office. This is a first-rate idea, for the pamphlet tells the man in the street just what he wants to know about interference with his wireless reception and of the ways in which it can be overcome. The sad part about the whole business is that, despite the willing help that they give to the listener, the Post Office authorities have still no power to say to those who cause interference, "You can't do that there here." I imagine that one of the purposes of the present G.P.O. campaign is to secure evidence of the widespread nature of interference. If they can obtain this—and it's up to every wireless man to see that they do—their hands will be very much strengthened and they will have a strong case for pressing for legislation. Everyone who suffers from interference should fill in without delay the questionnaire on the subject, which, again, is obtainable at any post office.



**Heard Throughout the World**

REPORTS show that King Edward's broadcast message was well received in almost every part of the world except for certain places in South America. This was a great piece of good fortune, for it so often happens that conditions over which the engineers have no control make the reception of large-scale short-wave relays somewhat patchy. This must have been the nearest approach to a world-wide broadcast that has yet taken place, for, in addition to direct

reception on the short waves, it was relayed on the wavebands devoted to broadcasting in most of the countries of Europe, in Canada, the United States and South America, in India, in the Far East, in Australia, in New Zealand, and in many parts of Africa. One would very much like to know how many people actually heard the King's message. Of course, there's no way of finding out, but the number may have run to something like a hundred millions.



**Five Hours Back**

I WONDER if you listen to the "Five Hours Back" programme which takes place at half-past five on Saturday afternoons. The somewhat cryptic official description is "A short-wave relay of what morning listeners in America are hearing this afternoon." How morning listeners can hear things in the afternoon I can't quite see! Anyhow, they can't be morning listeners unless they live a good long way inland, for at 5.30 p.m. G.M.T. it is half an hour after noon in the Eastern States of America.

To me it seems rather a pity that these relays should be the chief sample of American broadcasting that comes the way of the man in the street in this country. Like our own stations, those in the United States give their main programmes in the evenings, and you can't form a proper impression of them from the fare provided round about lunch time.



**What Do You Think?**

In my view, the B.B.C. would be better advised to "can" some of the best items of the week from the U.S.A. by means of the Blattnerphone and to serve these up



RADIO TOWER at St. Moritz, specially constructed to meet the needs of broadcast commentators on winter sports. Microphone points are fitted for a large number of commentators.

# Broadcast Brevities

## The Big Idea

ALTHOUGH the Regionals are almost at once to be raised in power from 50 to 70 kilowatts, the idea is to bring them ultimately up to 100 kilowatts and so place them on the same status as Lisburn (or Blaris, as they say in Blaris). The "Little Nats" will then be gnats indeed, if they have not already been swatted.

## A Real Regional Scheme

Swatted they will be if certain of the more influential B.B.C. engineers have their way, for a scheme is already tabled that extinguishes the medium-wave Nationals and transplants the apparatus to new Regional centres. Big Brother Droitwich would then be left to conduct the National service on its own account.

We shall hear more of this scheme in the very near future.

## When the Music Stopped

OLD ladies seem to be the bane of wireless dealers. The B.B.C. has just had an impassioned letter from a retailer who certainly deserves sympathy.

The "old lady" in his case was enchanted with the performance of a — All-Wave Superhet. When it played "The Music Goes Round and Round" she pulled out her cheque book. "Please play that one again," she said. Dealer's explanations useless. "Won't play it again?" fumed his client. "Then I won't have it!" Back went the cheque book and out went the old lady.

## By OUR SPECIAL CORRESPONDENT

### Organising the B.B.C.

THE great organ contest has been carried a stage farther. The contestants are the B.B.C. Music and Variety Departments respectively. "Music" won the first round with the erection of the Concert Hall organ, then "Variety," only a fortnight ago, capped this with the official decision to build a cinema organ in St. George's Hall. And now "Music" looks like winning the rubber again by gaining official consent for a concert organ at Maida Vale.

### Seconds Out

But the battle is not yet over. It has long been felt that the Music Department has an unfair advantage in having the only organ in Broadcasting House. No one wants jazz on the Concert Hall organ, but there is a strong feeling that organ interludes should be available in Variety Studio BA.

The Variety Department has the gloves on. Seconds out of the ring!

### The Television Trek

NEARLY two thousand four hundred and fifty persons have demonstrated their intense interest in television by applying to the B.B.C. for posts in Mr. Gerald Cock's department.

Within a few days of the announcement of the vacancies applications were cluttering up the

B.B.C. post bag in the following proportions:—

Music director, 89.  
Two stage managers, 166.  
Three producers, 110.  
Assistant producer, 85.  
Producer for special programmes, 26.  
Film assistant, 101.  
Artists booking assistant, 131.  
Male announcer, 588.  
Female announcer, 677.  
Hostess, 445.

This makes a total of 2,418. Sundry other applications arrived by devious routes, making a grand total of just on 2,450. And only 13 were chosen.

### Programmes for Television

STORIES that Alexandra Palace television is to be delayed until the late summer need not be taken seriously. Work is now going ahead with a spurt. One well-known producer of broadcast entertainment tells me that he has already been asked to prepare material for the first television programmes.

### Scotland Annoyed

SCOTLAND has its eye on Wales, which has just won a battle for broadcast independence. The B.B.C. is now advertising for a Welsh Regional Executive to supplement the efforts of the new Regional Director. Mr. Appleton, erstwhile Director of the Region, takes up his abode in Bristol as West Regional Director, leaving Wales for the Welsh.

And what of Scotland?

### Scottish B.B.C. ?

Only 47.5 per cent. of Scottish Regional programmes come from Scotch studios. The rest emanate from the Augean stables south of the Tweed. Scottish Nationalists want a B.B.C. of their own. They are not satisfied to have a Scotsman ruling the broadcast roost in England.

Trouble is brewing, or rather, distilling.

### Return of "Our Gracie"

GRACIE FIELDS has promised Mr. Eric Maschwitz to broadcast immediately upon her return to England on March 30th. She will travel straight from the docks at Southampton to Broadcasting House. At present she is concluding her tour of South Africa, and is so busy that it will not be until she reaches the comparative quiet of ship life on the return journey that she will be able to write and rehearse her broadcast act.

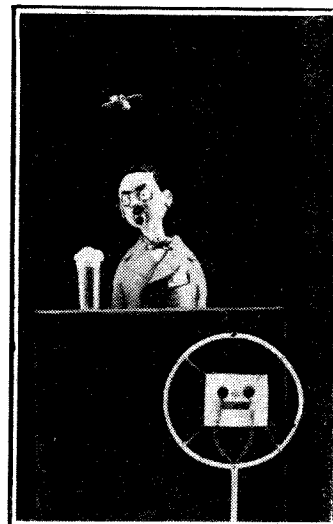
This act will include her latest song additions, and, in her own inimitable style, she will describe some of the most amusing experiences which have befallen her in Africa.

### Marionettes for Television

A BROADCAST orator now takes his place in the famous Viennese marionette show produced by Prof. Richard Teschner, who recently introduced his theatre to Londoners.

A correspondent tells me that the Professor's audiences are treated to a perfect burlesque, in miniature, of a talker at the microphone. A comic little man mounts a rostrum, waits for the red light to appear, and then gesticulates before a Reisz microphone. Unfortunately, his delivery is hampered by the lively and vicious hornet seen in the picture.

The marionette art, far from being moribund, is expected to take on a new lease of life with the arrival of television, for which it is eminently suited.



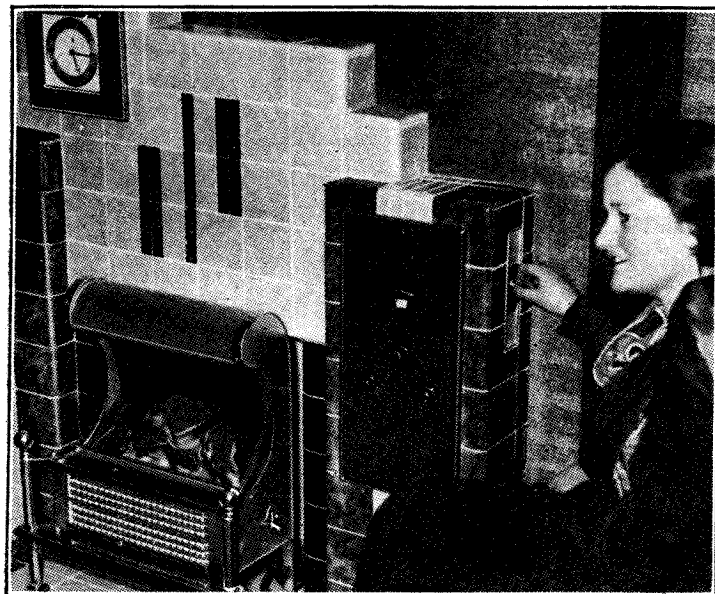
"GOOD EVENING, EVERYBODY!"

An amusing caricature of a radio speaker who appears in Prof. Teschner's marionette show, described above.

### The Grand National

ONCE again the B.B.C. will bring to listeners' loud speakers a description of the race for the blue ribbon of steeplechasing — the Grand National. The race will be described in two parts: Mr. R. C. Lyle, from Messrs. Topham's private stand, will be in charge of that part of the course, on the Grand Stand side of Becher's and Valentine's Brooks to the Canal turn. From this famous jump, which all the horses have to pass and turn immediately, Mr. W. Hobbiss will describe the race to the end, including the run-in.

Last year the Grand National took place under perfect atmospheric conditions.



**FIRESIDE WIRELESS.** This all-electric fireplace at the South London Exhibition, Crystal Palace, would not have been complete without its up-to-date radio set, which fits into the general design with very happy effect.

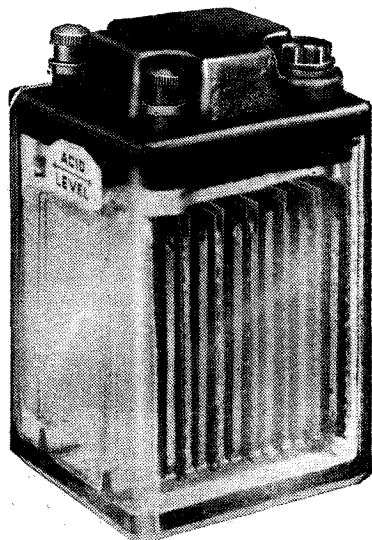


# New Apparatus Reviewed

## Recent Products of the Manufacturers

### NEW PERTRIX LT ACCUMULATOR

AS there is a marked tendency in battery-operated sets to employ more valves than hitherto, especially in the case of the transportable type in which superhetero-



Pertrix Type S.U.30 semi-unspillable heavy-discharge LT cell.

dyne circuits are becoming quite general, Britannia Batteries, Ltd., has introduced a new semi-unspillable LT accumulator designated the Type S.U.30 and designed for a maximum discharge of 2½ amps.

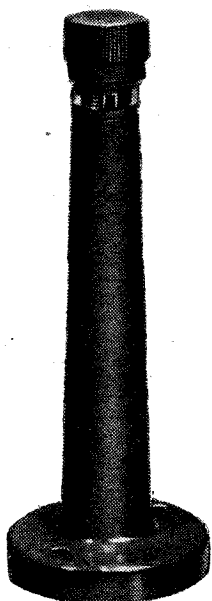
Free acid is used, but a new style of gasket, embodied in a chamber forming part of the top of the cell, precludes leakage under normal conditions of use. The cell should not be confused, however, with the truly unspillable type designed so that they may be fitted in the set in any position, i.e., either upright or on their side.

The cell is comparatively small considering it contains six negative and seven positive plates, the overall dimensions being 3 1/8 x 3 1/8 x 5 1/8 in. high. Its capacity is 38 amp. hours, at 100-hour rate and the price is 13s. The maximum charging rate is 3 1/4 amps.

### BULGIN STAND-OFF INSULATOR

A NEW model of the Bulgin Type SW 59 stand-off insulator is now available at the same price as the model it replaces, namely, 1s. The stem is hollow and is moulded in a new low-loss bakelite and capped by a large terminal fitting into a castle-head wire-grip. It measures 3 1/2 in. high.

A multitude of uses can be found for this insulator, but possibly



New model Bulgin Type SW59 stand-off insulator.

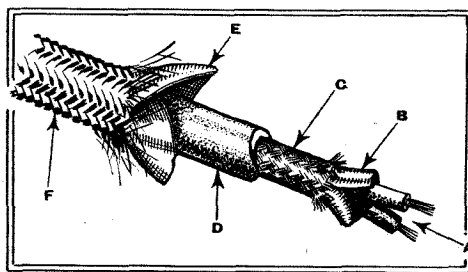
its most useful field is in short- and ultra-short wave sets, more especially the latter, as, owing to the very high frequencies involved, coils and the like often need to be raised well above the baseboard or chassis.

### INSULATED TWIN CABLE

A SPECIMEN length of twin-cable in which the braided metal screening is totally enclosed and insulated by a thick covering of rubber has been submitted for examination by J. Dyson and Co. (Works), Ltd., as being suitable for the input leads to the Universal Gramophone Amplifier described in *The Wireless World* of January 24th last.

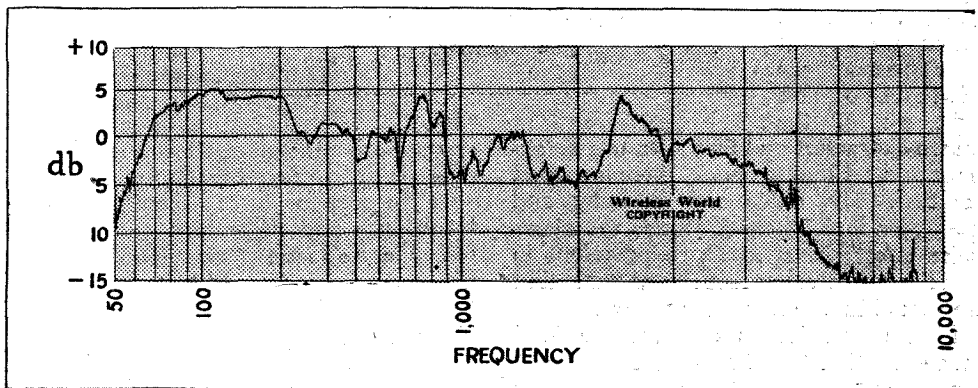
It will be recalled that as the chassis is at mains potential the exposed metal screening on the cable could not be earthed directly and that a condenser should be interposed.

The cable submitted by Dyson and Co. is made especially for occasions such as this, and as its capacity is not unduly high, the measured value between one conductor and



Dyson insulated screened input cable. A = conductors, B = inner cotton covering, C = screening, D = outer rubber covering, E = vulcanised cotton tape and F = braided cotton finish.

screening is about 40 m-mfds. per foot and a little less between both wires, reasonably long leads can be used without appreciable loss in the treble.

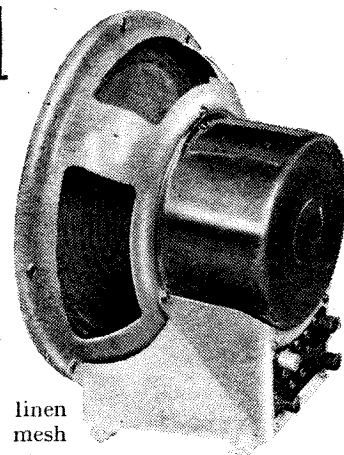


Axial response curve of Grampian "Pantone." Microphone distance 4ft., power input 1 watt.

As it is well insulated the screening can be connected direct to the chassis. The price is 2s. per yard.

### GRAMPIAN "PANTONE"

AN unusual form of diaphragm construction is employed in this speaker. The main cone is reinforced at the apex by one of smaller size, and the back of the cone is



Grampian "Pantone" loud speaker.

covered by linen of open mesh which has a strengthening effect and reduces the tendency to the formation of nodes at high frequencies.

The response curve shows that the output is free from major peaks and does not deviate more than ± 5 db. between 55 and 4,500 cycles. An unusually free cone suspension has resulted in a well-maintained bass output which is free from appreciable harmonic distortion.

A nickel-aluminium permanent magnet provides the field and a multi-ratio transformer suitable for all types of low- or high-impedance output is included. The price is 2 guineas and the makers are Grampian Reproducers, Ltd.

## The Radio Industry

IN preparation for next season's activities, four new bays are being added to the McMichael factory at Slough.

Radio Manufacturers Service, the organisation created by Philco, celebrates its first birthday with a special issue of the "Philco Serviceman."

Union Radio Co., Ltd., are shortly moving into new and larger premises in Aurelia Road, Croydon (off Purley Way).

Higgs Motors, Ltd., Birmingham, 6, have issued a new list dealing with electrical motors of many different types.

The 1936 edition of the "Broadcaster" Trade Annual has now been published at 5s., post free (trade circulation only). In addition

to the usual directory sections, helpful data are given for testing sixty popular receivers, and there is a great deal of other information, both technical and non-technical, for the wireless trade.

An electric engraving tool, available either as a battery or mains-driven model, has been introduced by Runbaken Products, 280, Deansgate, Manchester, 3.

# The GIANT — VOICE OF THE ANNOUNCER



## Why Amplified Speech is So Different

By N. W. McLACHLAN, D.Sc.

EVERYONE who visited the last National Radio Exhibition at Olympia heard the giant voice of the announcer. It filled every corner of the vast building and echoed hither and thither. Although every word he said was intelligible, the quality of the speech differed entirely from that of the original. In fact, the comparison was grotesque. The normal speaking voice seemed to have suffered considerable distortion, for the low tones were far too powerful to be pleasant for the listener. Here and there in the show critical listeners commented on the Gargantuan voice, and whispered that there must be distortion somewhere in the system. Those who have radio sets—and who is there amongst you that can deny possessing one!—know from experience that it is merely necessary to turn up the volume sufficiently to reproduce this booming type of speech. Although the reproduction of music does not seem to be spoiled very much, speech sounds entirely unreal. If, when we are at a cinema, we listen to the speech of the

screen characters and then turn to a neighbour and get him to speak, there is a great contrast. His voice sounds puny and relatively high pitched. Since the giant-voice effect seems to be so prevalent in speech reproduction, it is natural that we should like to know the reason.

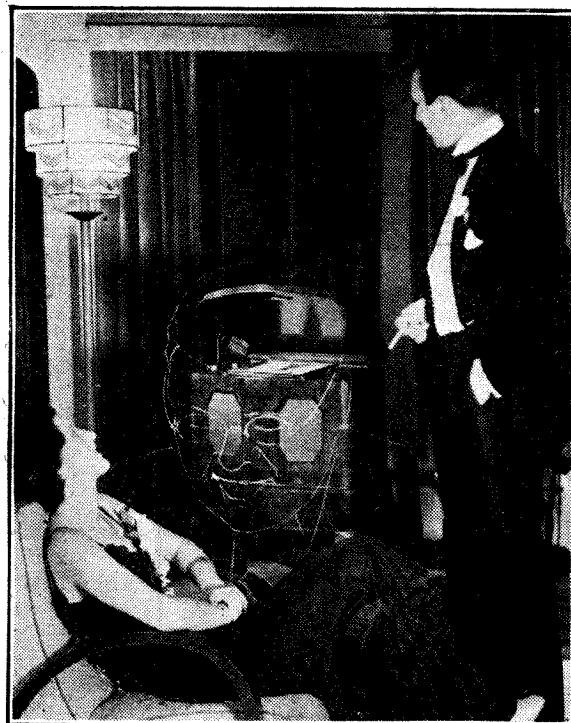
First of all let us consider the loud speaker. If it is a hornless, moving-coil type there is always a low-frequency resonance due to the centering spider and the outer surround. When the diaphragm is pushed inwards and released, it comes backwards, due to the spring effect of the spider and surround. If tapped by hand it may emit a low-pitched note, unless this happens to be below the audible limit of about 25 cycles per second. When this resonance frequency lies between 40 and 200 cycles per second, speech at even a

moderate level is reproduced with a superfluity of bass, due to the resonance of the diaphragm. The lower the level, the less noticeable are the bass tones. Even at a level equal to that of the original in the broadcasting studio, the speech is inclined to be too low pitched. Unless additional evidence were available, we might conclude that the unnatural deep tone of the giant voice was due to loud speaker resonance alone. To elucidate this point let us suppose that we have a horn-type speaker which cuts off all frequencies below 100 cycles per second and is known to have no low-frequency resonance. Broadcast speech from a studio is reproduced in an ordinary room at a level, say, from

15 to 30 decibels higher than that of the original. The giant effect is undoubtedly there still, despite the lack of loud speaker resonance. This seems to show that although the resonance of the hornless speaker accentuated the low tones, it is not entirely re-

sponsible for the giant effect. Part of the effect is due to reverberation in the room.

In the open air, or in a room with heavy furnishings and near thick curtains, ask someone to speak in your ear (not whisper) to give a normal level. Then ask them to say the same words at a distance of six feet from you, the level at your ear being the same as before. This means that in the latter case the speaker's voice will be about its normal level, whereas in the former it will be less. With a fairly deep-voiced speaker the low tones are relatively more powerful when he is right at your ear than when he is six feet away. When a person speaks near a microphone in a highly damped studio the same effect occurs. In the case of plays or excerpts from theatrical productions, where the speaker is some distance from the micro-



phone, the low tones are usually less powerful. One notices, too, that the low tones of the same announcer are less powerful at certain times than they are at others, doubtless owing to changed conditions at the transmitting end. Even if we stand some distance from the microphone, to reduce the low-tone effect caused by lowering the level of the voice, and reproduce speech using the aforementioned horn loud speaker, the giant still looms up largely. The effect does not seem to be caused by the reproducing system, so we must seek another avenue of approach in order to solve our riddle.

### The Explanation

The curves of Fig. 1 show the relationship between sound intensity and level at various frequencies within the audible range.<sup>1</sup> They can be regarded broadly as sensitivity curves for normal ears. Consider the curve marked O. This represents the lower threshold of audibility. Any tone whose intensity falls below this line cannot be heard by a normal person. It will be seen that the intensity level at 1,000 cycles per second is marked O, this being regarded as the datum or reference level. The intensity level at 90 cycles per second is 40 decibels above this reference level. This means that when a tone of 90 cycles per second is just audible, the sound output is 10,000 times that required at 1,000 cycles per second. It follows, therefore, that near the threshold of audibility the ear is extraordinarily insensitive to low tones. The level of normal conversation is approximately 60 decibels above the threshold of audibility. Here the intensity levels of the equally loud tones of 1,000 and 90 cycles per second are 60 and 73 decibels, respectively, above the datum. The interpretation of this is

<sup>1</sup> Fletcher and Munson, Journal Acoustical Society of America, 6, 59, 1934.

*AFTER fifteen years of broadcasting we still have to submit, at times all too frequent, to the presence in our homes of a giant who suddenly shouts at us from the loud speaker. In this article the author explains why this change in volume is so distressing to listeners.*

**The Giant Voice of the Announcer—**

that if the two tones are sounded consecutively by a loud speaker, then for equal loudness the (sound) power in the 90-cycle tone exceeds that in the 60-cycle tone by 13 decibels. In other words, the sound power at 90 cycles per second is twelve times as great as that at 1,000 cycles per second, when an observer with normal hearing judges them to seem equally loud. Turning to the curves marked 80 and 90 decibels, we see that the ear is almost equally sensitive at 90 cycles per second and at 1,000 cycles per second. Consequently it can be stated broadly that the ear is uniformly sensitive over the frequency range 90 to 1,000 cycles to very intense sounds.

Coming back to experiment, let us tune in our receiver to the B.B.C. orchestra from Queen's Hall. Starting with an extremely low output, the intensity is steadily increased until it is equivalent to, say, 85 decibels on the chart of Fig. 1, this curve being midway between those marked 80 and 90 db. During this volume-raising process we have undoubtedly observed a complete change in quality. At first, when the output was quite low, the fiddles and piccolos and other high-pitched instruments were the only ones audible, there being little or no trace of double bass and the like. As the volume increased, the bass instruments could be discerned, and finally, at 85 decibels, these instruments were there—well and truly. The complete aural transformation is, therefore, due to the variation in sensitivity of the human ear at different output levels.

The main reason for the announcer's voice taking on its giant type is, therefore, due to its being reproduced at an abnormally high level. If we wish the announcer to sound natural we must reproduce his voice at its natural level and without distortion being introduced by the loud-speaking apparatus. In public address work in the open air—especially at electioneering campaigns!—and in cinemas this is not expedient. Nor is it expedient in the average home, where different members of the family ventilate their views, not always at normal level. The voice level must be adequate to overcome the extraneous noises, so that it is bound to sound unnatural, due to the increase in sensitivity of the ear to low frequencies with rise in the output level.

Difficulties are sometimes experienced in cinemas, especially those fitted with reproducing apparatus covering a frequency range from 50 cycles per second upwards. Although the acoustical damping of the cinema may have been adequate to deal with the narrower range of 100 to

4,000 cycles per second, the extra octave in the bass register may introduce undue low-frequency reverberation, which is extremely unpleasant for the listener. If a film is not well recorded and lacks high tones, the reverberation at low frequencies may reduce the intelligibility seriously. To overcome this, a zealous operator may increase the level, with the result that it merely makes matters worse, owing to the increased sensitivity of the ear to low tones. Since these tones now appear relatively louder to the listener than before, they mask the higher tones, which convey the intelligibility characteristics in speech and music more than ever. Consequently when intelligibility is low, due to the above cause, the volume should be reduced, not increased. If reduction in

volume does not effect a cure, then something has to be done about it by way of cutting down the bass register.

It is suggested, therefore, that at the next Radio Show an electrical network should be included in the reproducing system, so that, although the level of the voice is adequate to drown all the tittle-tattle in the auditorium, it shall not be projected with a surfeit of low tones. Intelligibility would be enhanced and listening made more pleasant. A somewhat similar suggestion might be made with regard to many announcements in broadcasting, where the giant's voice is often to the fore. When the volume control is set for programme reception (music), it ought not to be necessary to reduce it for speech.

# Portable Boom in Germany?

Revelations at the Leipzig Fair (By Our Special Correspondent)

ORDINARILY the Leipzig Spring Fair does not show many new developments in the design of German broadcast receivers, as most of the firms prefer to wait until the August Radio Exhibition before placing new models on the market. This year visitors to Leipzig have had a surprise. The usual policy had been upheld regarding ordinary receivers, but all the

"straight" set and weighs about 28 lb. It has been designed to serve as a portable as well as a home battery receiver. It is housed in an ordinary shiny black leather case which can be entirely removed.

The set of five valves for this receiver costs over Rm. 50, so that readers will understand the reason for the comparatively high prices. Braun, of Frankfurt am Main, have produced a five-valve all-wave superhet portable selling at Rm. 240 in Germany, complete with valves and batteries.

The German Wholesale Traders' organisation arranged a competition for the design of a portable set some months ago. The results of this competition were published a few days before the opening of the Leipzig Fair, and it is understood that the best features of the prize-winning sets will be combined to produce a kind of "People's Portable Set" on the lines of the famous "Volksempfänger." Production, however, will probably be limited to the smaller firms, as the larger ones are apparently not interested in this type of set.

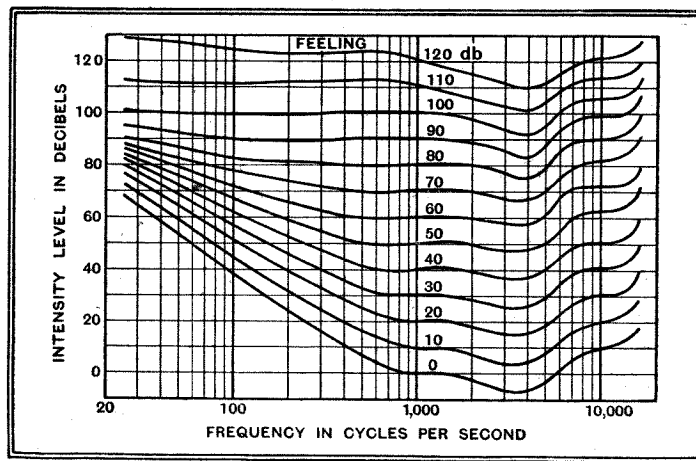
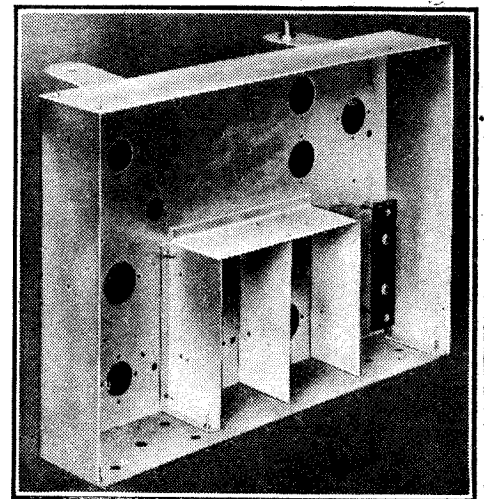


Fig. 1.—Relationship between sound intensity and level at various frequencies.

smaller firms had portable sets on view. Germany has never taken kindly to the portable, and in previous years there have been only one or two types which remained more or less popular.

Now that the German valve manufacturers have provided suitable 2-volt battery valves, the smaller firms have taken the plunge and hope to tide over the forthcoming summer season with the portable.

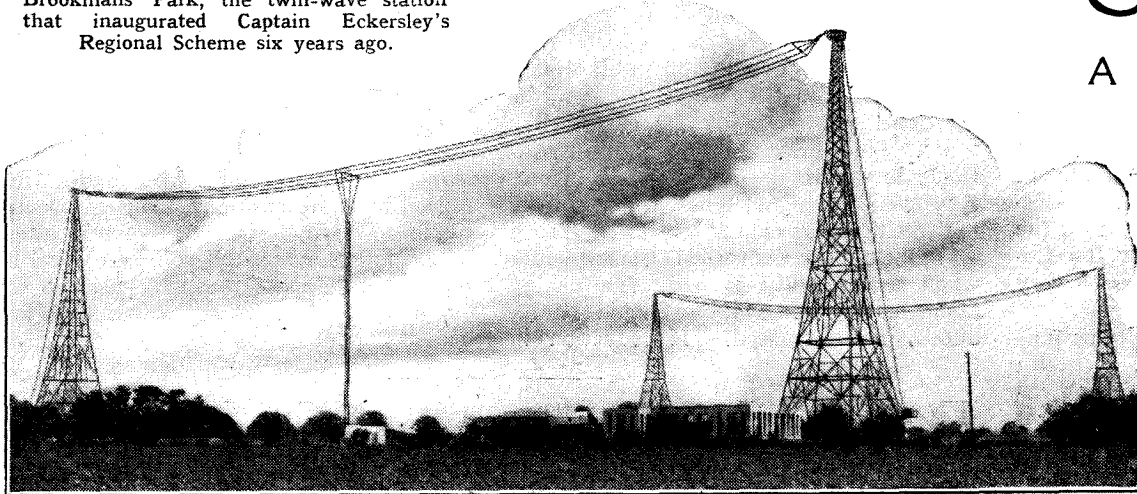
The new portables are, unfortunately, rather expensive, even for Germany. This is due to the contracts binding the German radio industry and to the sub-division of all radio receivers into price classes. The price of these sets ranges from Rm. 122.50 to Rm. 248.50. The cheapest receiver selling at Rm. 122.50 is manufactured by Lumophon, has three valves, and is of the single-circuit "straight" type. The price includes batteries and valves. The highest-priced receiver is manufactured by Owin, of Hannover. It is a five-valve three-circuit



This Scientific Supply Stores, Ltd. chassis for the QA Super is complete with screening partitions, brackets, and paxolin strip for the aerial circuit rejector condensers. All the necessary holes are provided so that no drilling is needed, while fixing screws and rubber mounting cushions are supplied. It is well finished and priced at 17s. 6d.

# Does Broadcasting Serve

Brookmans Park, the twin-wave station that inaugurated Captain Eckersley's Regional Scheme six years ago.



A REGIONAL TOUR OF

XII.—

## East Anglia and Brookmans Park

to Droitwich, and reducing its wavelength, has made reception so poor. Certainly I found that North

**L**INCOLNSHIRE was recently transferred from Midland to Northern B.B.C. administration, thus adding considerably to a Region already the largest in population, if not in area. The North Region gains a great agricultural county, with historical towns such as Lincoln and Boston, and with a coastline that includes the port of Grimsby and holiday resorts like Skegness and

Mabelthorpe. There are evident programme potentialities in Lincolnshire, but how they are to be exploited is an immediate problem.

One of the first results of the transference of Lincolnshire was heard early in February, when the Band of the R.A.F. College, at Cranwell, Lincs, broadcast from North Regional, instead of from Midland as they had always done before.

The Bishop of Grantham has joined the North Regional Religious Advisory Committee, and in other ways, as the North Regional Director said to me: "We are gradually making our contacts in Lincolnshire."

*Gradually* is the word. As I travelled through Lincolnshire I heard complaints that this county is not receiving sufficient B.B.C. attention (and, as a matter of fact, the same thing is heard in East Yorkshire, especially around Hull, a city of over 300,000 inhabitants which once had its own B.B.C. station, and now feels itself to be rather left out in the cold).

### A New Studio-Centre?

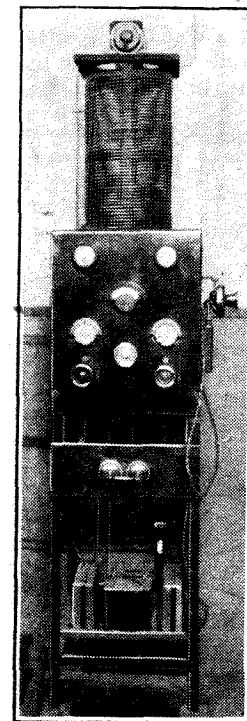
But I have already shown in these articles how the Northern staff has to race around between the Manchester, Leeds, and Newcastle studios in a strenuous effort to cover the North; so how they are going to find the time and energy to cover Lincolnshire as well is difficult to imagine, unless a fourth studio-centre with *adequate resident staff* is fitted out, either at Sheffield or Lincoln. This would also save Lincolnshire broadcasters long journeys to the microphone. The Cranwell Band has to travel 80 miles to the Leeds studios, and then back. The journey to Sheffield would have been 55 miles. At Sheffield, as I mentioned last week, a small studio, without permanent staff, is maintained, but this is not at present suitable for band performances.

The reason for the transference of Lincolnshire is that shifting the Midland transmitter farther away, from Daventry

Regional gives a much superior signal. A wireless trader at Lincoln told me that North is the only B.B.C. medium-wave transmitter which does not fade appreciably, whereas

Midland is the worst.

But as I motored on from Lincoln eastwards, over the wolds to Boston, I heard deteriorating reports of North reception. Evidently these few miles over the hills make a big difference. At Boston, on the shores of the Wash and 90 miles direct from Moorside Edge, the reports I gathered were that North is fairly good but cannot be relied upon not to fade and distort just when one is most enjoying a favourite programme. All the other Regionals fade persistently, so it is altogether annoy-



Sheffield's original transmitter—a n interesting relic of 1924.

ing. Only Droitwich National gives complete satisfaction.

From Boston I travelled on to King's Lynn, a town whose narrow streets, and Guildhall, and harbour are the very stuff of history—here King John granted the citizens a Charter in 1205, here Dr. Burney was organist and his famous literary daughter, Fanny, was born, here Eugene Aram served as an usher at the Grammar School and here was he arrested in 1758. Yet when, if ever, was this source of programme material touched?



A corner of King's Lynn—"a town whose narrow streets . . . are the very stuff of history . . . yet when, if ever, was this source of programme material touched?"

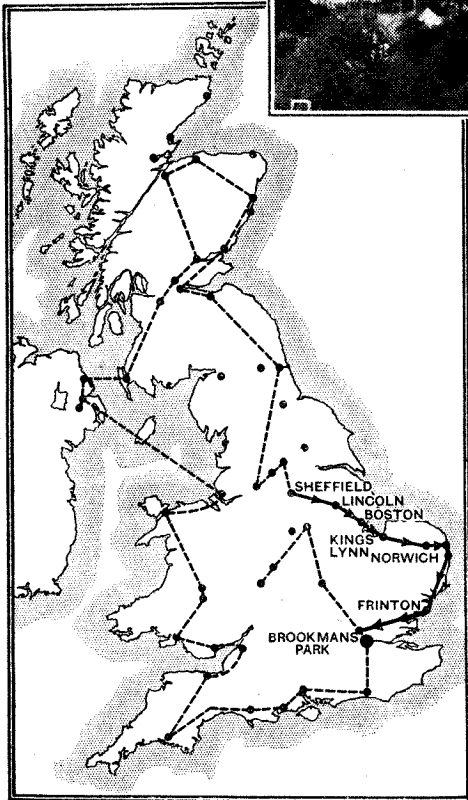
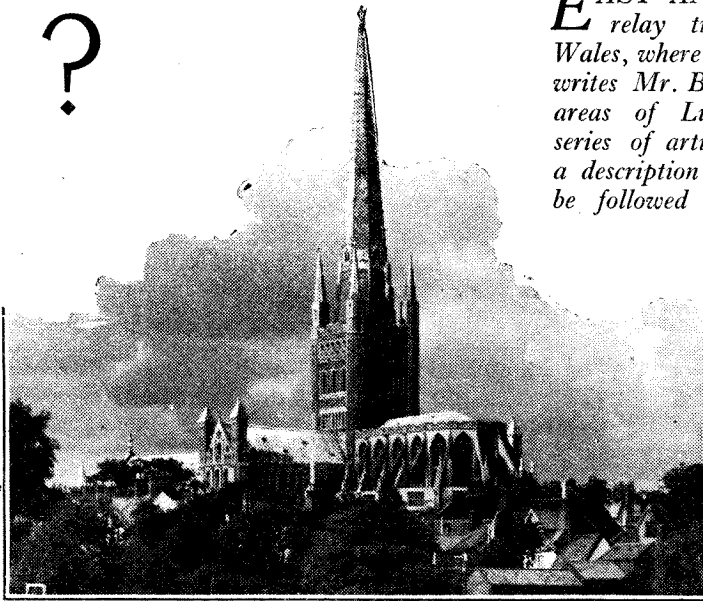


# Britain ?

## INVESTIGATION

By LESLIE BAILY

The city of Norwich is in the centre of the "neglected areas" of East Anglia.



The same question occurred to me when I reached the ancient cathedral city of Norwich. And when I came to the coast I wondered why holiday resorts like Yarmouth, Lowestoft, and Cromer are not tapped by the programme-builders. The North Region, with its relays from Blackpool and half a dozen other seaside resorts, has shown how these places can enrich the radio programmes. Norfolk is not in the North Region. I crossed the boundary from the North Region when I left Lincolnshire. What Region is this district in? Whose responsibility, for instance, to consider King's Lynn with a view to its radio exploitation? When I addressed these questions to the B.B.C. I was told that Norfolk comes in "the London Region." But that is farcical. From a programme point of view there is no London Region. The London Regional programme is merely a second kind of National programme; it bears no relationship (cultural, artistic, historical, or what you will) to the counties it is supposed to cover. There is no London Regional Director. No Regional staff is employed

to explore and exploit this great area. Hence, King's Lynn—Norfolk—the whole of East Anglia—is "no man's land."

This is deplorable enough, but there is the added misfortune of third-rate reception conditions throughout the whole of this territory.

### "Pernicious Fading"

At Norwich I had a talk with the manager of the local relay service, who has had to battle with the most pernicious fading and interference troubles in his efforts to give his subscribers a Regional alternative to the National programme (which, at least, nobody can grumble about). All the Regionals fade, and though North generally fades less than London, it is often jammed.

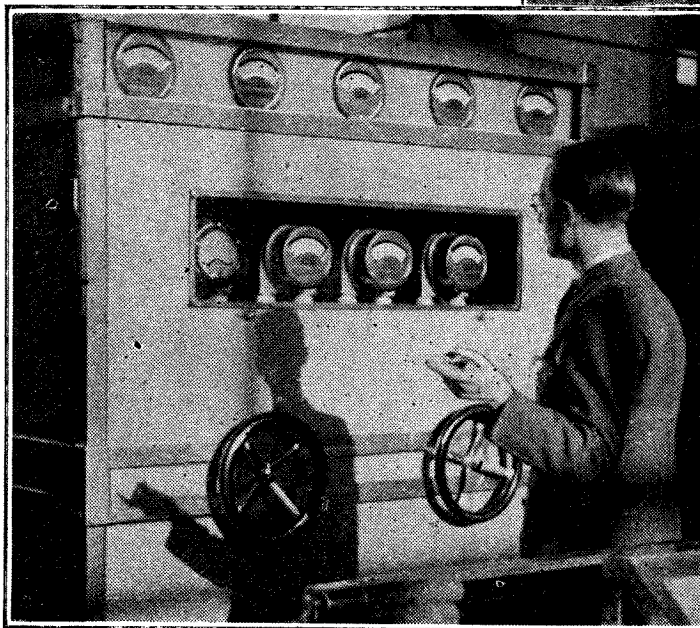
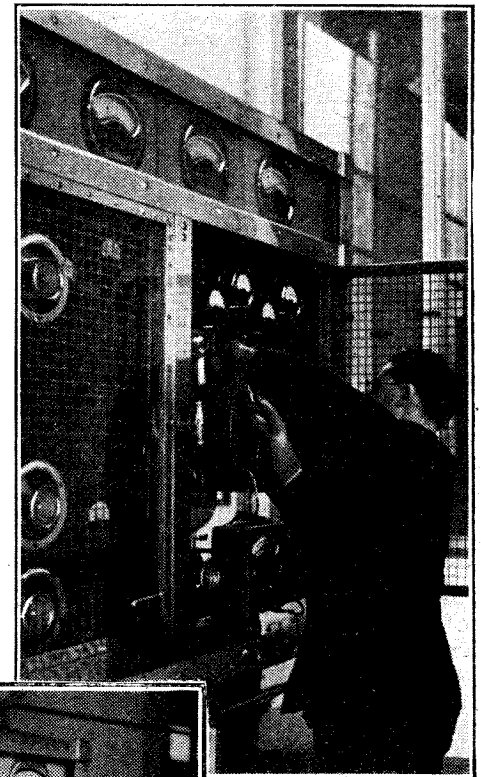
This is an interesting phenomenon—that the London Regional transmitter, 90 miles from Norwich, should give a service inferior to that from North Regional, 150 miles distant. Actually, I believe that the B.B.C.'s own field strength figures here show that London is slightly stronger than North, but on an ordinary receiver this

"*EAST ANGLIA has as much need of a Regional relay transmitter as North Scotland or North Wales, where such transmitters are now being built*" writes Mr. Baily in this survey of the badly neglected areas of Lincolnshire, Norfolk and Suffolk. The series of articles is brought to a close this week with a description of the Brookmans Park station, and will be followed in our next issue by a brief general review of the tour.

would hardly be noticed, and fading is certainly more pronounced on London. North, of course, has the advantage of a longer wavelength and higher masts.

I had the good fortune to meet the East Anglian traveller of a leading radio manufacturer, who told me that similar conditions are experienced over a wide area, from King's Lynn to Yarmouth and down the coast even farther south than that. Indeed, I found for myself that even at Frinton reception of London Regional is hardly satisfactory, though the distance is less than 60 miles.

So East Anglia must definitely go down

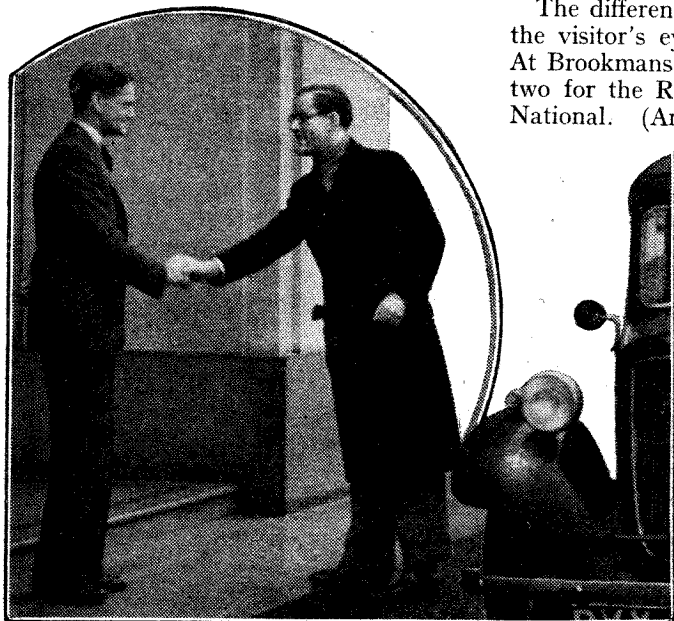


Two action pictures at Brookmans Park. In the upper illustration an engineer is seen adjusting the modulator stage of the National transmitter. (Left): An observer signalling to the control engineer during a modulation adjustment.

in my report as an area of inferior service. My own impressions have been strengthened since my return to London by a couple of letters from readers.

**Does Broadcasting Serve Britain?—**

Mr. S. C. Ceoghan, of Norwich, says that with a ten-valve set, one year old—"a quality job"—the distortion on Regional "makes AVC a doubtful blessing, while a large number of Continental transmissions arrive with equal or greater



The end of the tour. Leslie Baily, after having visited every transmitter and studio in Great Britain and Northern Ireland, takes leave of Mr. Lyne, Engineer-in-Charge at Brookmans Park.

strength and much greater reliability. Selectivity must therefore be of a very high order. Scottish Regional is the most useful of the British medium-wave stations."

Mr. C. L. Wolsey, of Yarmouth, writes: "We regard the Regionals as weak, difficult-to-get stations, jammed in between shiploads of kilowatts which come hurtling at us across the North Sea. Immediately after sunset the fading on all Regionals is so bad as to make reception hopeless for any set except one fitted with an extremely efficient AVC system. Even then distortion is sometimes so bad as to render speech quite unintelligible for about 30 seconds at a time."

**Wanted: A Relay Station**

East Anglia has as much need of a Regional relay transmitter as North Scotland or North Wales, where such transmitters are now being built. As the B.B.C. is giving attention to other areas, it can hardly delay much longer the modernisation of its service to eastern England.

So, down through Suffolk and Essex, I came to Brookmans Park—the first of the Regional stations and the end of my 2,000 miles journey, during which I have visited every transmitter and every studio in the country.

It seems only yesterday since Captain Eckersley's Regional Scheme was inaugurated by the world's first twin-wave station; actually, it is six years, as Engineer-in-Charge Lyne reminded me, and he has been at Brookmans Park since the beginning. In those years four other Regional stations have been erected, with

modifications based on experience at Brookmans Park, and the Regional scheme itself has been modified; but it is a testimony to the fundamental soundness of the London Regional design that the changes at the later transmitters were only in matters of detail.

The difference that immediately strikes the visitor's eye is in the aerial system. At Brookmans Park there are four masts, two for the Regional aerial, two for the National. (An interesting point, by the way, is that the Regional masts are earthed, but the National are insulated at the base—the reason for this is that when originally all masts were insulated it was found that absorption by the Regional masts badly distorted the National polar diagram, which was cured by earthing the Regionals.)

When North Regional was built, the second of the series, the masts were reduced to three, one of these being a common support for both aeri-als. At Moorside Edge, also, it was possible to go up to 500 ft., whereas at Brookmans Park the Air Ministry restricted the height to 200 ft.

At Scottish and West Regionals masts were further economised to two. And lastly, at the new North Ireland Regional, even the aerial wire is abolished, the single mast itself acting as aerial.

Apart from the provision of tuning-fork drive to synchronise London National on the same wave as North and West Nationals, and a Parkin drive to regulate London Regional's frequency to a  $\pm 10$  cycles constancy, there have been no changes at Brookmans Park in these six years until recent weeks, when a most interesting experiment was carried out.

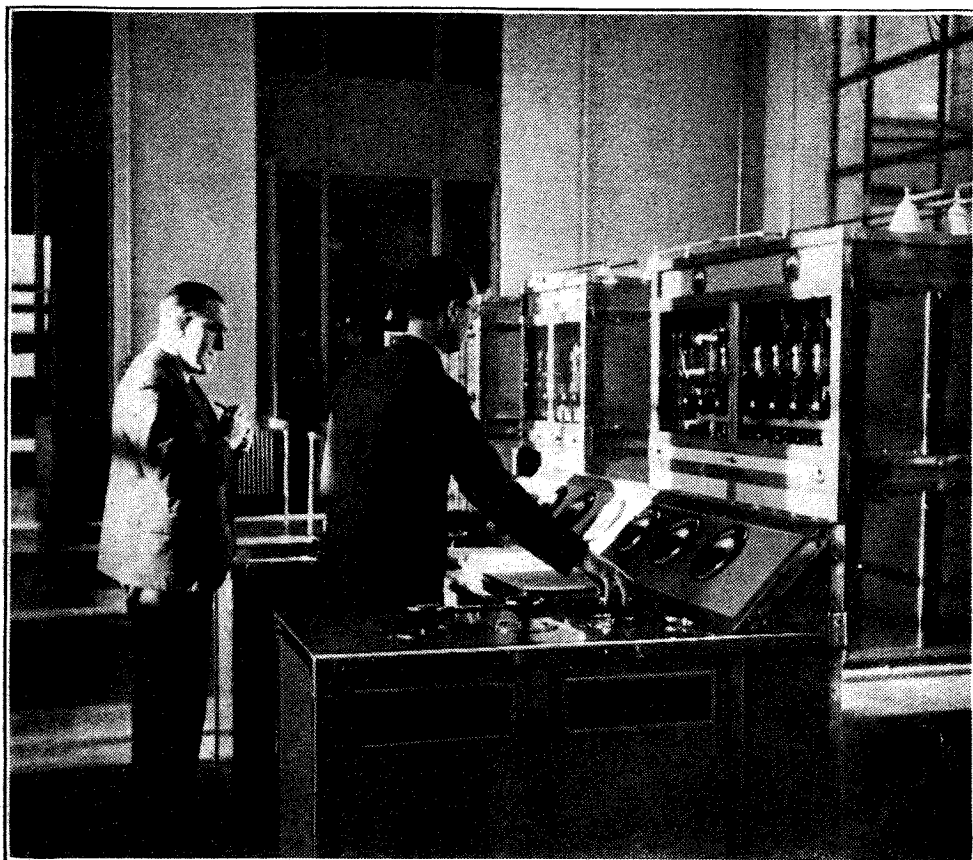
This was in the use of concentric feeders, instead of the old overhead feeder wires which run on 12 ft. posts from the transmitter building out to the feeder huts below the aeri-als. The concentric feeder system was tried out on London Regional.

Inside the transmitter hall the feeder tubes are brought to a closed circuit coil immersed in a bath of oil. Before the experiments started this oil had to be dehydrated by keeping it at boiling point for five hours—a sidelight on the odd jobs of B.B.C. engineers!

The whole thing was a "lash-up" when I saw it, but results were so satisfactory that apparatus had already arrived to make it permanent. It was as a result of these tests that the B.B.C. decided to have concentric feeders at North Ireland Regional, as I reported when I visited that station. The advantages as compared with overhead wires are higher efficiency and freedom from static interference.

Concentric feeders are very expensive; but I gather that London National will also be so equipped, from which it would appear that the recent notion of closing this transmitter down has been definitely negated.

*(To be concluded with a summary.)*



Applying H.T. to the drive valve of the Regional transmitter at Brookmans Park.

# THE RADIO GRAMOPHONE

## Reproducing Records Through the HF Circuits

By  
"CATHODE RAY"

THE expression "radio-gramophone" is one that does not appear in the family dictionary (the one grandfather carried away as a prize from school), but is generally understood to refer to a combined radio receiver and electrical gramophone. Though a more seemly term than the American "combination," it is not entirely free from ambiguity, for it might be taken to refer to a gramophone worked by radio. The reply would be that one does not work one's gramophone by radio. The counter-reply might be an enquiry as to why one does not work gramophones by radio, seeing that in certain circumstances it is quite a good thing to do.

The vast majority of receivers are believed to be fitted with terminals or sockets for a gramophone pick-up; consequently, it is a simple matter, having a pick-up, a motor, and something to hold them together, to convert the receiver temporarily or permanently into a radio gramophone. Of those that lack this facility, some may be brought into service with a trifle more trouble by means of a valve adaptor. It is necessary, in this case, to find a touch of grid bias from somewhere to convert the detector into a satisfactory amplifier. There are still others—particularly among modern superhets—where the LF amplification is inadequate for a pick-up. Even where provision is made for "Gram.," one sometimes runs into unexpected spots of bother, long leads from the pick-up introduce severe hum—particularly so if the obviously most convenient portable "playing desk" is adopted, with the unfortunate concomitant of a trailing flex lead. Another minor imperfection—again, most likely to occur in modern receivers—is a very marked disparity between the tone of radio and that of gramophone reproduction. The LF end of the receiver is usually designed to compensate in some measure for the sideband cutting necessary to fulfil modern standards of selectivity, and may not make at all a good yoke-fellow for a pick-up.

When one or more of these circumstances exists, the use of a radio link is at least worth considering. Perhaps an oscillator already forms part of the experi-

mental equipment. If not, it is a simple enough thing to rig up. I am not going to give detailed constructional information for making up a specific design of radio link, because it might not be considered worth the trouble and expense of buying special components. Even a small store of superannuated parts is likely to furnish all that is necessary if the circuit is made to fit them.

### From Playing Desk to Receiver —a Miniature Transmitter

The link consists of almost any valve oscillator capable of being adjusted to a wavelength within the range of the receiver. As it should not clash with any notable station, somewhere about 200-250 metres is a good choice for most people. A longer wave is not only less likely to find a quiet patch on which to be received, but requires more power for radiation. And the general idea is to have a midget sort of oscillator, costing next to nothing to run.

One could, of course, run the whole thing from the mains, connecting it in parallel with the mains-driven gramophone motor; but, considering that about 20 volts 0.5 mA. is about the probable HT power needed, it is likely to be much cheaper to run it from a small dry battery. There is rather more of a case for running the cathode from AC, as all that is required is a small transformer to step down to 4 volts. Otherwise the battery valve with the lowest consumption is selected, and run off a 2-volt cell. Sometimes there is an accumulator that is past giving reliable service for a whole set, but is quite capable of feeding a single small valve. The Hivac "Midgets" are excellent, for they take only 0.06 amp.—the XL is particularly suitable. But, of course, if there is an odd "210" battery valve lying about—why, use it!

Almost any sort of oscillator circuit can be used; the familiar Hartley has the advantages of simplicity and of readiness of oscillation on low HT volts. Any medium-wave coil with a tap at or near the centre will do. It is not even compulsory to have variable tuning, but it is useful to be able

to dodge interference from prominent stations. Perhaps the best condenser is an ordinary trimmer, which will bring the wavelength just up into the usual medium band. But there is no reason except possibly bulk why an old tuning or reaction condenser—most of us have several relics of this kind—should not be used.

Lastly, there is the question of modulation by the pick-up. The usual magnetic type of pick-up giving an output of not less than a volt is assumed; rather different methods are necessary with piezo-

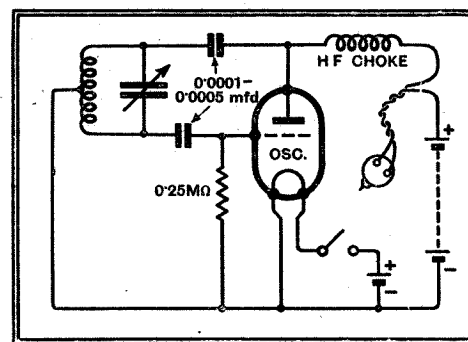


Fig. 2.—A circuit for high-quality modulation which, however, may require careful adjustment.

electric or electrostatic types. The obvious method would seem to be to connect the pick-up in the grid circuit, as in Fig. 1. For reasons which are too involved even for "Cathode Ray" to elucidate in a couple of lines, but which a cathode-ray tube shows admirably, this scheme is largely ineffective as a method of modulation. Any voltage introduced at this point merely stops and starts oscillation.

Very good, but unfortunately not very deep, modulation is obtained simply by connecting the pick-up in series with the HT battery (Fig. 2). If the receiver includes AVC it is likely that with such shallow modulation the volume will be rather poor. The modulation can be deepened by taking some care about the adjustment of the HT voltage, or else, and perhaps more conveniently, by using a variable reaction condenser in the oscillator.

### Almost Perfect Modulation

The really proper way of doing it, of course, is to have a "choke control" system, like a broadcasting station; but that involves an LF amplifying valve—again, the complication may be hardly worth it. But, if a "Westector" can be spared, there is an excellent method which gives almost perfect modulation of great depth, even with a relatively insen-

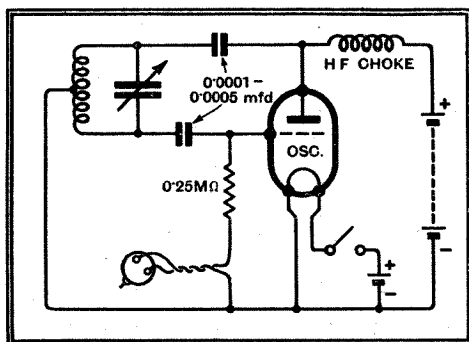


Fig. 1.—A simple, but rather unsatisfactory, method of modulating the oscillator.

tion on low HT volts. Any medium-wave coil with a tap at or near the centre will do. It is not even compulsory to have variable tuning, but it is useful to be able

**A Radio Gramophone—**

sitive pick-up. Fig 3 shows the circuit, which should be followed fairly closely in its details. However, scratch filter or tone-correcting devices may be connected in the usual manner in relation to the pick-up and volume control, that is to say, generally between them. This circuit is an interesting one for readers who may want a modulated oscillator for test or other purposes.

When the oscillator is set going, try to pick it up on the receiver, which had better be not more than a foot or two away for a start. It is advisable to disconnect the aerial, and, to make it easier to establish contact at first, trail a short wire from the aerial terminal across the oscillator. When you have "found the place," it is likely that the short lead from the set to the aerial earthing switch will receive the gramophone oscillator within a radius of a few yards. The power of the oscillator should be not greater than this, for

obvious reasons (including those not unconnected with Post Office officials).

Suppose it has been picked up on, say, 210 metres, it is wise to tune the receiver around 420 just to make sure that it is not the second harmonic that was heard.

By taking the aerial lead-in into another room where the radio gramophone link is established, one has the material

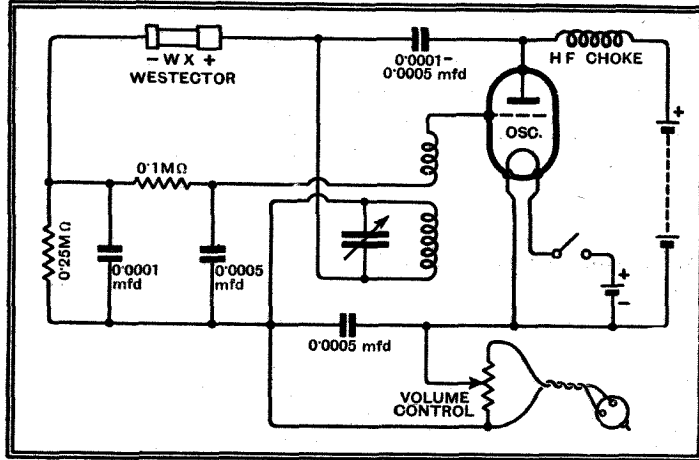


Fig. 3.—A method of obtaining almost perfect modulation of great depth.

for amusing stunts, causing innocent (we hope) deception and mystification. This feature is in addition to the more virtuous advantages I have already outlined.

## Letters to the Editor

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

**Transmission Quality**

IS not much of this criticism of the quality of B.B.C. transmissions rather futile?

The listener's uncalibrated receiver is pitted against the skilled engineering of the B.B.C. On a mass-produced receiver Henry Hall's band sounds "tinny," so the B.B.C. must be wrong! Is not the whole idea presumptuous?

The utmost that can be done, obviously, with a set of which the exact frequency response is unknown, is to compare transmissions among themselves. For instance, I might say that, as heard in the London Regional programme, the Midland, Northern and Scottish Orchestras are weaker in bass than the various sections of the London B.B.C. Orchestra; also that the Liverpool Philharmonic Orchestra at Liverpool, as heard in the same programme, has not quite the breadth of tone given by the B.B.C. Symphony Orchestra from the Queen's Hall.

When I hear someone suggest that the Wireless Military Band is lacking in bass I am astounded. It has always seemed to me that this is one of the combinations that consistently give a realistic account of themselves through the loud speaker. I always delight in the bright tone of the wood-wind reeds, the breadth of tone of the low brass, not to mention the drums, which always seem in the right proportion.

Neither can I endorse the criticism of the B.B.C. Theatre Orchestra on the same grounds.

Our disagreement is due, no doubt, to differences in our receivers, probably in the

loud speakers: I have an old 6-10 volt field moving coil speaker capable of handling a greater volume than can be listened to with comfort; the modern tendency in speakers is, I believe, to exaggerate the upper register.

W. E. ELLIS.  
East Sutton, Kent.

IT gives me much pleasure to see that so much more interest is now being taken in the subject of B.B.C. transmissions. Apart from the question of balance and control, which will always be a controversial matter, it is quite clear that the new B.B.C. studio acoustics are far from satisfactory.

This may be due in part to the more extensive use of ribbon microphones, which require a good deal of experience in setting up. Some comment has been made on the subject of excessive echo; a ribbon microphone is alive on both sides, and in the type used by the B.B.C. the corrugations are liable to act separately as local collectors of echo from almost every angle, thus magnifying reflected sound disproportionately to the source of sound.

I have been using ribbon microphones for five years for recording, and experience has led me to abandon the corrugated ribbon for a straight one of much less weight. It will be appreciated that with a microphone having a ribbon thickness of 0.001 in., the corrugating tends to over-energising by the higher frequencies, since the total mass of the B.B.C. ribbon is quite high; this is an explanation of the disproportionate treble which is a feature of the present trans-

missions from this type of microphone. On the other hand, the increase in area increases the sensitivity.

My microphone has a straight ribbon of only 0.0035 mm. in thickness, and the frequency response is excellent, the resonant point being at 3 cps. Moreover, means are employed to neutralise cavity resonance and a cross-section of only 1 in. is presented to the source of sound.

The response of ribbon microphones is adversely affected by tilting them. The B.B.C. microphones are, in my opinion, too sensitive for orchestral or dance band work, and with regard to the question of balance an improvement may often be effected by placing some of the instruments on one side of the ribbon, and some on the other.

I should like to mention the poor quality of the gramophone record transmissions; constant chatter and some distortion suggest that an unsuitable type of needle is employed; and it must not be forgotten that unless the turntable runs dead true the diagonal swing resulting from a rise and fall simultaneously with rotation will adversely modulate the output from a needle armature pick-up. RECORDING SUPERVISOR.

London.

**Wavebands**

REFERRING to the paragraph, "Short or Ultra-Short?" in "Current Topics" of the February 14th issue, it is interesting to note that the British Admiralty divides the radio-frequency spectrum as follows:—

Below 100 kc/s ..... Low frequency.  
100—1,500 kc/s ... Medium frequency.  
1,500—6,000 kc/s .. Intermediate frequency.  
6,000—30,000 kc/s High frequency.  
Above 30,000 kc/s Very high frequency.

which almost coincides with Rule 186 of the American F.C.C. Regulations. If there is a big difference between the British and American ideas on this subject, what official body is responsible for the British opinion?  
Southend-on-Sea. A. W. STEPHEN.

**The Radio Companion**

HAVING just constructed a "Radio Companion" (W.W. 25.10.35), I feel I must congratulate you and the designer on the most fascinating little gadget imaginable. Its construction alone is a lesson in the art of getting a quart into the proverbial pint pot, and its performance has been in no way overrated. For instance, it will receive here by daylight London Regional, Paris P.T.T. and Poste Parisien, while Fecamp comes in at "phones-on-table" strength of former days. After dark any station of 50 kW. or over within nearer Europe seems to be attainable, though perhaps Rome and Frankfurt are the high-spots so far.

I hope the following notes on construction will not be reckoned superfluous:

It is not easy to secure the hinged back to the small amount of thin ply wood available in the frame; I have found two pieces of wire threaded 6BA. passed from this in the extreme corners through holes in panel and secured by small terminal nuts quite satisfactory.

It is a good plan to use a little sponge rubber to pack the batteries in position.

Lastly a curious point; I covered the frame and back with some motor car hood fabric I had on hand (rexine or similar) and made a handle of same for carrying. The set was extremely "touchy" even for a frame aerial; this was, I found, due to the fact that this material is conductive to the extent of roughly 1,200 ohms per sq. in.



On replacing the covering by one of thin "skiver" leather good behaviour has been established and one can now give it an approving pat without a squeal of protest.

With thanks for the continued interest *The Wireless World* gives me. G. A. T.  
St. Leonards-on-Sea.

**Listening to Australia**

I THOUGHT perhaps some of your readers might be interested to know more about VK3LR. This station, which is apparently received well in England, broadcasts every day except Sunday from 10.30 a.m. to 2.30 p.m. G.M.T. On Saturday it opens early at 5 a.m. G.M.T.

VK3LR relays ordinary broadcast programmes from the Australian Broadcasting Commission's national station 3LO at Melbourne. In this way listeners to VK3LR often hear programmes which are being relayed to other national stations as far apart as Brisbane and Perth. The A.B.C., as the Commission is known, is very pleased at the results obtained with VK3LR. I think it uses only 500 watts, and is primarily intended for north and inland Australia and the nearer Pacific Islands, where our ordinary broadcast stations cannot regularly be heard.

The largest station at present in operation in Australia is a meagre 7½-kilowatt station at Crystal Brook in South Australia. However, in the south-west of Western Australia a new station is nearing completion. This giant (?) will use 10 kilowatts, and may, if necessary, be altered to use up to 60 kilowatts. Commercial stations in Australia (which we call B Class stations) are only permitted to use 1 kilowatt if in a city, or, if in the country, two kilowatts. What a difference from Europe and America!

J. D. PICKERING.

Cottesloe, W. Australia.

**Deaf-aid Components**

WE notice from your correspondence columns that Mr. H. B. Houghton, of North London, complains that he experiences difficulty in obtaining a suitable microphone and midget-type earphones for use in a deaf-aid amplifier he proposes to construct.

As British manufacturers of all types of deaf aids, we shall be happy to assist Mr. Houghton if he will get in touch with us, and this also applies to any other of your readers who require deaf-aid component parts.

Very few of the deaf aids on the market are British made, and this is possibly the reason that Mr. Houghton has so far been unsuccessful in obtaining the components he requires.

Ossicaide, Ltd.,

H. INNOCENT, Director.

London, W.1.

**Short-wave Quality**

HAVING been a reader of your excellent paper for some years I have come to the conclusion that what *The Wireless World* says to-day others in the radio field think about later, and even the "powers-that-be" sometimes act upon suggestions made by you.

There is, however, one point on which I think a lead should be given before it is too late, and this relates to the new B.B.C. television service.

Surely, with the coming broadcasting of sound on the ultra-short wavelengths, bringing the opportunity of real quality repro-

duction at last as regards side-band width, it is not too much to hope that that anomaly the "control engineer" will be dispensed with at the outset?

Does not the new service afford a glorious opportunity for set designers and B.B.C. to co-operate, so that a known degree of automatic volume contraction at the transmitting end may enable the designer of receiving equipment to incorporate a standard degree of volume expansion in the receiver?

To introduce such a change in the present service would, of course, involve an unthinkable amount of difficulty owing to the unsuitability of receivers in use at present, but in the case of an entirely new service it would seem that every technical advance known to date should be embodied while design is in embryo.

Warrington.

J. A. MEACOCK.

**Programme Distribution**

I NOTE with interest in your editorial that the B.B.C. should put out considerably more alternative programmes and at the same time increase the power of their Regional transmitters. I quite agree with both these suggestions.

There is urgent necessity for some real alternative programmes. They have never yet truly materialised, and in particular it is scandalous that on Sunday afternoons all the transmitters of the B.B.C. should radiate nothing but the same programme.

It is very desirable, however, as far as

we in the West Country are concerned, that there should be a considerable increase in the power of the Regional transmissions before such alternative programmes can be of any real value. In this district there are only two B.B.C. transmitters, viz., Droitwich and West Regional, which can be received with any regularity, especially after sundown. Even when it can be received the West Regional is often useless because of the large proportion of Welsh material in its programmes, and owing to the hilly nature of the country and narrowness of the separation from powerful Continental transmitters only the most sensitive and selective sets can use the station consistently.

Droitwich is practically always reliable, but suffers occasionally from night fading and distortion. As a result, if we require any alternative to Droitwich we are compelled to turn to the Continent.

I do not know whether it is due to the high power used or to the type of aerial which has been erected, I understand, for many German and foreign transmitters. The fact remains that on most evenings German, Austrian and Italian transmitters can be received with very much more reliability than B.B.C. medium-wave stations.

It would appear, therefore, that an essential to truly alternative programmes is a considerable increase of power in all Regional transmissions, the erection of anti-fading transmitting aerials, and the retention, at all costs, of the Droitwich transmitter.

GRAHAM HUNT.

Torquay.

YOU invite the views of readers on whether the B.B.C. should regard all their transmitters as alternatives to the local and plan programmes accordingly. Here are mine.

I consider that, due to the state of their finances, the third programme could not be produced by the B.B.C. without detriment to the usual two. Further, they seem unwilling to spend more on programmes.

With the above in mind, I suggest the *status quo* is preferable to your correspondent's suggestion, due to the possibility of high-quality reproduction, in areas local to the transmitter, such as that in which I reside.

I have taken advantage of the high field strength of the Brookmans Park transmitters to use an insensitive receiver, just sufficiently selective to separate the twin programmes, coupled to a high-class loud speaker on a 6ft. baffle. (A small degree of tone correction and a whistle filter are used.) This replaced a commercial receiver; the (non-technical) family are unanimous that good reproduction of the B.B.C.'s material is preferable to a choice of many poorly reproduced programmes.

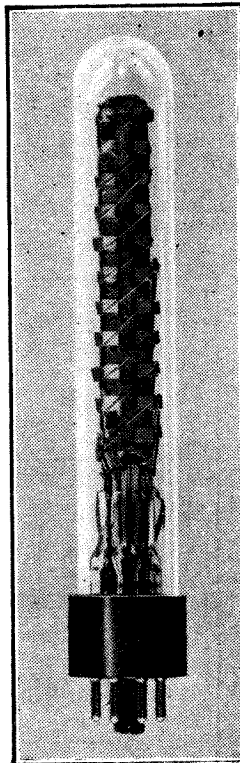
To adopt your correspondent's suggestion would prevent a receiver of the above type being used, and considerable elaboration would be required for the same results, if these could be obtained at all.

D. J. ROBINSON.

Harrow, Middlesex.

**Pioneers Join Forces**

OWING to the retirement of Mr. G. A. Huxley and Mr. T. G. Weaire, the business of Wright & Weaire, Ltd., together with the factory at Tottenham, have been acquired by Wingrove & Rogers, Ltd., makers of Polar condensers, etc. Mr. J. G. Wright will act as Technical Director, and the pooling of resources will result in the production of a comprehensive range of radio components by the combined Polar, Waerite, and N.S.F. firms.



The Electron Multiplier, invented by Dr. Vladimir Zworykin, is now on view at the Science Museum, South Kensington, the actual specimen being shown in the left-hand photograph. In the lower picture Dr. Zworykin is seen during a lecture given a few days ago in Berlin. Note the Electron Multiplier on the table in the foreground.



# Recent Inventions

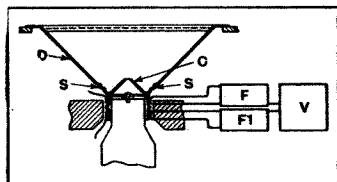
The following abstracts are prepared, with the permission of the Controller of H.M. Stationery Office, from Specifications obtainable at the Patent Office, 25, Southampton Buildings, London, W.C.2, price 1/- each

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

## LOUD SPEAKERS

THE diaphragm of a moving coil speaker is made in two sections, the first, which responds to the higher notes, consisting of a small cone C, say, of aluminium, mounted directly on the coil former. The second or low-frequency diaphragm D is made of stiff paper and is connected to the coil-drive through a corrugated strip S, which acts as a flexible coupling. The two diaphragms are driven through separate coil windings, which are fed through high and low pass filters F, F1 from the amplifier V.

The coupling-strip S is relatively rigid at low frequencies and transmits vibrations from the moving-coil to the diaphragm D up to and around 2,000 c/s with full effect.



Twin-diaphragm loud speaker.

But beyond 6,000 c/s it becomes so flexible as to be unable to transmit any drive to that diaphragm, which in consequence only responds to the lower notes.

Marconi's Wireless Telegraph Co., Ltd. (assignees of A. S. Ringel). Convention date (U.S.A.) 17th March, 1933. No. 439561.

## TELEVISION SYSTEMS

A METHOD of scanning is based on the fact that when high-frequency mechanical vibrations are applied, say, by a piezo-electric crystal or a magnetostrictive oscillator, to a transparent body, and a ray of light is simultaneously passed through that body, the light is subject to alternate acceleration and retardation as it traverses the regions of compression and rarefaction produced by the mechanical waves. By adjusting the frequency of the mechanical vibrations, the ray may be completely or partly extinguished, and so modulated.

The method can be used to scan a continuously-moving cinema film in such a way as to offset the movement of the film. In the same way a number of picture elements can be reproduced simultaneously on the viewing screen, thereby increasing the overall intensity of illumination. A system of television is also described in which all the signal elements corresponding to a complete picture are handled simultaneously, each "line" of the picture being superimposed on a different sub-carrier, which is then modulated on to a common carrier-wave.

Scophony, Ltd., and J. H. Jeffree. Application date 3rd March, 1934. No. 439236.

## BEAM AERIALS

TWO horizontal wires, each, say, eight wavelengths long, are mounted one above the other and are energised 90° out of phase, so that radiation is cancelled out in one direction. In the other direction two divergent beams are produced. The angle of deviation can be varied within limits by displacing the centre of one aerial relatively to the other. The vertical spacing is preferably not less than a quarter wavelength.

C. W. Hansell (assignor to Radio Corporation of America). No. 2017047. (U.S.A.)

## FILM TELEVISION

WHEN televising from a cinema film there is a danger, should the drive break down, of burning or warping the film by the heat from the arc lamp used for scanning. According to the invention provision is made for stopping the scanning-disc whenever the film stops and, in addition, the arc lamp or other source of light is immediately quenched.

M. A. Trainer (Assignor to Radio Corporation of America). No. 2017136. (U.S.A.)

## VALVE CIRCUITS

THE non-linear response of a valve amplifier is due, in part, to variations of plate resistance with changes of plate voltage, and also in the case of multigrid valves, to changes of amplification factor. In addition, when the grid is allowed to swing positive, serious distortion will arise from this cause.

The object of the invention is to offset such distortion by using a special kind of coupling-resistance which possesses a non-linear current-voltage response. The curvature of the valve and of the resistance element is then made complementary.

The coupling-element consists of porcelain clay mixed with fine particles of metal, the resistance of which falls off very rapidly with increasing voltage.

I. Wolff (assignor to Radio Corporation of America). No. 2017192. (U.S.A.)

## WIRED WIRELESS

RELATES to a system for distributing speech or music over line wires to a circle of subscribers. The signals are fed to the lines in high-frequency form so as to afford each subscriber a choice of programme at any time. The distributing network, which consists of existing power-lines, will sometimes be protected by metal sheathing, whilst other portions, such as the overhead lines and house-wiring, are not so screened.

According to the invention, in order to reduce interfering "pick-up" to a minimum, the current distribution in different parts of

the system is varied so that where the lines are already screened from induction the signals flow through a simple current with earth return, whilst in the unprotected parts of the system they are balanced with respect to earth.

P. P. Eckersley and R. E. H. Carpenter. Application date 26th June, 1934. No. 439747.

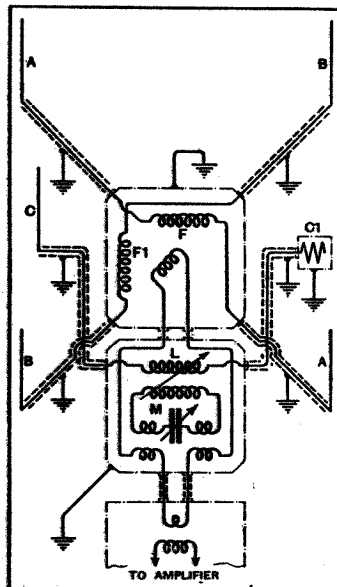
## REFLECTORS FOR MICRO-WAVES

ORDINARY wire-mesh is often used as a backing-reflector for aerials radiating waves of the order of decimetres, but is found to cause irregularities in the radiated field owing to the high-resistance contacts, and sometimes open-circuits, which occur at the crossing-points of the wire. These difficulties are overcome, according to the invention, by using a mesh reflector in which all the wires are separately soldered or welded together. Alternatively, the wire-mesh is prepared by spraying it with a metal coating.

Telefunken Ges fur drahtlose Telegraphie m.b.h. Convention date (Germany) 21st March, 1934. No. 439608.

## DIRECTION-FINDING

THE drawing shows a direction-finding aerial of the Adcock type in which two pairs of spaced vertical aerials A, A and B, B are connected by horizontal feed-lines to the two field-coils F, F1 of a radiogoniometer. A third aerial C determines the "sense" of the received signal by adding an out-of-phase component through the coil L and tuned circuit M.



DF aerial system to overcome phase variations.

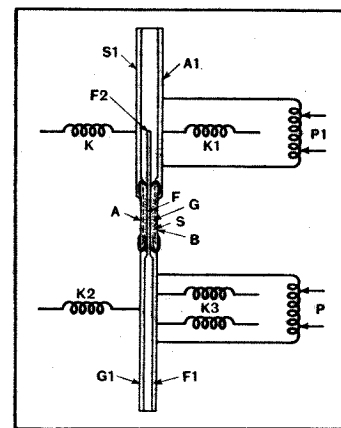
In order to avoid the phase variations which are liable to occur when this type of aerial is used for short waves, i.e., where the height of each aerial is comparable with the working wavelength, the sense-finding aerial C is "balanced" by a coil of wire Cr. This is screened so that it picks up no

signal voltage, but is otherwise similar in its electrical constants to the aerial C. Under these conditions the current flowing through the coil L will be exactly 90° out of phase with that flowing through the field-coils F, F1 for all signal frequencies. An additional 90° phase-difference is added by the tuned circuit M to bring the two currents into exact opposition.

R. H. L. Bevan and C. Cramp-ton. Application date 11th October, 1934. No. 439714.

## SHORT-WAVE VALVES

THE valve consists of a small bulb B with a central cathode F of large diameter, a control grid G, and a screening grid S. The



Schematic diagram of short-wave valve.

anode A forms the outer surface of the bulb. The control grid and cathode emerge from the lower end of the bulb as two tubular extensions G1, F1 which are made telescopic for tuning. From the top of the valve the screening grid and anode are similarly extended at S1, A1, with a prolongation F2 of the cathode between them. The drive coupling to the grid is shown at P, whilst the load is tapped off at P1. The operating voltages are applied to the electrodes through chokes K, K1, K2, K3.

J. Greig. Application date 24th August, 1934. No. 439755.

## VARIABLE SELECTIVITY CIRCUITS

A SUPERHET set is so arranged that by switching certain fixed condensers in the tuned circuits it can be operated at will either as a receiver accepting both side-bands, or as a circuit working on a single side-band only. The meeting and tuning controls are so arranged that the signal carrier lies to one side of the accepted frequency band.

The receiver is particularly suitable for television, where the received signals are usually of such high frequency that it is difficult to secure effective amplification. The circuit described is stated to have a gain factor of six per stage.

Marconi's Wireless Telegraph Co., Ltd. (communicated by Radio Corporation of America). Application date 10th October, 1934. No. 439528.

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

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## EDITORIAL COMMENT

### Making Ourselves Heard

#### Growing Importance of Sound Amplifiers

**A**LTHOUGH megaphone and other devices have been employed in the past to aid the human voice, it was really not until valve amplifiers were available that any serious progress in sound amplification could be made. Even then it was some while before amplifiers were applied to the purpose of increasing the intensity of the human voice so that large numbers of persons could be addressed by one individual or considerable distances covered by speech or music.

Public address equipment has to-day been applied so extensively to all kinds of uses that it is difficult to understand now what we should do without it. Still more surprising is it to find how slow people are to make use of it in cases where it is most needed. It is still missing from the majority of theatres and lecture halls, whilst only a very limited number of churches have so far adopted it.

With such great possibilities for expansion in view before anything like saturation is reached it is not surprising to find that a large number of firms are specialising in this type of apparatus, which is really a product of the radio industry.

In this issue we have endeavoured to give our readers some idea of the wide applications of PA equipment and a general guide to types of apparatus now produced by various makers.

Success in design and installation of PA apparatus depends mainly upon telephone engineering technique, although problems of acoustics which do not ordinarily trouble the telephone

engineer give an added interest to public address work.

We hope that this issue will be found an informative and useful introduction to the principles and practice of public address work and a guide to what is at present manufactured to meet these requirements, and whilst it cannot be claimed that this guide is an exhaustive one, it will nevertheless be found representative. Further articles and descriptions, which it is our intention to include from time to time in future issues, will keep the reader informed as to any new developments in this increasingly important branch of our subject.

### Broadcasting's Future

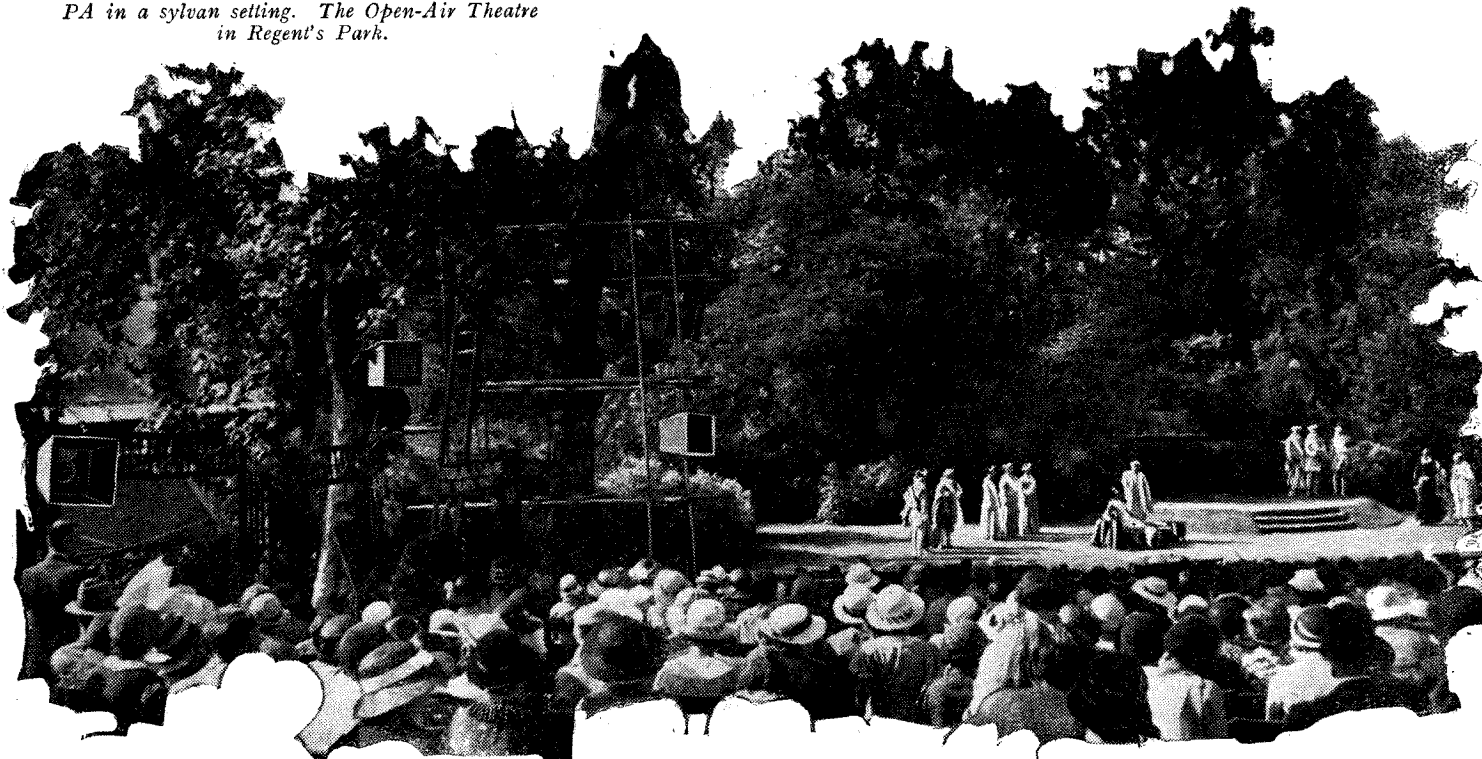
#### Publication of the Committee's Report

**T**HE long-awaited findings of the Committee appointed by the Government to consider the future of broadcasting have now been made public, and elsewhere in this issue we publish a summary of the Report, which is issued as a Government publication.

It will be recalled that the Committee, under the Chairmanship of Lord Ullswater, was appointed to consider what changes, if any, should be made in the B.B.C. Charter when it expired at the end of the present year. The Committee had an entirely free hand, and in theory, at least, could recommend a reorganisation of the very basis on which the broadcasting authority in this country has been built up.

The Report has only received publication just as we go to press, so that we do not propose to discuss it more than superficially in this issue, reserving our fuller comments for next week, when we shall have been able to examine in detail the proposals put forward.

*PA in a sylvan setting. The Open-Air Theatre in Regent's Park.*



# Addressing the Public

## TRIUMPHS AND TROUBLES OF THE PA ENGINEER

By E. C. THOMSON

**M**AN is not a noisy animal. His cry dwindles sadly beside the decibel-laden screech of the small parakeet, and compared with the sounds emitted by animals of much the same size as himself—the lion, the bigger types of dog, the hyena—his best vocal efforts are puny indeed.

And yet, for reasons too deep to go into here, man (both sexes) has always wanted to be heard. From the earliest ages he has had to "get it off his chest," so to speak, cupping his hand at his mouth and bawling to the gallery in the sheer effort to set the grey matter working in other brains than his own. In so doing he has sometimes excoriated his throat and even burst blood-vessels.

Many years ago science came somewhat feebly to his aid with the megaphone, a convenient means of concentrating vocal energy in one direction, but it was not until the introduction of valve amplifiers, microphones and loud speakers soon after the war that the throat lozenge industry really began to suffer.

Except, perhaps, in Hyde Park, on Tower Hill, and other

open-air speech grounds, the straining, salivating orator is seen (and heard) no more, for no public speaker can nowadays afford to dispense with the handy micro-

phone and ubiquitous loud-speaking equipment. With their aid the mildest of men can thunder his opinions across the Royal Albert Hall without endangering his dentures; hecklers are confounded, waverers are convinced, and virtue or villainy (strike out word not required) triumphs by sheer force of watts.

It was in this form that "public address" first came, like a fairy godmother, to give the human voice wings.

At first the politicians, preachers, after-dinner speakers, and other orators were just a trifle upset by the dangerous-looking contraption. The microphone was regarded not as a friend, eager to shout the good news from the rooftops, but as a nasty little eavesdropper and a magnifier of mistakes. These fears were not entirely groundless. In those days the combined system of microphones and loud



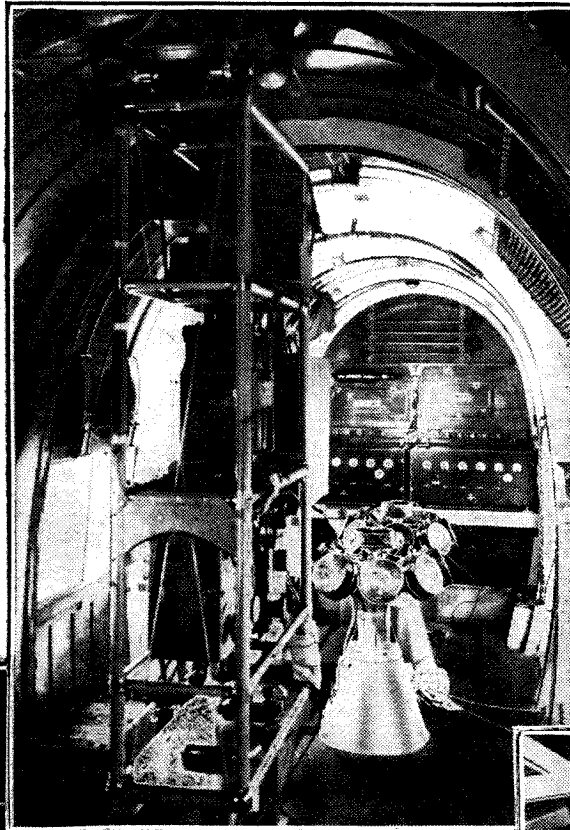
Public address in action at a recent pageant in Berlin's new sports palace. The control engineers in the foreground are using portable equipment. The microphones are supported on thin staves.



**Addressing the Public—**

speakers often suffered from feedback, or acoustic flatulence, and it was quite a common occurrence for a statesman's opening remark or cough to be immediately swallowed up in what sounded like the Last Trump, caused by interaction between the microphone and the loud speakers. Such incidents always cast a gloom over the proceedings and induced a sense of foreboding even after the public address system had been switched off.

As time went on this and other defects were overcome, so that today public address is used not only at banquets and other light-hearted gatherings, but in cathedrals and churches all over the country. The Marconiphone Company, besides equipping many Parish churches, has in-

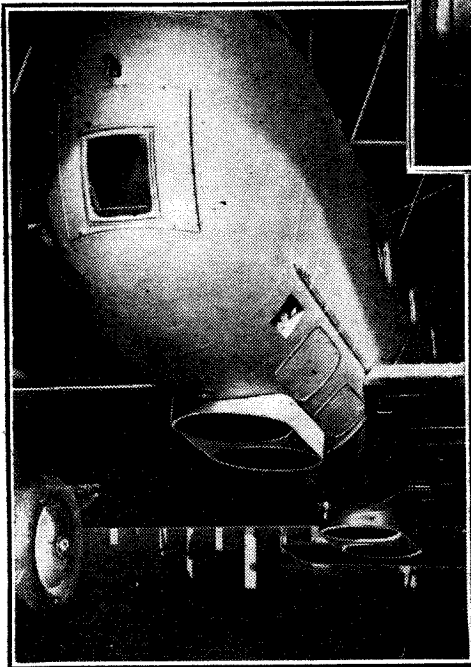


a "stage" measuring about 150ft. by 30ft.

Among the snags which had to be guarded against were the unrehearsed singing of the birds in the trees and the swish of the leaves in the wind.

**Nails as Gramophone Needles**

When the electric gramophone pick-up was introduced, the amplification of gramophone music was a natural sequel. Probably half the PA work carried out to-day is concerned with the diffusion of recorded music—at exhibitions, football matches, air displays, and on fair grounds. Sound equipment can be found on fair grounds all over the country. Unfortunately, not all showmen possess an ear for music, and some of them do not think that their amplifiers are earning their keep unless these are running "full out" all the time. The Tannoy engineers, who have to some extent specialised in fair ground PA, have had some amusing experiences. Not once, but many times, they have found a filed-down nail in place



Better than bombs. This Vickers-Valentia plane has been fitted with loud speaker equipment for addressing turbulent tribes on the North-West Frontier.

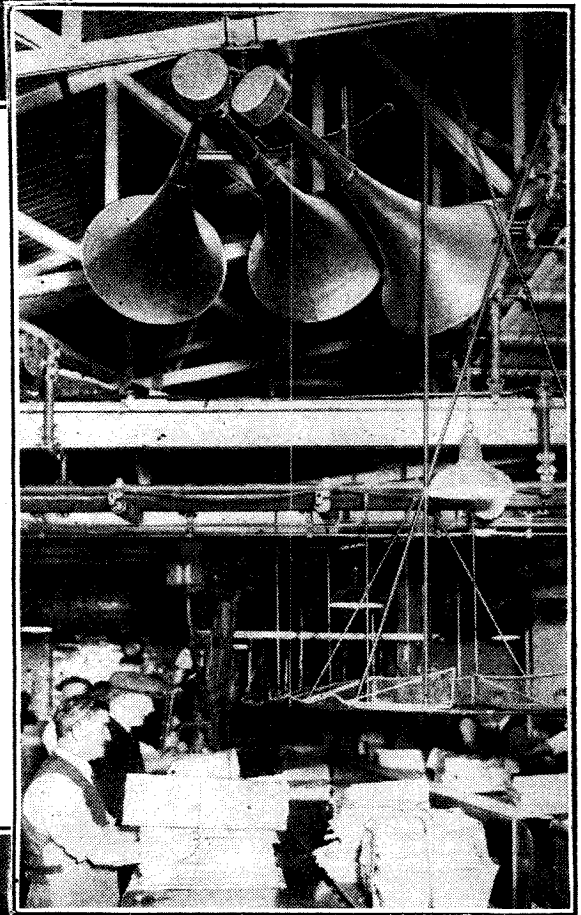
the medium of Blank's Patent Speech Propelling 50-watt Reproducers would have been frowned upon. The entire job had to be carried out with the art that conceals art, and it is a tribute to Trix that nothing marred the sylvan beauty of the scene, although every member of the audience was able to hear the words of the performers as they moved to and fro across the greensward. At most performances as many as fifteen concealed microphones were operated from the cunningly hidden control box, giving adequate coverage to

stalled PA in the Cathedrals of Truro, Exeter, Durham and Norwich, as well as in Bath Abbey, Sherborne Abbey and Brompton Oratory. Each building offers a separate problem to the installation engineers. It is a point worth mentioning that in public address systems of this kind the intention is not always to amplify the preacher's voice so much as to kill the echo which is nearly always prominent in sacred buildings.

**Art Conceals Art**

Indoor oratory, however, is not so difficult to cope with as the outdoor variety, in connection with which PA has scored its biggest triumphs to date.

In this department the palm must surely be handed to Messrs. Trix for the installation of the amplifying system at the Open-Air Theatre in Regent's Park. There was no opportunity here to "boost" the public address system for its own sake, and any attempt to inform the audience that Prospero's speech was coming to them through



Newspaper despatch made easy by means of amplifier equipment in the "Daily Telegraph" offices.



of a gramophone needle on a showman's equipment! Some showmen consider the life of a record to be at an end when the grooves have all disappeared.

On one occasion a showman's amplifier was sent back for repair, the complaint being that when the set was switched on, instead of music, a nasty smell was amplified.

When the amplifier was put on test the complaint was fully justified; the smell was indescribable and the test staff made for the door as one man. Eventually one

**Addressing the Public—**

braver than the rest (or with a less acute olfactory sense) returned, to find a dead rat cooking across the mains transformer!

Public address is a boon to the demonstrator. The General Electric Company, which is at present giving a series of mass cooking demonstrations up and down the country, is using its own public address system in a novel manner. Audiences of 3,000 are shown the advantages of electric cooking in spectacular style, one of the "draws" being cross-talk between two ventriloquial parrots on either side of the proscenium—the modern parrot and its old-fashioned antagonist.

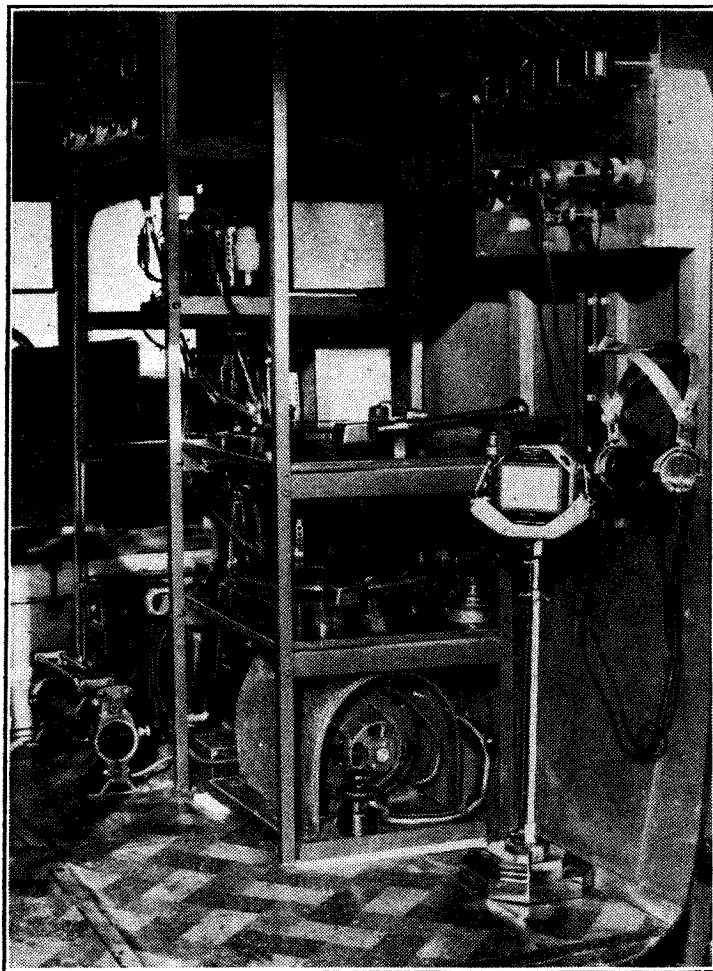
Marconiphone probably holds the record for the biggest public address relay ever staged. This was the occasion of the 1928 Schneider Trophy Race in Southampton Water. More than 12 miles of foreshore on the mainland and in the Isle of Wight

time whether to install loud speakers or a full-blooded cinema organ. The former won the day, and the hall now possesses a 70-watt amplifier and twelve loud speakers.

Thus far we have dealt with more or less straightforward examples of PA work. Of novel applications of PA there are so many examples that it is possible to enumerate only a few.

Besides installing a public call system at Euston Station, G.E.C. have fitted up an interesting microphone system in the night despatch

"I love the sweet church bell," sang the hymn-writer, nor, one imagines, would he have withdrawn his affection from the synthetic chimes which now draw worshippers in many parts of the country. Tannoy, Marconiphone, and



An outstanding example of public address van equipped by Messrs. Ross and Robinson, Ltd. The AC generator feeds three 10-watt amplifiers.

were "covered" by loud speakers. Every available loud speaker in the company's stores was commandeered. Twenty tons of amplifying apparatus were employed, and the number of people addressed amounted to well over 800,000.

The company's biggest "inside job" is the permanent installation at the Royal Spa Hall, Bridlington, which accommodates 2,000 dancers. One can gauge the magnitude of the work entailed from the fact that the management debated for a



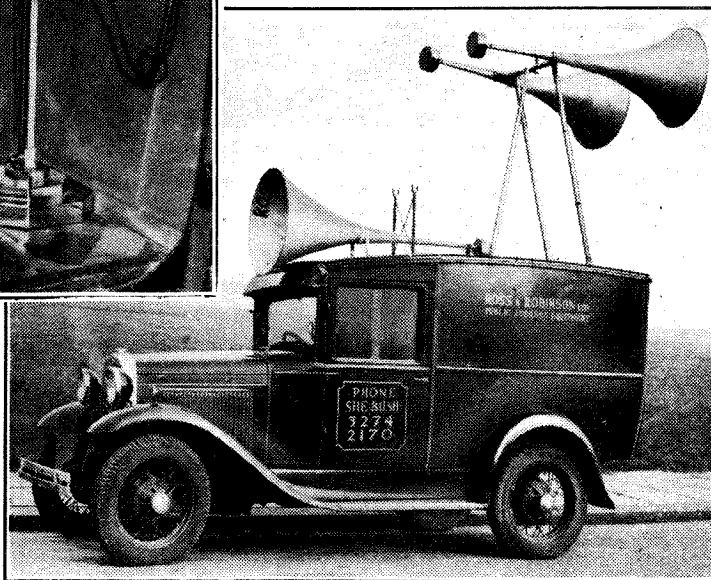
G.E.C. loud speakers give instructions to railway passengers at Euston.

offices of the *Daily Telegraph* in Fleet Street. The old-world method of bawling from the packing rooms to the delivery dock has given way to a system whereby the despatch chief murmurs gently: "One more packet for

other firms install gramophone amplifiers in the vestry, coupled with loud speakers in the belfry, with the result that the humblest village church can diffuse the loveliest of peals, rivalling the chimes of the great cathedrals.

In at least two cases amplification systems have been used at spiritualistic seances, and, according to persons present, the astral voices have made full use of the facilities accorded them. Many factory workers ply their tasks more hap-

pily to the cheering strains of amplified music; ships' loud speakers convey the band music to every part of the vessel; fire stations are fitted with "mikes" and speakers; night clubs use amplifying apparatus for reasons more or less obvious; a baby's cot has been fitted by Tannoy with a microphone to pick up the child's waking cry . . . and the list of unusual applications could be extended indefinitely.



Wolverhampton," or "No more for Birmingham," the instruction issuing in the same honeyed tones from a loud speaker three floors below. Thus "loud speakers" inculcate habits of quiet efficiency.

One of the most picturesque uses to which PA could be put is in the Sergeants' Mess at Chelsea Barracks—a job designed, presumably, to save parched throats when calling for "another."

# Wireless World PA Amplifier

## THE P-P.Q.A. MODIFIED FOR LARGE OUTPUT

By W. T. COCKING

FOR ordinary domestic requirements there is no doubt that an undistorted output of 4 watts is entirely adequate, even when the highest standard of reproduction is being aimed at. With modern high fidelity equipment designed throughout for a minimum of distortion in every stage an output of this order can be obtained with reasonable economy from a pair of PX4 valves operating in push-pull. It is, moreover, a truly undistorted output in that the input/output curve is a straight line until 4 watts is obtained in the output load. A somewhat larger output can be obtained with no more distortion than is customary in an output stage, so that a stage of this nature is best rated at 4 to 6 watts output.

For minimum distortion in the preceding stage, push-pull amplification is also desirable, as also is resistance-capacity coupling if both frequency and phase distortion are to be kept at a minimum. *The Wireless World Push-Pull Quality Amplifier* was designed on these lines, and its performance has so commended itself to constructors that the constructional details have twice been out of print.<sup>1</sup>

Despite the fact that 4 watts is an adequate output for most domestic purposes, many requests have been received for a modified version of the amplifier giving an output of some 12 watts. The need for this larger output is felt by those who wish to reproduce music in unusually large rooms, or who wish to operate simultaneously several loud speakers in different rooms, while for those who undertake small PA work, either in the open air or in small halls it is a necessity.

### Large Output

At first sight there is little difficulty in modifying the amplifier to obtain the larger output, and the obvious course is to substitute PX25 or PP5/400 valves for the PX4 type originally employed. These valves require the same signal input, so that no change in the penultimate stage should be necessary, and one would at once obtain the requisite output. All this is true, but the question of power supply at once raises difficulties. The two output

valves alone will consume about 126 mA, and the earlier stages are not likely to take less than 12 mA., allowing only for gramophone reproduction, or a total of 138 mA. This figure is considerably beyond the rating of a single standard rectifier valve, and it is consequently necessary to employ two rectifiers.

Now when two rectifiers are employed there are two different methods of connecting them. They may be in parallel and joined in the conventional rectifier circuit when the operation is normal, but

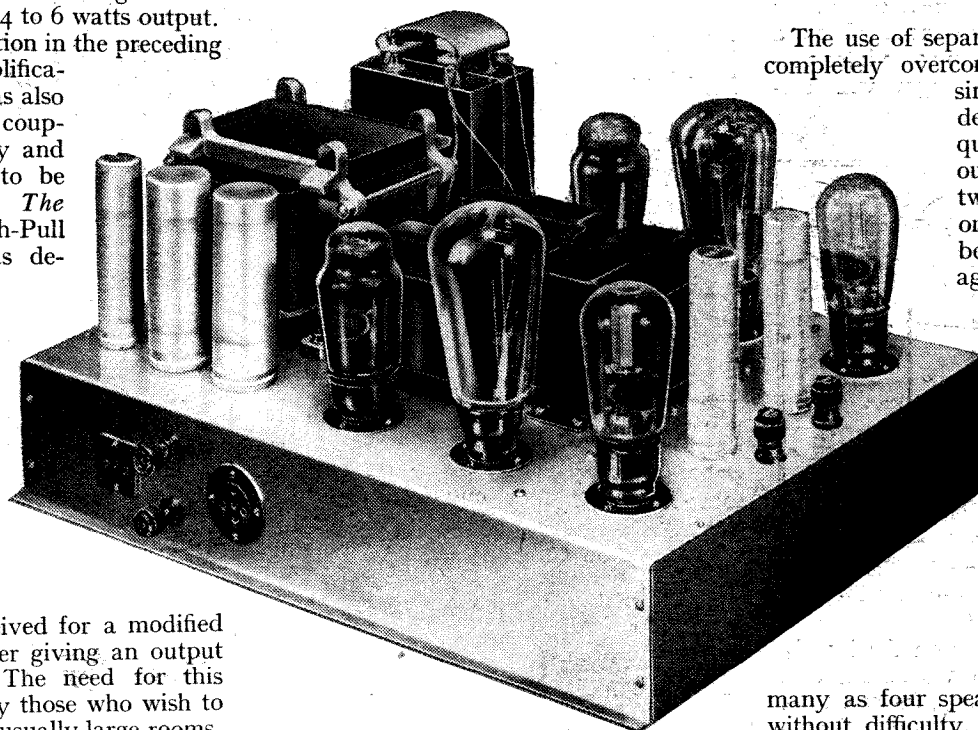
one-half for the early stages, so that there is likely to be considerable wastage unless the current can be used for energising a speaker field. More serious than this, however, is the fact that the voltage regulation would be very poor, with the result that smoothing and decoupling condensers would be subject to high voltages when the amplifier is switched on and until the cathodes of all valves have attained their normal operating temperatures. This would necessitate expensive high-voltage condensers being used throughout, and would probably prohibit the use of electrolytics in most circuits.

### The HT Supply

The use of separate supplies, however, completely overcomes this difficulty. A single choke and two condensers will provide adequate smoothing for the output stage, and these two condensers are the only ones which need to be rated for a high voltage. In the equipment for operating the early stages, the voltage is comparatively low, and inexpensive electrolytic condensers can be used throughout the smoothing and decoupling equipment. Moreover, it is easy to arrange for a very flexible field supply, and under certain conditions as

many as four speakers can be energised without difficulty. There is also the distinct advantage that feed-back effects are very greatly reduced; the possibility of feed-back from the output stage is, in fact, eliminated.

The 12-watt amplifier has accordingly been designed on these lines and has been arranged so that it is interchangeable with the earlier 4-watt model. That is, it may be used with any receiver or feeder-unit designed for the smaller amplifier without alteration. A special feeder unit for gramophone or microphone use has been designed, however, since it is felt that one of the chief uses of the 12-watt model will be in connection with small PA work. The amplification, therefore, is adequate for a microphone, and a wide-range tone control circuit is included which enables the bass and treble responses to be independently varied in steps without affecting the amplification.



The new amplifier, together with its associated mains equipment. Full constructional details will appear in an early issue of "The Wireless World."

up to 240 mA. may be drawn from the equipment without overloading the rectifier. Alternatively, two entirely separate supplies may be used. Thus, one rectifier can be fed from a high-voltage winding on the mains transformer and used to operate the output stage only, while the other can be fed from a lower voltage winding and used to provide the current for all early stages and for energising loud speaker fields.

The former course is the obvious one, but it appears less attractive when it is examined in detail. An output of nearly 500 volts is necessary for the output stage, and this must be brought down to about

<sup>1</sup> A reprint is now available at the price of 7d., post free.

# Microphones

By H. B. DENT

## Construction and Principles of Operation of the Various Types

IT is generally conceded that the first practical carbon microphone was the early pencil-type evolved by Professor Hughes about 1878, though intelligible speech had been transmitted electrically by Alexander Bell a few years earlier with an electro-magnetic telephone at each end of a pair of wires, and used alternately as transmitter and receiver.

The Hughes microphone consisted of a carbon rod pointed at both ends and resting lightly in cup-shaped depressions in two carbon blocks which formed the electrodes and to which electrical connection was made. These were mounted on a sounding board, though in some later versions a stretched diaphragm was employed.

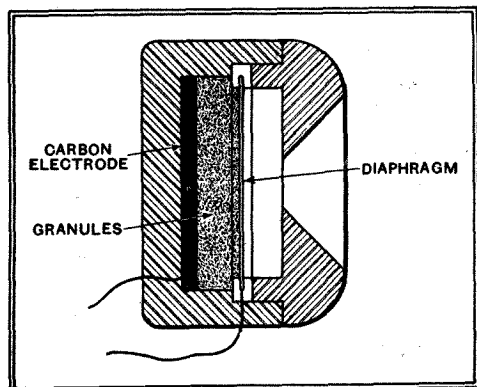
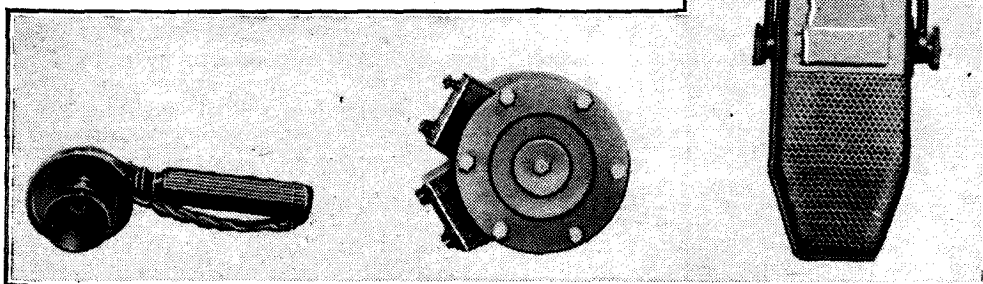


Fig. 1.—Humming carbon microphone, the forerunner of the present-day type.

Sound waves impinging on the loosely supported pencil set up vibrations, and the consequent changes in pressure on the fixed electrodes gave a variation in the resistance at these points. By joining a battery and a telephone receiver in series with the microphone the current fluctuations in the circuit caused the receiver's diaphragm to vibrate in accordance with the changes in the pencil transmitter, and so reproduced the original sounds.

This was soon followed by the Hummings microphone in which a small chamber filled with fine particles of coke was closed on one side by a thin platinum diaphragm, as shown in Fig. 1. This model is of particular interest, as it may be regarded as the forerunner of the modern carbon microphone.

Needless to say, it has required many years of patient work to bring the carbon microphone to its present state of perfection, though the early conception is still apparent in the construction of the solid-back type, which instrument is sometimes



A contrast in types. An early solid-back carbon microphone, the Magnetophone and a modern ribbon type.

referred to as the Post Office pattern, as it is used in one form or another in the ordinary domestic telephones in use to-day.

The essential details of the solid-back model are shown in Fig. 2, and it usually takes the form of a small brass cylinder A, about the size of a halfpenny, with a carbon back-plate B, and a movable carbon electrode C secured to a mica disc closing the open face of the cylinder. The inside of the case is filled with finely powdered carbon. A spindle attached to the movable electrode joins it to the large diaphragm D. These small inserts are often described as microphone buttons. Of course, there are many variations of this pattern, but the basic principles are the same in all.

### Transverse Current Carbon Type

Though somewhat different in construction, the transverse current carbon microphone is otherwise fundamentally the same, the main difference being that in

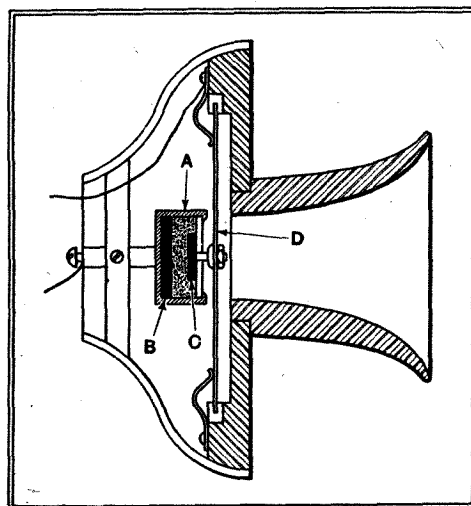


Fig. 2.—Details of the solid-back carbon microphone, sometimes referred to as the Post Office pattern.

this pattern the diaphragm is not joined to either of the principal electrodes, but is made of a non-conducting material, usually mica, and serves only to convey the variations in air pressure to the mass of carbon granules, thus varying its internal resistance. The essential details of this type are shown in Fig. 3.

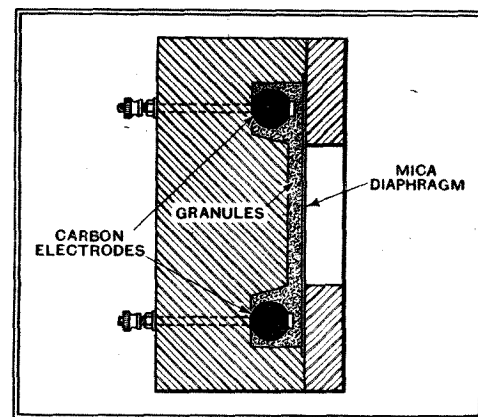


Fig. 3.—Typical arrangement of a transverse current carbon microphone.

The internal resistance is higher, the output lower, but the response characteristic usually much better than for the simple button pattern, though exceptionally good characteristics can be obtained with the button models when two are assembled back-to-back in a push-pull arrangement.

Although some modern carbon microphones are exceptionally good, the early ones left much to be desired, and investigation was directed along alternative channels.

One of the first to challenge the carbon model was a moving-coil type which, in the form of the Magnetophone, was used for some time in the early days of broadcasting by the B.B.C.

As a microphone, the ubiquitous moving-coil loud speaker leaves something to be desired, but it can be adapted to give



**Microphones—**

comparatively good results. One pattern in use to-day is, indeed, little different in actual construction from a miniature loud speaker, and in essentials is similar to Fig. 4. Cone diaphragms are not always employed, and in some patterns a dome-shaped diaphragm replaces it, but the sketch serves to illustrate the principles which are so well known that a detailed description is quite unnecessary here.

The ribbon microphone is also an electro-magnetic device, and consists of a magnet, either of the permanent or energised type, with a light corrugated metallic ribbon suspended edgewise between its poles. If the ribbon is open to the air on

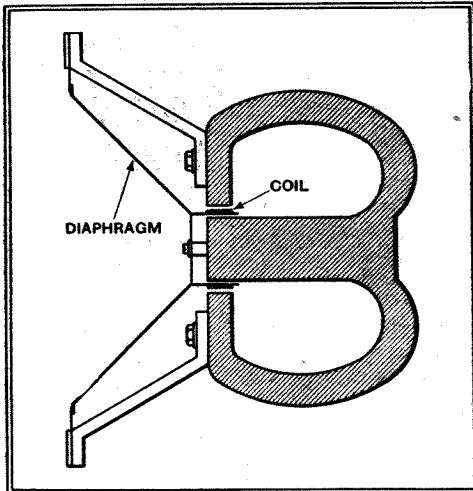
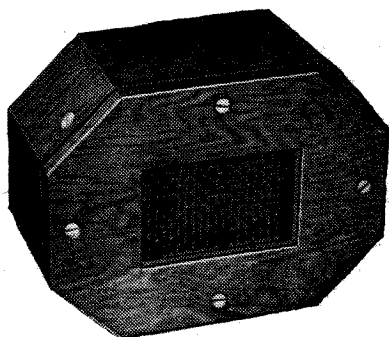


Fig. 4.—The moving-coil type bears a striking resemblance to a miniature loud speaker.

both sides it is often described as being velocity actuated, but an alternative type has been evolved in which the sound waves are accessible to one side only of the ribbon, while the other is terminated in an acoustic impedance, the function of which is to maintain a constant pressure on the back of the ribbon over the working range of frequencies. The ideal form of acoustic impedance is a long pipe, but, owing to its awkwardness, shorter pipes of special design, sometimes coiled and housed in a box below the microphone, are used. This style is usually referred to as a pressure-operated ribbon microphone.

The essential details of this type of microphone are shown in Fig. 5. With a very light ribbon, such as aluminium foil corrugated to give rigidity, the funda-



Transverse current carbon microphone described in the "Wireless World" of January 11th, 1935.

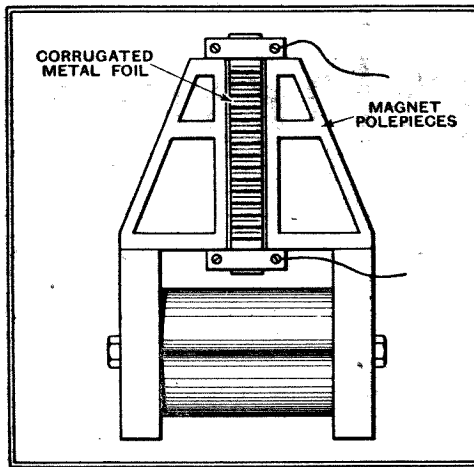


Fig. 5.—Essential details of a ribbon microphone.

mental resonance of the ribbon can be placed so low in the audible scale that it may be ignored, whilst the response up to 10,000 c/s and higher is good.

The action of the microphone is comparatively simple as it can be likened to a single strand of wire, which, if moved at right-angles to the flux in the gap of a magnet, results in an EMF being generated in the wire. This EMF is very small, so that considerable amplification is needed. With the moving-coil pattern many turns of wire can be located in the magnetic field and consequently considerably larger voltages are generated. However, in practice, they are usually of a low impedance type and step up transformers are employed between it and the amplifier.

Nevertheless, leads of several feet between the microphone and its transformer are permissible with the moving-coil pattern, but, owing to the very low impedance of the ribbon type, the transformer must be located as near to it as possible, or loss in efficiency will result.

In one particular make quite successful results have been achieved by the use

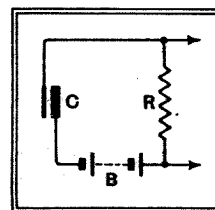


Fig. 6.—Circuit arrangement for a condenser microphone.

of multiple ribbons joined in series and a magnet system common to all. This gives a higher impedance, as well as a larger output and higher sensitivity, and it is not so essential that the leads to the transformer be reduced to the shortest possible length.

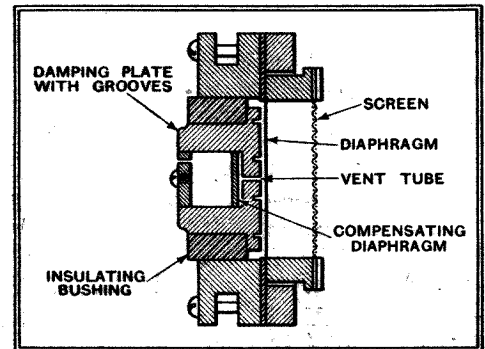
Experiments with condenser microphones can be traced back very many years, though it is only during comparatively recent times that this type has been available for general use. It depends for its operation upon changes in capacity, and constructionally consists of a rigid metal plate in front of which, but slightly spaced from it, is a tightly stretched thin metal membrane. As its description implies the arrangement forms a condenser, one plate of which is free to vibrate with vibrations in air pressure, these variations being caused by sound waves.

The circuit which is used with it is shown in Fig. 6, from which it will be noticed that, unlike the other microphones mentioned so far, it does not require a transformer, nor, indeed, would it work if one were used.

Joined in series with the microphone is a battery B and a high resistance R, usually of from 5 to 10 megohms. In the quiescent state no current should flow in the circuit after the initial charging of the condenser C. Variations in the microphone capacity effect the charge on its plates, and, as the function of the battery is to restore the charge to its normal steady value, current drawn from the battery for this purpose flows through the resistance R and sets up a fluctuating EMF across its ends.

**Diaphragm Resonance**

These voltage changes can be amplified by direct connection to the grid of a valve with a blocking condenser to isolate the polarising voltage. The main resonance of the condenser microphone can be located above the useful audible range by



(Applied Acoustics. Olson & Massa.)

Fig. 7.—Principal features of a stretched diaphragm condenser microphone.

making the membrane very light and stretching it very tight.

If a plain metal back-plate is used, the cushion of air between it and the diaphragm has a damping effect, and results in a reduction in sensitivity. One method of overcoming this is to fit a perforated back-plate, but in some designs this damping effect is utilised to smooth out diaphragm resonances by introducing suitable air chambers and vent holes. The construction of a typical condenser microphone is shown in Fig. 7.

With a tightly stretched diaphragm the characteristics of the microphone are largely dependent on the degree of tautness and other kindred properties of its diaphragm, and in order to minimise these effects experiments have recently been conducted with slack-diaphragm condenser microphones.

With this style, the characteristics of the microphone become more dependent on the damping, or cushioning, effect of the thin film of imprisoned air between the diaphragm and the back-plate. Otherwise, the general principles and the method of use are the same as for the stretched diaphragm type.

With all condenser microphones low-capacity leads are desirable, since such

# Below 100 Metres

## Notes from a Listener's Log Book

By "ETHACOMBER"

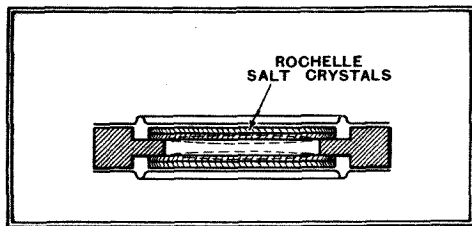
### Microphones—

capacity is in parallel with the microphone, which results in reduced efficiency as a portion only of the total capacity is variable.

Low-resistance leakage paths are also detrimental in that they reduce the effective value of the series resistance, but this does not affect the efficiency, but leads to non-linearity in the response and attenuation of the higher audio frequencies.

There is one other type of microphone that has attained prominence in recent years, and that is the piezo-electric type, or crystal microphone, as it is sometimes described. It depends for its action on the property of certain crystals to generate an EMF when pressure is applied in a certain manner.

This phenomenon is very marked in Rochelle salt crystals, and it has been known for a long time, but there were many obstacles in the way of its practical application. However, they have now been successfully overcome.



Piezo Electric Microphones. A. L. Williams.

Fig. 8.—Constructional details of the piezo-electric sound-cell.

If two thin slabs of Rochelle salt crystal are cemented together in a certain manner, and a voltage applied to them, the combination will tend to distort, due to one plate contracting and the other expanding. This distortion takes on the form of a twisting action. Now, if the mechanical and electrical forces are reversed, we have a small voltage generator with the voltage produced bearing a certain relationship to the applied distorting force. Briefly, then, this is the action of piezo-electric devices, one of which is the crystal microphone.

One very successful type of microphone consists of an assembly of piezo-electric sound-cells of small dimensions, so as to locate the resonant frequency high up in the audible scale and outside the normal useful range.

These miniature cells are sometimes assembled in a grill-type frame of long, narrow form, the cells being mounted tandem-wise on each side. An enlarged sketch of one of the cells is shown in Fig. 8.

In some models the cells are joined in parallel, while in others series connections are adopted. The frequency characteristic of a piezo-electric microphone is not affected by capacity in the leads, though the presence of unduly high capacity will reduce the sensitivity.

Neither polarising batteries nor transformers are needed with crystal microphones, and the usual method of connection is to the grid of a valve with a parallel resistance to provide a path for the required grid bias voltage, since the crystals are non-conductive to DC.

IN my last notes I mentioned that this week it was proposed to deal with the programme value side of short-wave transmission and reception. It is undoubtedly true to say short-wave listeners may be divided into two groups those who listen because of the novelty of hearing distant lands, and those who listen because of the entertainment they derive from listening.

To the first class the bulk of short-wave listeners in this country once belonged, as is the case in most countries where a good local broadcasting service is maintained, and as an example of the second class we may cite the overseas listener to the Empire station at Daventry, a listener who generally has not the advantage of local medium-wave noise-free reception.

The above classification no longer holds true in this country, however, and it ceased to be true in America some two or three years ago. Short-wave programme listening is becoming quite popular here to-day. The reason for the earlier demise of pure dx-ing in the U.S. is probably because, first, the all-wave receiver became commercially available in an efficient form and in large quantities about two or three years ago.

The second factor there was the development of the various European short-wave broadcasting systems, notably the B.B.C. Empire Service and the German R.R.G. stations at Zeesen. Both these services and others make a determined effort to maintain a programme value service in Canada and the U.S.A. for a period of several hours per day, directional aeriels and high-power (for short-wave) transmitters being used, and I have been informed that field strengths of over two millivolts per metre have been recorded in New York from the Empire Station.

### Higher Power U.S. Stations

The development of short-wave programme listening is now taking place rapidly in this country for reasons similar to those given above, efficient all-wave receivers are rapidly coming into prominence in the general market, and, owing to increases in power and improvement in the equipment of various overseas transmitters, in particular those of the U.S.A., strong short-wave signals are being more consistently received.

A third and very important factor is also becoming evident. This is the general increase in signal strengths and performance of distant short-wave stations owing to the increase in solar activity with the advent of the new eleven-year cycle.

During the past fortnight the entertainment value, providing you like the programmes, of course, of such stations as W3XAL on 16.87 metres, W8XX on 19.72 metres and 25.27 metres, and W2XAD and W2XAF on 19.56 and 31.48 metres has been very high indeed, and was very little short, if at all, of that obtained from the local station.

An example of the way in which the U.S. stations are looking to this country and Europe for their short-wave audiences may

be gathered from the new schedule brought into force by W2XE, the Columbia Broadcasting System's relay station at Wayne, N.J., on March 10th:—

	G.M.T.	Metres.
W2XE ..	12.30-17.00 ..	13.93
	17.00-18.00 ..	16.89
	18.00-22.00 ..	19.64
	22.00-03.00 ..	25.36

This schedule seeks to take advantage of the peak transmission period for each wave in order that the best results may be obtained from its 1kW transmitter, which, incidentally, is being quite well received here at the present moment.

Turning to a detailed review of short-wave conditions during the past fortnight, one can only comment on the extremely good conditions prevailing, all waves from 8-50 metres having been strongly heard.

So well have some of the U.S. police car transmitters on 8-9 metres been performing recently that trams starting up nearby have been overheard through their microphones.

The experimental 25 kW telegraph transmitter, NSS Annapolis of the U.S. Navy, has also been a strong, steady signal on 8.287 metres until as late as 8 p.m., a good R9 signal working with NPG Pearl Harbour, Hawaii, and NCO (NPO?) Cavite, Phillipine Islands.

On Thursday, February 27th, W1XAL was fairly good at 10.20 p.m., and a little later W2XAF was good, the programme being "Excerpts from the Works of Longfellow" on the occasion of the birthday of the great American poet.

Friday also saw excellent conditions. W3XAL on 16.87 metres was excellent at 6.35 p.m., and at 7.20 all the 19 metre group were very good. W2XAD was little short, if at all, of a local station signal.

A Welsh programme, with the famous United States Marine Band, was intercepted from W3XAL on 16.87 metres from 8 p.m. onwards, and at midnight W8XX and W1XAL in the 25-metre band, and W2XAF on 31.48 metres, were excellent.

Extremely strong sound signals were picked up from the Crystal Palace at 3 p.m. on Saturday afternoon, and strong signals were obtained from W2XAD, marred, unfortunately, by selective fading, until 10.20 p.m., when the usual Saturday broadcast of an opera performance from the Metropolitan Opera House concluded.

To give further details of reception would be pointless, and one can readily say that conditions have been nearly perfect, very good to excellent signals having been received every day from the better-known stations. Even VQ7LO Nairobi was a good loud-speaker signal for two hours on one occasion.

New stations heard have been PCJ or PHI, testing on its old wave of 31.28 metres (and, incidentally, "jamming" VK2ME and W3XAU on occasions), and one or two ultra short-wave stations between 8-9 metres, including one South American (?).

W9XAZ also has again been heard at good loud-speaker strength, alternately relaying the local programme and calling 10-metre amateur transmitters.

It would therefore appear that the normal short-wave bands have now become of programme value, whilst the ultra short-wave bands have become the happy hunting ground of the dx enthusiast.

# CURRENT TOPICS

## 7½ Million

THE number of German licences passed the 7½-million mark on March 1st, the actual total being 7,524,010.

## Athlone : 100 Kilowatts

RADIO ATHLONE is to be increased in power from 60 to 100 kilowatts. A contract for the erection of a new transmitter has been placed with Marconi's Wireless Telegraph Co.

## French Palace of Broadcasting

A "PALACE OF BROADCASTING" is the latest project of M. Mandel, the French P.M.G., whose aim is to centralise all the broadcasting studios and laboratories now scattered throughout Paris. It is hoped that the building will be completed in time for the Paris Exhibition of 1937.

## Broadcasting an Air Raid

YUGOSLAVIAN listeners have just had an opportunity of "enjoying" an air raid. The occasion was an imaginary aerial attack in connection with the defence manoeuvres in Belgrade. Three ground receivers picked up the sounds of the "bombardment," while a fourth transmitter fitted on a 'plane gave listeners a realistic impression of an air raid from the raiders' point of view.

## Calling Europe on 5 Metres

A FIVE-METRE "field day" embracing the whole of Europe is being planned by Mr. Douglas Walters (G5CV). His intention is to transmit from the summit of Jungfraujoeh, Switzerland, during a week-end in July, and already the suggested arrangement has evoked great enthusiasm in Switzerland and Central Europe. Parts of Great Britain may be expected to come well within the possible range of signals.

## Irish Pirate Transmitter

IRELAND'S first "pirate" transmitter has been run to earth, the owner, Michael Madden, of Limerick, being fined £1 and two guineas costs.

Madden explained that he was experimenting on short waves with gramophone records, and that, never having sent offensive matter over the air, he must not be associated with another pirate transmitter who was known to be operating in the same district.

## Public Lecture on 5-Metre Work

A LECTURE on 5-metre reception is to be given by Mr. D. N. Corfield, under the auspices of the Golders Green and Hendon Radio Society, at the Regal Cinema, Finchley Road, on Wednesday next, March 25th, at 8.15. *Wireless World* readers are cordially invited to attend.

## 300-kilowatt Station for France ?

THE raising of the power of "Radio-Paris" to 300 kilowatts is being envisaged by M. Mandel's radio engineers, who are searching for a new site for the "Poste National." For the last two months a search has been made for a central site to which the national station, now Radio-Paris, is to be trans-

commenced some weeks ago nearly 5,000 "absent-minded" listeners have been summoned.

## Preventing Accidents

ACCIDENTS in radio and electrical factories are to be discussed at the National Industrial Safety Conference organised by the National "Safety First" Association, to be held at Balliol College, Oxford, on April 3rd.

The Association is concerned at the high rate of accidents among young people.

## Boys' Wireless League

BOY radio amateurs in the Portsmouth district enjoy the advantage of having a local "Boys' Wireless League," of which the Secretary is Mr. L. Harrison, 1, Devonshire Avenue, Southsea. Boys can become members on paying a

## Events of the Week in Brief Review

himself in the period of January, 1931, to December 31st, 1936. Full particulars can be obtained from the Secretary, Royal Society of Arts, John Street, Adelphi, London, W.C.2.

## Public Loud Speakers ?

"NOW that broadcasting is a permanent feature of the life of the nation," writes a correspondent in the *Manchester Evening Chronicle*, "would it not be possible to install loud speakers in public places when His Majesty the King or the Prime Minister is to address the nation?"

## "Saved by Wireless"

OUR contemporary, the *Haut Parleur*, publishes an illustration showing the arrival of a party on a desert island. A castaway, welcoming his rescuers with obvious joy, exclaims: "I have been saved from death by wireless!"

"What, you have a transmitter?"

"Not at all. I have a valise set and have kept myself alive by eating the leather."

## Latest : "O.B." Boats

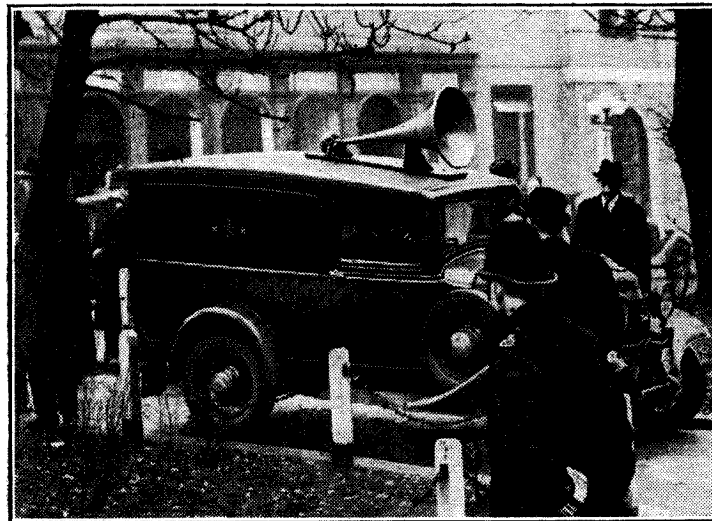
THE "O.B." van idea has always been popular in Norway, but the officials have now gone one better by equipping a fleet of "O.B." boats, each of which carries a short-wave transmitter, microphones, amplifiers and recording apparatus. They will be used for exploring the fjords and broadcasting from country villages.

## Radio Opportunities in R.A.F.

NO fewer than a thousand boys are required for Royal Air Force service during the summer. Of these approximately eight hundred will be required in August for training as aircraft apprentices and the remaining two hundred in September as boy entrants.

The most highly skilled trades (with the highest rate of pay) in the R.A.F. are open to aircraft apprentices, who are given three years' thorough training at a technical school for such trades as fitter, fitter (armourer), wireless operator mechanic and instrument maker. Boy entrants also have opportunities to serve as wireless operators.

Full particulars of both schemes can be obtained from the Inspector of Recruiting, Royal Air Force, Victory House, Kingsway, London, W.C.2.



PA FOR AIR RAIDS. The Metropolitan Police are now experimenting with public address vans for the issue of warnings and instructions during air raids. This photograph was taken last week at the Police College, Hendon.

ferred, and we understand that the choice is likely to fall upon Allouis, a little town between Vierzon and Bourges.

Meanwhile, Radio Colonial is to be moved to Noyant-Fremières, near Moulins, with a power increase to 100 kilowatts. Six aerial arrays will be employed.

It is expected that both Poste National and the new Radio Colonial will be completed by next spring.

## Postmen v. Pirates

DANISH postmen have been enlisted in the war against radio pirates. Their instructions are to provide the postmasters with confidential lists of all addressees having wireless sets. Since the new régime

subscription of 2d. per meeting, with badges at 2d. each.

The Secretary has opened a short-wave wavemeter calibration service on Saturday mornings.

## Opportunity for Inventors

WIRELESS amateurs have an opportunity to win a prize of £100 which is being offered by the Royal Society of Arts, under the Thomas Gray Memorial Trust, for an invention, publication, or diagram which, in the opinion of the judges appointed by the Council, is considered to be an advancement in the science or practice of navigation. The device must have been proposed or invented by the competitor

# The Importance of Matching in PA Equipment

## Valve-to-Line and Line-to-Valve Transformers

By N. PARTRIDGE, B.Sc. (Eng.), A.M.I.E.E.

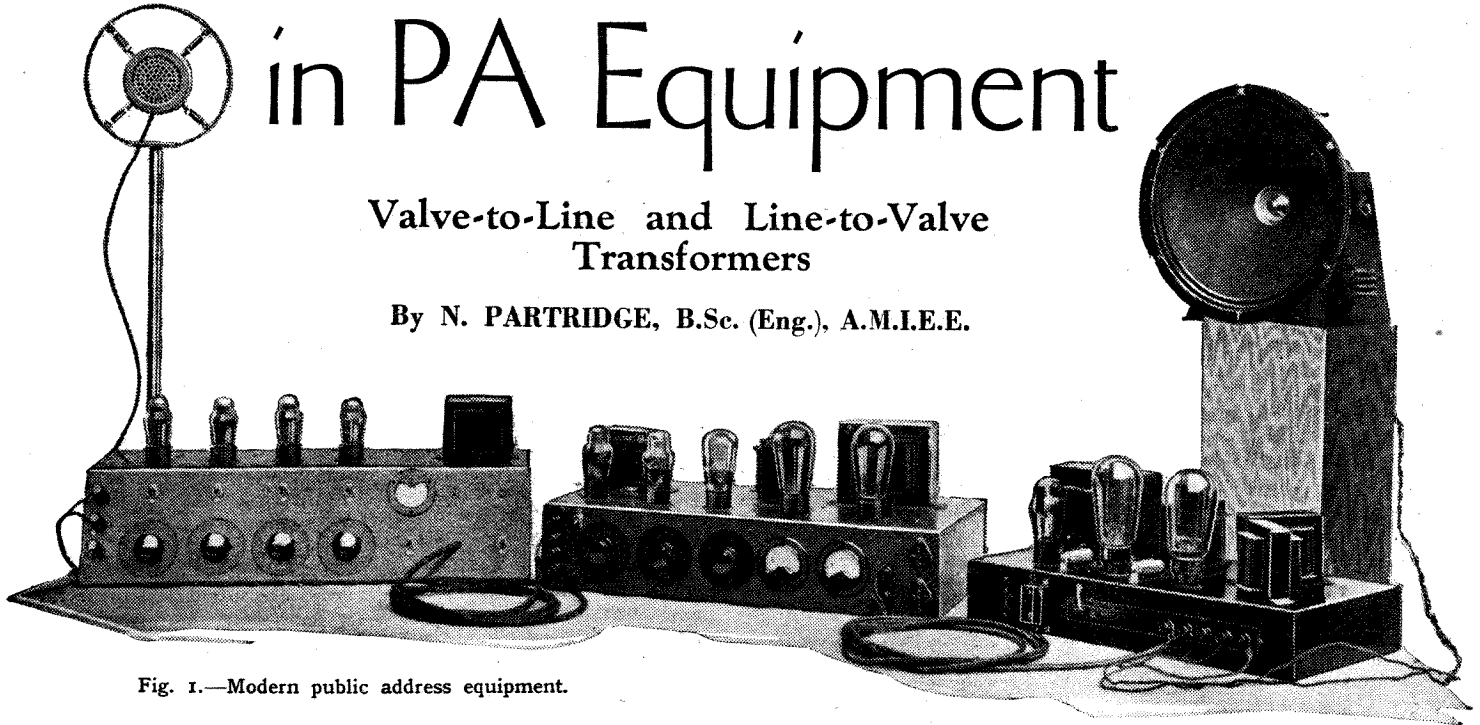


Fig. 1.—Modern public address equipment.

*THE choice of the correct transformers for matching valves to a short transmission line of the type commonly used in public address work is a matter of considerable importance if satisfactory results are to be obtained. In this article the conditions are described in detail and it is shown how the best performance can be secured.*

THE diversity of uses for which public address apparatus is required makes the need for distortionless audio-frequency lines imperative. The correct application of such lines is well illustrated in Fig. 1, which shows a part of a very flexible and comprehensive equipment built by Messrs. Radiovox Wireless Services, Ltd., of Leeds, to whom the author is indebted for the photograph.

The panel on the left is a battery-driven mixer-preamplifier capable of accommodating four separate microphones of which only one is shown. The centre chassis is the main amplifier which is mains-driven and is fed via a low-impedance line that may be anything up to several hundred yards in length. On the right is seen an output unit, also mains-driven, with its associated speaker. The main amplifier is so arranged that it can feed any number from one to four similar output units each with its own line which may be run in any direction independently of the others.

The theoretical advantages to be gained

by using a low-impedance as opposed to a high-impedance line are well known, but unfortunately the practical results achieved are not universally excellent. The object of this article is to show how a short transmission line with its associated transformers can be designed to operate from 30 to 12,000 cycles without audible distortion.

Attention must first be directed to the line itself. This will possess resistance, inductance and capacity. These constants are uniformly distributed throughout the length of the line, which must therefore be represented as in Fig. 2. Such a network behaves in an extremely complicated manner when fed with A.C. As an instance, current will be by-passed by the capacity and beyond a certain length of line more current will be by-passed than will be transmitted! Clearly such effects will not be measurable in the case of very short lines and the immediate problem is to determine how long a lead may be and yet remain for our purpose equivalent to the simplified circuit of Fig. 3.

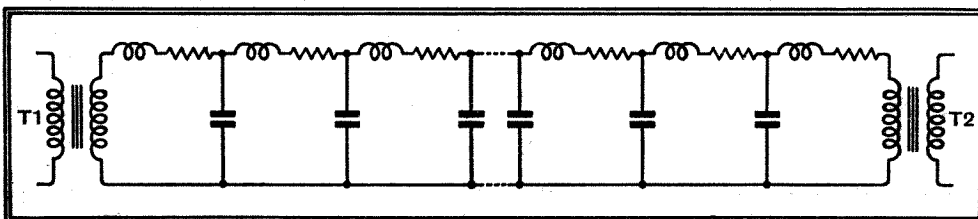


Fig. 2.—The equivalent circuit of a transmission line terminating in transformers is shown here.

Measurements were taken upon a number of flexible conductors suitable for interconnecting P.A. apparatus. The results for standard 23/0.0076 lighting flex may be given as typical. The constants expressed per mile were found to be  $R =$

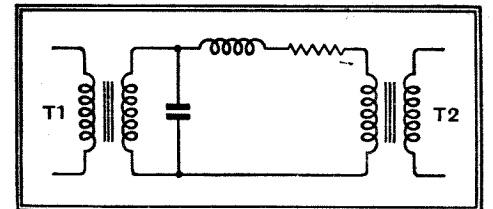


Fig. 3.—A short line may be represented by this circuit.

87 ohms,  $L = 1.3$  mh,  $C = 0.075 \mu\text{F.}$ , and  $G = 150 \mu\text{mhos}$ . Calculation shows that 300 yards can be accepted as the limit for an electrically short length, and the remainder of this article will apply only to lines up to but not materially exceeding this length. Electrically long lines demand an entirely different method of treatment.

Having reduced the line to the equivalent of Fig. 3 it is possible to state the conditions necessary to avoid frequency distortion. The figures given for lighting flex show that the inductive impedance at 10,000 cycles is of the same order as the resistance. Hence so long as the line resistance is kept sufficiently low to keep the voltage drop less than 10 per cent. the effect of the line inductance can be neg-



**The Importance of Matching in PA Equipment—**lected. The capacity can be rendered harmless by a judicious choice of ratios for the transformers; the lower the effective impedance of the line circuit the less important will the capacity become. Since the length is limited to 300 yards the DC resistance will be less than 20 ohms, therefore 200 ohms will be the lowest suitable value for the effective load with which to terminate the line.

The problem now resolves into that of successfully operating two audio-frequency transformers in cascade.

**The Transformer Circuit**

Fig. 4a shows a valve feeding an audio-frequency transformer (step-up or step-down) with a resistance  $R_s$  connected across its secondary. Considering the lower frequencies the equivalent circuit, reduced to unity ratio, of Fig. 4b is approximately correct. The amplification of the stage will remain constant so long

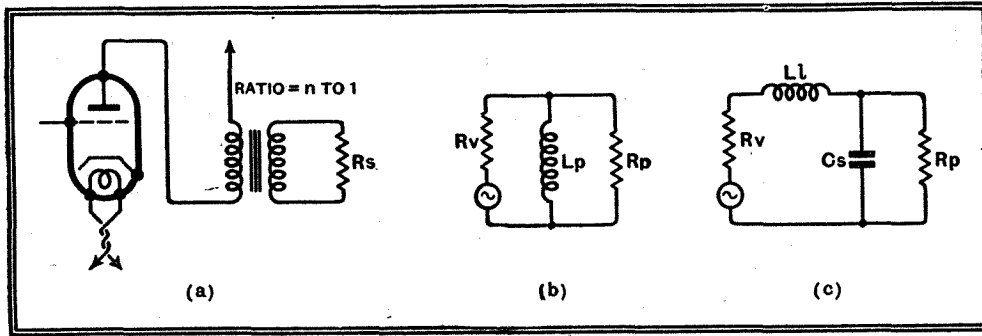


Fig. 4.—The output circuit of a valve is shown at (a), the secondary load being represented by  $R_s$ . At low frequencies the equivalent circuit is (b) and at high frequencies (c), where  $L_p$  and  $L_l$  are the transformer primary and leakage inductances respectively, and  $R_p = R_s/n^2$ .

as the impedance of the primary inductance is high enough not to reduce appreciably the total impedance in the anode circuit. For practical purposes  $L_p$  expressed in henrys must be at least as great as  $R_p (= \frac{R_s}{n^2})$  expressed in ohms divided by 150. When this relationship holds the impedance due to the primary inductance at 50 cycles is twice the nominal anode load ( $R_p$ ), and similarly the impedance of the secondary inductance at 50 cycles will be twice  $R_s$ .

Fig. 4c shows the equivalent circuit applicable to the higher audio frequencies. The small inductance  $L_l$  represents the leakage inductance of the transformer and this is in series with the load  $R_p (= \frac{R_s}{n^2})$ . It follows that there will

be a voltage drop across this impedance which will increase with frequency. Again, this drop will be more serious the lower the value of  $R_p$ . If  $R_p$  is infinite the only current flowing will be the small amount passing through the stray capacities, hence the drop across  $L_l$  will be slight. If  $R_p$  is made small a heavy load current will flow and consequently the drop across  $L_l$  will form a large percentage of the available voltage. Experience

with output transformers shows that if  $R_s (= R_p n^2)$  is not materially less than  $150L_s (= 150L_p n^2)$ , which is the requirement for good bass response, the fall of voltage at 10,000 cycles can be made negligible by the careful arrangement of the transformer windings.

Unfortunately a further complication arises; the leakage inductance forms a resonant circuit with the stray capacities. Fig. 5 shows a typical response curve for an intervalve transformer, in which the effect of this resonance can be seen. The dotted curve shows the result of connecting a resistance across the secondary. It is important to note that the resonant rise of voltage can be damped out but the response at and above the resonant frequency is poor. The frequency at which resonance occurs is largely determined by the disposition of the transformer windings and by the inductance of the secondary. In a very well designed transformer this frequency can be kept as high as 7,000 cycles with a secondary induct-

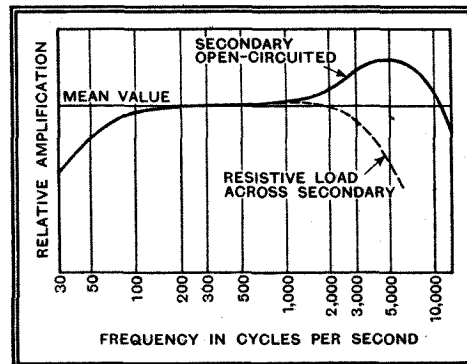


Fig. 5.—The effect of loading the secondary of a transformer is shown by these curves.

cade must each possess double the inductance that would be required for a single transformer working alone to produce an equal bass response. Hence the inductances of  $T_1$  and  $T_2$  must be  $R$  divided by

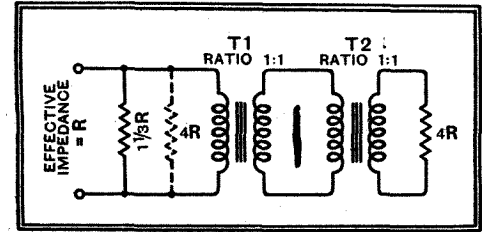


Fig. 6.—This circuit is recommended in order to secure correct operating conditions.

75 instead of 150, as in the case of a single transformer.

Considering the higher frequencies, it is desirable to load the secondary of  $T_2$  to damp resonance, but if this load resistance is of too low a value an excessive voltage drop will occur through the leakage inductance. It has been stated that a resistive load across a single transformer may be as low as 150  $L_s$  ohms, but when the load is placed across the secondary of  $T_2$  it is obvious that the current passing through two transformers must give rise to double the voltage drop occurring in one. The ideal way of avoiding this would be to reduce the leakage inductance of each of the transformers to one-half the normal value, but unfortunately this is impossible without prohibitive expense. The alternative method of ensuring that the response shall be maintained is to reduce the current to one-half by doubling the load resistance, the lower limit of which will therefore be increased to 300  $L_s$  ohms.

**The Load Resistance**

Suppose it is required to maintain an effective impedance of  $R$  ohms across the primary of  $T_1$  (Fig. 6), i.e., in the anode of the sending valve, the preceding two paragraphs demand that the inductance

of the primary of  $T_1$  shall be  $\frac{R}{75}$  henrys

and also that the load across the secondary of  $T_2$  shall not be less than  $300 \times L_p$

$= 300 \times \frac{R}{75} = 4R$  ohms. But a resistance

of  $4R$  ohms across the secondary of  $T_2$  will give an effective resistance of  $4R$  as measured across the primary of  $T_1$ . Hence, to reduce this to the required value of  $R$  ohms it is necessary to connect a parallel resistance of  $1\frac{1}{3}R$  ohms directly in the anode circuit across the primary of  $T_1$ . This introduces the second important conclusion: To obtain from a pair of transformers connected in cascade a voltage response to the upper frequencies equal to that of a single transformer, the effective working impedance ( $R$ ) across the primary of the first transformer must be divided into two parallel impedances equal to  $1\frac{1}{3}R$  and  $4R$  ohms; the former ( $1\frac{1}{3}R$ ) being connected across the primary of the first transformer, and the latter ( $4R$ ) being provided by the reflected im-

**The Importance of Matching in PA Equipment—  
pedance of the load across the secondary  
of the second transformer.**

Sufficient data are now to hand for a practical design to be worked through. Suppose a pre-amplifier in which the last valve is an ACHL working with an effective anode load of 12,000 ohms is required to feed an amplifier at any distance away up to the limit of 300 yards. (The reason for selecting 12,000 ohms as the working load for the ACHL cannot be discussed here, but it is a practical and, in fact, popular valve for this particular purpose.)

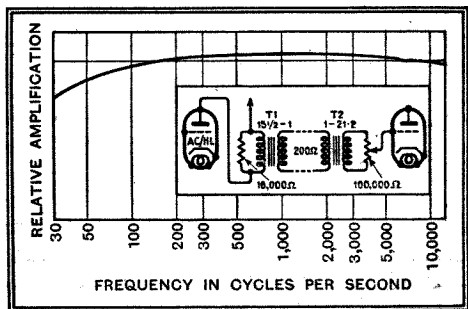


Fig. 7.—The type of response curve obtained when circuit conditions are correctly adjusted.

The inductance of the primary of the sending transformer is determined solely by the working load required in the anode of the sending valve. In the present case

$$L = \frac{R}{75} = \frac{12,000}{75} = 160 \text{ H.}$$

12,000 ohms must now be split into two parallel impedances of  $12,000 \times \frac{1}{3} = 16,000$  ohms and  $12,000 \times 4 = 48,000$  ohms. The resistance to be connected across the primary of the sending transformer is therefore 16,000 ohms, and the parallel 48,000 ohms must be provided by the load on the line. It has been shown that 200 ohms is an excellent effective load for the line, hence T<sub>1</sub> must step down from 48,000 to 200 ohms, and the ratio

$$\text{will be } \sqrt{\frac{48,000}{200}} = \sqrt{240} = 15\frac{1}{2}.$$

The primary inductance of T<sub>2</sub> will

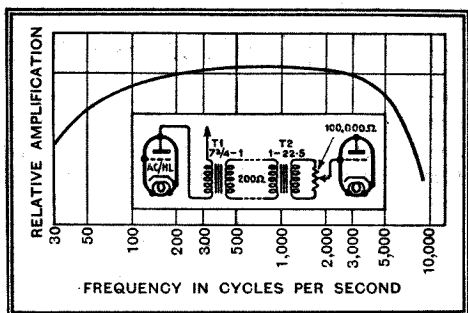


Fig. 8.—The effect of incorrect operating conditions is shown by this curve.

obviously be the same as that of the secondary of T<sub>1</sub>, which is  $160 \times \left(\frac{1}{15\frac{1}{2}}\right)^2 = 0.666\text{H}$ . The inductance of the secondary of T<sub>2</sub> limits the step-up ratio that can be employed, and taking 300 H as the highest inductance permissible to ensure

the resonant frequency being well above the audible range the ratio of T<sub>2</sub> must be

$$\sqrt{\frac{300}{0.666}} = 21.2.$$

The resistance across the secondary of T<sub>2</sub> to give an effective load of 200 ohms across the line will be  $200 \times 21.2^2 = 90,000$  ohms. The nearest practical value to this is 100,000 ohms, which could conveniently take the form of an input volume control on the amplifier.

Even now that the correct inductances, ratios and loads have been determined the response can easily be ruined by a poor mechanical construction of the transformers. All the known precautions for reducing leakage inductance and interwinding capacity must be rigidly observed.

Two transformers were wound in accordance with the best winding practice to the design worked out above, and Fig. 7 shows the result of a frequency test. The input voltage was measured across the grid of the ACHL, and the output voltage across the secondary of T<sub>2</sub>. It can be seen that aurally the line causes no distortion between 30 and

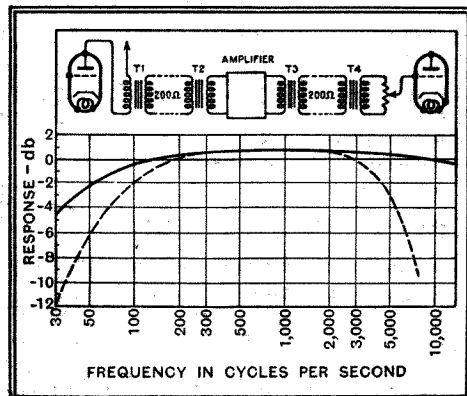


Fig. 9.—When two lines are used involving four transformers, the full-line response curve can be secured by the correct choice of the circuit and transformers, whereas a response of the type shown by the dotted curve is likely to result from a haphazard arrangement.

12,000 cycles. The greatest deviation is at 30 cycles, but since the smallest change of intensity that the ear can detect at this frequency is of the order of 5 db the falling off in the present case is quite inaudible.

**Ordinary Transformers**

A very prevalent but equally erroneous notion entertained by amateurs and professional engineers alike is that the transformer at the sending end of a short line is simply an ordinary output transformer matched to 200 ohms instead of to a speaker impedance. To expose the error more fully a design for a pair of transformers will be worked through on the output transformer basis, and experimental figures given for components manufactured in accordance with this design. Let it be assumed that the amplifier volume control will be 100,000 ohms as in the previous example, and that the effective load on the line will also remain at 200 ohms. Referring to the original

problem, the primary inductance of T<sub>1</sub> (treated as an output transformer) will

$$\text{be } \frac{12,000}{150} = 80 \text{ H; the ratio will be}$$

$$\sqrt{\frac{12,000}{200}} = \sqrt{60} = 7\frac{1}{2}.$$

The inductance of the primary of T<sub>2</sub> will be the same as the secondary of T<sub>1</sub>, which is  $80 \times \left(\frac{1}{7\frac{1}{2}}\right)^2 =$

$$1.34 \text{ H. The ratio of T}_2 \text{ will be}$$

$$\sqrt{\frac{100,000}{200}} = \sqrt{500} = 22\frac{1}{2}.$$

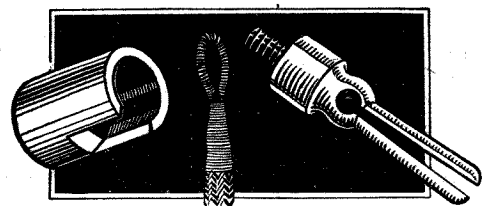
The measured frequency response for the above transformers is given in Fig. 8. It is extremely important to realise that the inferior result is due to the inductances, ratios and loads being wrongly calculated and not in any way due to the method of constructing the actual transformers, which were wound exactly as those employed for the curves of Fig. 7.

Referring back to Fig. 1 it will be remembered that two lines are employed in the system. Fig. 9 gives the response for two lines, i.e., four transformers, operating in cascade. The full curve is for the correct arrangement of Fig. 7, and the dotted curve for the incorrect arrangement of Fig. 8. The distortion indicated by the full curve could just be detected by listening to a pure 30-cycle note, but it is very doubtful if it could be noticed when listening to music, and would certainly not be heard at all with speech.

**THE RADIO INDUSTRY**

VISCOUNT FALMOUTH, who now becomes president of the Electrical Industries Benevolent Association in succession to Sir Felix J. C. Pole, will preside at a luncheon at the Savoy Hotel on April 3rd. Tickets (10s. each) from Mr. A. Hugh Seabrooke, 36 Kingsway, London, W.C.2.

With reference to our recent announcement regarding Shaftesbury Supplies and Shaftesbury Microphones, Ltd., it should be made clear that the acquisition of goodwill by the latter company relates only to the manufacture and distribution of Public Address Equipment. The retail business of Shaftesbury Supplies is still being carried on as a separate entity.



A new type of Belling-Lee wander plug. As the end of the flex wire must be whipped and formed into an eye, it appeals mainly to set manufacturers.

A "Catalogue of Measuring and Testing Instruments for the Electrical and Allied Industries" is issued by the Instrument Department of E. K. Cole, Ltd., Southend-on-Sea. This publication, which contains full technical data, is of interest to the staffs of laboratories, research departments, or factories. The apparatus described includes an inductance bridge, A.F. oscillator, beat frequency oscillator, a variable attenuator, and a standard signal generator.

# Northern Ireland Calling

B.B.C.'s 100-kW STATION AT LISBURN OPENS TO-DAY

**A**FTER being a third-rate B.B.C. region for many years, Northern Ireland, at 3.30 this afternoon (Friday), becomes the most up-to-date region in the British Isles, if not in Western Europe. The Lisburn 100-kW. station is to be opened by the Duke of Abercorn. The transmitter, although smaller in general design than that of the long-wave National transmitter at Droitwich, embodies the very latest improvements, and is provided with the only mast-type radiator in this country.

The HF input is passed through two low-power stages of LF amplification, the

plification stage is designed for a maximum power output of 100 kilowatts at a depth of modulation of 90 per cent., with a total harmonic content not exceeding 4 per cent.

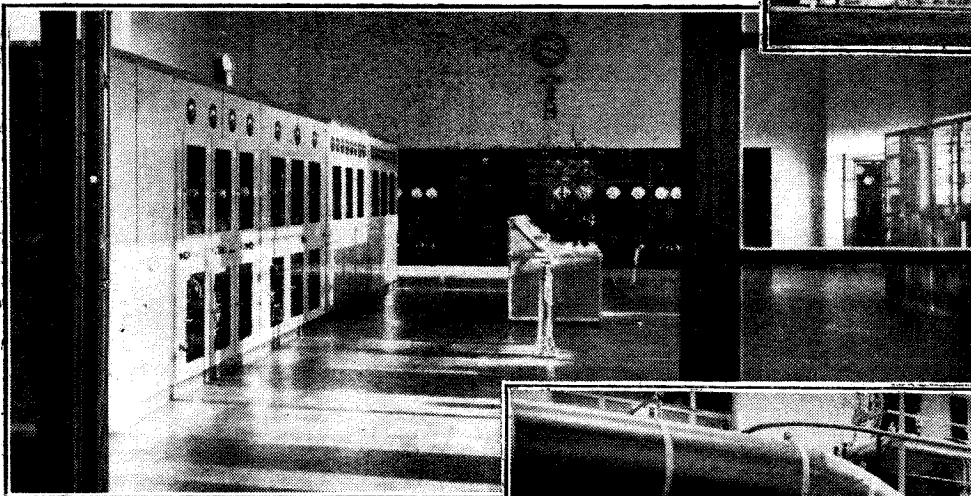
In appearance the station differs considerably from the other B.B.C. transmitters, for, instead of being built in small units, it is constructed in one large unit subdivided internally.

The insulated steel mast, 475ft. high, has three sets



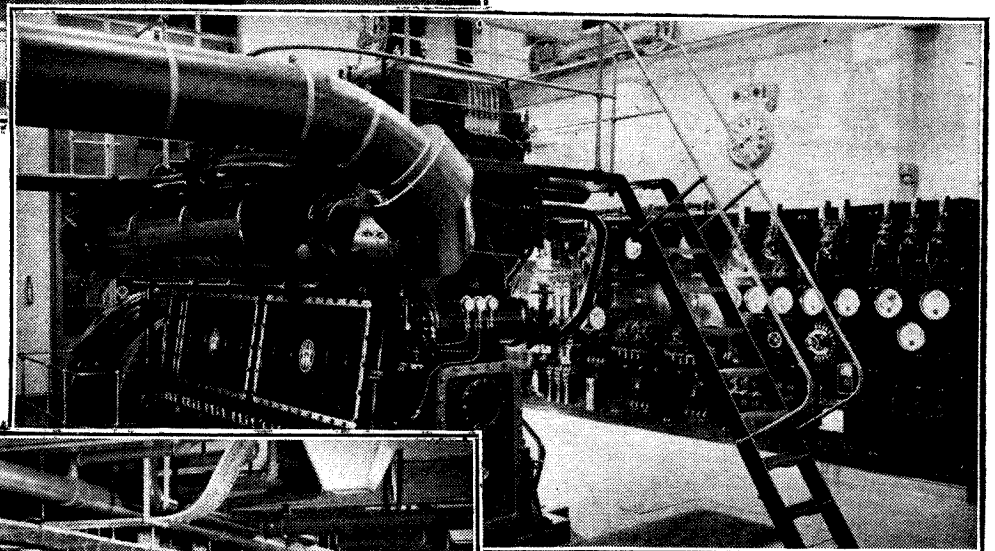
of stays, each consisting of two separate pairs of parallel stays attached to the mast at half its height and at two-thirds of its height respectively. The sliding top mast permits of adjustment of the electrical constants to the appropriate wavelength. It takes the form of a 75-ft. steel tube operated by a winch.

Power is supplied to the station by the Northern Ireland Electricity Board

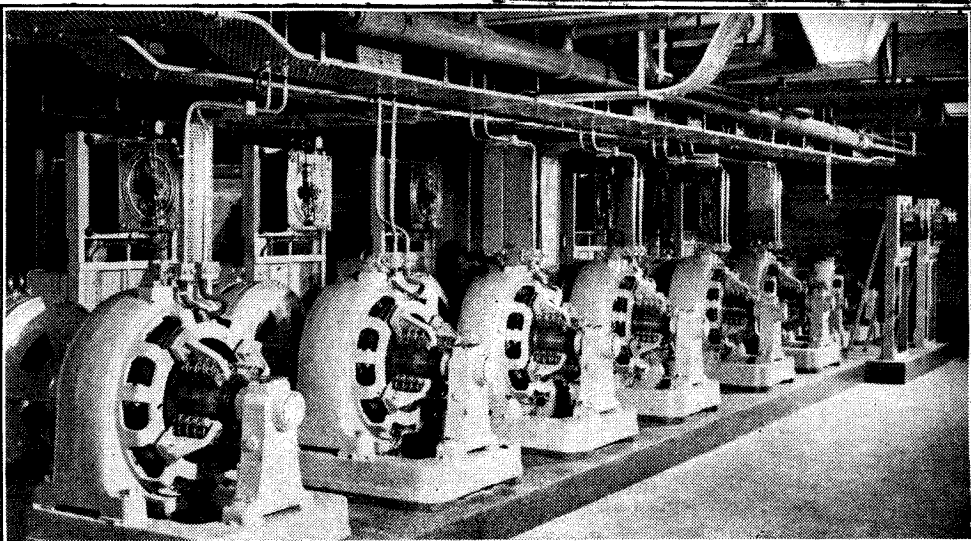


The transmitter is built as one large unit sub-divided internally. Like Droitwich (long wave) it employs series modulation.

second of which feeds into the modulator stage consisting of two C.A.M.<sub>3</sub> valves in parallel. The high-frequency input is provided by a Marconi constant-frequency oscillator. The Marconi system of series modulation is employed. The main am-



Although taking its power from the local mains, Lisburn is independent in an emergency. Above is the stand-by Diesel generator plant. On the left are the filament-heating generators and control gear in the "crypt."



through a sub-station on the site. For emergency supply purposes a 600 h.p. six-cylinder diesel engine driving an alternator has been installed.

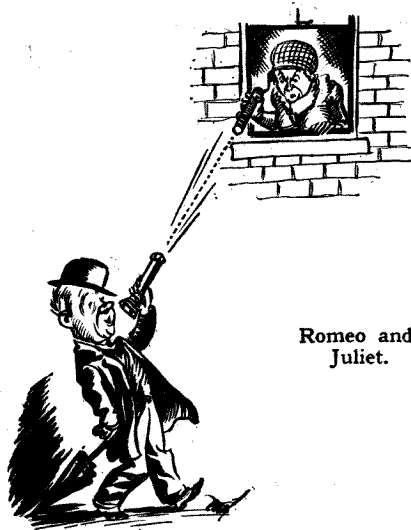
The general plan of the building is similar to that of other B.B.C. stations, the design being restrained and modern in character. The granite surround of the main entrance incorporates the B.B.C. coat of arms.

# UNBIASED

## On Beams of Light

ONE of our leading radio manufacturers has, I notice, produced a really portable micro-wave transmitter and receiver employing a wavelength which is far less than one-millionth of a metre, and there ought, I think, to be vast possibilities for it. Its range is measured in yards rather than in miles, and as it is highly directional it should make for even greater secrecy than the ordinary wired telephone, since it is possible to tap the latter far more easily than the new device.

The arrangement is, of course, nothing more or less than our old friend the Photophone, in which the carrier wave is a beam of light modulated *via* a suitable



Romeo and Juliet.

microphone circuit. The Photophone is, of course, as old as the hills and used to delight our grandfathers at the great Exhibition in 1851, but this is the first time, so far as I am aware, that it has been produced in really practicable and yet portable form.

It has been suggested that it will be highly suitable for modern Romeos and Juliets, since the lady can hang the main part of the apparatus outside her bedroom window and, owing to its highly directional nature, conversation will be far more secret than with the ordinary ultra-short wave receiver, which would, in any case, be banned for such uses by its bulk. In my opinion, however, the use of this portable Photophone on such occasions is likely to be spoilt by the emotion engendered by love, since it will need a steady hand to keep the beam focused on the eye of the photocell, and the resultant articulation in the receiver is likely to be exceedingly tremulous.

Another use which has been suggested for this arrangement is for assisting sports-car drivers in their laudable efforts to move lumbering lorries from the crown of the road. The lorry would have its photocell hung out at the back and connected

to a loud speaker in the driver's cabin. The speed merchant in the car behind would then make known his desire to pass by a gentle request breathed into a microphone, which would modulate the beam of his headlights shining on the back of the vehicle in front.

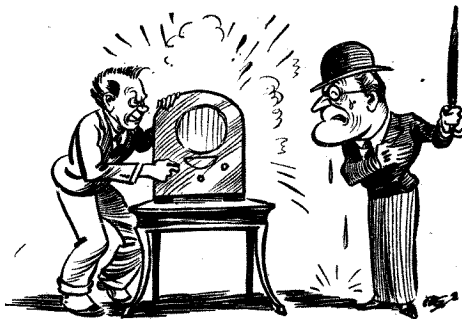
This would be far better than the use of ordinary ultra-short waves, since no interference would be caused in the ether to the annoyance of other listeners and, of course, it would enable the driver to signify his intentions when still a considerable distance behind. When the old-fashioned method of suspending a microphone at the back of the obstructing lorry is employed not only has the man behind to get quite close up before he can address the driver of the car in front, but owing to the necessity of his having to lean out of his car to get at the microphone, his language can offend the delicate ears of susceptible passers-by.

## Short-wave Learners

NOW that the great short-wave boom is commencing and manufacturers are getting killed in the rush to bring out all-wave receivers, an old, long-forgotten menace to peaceful listening has reared its ugly head once more.

I refer, of course, to the bugbear of oscillation on the part of Ham-handed Henry and his friends. In the days when we depended for our foreign stations on the use of two passenger valves and fierce reaction, such troubles were common enough, but with the coming of respectable receivers which really did provide a substantial measure of HF amplification, things gradually became much better.

The growing popularity of short-wave work has, however, revived the trouble once more, and listening to American stations in certain districts has become a very painful practice. The trouble is that manufacturers have once more been caught unawares and relatively few firms have, as yet, put all-wave sets on the market.



Appealing to short-wave fan's better nature.

The result is that people are falling back on some really awful contraptions as stop-gaps. Reaction is far more efficacious on

short waves than on medium waves, and this, combined with its cheapness, makes it popular. Used properly it is an excellent thing, but a short-wave set relying solely on reaction for its results and placed in the hands of a complete novice can be a truly terrible weapon.

It is of little use trying to appeal to people's better natures for, after all, you can't stimulate something that isn't there. The only suggestion I can make is that a special licence be required for listening in on short waves, and that, as in the case of the motor driver, a special beginner's

## By FREE GRID

licence be issued, every holder of it being compelled to nail a large L to the top of his aerial mast during the period of his novitiate. This would, at any rate, enable us to know whom to suspect.

## The Cup Final

I SEEM to have aroused a hornet's nest about my ears as a result of my disclosures the other week of the B.B.C.'s quondam intentions to give us a surreptitious broadcast of next month's Cup Final.

The burden of the song of the letters which I have received concerns the short-sightedness of the B.B.C., who could, so my correspondents say, have a high definition land line link between a near-by house and the Alexandra Palace and so put the programme out on the main television transmitter. The whole business would be somewhat analogous to the annual boat race broadcast, where a low-powered wireless link is used to put the commentary on to the land line and thence to the main transmitters. In this manner, of course, the commentator would be eliminated as lookers in could see things for themselves.

Now I could understand these heartless letters of criticism if the majority of them came from the London area, but they come from all over the place, ranging "from Scotland's mist-clad mountains to Simpsons in the Strand," as the poet puts it. In the first place the range of the Alexandra Palace transmitter is restricted very severely to the Home Counties area.

In the second place only a very small proportion of the people have—or will have by April—even the rudiments of a television receiver. Thirdly, a commentator would still be desirable even if television were as firmly established as acoustic broadcasting, for, as I have previously pointed out in these columns, a pocket portable set is a *sine qua non* even to the people who personally attend at Wembley, since an expert commentary is essential to the full enjoyment of the Cup Final by experienced onlookers as well as the rawest novices. Fourthly, the match is to be broadcast in the normal manner.



# Sound Distribution in PA Work

## Some Acoustic Considerations Affecting the Placing of Loud Speakers

By P. G. A. H. VOIGT, B.Sc. A.M.I.E.E.



Fig. 2.—A simple experiment demonstrating the loss of sense of direction for sounds originating in the vertical centre plane between the ears.

**B**ROADLY speaking, PA work can be divided into two classes, namely, indoor and outdoor. The more difficult acoustic problems are nearly all encountered with indoor work, and this will, therefore, be dealt with primarily. The most usual application of PA consists of amplifying the human voice so that it can be heard in a hall which is too large for the voice unaided; or because the speaker cannot be present in person, talkies being the most common example of the latter.

Since the two ears of a person when sitting or standing normally are on the same horizontal line, sounds originating

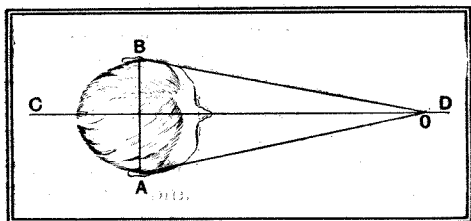


Fig. 1.—Sounds originating at any point on the vertical plane CD reach the ears simultaneously.

on the vertical plane which bisects this line and is at right angles to it will reach both ears simultaneously. The time factor by which the ear primarily determines direction is therefore the same, whether the sound is above, behind or in front of the listener; in fact, it is only the outer ear situated at the mouth of the ear channel which disturbs the sound field and gives any clue to direction. This clue is so slender unless direct comparison is possible that it can be said that the ear is nearly non-directional in a vertical plane.

Fig. 2 shows a simple test for proving this: Get someone (not a W.W. reader!) to sit down and close his or her eyes; then snap your fingers once above and behind his or her head, but exactly on the centre plane. Next ask him or her to point in the direction from which the sound originated; the result, to say the least, is generally very amusing.

This "deficiency" of hearing can often be utilised to advantage by remem-

*PA, which began with the megaphone, has assumed an entirely different aspect with the advent of valve amplifiers. Sometimes the results are appalling—often quite good. But without full knowledge of the acoustic considerations underlying PA work, good results, even with the best apparatus, can only be regarded as an accident.*

bering that the loud speaker can be displaced vertically a much greater distance than is possible horizontally before the ear can detect the change. A loud speaker can therefore be supported near the ceiling above a lecturer's head, and, if the quality be good enough, the fact that PA is in use may pass unnoticed. This is as it should be, but is rather thankless for the engineer concerned. If the lecturer is clearly visible on the left while the loud speaker is bellowing into the back of the right ear, the fact that PA is in use not only becomes noticeable, but the sensation is disconcerting and objectionable.

### Acoustic Images

Should circumstances make it impossible to use one loud speaker on the correct plane, then the next best arrangement is to use two loud speakers equidistant, but as close as possible, and on each side. They must, however, then be in phase with one another. If it is not convenient to test the phasing before erection, then the quickest test is to listen over the region on the plane between the speakers. As the listener moves from one side of the plane to the other (see Fig. 3) he should pass a spot where the sound seems to be coming from a point exactly midway between the speakers. If no such spot is encountered, and in its place there is a "dead" region, it can safely be assumed that the loud speakers are out of phase and one pair of connections only (either speech or field) of one of them should be reversed.

In actual practice the lecturer usually moves about while the loud speakers are fixed. This is not, however, very material, since the ear as a direction finder is not very accurate so long as the eye interferes with its judgment. The ease with which a ventriloquist can deceive us into "hearing" his dummy speak is proof of this. If you have any doubts as to where the dummy's words really originate, close your eyes so as not to be deceived and listen again.

It is particularly difficult to avoid disconcerting the listener in those cases where local sound reinforcement only is required, a typical example being the space under a large balcony in a theatre. The ideal (usually unattainable for decorative reasons) is to use a number of small speakers directive in the direction of travel of the original sound waves. The spacing of the loud speakers should be as close as practical considerations permit so that the worst angle sideways (Fig. 4) off the true direction is as small as possible. In this connection it should be remembered that if the loud speakers are as far forward as possible, and the sound is kept off the

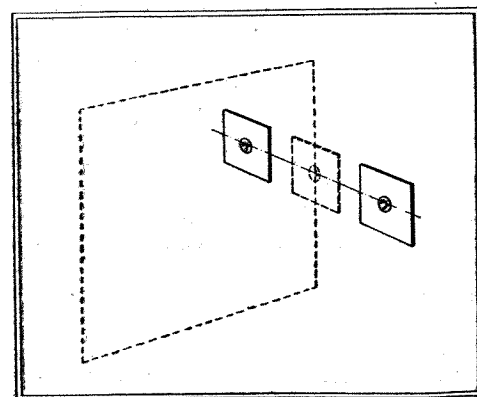


Fig. 3.—In the plane at right angles to and bisecting the line joining pairs of speakers (in phase) the sound will appear to emanate from a point midway between.

**Sound Distribution in PA Work—**

people near them, then the angle off correct direction for those intended to hear the loud speakers will be smaller, and consequently the effect better.

Fig. 4 shows five small speakers fixed under a balcony. A listener situated at X should not be able to hear the nearest speaker as it subtends too large an angle to the source of sound S. This brings out the advantage of projectional type speakers for this kind of work. Further back the angle becomes smaller, and therefore the directional error less noticeable. Fig. 4 also shows the lines over

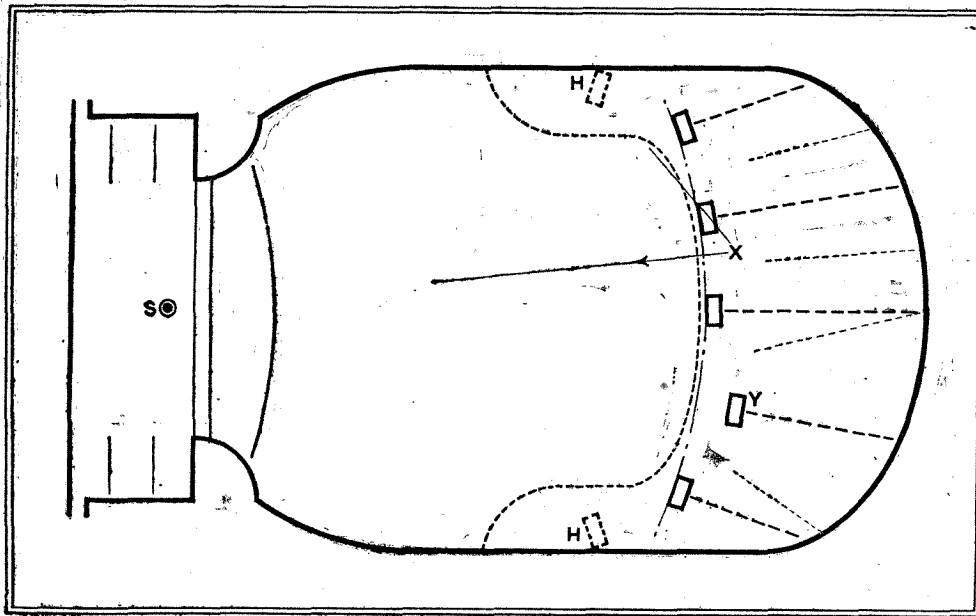


Fig. 4.—Plan of theatre with loud speakers arranged to reinforce the sound under a balcony. Errors of spacing will introduce objectionable directional effects.

which the sound as regards direction will be perfectly correct. To each speaker there is a line, and the intermediate lines are due to pairs of speakers. The position of the intermediate lines is determined by the position of the corresponding pair of speakers. The speakers must lie on a circle if the intermediate lines are to run midway between the main lines. One of the speakers (Y) is shown off the circle, and it will be noted that this causes two of the intermediate lines to run in the wrong direction.

The centre of the circle on which to locate the speakers should be just forward of the centre of the stage, and it should hardly be necessary to mention that phasing is of the utmost importance on an equipment of this kind.

**Time Lag**

In such an equipment there is one small but fundamental fault, and that is the slight time difference between the amplified and the true sound. This, fortunately, is not serious, particularly with theatres of normal dimensions. The various methods of introducing delay, e.g., a modified Blattnerphone or pipe lines, introduce undesirable complications, while the direct alternative is to have the microphone the correct distance from the stage, say, near the ceiling. This, however, in-

roduces difficulties owing to echo effects, low sound pressures, etc. Sound mirrors may be used to overcome this, but unless large they will not cover the lower musical frequencies adequately.

Let us return now to the ordinary case of single loud speakers. Fig. 5 shows a plan of a typical small hall in which only a few of the possible sound paths from the lecturer to the listener are shown. When PA is used in such a hall there is often an amazing difference between the sound of the original person's voice and the PA reproduction as heard at the back of the hall.

The explanation is much easier than its cure, and is often directly due to the fact that the "spherical" characteristic of the loud speaker is very different from the published "axial" characteristic. Listening at the back of the hall a mixture of direct and reflected sound is heard, whether the original is the human voice or a loud speaker. Those sound waves of the original voice which travel sideways or upwards, while slightly different to those heard by a person directly in front, are not very different. When they are reflected they are therefore still generally very similar to the original, and consequently do not cause appreciable change in tone. With the majority of loud speakers, however, this cannot be said, the sideways sounds in many cases being utterly different, and as a rule starved in upper frequencies. In due course they are reflected, and instead of helping the listener only serve to increase the "boominess" of what he hears.

Over-amplifying the top register helps greatly when such a state of affairs exists, but tends also to make the sounds harsh and displeasing.

The use of a loud speaker which radiates a perfect frequency response in all directions would meet the case excellently, but would be inconvenient owing to "howl-back" if the microphone were in the same hall. In such cases a loud speaker which

projects the bulk of its energy in the desired direction and a minimum in other directions is definitely advantageous.

Since practically all loud speakers radiate some energy sideways, it is interesting to study what happens to the sound radiated. Every time a sound wave strikes a surface, whether it is reflected or not, there is exerted on that surface a force.

**Selective Absorption**

At high frequencies all normal walls, even thin plywood partitions, are substantially stationary. If the surface is porous there will be some sound absorption, particularly at the higher frequencies.

At low frequencies sound absorption due to porosity becomes negligible, but a loss due to bodily vibration of the wall may take place. With increase in wavelength larger patches of the surface are exposed to sound pressure of the same phase simultaneously. This increase in area subjected to pressure (and, of course, suction immediately before and after), taken together with the increase in time during which each half-wave lasts, results in setting the reflecting surface into motion to a greater and greater extent. It may seem silly to think of a brick wall being in motion, but it should be remembered that in acoustic matters one-tenth of  $\frac{1}{1000}$ th inch is not only motion, but motion of considerable magnitude. In fact, if a wall 12ft. square is moving as much as this, it may absorb more energy than a large loud speaker can deliver. A patch of wall 12ft. square would be a very small patch indeed in the wall of a cinema, and in any ordinary lecture hall the window area may easily exceed this figure several times.

When the surface moves bodily the frequency concerned tends to pass through and be lost. It will be seen, therefore, that the normal tendency is for the high and low frequencies to be diminished on reflection, circumstances deciding the magnitude and frequency range of the effect. When the walls are very thin the "low-frequency" loss may extend into the middle register and cause a clear but hard effect. This can be countered partially by additional absorption of high

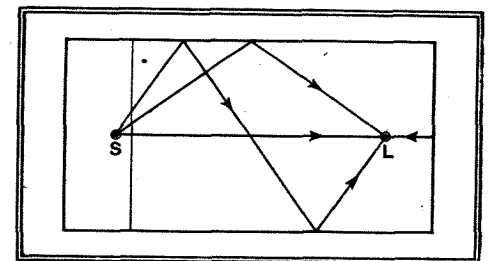


Fig. 5.—In a small hall internal reflections between speaker and listener have an important influence on the quality of speech.

frequencies, but two wrongs do not necessarily make a right, and in such halls it will always be difficult to obtain a pleasing bass register.

In practice it is the top loss which usually predominates, and this reduces such traces of top as were radiated sideways by the speaker. The result is that

**Sound Distribution in PA Work—**

the reflected sound is more than ever over-rich in the lower middle register, and contributes nothing to intelligibility.

Of all the reflecting walls the back one against which the loud speaker is projecting is probably the most important. In an ideal case this wall would absorb *all* the sound reaching it. In practice, however, this hardly ever happens, and the wall plays its full part in adding to the reflected waves.

It is usually impossible when setting up a PA equipment in a hall to make extensive acoustic investigations. It is, therefore, convenient to be able to make a few rough tests. Probably the most valuable quick test is to turn the volume control until the system starts howling.

I believe that the ideal is for the listener to hear an undistorted image of the sounds reaching the mike. This involves, among other things, a chain comprising microphone-amplifier-loud speaker-hall (to the listening point), the frequency response of which should be as level as possible.

If now the microphone is situated at a listening point and the system allowed to start howling, then the note on which it howls will be on or very close to a peak in the chain. Now, if the chain had a substantially level frequency response, the stationary waves caused by reflection would see to it that there were peaks all the way up and down the scale. The chain should therefore tend to howl on *all notes at once*. The average equipment in use for PA is not nearly perfect enough for this to occur, but if the amplifier is provided with the necessary controls it should be possible to adjust the frequency response so as to suit the hall and obtain simultaneous howling at low, medium and high frequencies. This setting of frequency response will generally be found the best for that listening position, and will probably be found typical for that equipment in that hall.

When the mike is on the platform it may be out of the field of the loud speaker, so that the howl test taken in that position gives different results, but, even so, if the howl test cannot be made with the mike in the listening position, an adjustment made to the howl test with the mike on the platform is much better than none at all—particularly as the setting thus obtained will be the setting for maximum amplification—which is sometimes more important than getting the most natural quality possible.

The howl test applies equally to open-air working. The corrections then made are, however, not to compensate for defects in acoustics so much as for defects in the gear itself.

Normally, acoustics do not enter into outdoor problems, which are nearly all problems of distribution. The difficulties being generally those of overcoming echo effects or of covering a scattered audience as uniformly as possible.

The best mode of solution in such cases depends almost always on details of the site, and cannot, therefore, be dealt with satisfactorily in an article of this kind.

# Random Radiations

By "DIALLIST"

**Bigger Regionals**

THE raising of the power of the West and Midland Regionals from 50 to 70 kilowatts is a step in the right direction, though I am afraid that the additional 20 kilowatts will not produce any sensational improvement. All of the B.B.C. Regionals could go to 100 kilowatts under the Lucerne agreement, but only those at present under construction—Northern Ireland, North Scotland and North-Eastern England—are designed for such an output. The existing Regionals can be brought up to 70 kilowatts, and the London, North and Scottish stations will shortly reach this figure; but to increase the power to 100 kilowatts the transmitters would have to be reconstructed. I expect that the B.B.C.'s intention is to rebuild the older stations one after another as soon as the three under construction are completed. After all, the Brookmans Park plant is more than six years old, and that is a considerable age for broadcasting stations nowadays. The North Regional is the next in order of seniority, dating as it does from July, 1931. The Scottish came into full operation in September, 1932, and the Western in the following summer.

**How Do You Find Them?**

Myself, I don't find any great increase in the field strength of either West or North Regionals. They have always been pretty good signals for me, even in daylight, and it is seldom that either shows any great tendency towards fading. Such improvement as there is will probably be noticeable towards the fringes of their respective service areas, where the increased power may result in both a stronger and a steadier signal. I hope to be paying a short visit to Devonshire towards the end of the month, and whilst I am there I shall be able to discover whether the West Regional is now better received in the middle of the county than it was when I was there last year. It would be interesting to hear from readers living within 50 to 70 miles of West and Midland Regionals whether they are now obtaining better reception through the increase in power.

Northern Ireland, which is due to come into action to-day (March 20th) will, it is reported, make a start with 70 kilowatts, going up to 100 kilowatts if it is found necessary to do so.

**More Dance Music**

THE B.B.C. is certainly determined that those who want dance music shall have it. Henry Hall's orchestra has been increased in size, and dance music programmes from the end of this month are to average rather more than two a day. Another change is to have earlier dance music programmes. The reason for this is to enable the B.B.C. to enlist the services of a number of bands which are not available late in the evening. I am not myself able to digest more than small quantities of dance music, and those quantities become

minute when it is accompanied by crooning. Many other listeners are similarly constituted, and I hope that the B.B.C. will cater for us by giving us desirable alternatives.

**Too Much Music?**

THE older I become as a listener to broadcast programmes the more, I find, do I welcome the spoken parts of the programmes. I am very fond of music of most kinds (though the ultra-modern highbrow cacophony generally leaves me bewildered and exasperated) but I don't feel at all sure that we aren't getting too much of it, not only from the home stations, but from all broadcasting stations. At one time the B.B.C. struck a distinctly bad patch with what were then known as Topical Talks. They now have the happy knack of bringing to the microphone people who can deal in an interesting way with subjects that must appeal to a very large body of listeners. In addition to the talks I like the debates, especially those of the unrehearsed variety; I find many of the readings entertaining, and I nearly always turn to the broadcast plays. I have an inkling that in the future the spoken word is going to play a greater and a more welcome part in the broadcast programmes.

**A Wonderful Cable**

SINCE the laying of the co-axial cable between London, Birmingham and Manchester is proceeding so rapidly, it seems practically certain that the Birmingham high definition television transmitter will be put in hand soon after the Alexandra Park station is completed, and that Manchester will follow before long. I imagine that the G.P.O. is not laying this cable, which costs about £1,000 a mile, purely for television purposes. Their intention is probably to make great use of it for the telephone services. Owing to the enormous range of frequencies with which it can deal a co-axial cable may be able to carry simultaneously scores and scores of telephone conversations by means of the "wired wireless" (another contradiction in terms!) system. As the television programme will last, to begin with at any rate, for only three or four hours during the day, the cable will be largely available for telephony, and it should be most useful during the busy morning hours when television transmissions are not likely to take place.

**Low Power—Long Distance**

SEVERAL hard-boiled long-distance enthusiasts have told me that they can't make out why I should be surprised that low-powered medium wave stations rated at one kilowatt or less should manage to span the Atlantic in both directions. You may remember that I mentioned recently that many of the small European stations were regularly heard in North America by DX enthusiasts, whilst tiny American stations are picked up in this country. Well, I can't help regarding it as remarkable that such minute power can achieve ranges of 3,000 miles or more; almost more wonderful is the fact that the wireless valve can be sensitive enough to deal with the microscopic impulses that reach its grid when it is dealing with such transmissions. One would very much like to know something about the way in which radio waves accomplish their long journey. Reception must, of course, depend purely on the sky wave.

# The Future of British Broadcasting

## Recommendations of the Broadcasting Committee : Summary and Comment

*"The position of the Corporation is one of independence in the day-to-day management of its business, and of ultimate control by His Majesty's Government. We find that this line of demarcation has been observed in practice, and we are convinced that no better could be found."*

**A** RECOMMENDATION that the general structure of the broadcasting system should be maintained as it now stands is the principal feature of the Committee's report; they endorse the chief features of its administration in the past, and they express high appreciation of its management by the British Broadcasting Corporation, describing their own recommendations as "directed towards the further strengthening and securing of the position which the broadcasting service in Great Britain has happily attained in the few years of its history." They recommend that the Royal Charter be extended for a term of ten years.

### Ministerial Responsibility

In the matter of control, it is recommended that the Postmaster-General should continue to deal with the licensing system and those technical matters arising from the Wireless Telegraphy Acts, but that the Ministerial responsibility in respect of broad questions of general policy and culture should in future be allocated separately to a Cabinet Minister in the House of Commons, free from heavy departmental duties. This is, of course, an interesting and highly important recommendation.

Subject to the right of the Government to ultimate control of broad issues of policy, the Committee considers that the Corporation should, as in the past, be allowed as much freedom as possible in its domestic affairs and in details of management.

### The Licence Fee

It is recommended that the broadcast receiving licence fee should remain at ten shillings, and that, of the net revenue from these licences, after deducting Post Office costs, a larger share (namely, 75 per cent.) should in future be allotted to the Corporation.

The Committee recommend that an improvement in the Corporation's income should be brought into effect at once,



SIR JOHN REITH, the British Broadcasting Corporation's first Director-General.



that is, during the present calendar year; and that the balance of 25 per cent. of the net licence income should be regarded as potentially available for broadcasting so far as it may be required.

The important service of Empire broadcasting should be developed and, it is considered, extended with additional funds from the increased share of licence receipts, and the appropriate use of languages other than English in this service is regarded as desirable in the interests of British prestige and influence in world affairs.

As regards television, the Committee recommend that the Corporation should be formally authorised to undertake television broadcasting, and that the financial requirements for this purpose should be re-examined in the autumn of this year, in the light of experience of the television service shortly to be introduced in London.

### Relay Exchanges

The Committee propose that the ownership and operation of broadcast relay exchanges should be transferred to the Post Office, whilst the control of programmes for this service should be in the

hands of the B.B.C., who should take into consideration any desire of the subscribers for a selection from foreign programmes.

The proposals outlined above may be regarded as the principal recommendations of the Committee, but a number of additional points are dealt with and many comments are made in the full text of the Report.

### Governors and Organisation

The Committee recommend that the number of Governors should be increased to seven and that in their appointment full attention should be paid to width and variety of outlook. They consider that the internal organisation has been established on sound lines and has worked successfully.

A gradual enlargement of the responsibilities of Regional Directors is noted with an increase in the proportion of programme material originating within the Regions. They recommend a continuance of this policy.

The Committee quote and endorse a statement from a recent report expressing satisfaction with the effects of past appointments of staff to the B.B.C. They



# Broadcasting

recommend that future vacancies should be advertised and filled on the recommendation of a specially composed Selection Board. The Corporation should, they consider, make it clear that it will provide facilities for a staff representative organisation, which its employees may wish to set up.

## Programmes and Service

The Committee believe that the B.B.C. would in the past have been able to provide more varied programmes and a more rapid extension of service, if its income had been larger. They consider that the Corporation has followed the right and the best course in meeting capital requirements from surpluses of revenue over current expenditure, and suggest that in future, when the annual Estimate for broadcasting is presented to Parliament, the major items of capital expenditure contemplated in the ensuing year should be stated. They propose a definite form for the published Annual Account of Expenditure.

## Political Broadcasting

The Committee found in the evidence and correspondence submitted to them proof of general satisfaction with the broadcast programmes. They regard as satisfactory the present arrangements for the home news service. They think it important that controversial topics should continue to be discussed, and refer to the independence and wisdom shown by the B.B.C. in handling these matters. In political broadcasting they consider that the B.B.C. have on the whole been successful in holding the scales evenly between the various political parties. During a General Election campaign it is proposed that the time allowed by the B.B.C. for political broadcast speeches should be apportioned by agreement between the Government, the official opposition, and other parties.

In regard to music, the Committee support the policy of studio performances and public concerts by the B.B.C. orchestras, and the relaying of the best performances of other organisations. They regard it as important that in the selection of light music (which occupies about one-third of the programme time) attention should be continuously directed to good musical quality and to the improvement of public taste.

## School Broadcasting

The Committee look forward to the time when every school will have wireless receiving apparatus. They suggest that a set might be specially designed for school use and widely adopted by Local Educa-

tion Authorities. It is not mentioned, however, that this idea was adopted some years ago but abandoned. While approving the present system, they suggest that the Councils for Schools Broadcasting should be given independent status.

## Advertisements

The Committee recommend the continued exclusion of direct advertisements from B.B.C. programmes, and express their anxiety "that the intellectual and ethical integrity which the broadcasting system in this country has attained should be preserved."

## "Sponsored" Programmes

They recommend that the B.B.C. should have the power, as in the past, to admit sponsored programmes at their discretion—a view which was not, however, shared by all members of the Committee.

The Committee were informed that in

They observe that there has been a conspicuous development of broadcasting in English from certain foreign countries, whose broadcasts are received in all parts of the Empire, and that it is all the more important that what has been called "the projection of England" should be effectively carried out by a steadily developing Empire service of our own.

## Electrical Interference

It is very satisfactory to find that the Committee has taken a strong line in regard to interference, urging that the technical investigations which have extended over two years should be concluded as soon as possible, and that if further statutory powers are necessary to protect the listener they should be sought.

A suggestion which is likely to cause considerable discussion is that, as has been done abroad, the B.B.C. and the wireless trade should consider the question of designing a standardised receiver to be sold at a low fixed price.



THE ULLSWATER COMMITTEE. A photograph taken at a meeting of the Committee to advise on the future of the B.B.C. Seated (left to right): Major the Hon. J. J. Astor, Lady Reading, Major C. R. Attlee, M.P., Viscount Ullswater (chairman). Standing: Mr. H. G. G. Welch (secretary), Mr. Graham White, M.P., Mr. Clement Davies, the Rt. Hon. Lord Selsdon, Lord Elton.

the early stages of television broadcasting it might be necessary to resort to sponsored programmes. They observe that in the actual use of the power discreet judgment has been shown in the past, and they hope that any increase in its use will be limited to the initial stages of television broadcasting.

The Committee mention with approval the endeavours of the Post Office and the Foreign Office to prevent the broadcasting from foreign countries of programmes in English which include advertisements.

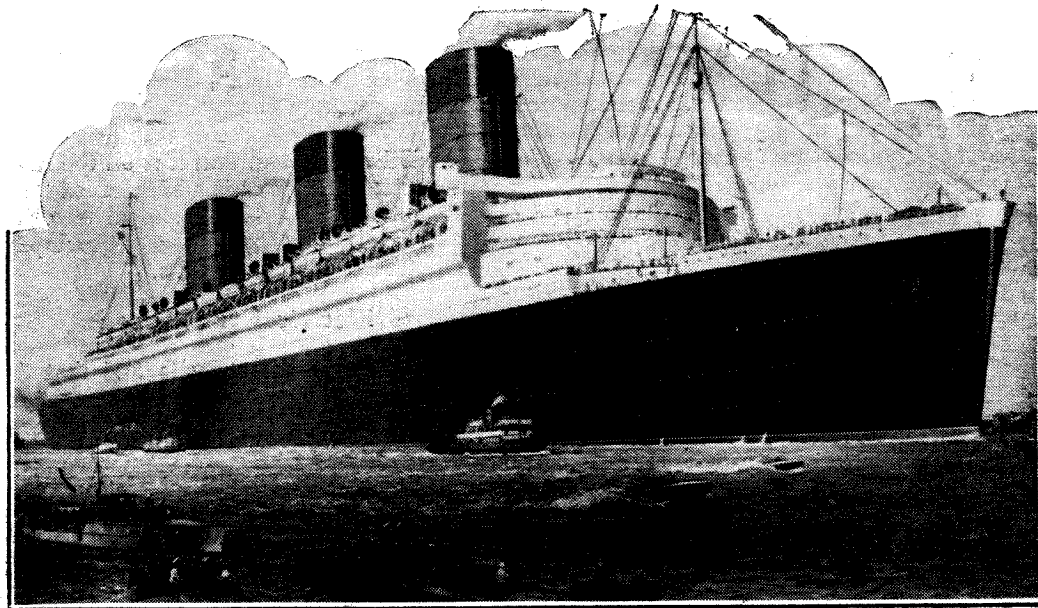
## Empire News Service

The Committee regard the news broadcast service to the Empire as satisfactory.

With regard to noise from loud speakers, a model by-law designed to check the inconsiderate use of loud speakers, etc., is quoted and the suggestion made that it should be adopted by local authorities.

## Reservations

For the most part the conclusions of the Committee are put forward in a Report signed by all the members. The main structure of the recommendations is thus unanimous, though there are reservations appended to the Report expressing certain differences of judgment on past events and of opinion as to future methods.



# Listeners'

Wednesday next, March 25th, when the National wavelengths will be modulated to the strains of the famous Hungarian composer's "Cantata Profana." This "profane" work, scored for tenor and baritone soloists, mixed chorus and orchestra, was composed in 1933. The "story" of the Cantata is unhappy, being based on a Hungarian folk legend telling how nine young huntsmen, bewitched, are turned into stags. The father searches for his sons in the forest, but when they see him coming they beg him not to shoot them lest they turn on him and kill him.

The concert will be given by the B.B.C. Orchestra and Choral Society, Dr. Boult conducting, and the second part will consist of Beethoven's Ninth Symphony—the Choral.

## ENGLAND v. SCOTLAND

ENGLAND hopes to draw level with Scotland in to-morrow's Calcutta Cup Rugby match with Scotland, on which a running commentary is to be given by Captain H. B. T. Wakelam at 2.50 (Nat.). Since 1871, when the first match of the series was played, Scotland has won twenty-four and England twenty-three, the remaining ten having been drawn. In his broadcast Captain Wakelam will doubtless communicate some of the feverish enthusiasm with which the game will be watched by Scots and Sassenachs alike.

"WEATHER permitting" is an inscription not often appended to a prospective broadcast arrangement, but it applies in the case of the relay from Clydebank next Tuesday morning when George Blake will be in charge of a running commentary on the big but delicate task of manoeuvring the "Queen Mary" round Bowling Bend, a critical point in her journey down the Clyde on the way to Southampton. The broadcasting schedule will be as follows:—the first broadcast will begin at 10 and end at 10.10 a.m. (Nat.). A further broadcast will be given from 11.50 a.m. to 12 noon.

Should weather conditions prevent the ship from moving from her fitting-up berth on Tuesday, the same times and conditions will apply to any other day when the tide and elements will allow of her journey. In the evening news bulletins there will be recorded descriptions of the journey down to the sea.

## TWENTY-TWO YEARS BACK

THE 1914 "Scrapbook," first broadcast two years ago, is probably the most impressive yet devised by Leslie Baily and Charles Brewer. It is to be presented to National listeners at 8.30 on Monday and Regionally at 7.15 on Tuesday.

Naturally the opening of the War looms largest, but the year is full of interest. Some of the greatest figures of variety were in their prime, and it was a bumper year for opera, four "seasons" running in London, three of them concurrently. The programme

"QUEEN MARY" SAILS. An artist's impression of the giant liner, which leaves the builder's yard on Tuesday on her first voyage to Southampton. Mr. George Blake will give running commentaries at 10.0 and 11.50 a.m. on the ship's departure, and electrical recordings will be heard in the night news bulletins.

fittingly concludes with the fraternising of the German and British troops between the lines on Christmas Day, 1914.

Several prominent personalities are coming to the microphone, including the Countess of Oxford and Asquith and Admiral Sir William Goodenough.

"Scrapbook for 1914" is the first of its type to be revived. Have the authors run short of years?

## HARLEM: LOCAL COLOUR

THE B.B.C. promises us at least one real song hit in "The Molasses Club," a special Harlem feature which comes to the Regional microphone at 8.15 on Wednesday next. Annette Mills has collaborated with Arthur Campbell in writing a vivacious story to be played by a cast composed entirely of coloured artists, supported by a "hot" band.

We begin in a beauty parlour, with its "Shoe Shine" chorus, then switch over to the "Molasses Club"—much the same as the famous Greenwich Village Garden Club—and say good-bye in a railway station. The cast will include Ike Hatch, the Cole Brothers, and Roy Peyton and his Coconut Grove Boys.

## IN A RAILWAY CARRIAGE

"CONVERSATIONS in the Train" was one of the most successful talk features ever devised by the B.B.C. Although, according to present arrangements, no new series has been planned, there is to

be one "conversation" on Wednesday next (Reg., 9). The script, by Patrick Hamilton, will deal with the perennial problem of domestic service and whether it is really slavery or just a job like any other. Two ladies of the servant-employing class will introduce the subject, an elderly bachelor will point out the fallacies of their statements and, finally, a little woman in the corner—herself a domestic servant of twenty years' standing—will give her views. The fat will then be in the fire . . . and many listeners will be sorry they cannot join in this wordy war.

## PROFANE CANTATA

YET another chance to decide what Bela Bartok is getting at comes our way on



"SCRAPBOOK FOR 1914." Memories of the first days of the War will be revived in the feature programme by Leslie Baily and Charles Brewer on Monday and Tuesday. Above is a unique unpublished photograph showing the first British troops to land on Continental soil in 1914—Royal Marines at the Maritime Station, Ostend.

# Guide for the Week

## Outstanding Broadcasts at Home and Abroad

### HIGHLIGHTS OF THE WEEK

FRIDAY, MARCH 20th.

Nat., 8.15, "The Green Goddess."  
11.15, Film Carnival Ball.

Reg., 7.30, B.B.C. Orchestra. 9.15,  
Café Colette Orchestra.

Abroad.

Warsaw, 7, Alfred Cortot (piano-  
forte) and Station Symphony  
Orchestra.

SATURDAY, MARCH 21st.

Nat., 2.50, England v. Scotland  
Rugger. 8.30, Floor Show. 11,  
Lew Stone and his Band.

Reg., 4.15, "The Fol-de-Rols."  
8.30, Sir Landon Ronald conducts  
London Symphony Orchestra.

Abroad.

Cologne, 7.10, "German Police  
Day"—Winter Relief Fund Con-  
cert.

SUNDAY, MARCH 22nd.

Nat., Isidore Schuller String  
Sextet. 6.45, Imaginary Bio-  
graphy: "The Original of Mona  
Lisa." 9, "The Carlyles at  
Cheyne Row."

Reg., B.B.C. Military Band. 5.15;  
"A Pre-War Sunday Concert"  
(gramophone recital). 9.30, Sir  
Henry Wood conducts Sunday  
Orchestral Concert.

Abroad.

Leipzig, 7, "Love's Songs," with  
Leipzig Symphony Orchestra.

MONDAY, MARCH 23rd.

Nat., Carroll Gibbons and his  
Band. 8.30, "Scrapbook for  
1914." "International String  
Quartet.

Reg., "Let's Broadcast," new  
broadcasters' feature. 8.30,  
B.B.C. Orchestra, conducted by  
Sir Hamilton Harty. "Sydney  
Lipton and Grosvenor Hotel  
Dance Band.

Abroad.

Luxembourg, 8.55, Operetta: "La  
Poule" (Christine).

TUESDAY, MARCH 24th.

Nat., 10 and 11.50 a.m., "Queen  
Mary" running commentary.  
8.30, Nomo King in Variety.  
"Leslie Bridgewater's Quintet."

Reg., 7.15, "Scrapbook for 1914."  
"Elgar and Handel Oratorio  
Concert." "Joe Loss and his  
Band.

Abroad.

Poste Parisien, 9, Colonne Concert  
Orchestra.

WEDNESDAY, MARCH 25th.

Nat., 8.30, Bela Bartok's "Cantata  
Profana" (B.B.C. Symphony  
Concert.) "The Little Show."

Reg., 8.15, "The Molasses Club"  
—a Harlem programme. "B.B.C.  
Military Band." "Roy Fox and  
his Band.

Abroad.

Hamburg, 7.45, "A Colourful  
Spanish Mosaic."

THURSDAY, MARCH 26th.

Nat., Chopin Recital by Irene  
Scharer. 8.30, Comic Opera  
Selections (B.B.C. Theatre  
Orchestra).

Reg., 8.30, Radio Play: "The  
Ringer" (Edgar Wallace).

Abroad.

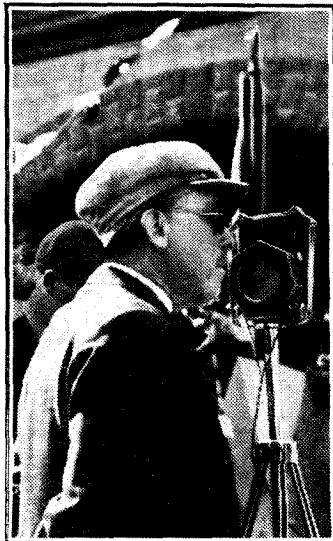
Kalundborg, 7.10 Beethoven Con-  
cert from the State Broadcasting  
Building.

### ENGLISH PRIZE PROGRAMME FROM MOSCOW

Moscow (1,724 metres) has  
an unusually interesting pro-  
gramme for English listeners  
to-night (Friday), for it is the  
winning selection from twenty  
model programmes submitted  
in a competition for the best  
broadcast feature in English.  
The broadcast is designed on  
lines suggested by an ordinary  
Russian listener.

### OPERA ABROAD

An operatic curiosity this  
week is Hamburg's bringing to  
light an almost unknown early  
oratorio of Mozart's, "La  
Bethulia liberata," a work  
based on the legend of Attila.



INFORMAL COMMENTARIES are  
a leading feature of French broad-  
casting. The above picture taken  
at a Nice carnival shows the com-  
mentator giving listeners his  
impressions.

The original "book" was in  
Italian, and has been trans-  
lated into German by Hans  
Joachim Moser, the title being  
changed to "Ildiko and At-  
tila." The oratorio is being  
relayed at 10 this evening by  
Hamburg from Flensburg.

To-day's foreign operatic  
programmes also include  
Grieg's "Peer Gynt"—from  
Prague at 7, and Verdi's  
"Masked Ball," from Rome  
at 7.45.

A notable electrical recording  
is to be given by Leipzig on  
Tuesday at 9.20—Act III of a  
new opera-comique "Ero" by

Jakov Gotovac, made  
at the original per-  
formance in Zagreb.  
The same evening  
Warsaw is relaying  
from the State Opera  
a rendering of Wag-  
ner's "Tannhauser"  
at 7.10.

IF EARS COULD SEE,  
no Czecho-Slovakian  
listener would fail to  
tune in Mlle. Tomanova  
broadcasting the news  
bulletin from Prague.



### SPRING OPERETTAS

In the spring the listener's  
ear turns to light opera, of  
which there will be an abun-  
dance on the Continent within  
the next seven days. Bero-  
munster offers us "Frühlings-  
luft" (Spring Air) by Josef  
Strauss at 6.50 to-morrow,  
while at 7.40 Bratislava pre-  
sents Lehar's "Spring," clash-  
ing with Milan's version of  
"The Rose of Stamboul"  
(Leo Fall). This perfect Satur-  
day evening will conclude with  
a Toulouse version of Lehar's  
"Merry Widow" at 9.10.

On Tuesday Strasbourg gives  
us a richly varied programme  
at 8.15 p.m. The studio pro-  
duction is under the leadership  
of M. de Villers, and consists  
of: (a) "Bonsoir, Voisin"  
(Poise); (b) Orchestral Fan-  
tasia on Messager's "Véron-  
ique," "Monsieur Beaucaire,"  
"L'Amour masqué," and  
"Passionément"; (c) "La  
Bergamote" (Jean Iri).

### LISTEN FOR THESE . . .

A "RADIO MAZE" suggests  
novelty in the Berlin (Funk-  
stunde) programme at 7.10 on  
Thursday next. Other notable  
concerts within the next seven  
days will be a Vivaldi concert  
from Monte Ceneri at 4.30 to-  
morrow, Handel's oratorio,  
"Israel in Egypt," relayed by  
Strasbourg at 4 on Sunday  
from the Palais des Fêtes, and,  
from Leipzig, at 7.10 on Tues-  
day, "Through the Battlefields  
of Central Europe"—a mili-  
tary band sequence.

### HITLER'S ELECTION AD- DRESS

A MONDAY morning tonic  
for those who understand  
German will be the Election  
Address by Herr Hitler's  
deputy, Herr Rudolf Hess, to  
be played at 10.15 on March  
23rd from the "Leuna"  
Works, Halle, by all German  
stations.

### GREEK MUSIC

An unusual "national"  
music programme comes from  
Berlin (Funkstunde) at 7.10  
on Wednesday in the form of  
a German-Greek evening.  
There are to be addresses by  
German officials and by the  
Greek Minister in Berlin, and  
Greek music by the station  
orchestra, with Greek folk  
songs.

### CORTOT AND THIBAUD

"STAR" artists of the week  
are Alfred Cortot (pianoforte),  
broadcasting from Moscow  
(726 metres) at 5.30 on  
Sunday, and Jacques Thibaud  
(violin), in the Warsaw pro-  
gramme at 9.10 on Thursday.

### SYNCOPIATED ORATORIO

A JAZZ oratorio must win  
the weekly biscuit. It is to be  
relayed from Kalundborg on  
Thursday next, at 3.35 in a  
Boys' Corner broadcast. The  
composer, Mr. Bernard Chris-  
tensen, combines the dual  
rôles of organist at Christians-  
borg Castle Church and leader  
of the jazz life of Denmark.

THE AUDITOR.

# Public Address Equipment

## A REVIEW OF COMMERCIAL APPARATUS

**T**HE demand for what is colloquially called public address equipment grows steadily as new uses are found for such apparatus. When one surveys the products of the many firms which supply the demand, one gets the impression that the public are "addressed" a good deal and probably enjoy it. It is but a few years since the man with the puny, indistinct and ineffective voice who attempted to address a large audience got on our nerves. If we had perforce to sit at the back of a hall under a balcony little was audible, although the speaker might be strutting up and down the stage gesticulating wildly. Public address equipment has eliminated all this, and however weak may be the vocal organ, it can be amplified and even clarified by aid of microphone, amplifiers, and loud speakers. Whenever we go to a sports meeting or a large auditorium, the PA system is there and adds inevitably to our enjoyment. Brooklands, for example, has been made much more enjoyable for motor car race meetings by the introduction of a PA system, whereby all information concerning the start and finish of a race is broadcast over a wide area by a plurality of loud speakers having short flares. The directional properties of these flares is also very conspicuous, and is apt to be a disadvantage. When a large gathering of people is to be covered the distribution should be fairly uniform, a condition easily obtained by using certain methods of diffusion.

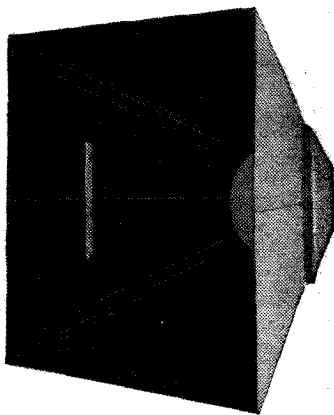
### High-efficiency Output System

In addition to itinerant PA outfits for such purposes as electioneering, there are important applications to hospitals, hotels, clubs and for broadcast relay purposes. These latter do not, of course, call for watts of acoustical power from any individual loud speaker, but a considerable wattage must be available to supply hundreds of individual points. The introduction of the improved method of push-pull operation in which the power valves are preceded by a "driver" stage has resulted in a much higher efficiency than that obtained in the usual way with class "A" amplification. The quality is, of course, not so good as in the latter method, but the highest quality is not needed in PA work. Here the governing factors are high power, clarity, and economy, so that the new high-efficiency method has everything to recommend it. The object of the following descriptive notes is to give readers a representative idea of some of the public address equipments of various kinds

*WITH commendable enterprise, firms manufacturing sound amplifying equipment have produced apparatus suitable for a wide diversity of purposes. Indeed, each of the specialised applications of "public address" is so well catered for that all equipment cannot be described individually, but this guide gives a good idea of the various apparatus now available*

which can be purchased at the moment.

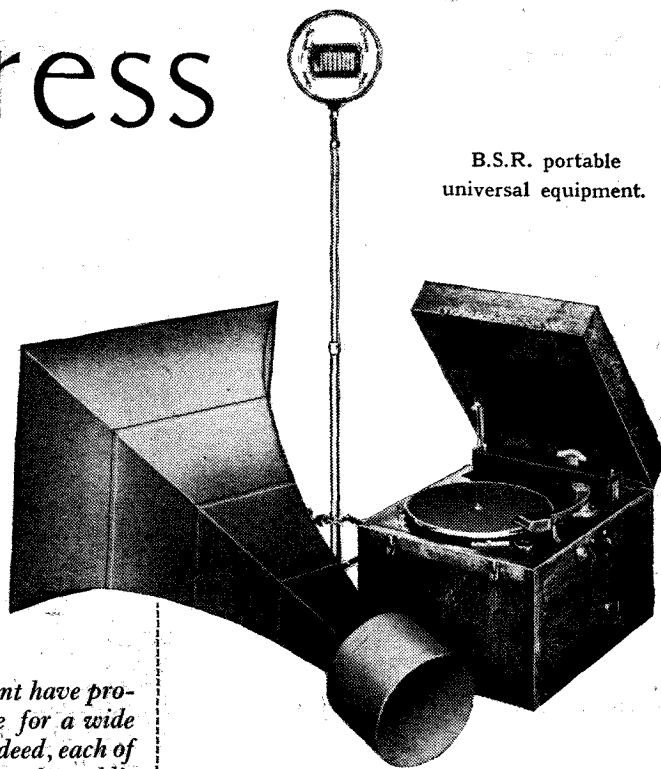
The firm of ARDENTE supply four types of amplifier chassis for either indoor or open-air functions. All chassis are suitable for 200-250 volts AC and 40 to 100 c/s. Model TA205 has an input of 90 watts and an undistorted power output of 5 watts, the weight being 21lb. Model UA310 takes 150 watts and delivers 10 watts, the weight



Ardente folding speaker flare.

being 35lb. Model SA318A consumes 160 watts and delivers 15 watts, the weight being 42lb. Model SA318 weighs 42lb., consumes 180 watts and delivers 20 watts. Features of these amplifier chassis are: anode current meter jacks in cathode circuits for checking and balancing all valves; calibrated gain control; choice of three output transformer ratios to ensure correct matching of loud speaker.

This firm manufactures a ribbon microphone with a wide frequency range. The thickness of the ribbon is only one quarter



B.S.R. portable universal equipment.

of a mil (0.00025in.). There are also moving-coil and carbon microphones, and, in addition, mixing units for microphone and gramophone pick-up or radio input. The Model PMH loud speakers, with 6ft. exponential horns 2ft. 6in. diameter at the mouth, have a peak input capacity of 10 watts each. There is also the Model PMF directional flare speaker, 2ft. 4in. long, 28in. diameter at the mouth, and peak power capacity 10 watts. Both speakers have permanent magnets.

The Ardente firm also supplies mobile equipment suitable for addressing small or large crowds. Model TB205 amplifier can be mounted in any private car or commercial vehicle. It derives its power from the car battery and consumes approximately the same current as the head lamps. It can be operated for twelve hours from a fully charged 6-volt battery and gives an output of 4 watts.

In addition there is the Junior Portable universal amplifying equipment for vocalists, public speakers, lecturers, and the like. It comprises a moving-coil microphone on a folding stand, amplifier with moving-coil loud speaker and mains cable, the whole outfit weighing 32½lb.

A large variety of equipment for PA work of all kinds is available from BIRMINGHAM SOUND REPRODUCERS. Starting with amplifiers, there is a wide range giving undistorted outputs from about 5 watts to 520 watts. The former is for outdoor use, e.g., lectures, electioneering, fashion displays, etc., and has a frequency range from 40 to 8,000 c/s with a maximum deviation of 1.5 decibels. The amplifier is designed on class "B" principles, there being one LF valve, a driver valve, and two power valves in push-pull. There is also a 12-volt (car battery) portable equipment giving 10 watts undistorted output. The complete outfit comprises microphone, gramophone motor, pick-up, amplifier, and exponential horn speaker. The portable universal amplifying equipment gives 8 watts undistorted output and is operated from either 200/250 DC or AC mains, or a 12-volt, 5 amp. car battery via an anode converter, which is mounted in-

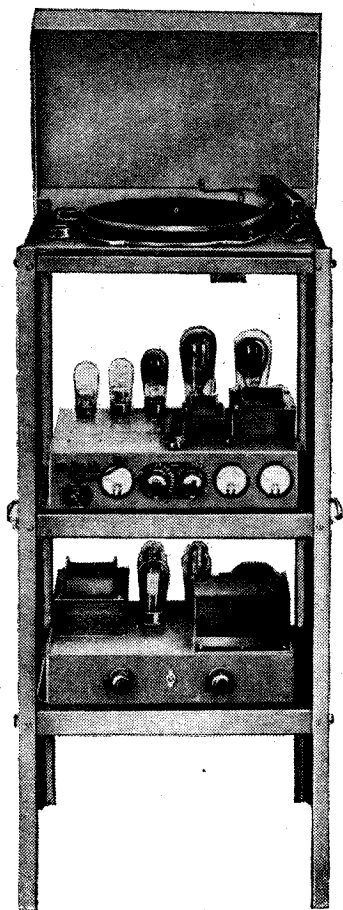


**Public Address Equipment—**

side the cabinet housing—the amplifier, gramophone motor, etc.

Another product of B.S.R. is the local-station school radiogram, complete with moving-coil speaker in an oak cabinet. The B.S.R. 30-watt rack-type amplifier works off AC mains and consumes 180 watts. With an anode dissipation of 50 watts at the power valves in push-pull the output is 30 watts, the gain from input to output being 80 or 100 decibels, according to the input transformer used. The apparatus has the usual feed meters, gain and tone controls, etc.

The high-power amplifiers manufactured by B.S.R. are mainly for relaying broadcasting programmes to a large number of subscribers. The 520-watt undistorted output (Code R.520) amplifier has an overall consumption of 1,100 watts from the supply mains and an input impedance of 600 ohms, this being the usual value for P.O. lines. The frequency range is 50-12,000 c/s with a variation of 1 decibel. The overall dimensions are 79in. high × 43in. wide × 25in. deep. The main HT power circuit and output circuit are in the top chassis, whilst the driver chassis is below. There are the usual meters and controls. The input is a nickel-alloy electrostatically screened transformer, which is followed by one stage of LF resistance-capacity amplification to an AC/P valve. The latter is transformer-coupled to the driver stage comprising two PP5/400 valves in push-pull. These feed to the two output valves (MZ2/250) via a special transformer. There is a multi-ratio output transformer which is screened to comply with

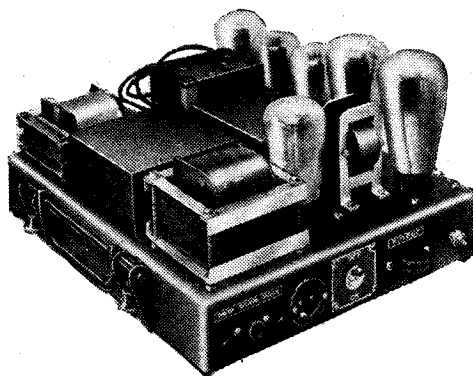


B.S.R. 30-watt rack amplifier.

G.P.O. regulations. A separate bias supply is obtained for the main output valves from a rectifier in the lower chassis, this supply being adjustable by two sliding rheostats.

Separate moving-coil meters are used for each valve and also a 0/3,000-volt meter. The main rectifiers are mercury vapour valves, Type GU2, whilst the bias supply and driver circuit are obtained from UU3 and MU14 rectifiers respectively. This firm also supply a variable-selectivity super-heterodyne receiver and a large range of mains, filament, inter-valve, driver transformers, and heavy-duty chokes of constant inductance.

The BRITISH THOMSON-HOUSTON COMPANY supply a variety of amplifiers ranging from a portable giving 10 watts undistorted output to one for relay PA work giving 120 watts undistorted output. The output from this can be passed on to a 40-watt power unit when additional power is required. There is also a 10- to 30-watt rack and panel equipment designed for hospital work.



B.T.H. 10-watt amplifier chassis.

In addition this company manufacture heavy-duty moving-coil loud speakers with energised or permanent magnets complete with transformer and volume control for relay work.

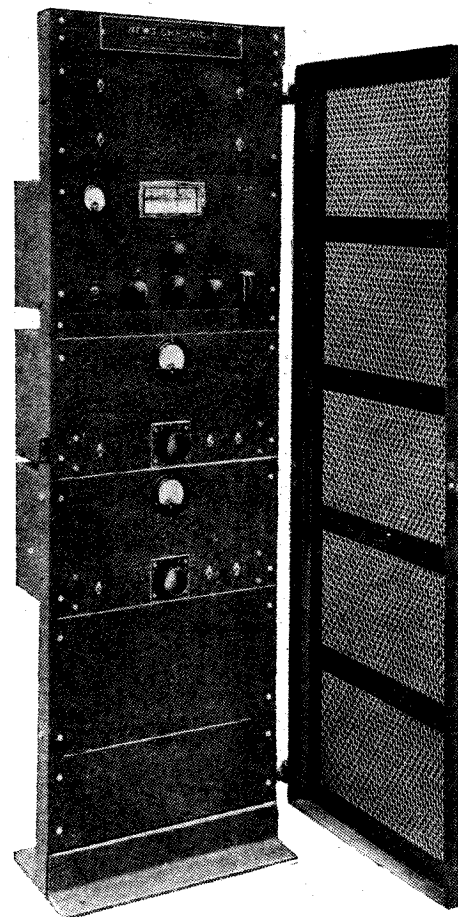
FERRANTI has several constructional amplifiers which are suitable for low-power public address work. Type AC12C, for AC mains operation, gives an output of 12 watts and employs two transformer-coupled LF stages followed by a pair of PX25's in push-pull. Gain is ample for use with relatively insensitive microphones. A similar amplifier, but with an output of 6 watts, is also produced, and there is a battery model with QPP output.

A good selection of products for all classes of PA work is available from FILM INDUSTRIES. The amplifiers cover a range from a few watts for public address equipment on cars and vehicles, to the large outputs needed for hospitals and radio relay installations. Amplifier Type 4/40 PP is intended for use at football grounds, sports stadiums, speedways, racecourses, swimming pools, ship's band relay installations, and similar requirements. The amplifier is designed to work off AC mains and gives an undistorted speech output of 40 watts. It consists of two stages with AC/HL's, choke-coupled to a DO.24, this being transformer-coupled to two ES75H valves in push-pull. The power output transformer is provided with tapings for loud speakers having 8, 16, and 24 ohms impedance. The overall gain at 1,000 cycles is 89 db., the input for full load being 0.1 volt RMS.

Amplifiers 4/7 PP, 4/20 PP, with 7 and 20 watts undistorted output respectively, each have a gramophone motor and pick-up incorporated in a strong oak case. The 4/7 PP works off a car battery, and the 4/20 PP from AC mains.

The universal AC/DC two-valve pentode

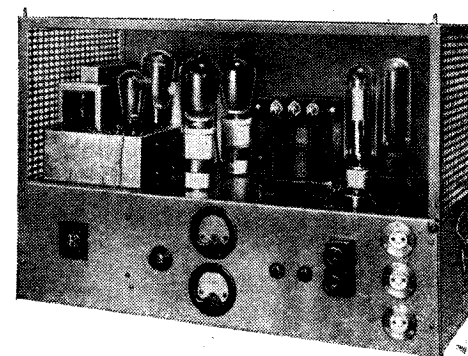
amplifier equipment consists of a moving-coil microphone and stand, amplifier in leatherette case, and LS4 unit with folded horn for indoor use. For outdoor use a 40-inch metal horn and LS6 unit are used.



B.T.H. rack and panel system for hospitals, etc.

The weights of these components are respectively 6 lb., 20 lb., 24 lb., and 17 lb. The power output to the speaker is 6 watts. Due to the low impedance of the microphone, a line between it and the amplifier up to 100ft. long can be used.

The F.I. "Westminster" public address equipment for cars and vehicles is one which is housed entirely in the car. A horn type of loud speaker is mounted under the bonnet of the car. Film Industries also have a variety of speakers for PA work. The LS5 unit is a small diaphragm type which communicates with an exponential horn. The



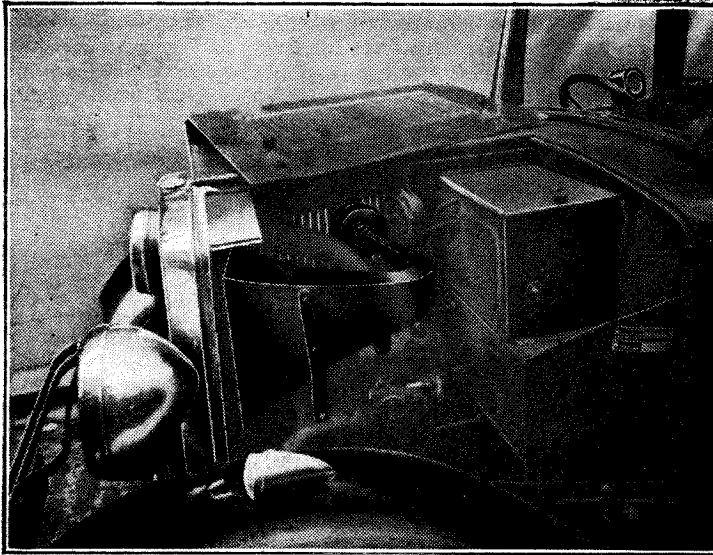
Film Industries amplifier Type 4/40 PP.

input is 8 to 10 watts, and the driving unit (with permanent magnet) weighs 12½ lb. The same firm also have a public address van on the roof of which two speakers of the

**Public Address  
Equipment—**

above type are fitted. There is also the F.I. power cone speaker with a metal flare. The speech coil is mounted on a special centring device, and the interior is dust-proof.

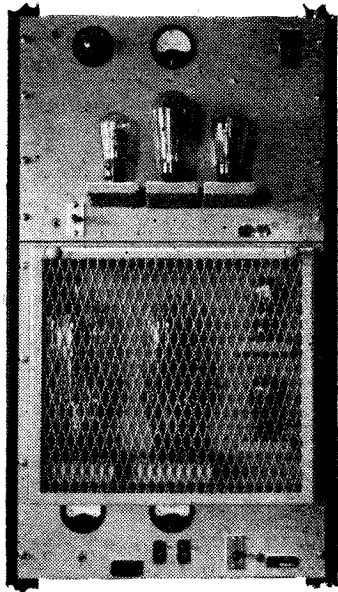
Film Industries equipment mounted under bonnet of car. Note microphone mounted near the steering wheel.



The GENERAL ELECTRIC COMPANY has a wide range of amplifying equipment to suit various PA needs. Starting at the low-power end of the scale is an all-purpose 6-watt amplifier with a flat characteristic over a fairly wide range. This is available in chassis, panel or transportable form. In the latter form the amplifier is housed in a stout box 16½ in. × 8½ in. × 12 in. high, with leather strap, the whole weighing 40 lb. The power supply is from AC mains. There are input circuits for microphone, gramophone or radio. The output is arranged to match 1.25, 2.5, 5, 7.5, 15 and 600 ohms. There is the usual volume control. In the battery-operated portable amplifying equipment the output is 1.25 watts, the weight being 27 lb. The LT is an unspillable 2-volt accumulator, and the HT dry battery one

within ±3 db. from 60 to 6,000 c/s and the output impedance is 15 ohms.

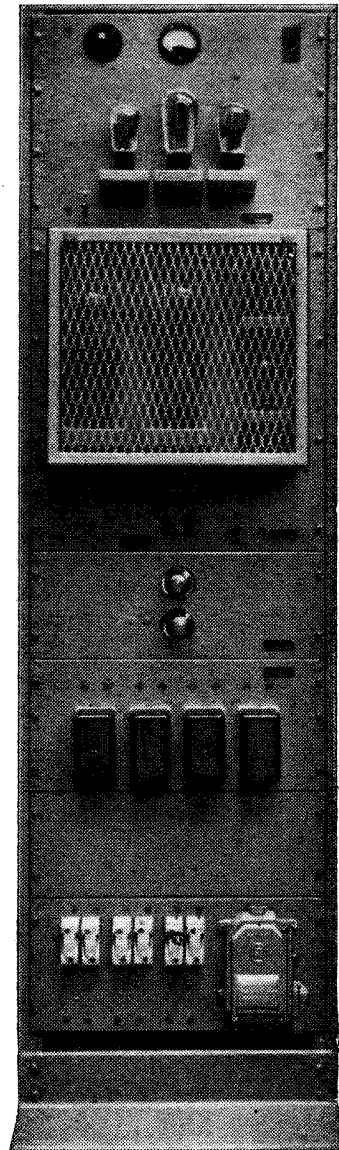
By way of high-power amplifiers there is the 90-watt unit for arenas, speedways,



G.E.C. high-power amplifier for speedways, aerodromes, etc.

of 150 volts, the consumption from which averages 14/18 mA. at full load. The life of the battery is about 100 working hours.

A horn loud speaker of the small diaphragm type is used with this outfit. The same company also has a 12-volt 3-stage car amplifier equipment for microphone or gramophone input, the gain being 87 db. and the output 2 watts for a current consumption of 3 amps. The response is flat



G.E.C. subsidiary rack amplifying equipment.

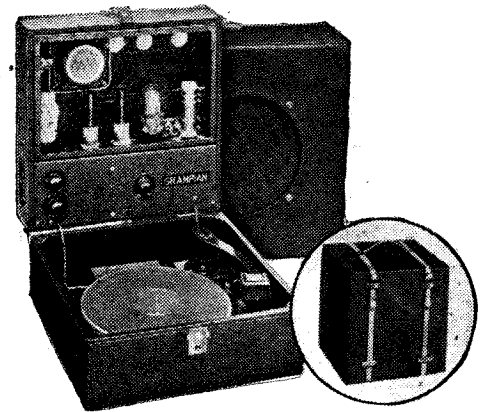
aerodromes, hospitals, factories, relay stations and so on. It is built as a standard

rack-mounting assembly employing two separate panels: namely, the intermediate amplifier panel and the power output panel. The former will operate up to four of the power output panels, so that the cost per 90 watts output is proportionately decreased for installations up to 360 watts undistorted output. There are the usual current meters and controls, and the input is 0.45 volt RMS for maximum output.

The company manufactures rack-mounted assemblies comprising (1) 5-valve super-heterodyne radio receiver unit with AVC, interstation noise suppression, tone control, etc.; (2) delayed switching panel to safeguard GU1 rectifying valves employed in the DA 100 power amplifier by imposing a delay of 40 seconds before the load is applied to the valves; (3) clock control panel which uses an 8-day spring-driven time control to switch the main amplifier on and off at predetermined hours.

Amongst other apparatus is the lapel microphone, 1½ in. × 1½ in. × ¾ in., various types of loud speaker, the loud speaker call system whereby persons can be located in a large building, moving-coil and carbon microphones.

GRAMPIAN REPRODUCERS manufacture portable PA equipment comprising moving-coil microphone, gramophone turntable and pick-up, and an amplifier with external loud speaker. The power input is from DC or AC mains, and the output is from 4 to 5 watts to the loud speaker. Thirty feet of loud speaker and microphone leads are supplied.



Grampian universal portable equipment.

With regard to microphones, the dynamic type is generally preferred, and for ordinary purposes a moving-coil instrument is supplied. The velocity pattern is used where the widest possible frequency response is required.

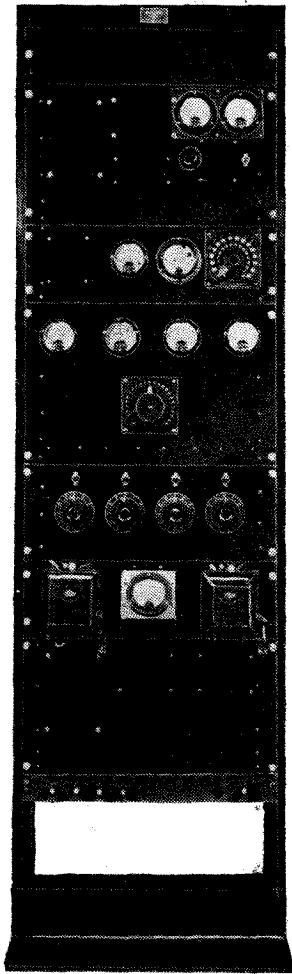
This firm also manufacture (1) a local-station radio unit for use with a self-contained amplifier; (2) a portable playing desk, the lid of which will carry several 12 in. records; (3) a public address projection moving-coil speaker with metal flare 24 in. diameter, 27 in. long, the total weight being 11 lb.; (4) various hornless moving-coil speakers.

The HAYNES RADIO PA amplifier gives 30 watts output (Class "A"). The amplifier is a four-stage resistance-coupled type, with attenuators and inputs for several microphones. There is a monitoring unit with attenuator calibrated in db.

The firm of MAGNAPHONE supplies a universal band equipment comprising microphone with adjustable stand, amplifier, and moving-

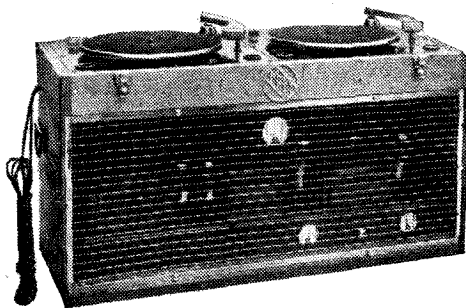
**Public Address Equipment—**

coil loud speaker in a black leatherette case. They also manufacture (1) the Model PA 50 amplifier with generator, microphone, and twin turntables in strong case, the output being 25 watts undistorted output; (2) a box auditorium model speaker; (3) a



Haynes 30-watt 4-stage amplifier.

moving-coil unit with flare; (4) a 110-volt low-power amplifier having a gramophone turntable, pick-up and microphone input. In addition there are the PA 100 and PA 200 amplifiers, having undistorted output of 40 watts and 80 watts respectively. Both of these amplifiers have twin gramophone turntables and pick-ups. Features incorporated are "direct coupling," remote con-



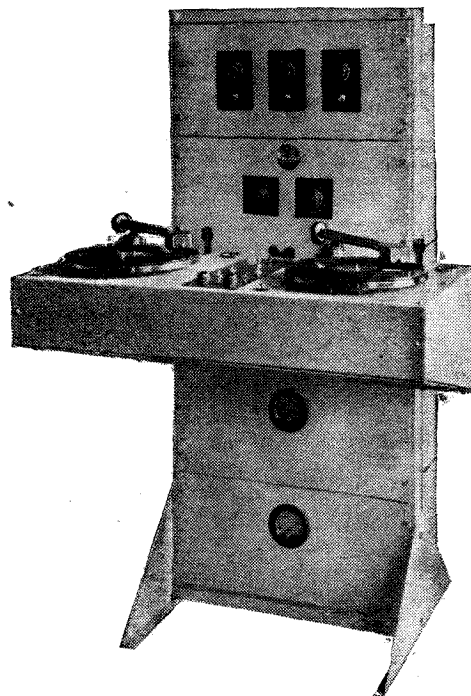
Magnaphone PA100 amplifier, with dual turntables.

trol microphone, and a visual output, by means of which the operator at a distance knows if the amplifier is functioning correctly.

As pioneers in equipment for PA work, the MARCONIPHONE COMPANY manufactures

an extensive selection, ranging from demonstration equipment to high-power amplifiers for hospitals, arenas, and radio relay stations, together with the associated microphones and loud speakers. The Model P-501 power amplifier gives an undistorted output of 10 watts. It has one MH4 valve in the first stage and two PX25 power valves in push-pull. The amplifier is AC mains driven. All the components are mounted on a steel chassis which is sprayed and stoved with a special aluminium finish. The circuits are completely screened, and the output transformer is tapped for two, four or six loud speakers. The Model P-504B is a combined two-stage microphone amplifier and two-stage power amplifier having an output of 10 watts undistorted output. The power portion is identical with that of the P-501. The microphone stages are resistance coupled, using MH41 and MH4 valves. There are volume and tone controls, mains switch, and a switch controlling the supply of polarising current to the microphone.

The portable equipment MAL/1 is designed for meeting the requirements of auctioneers, bands, crooners, etc. It consists of three units: (1) combined battery-driven microphone and power amplifier with HT and LT batteries, assembled in a wooden carrying case and fitted with non-

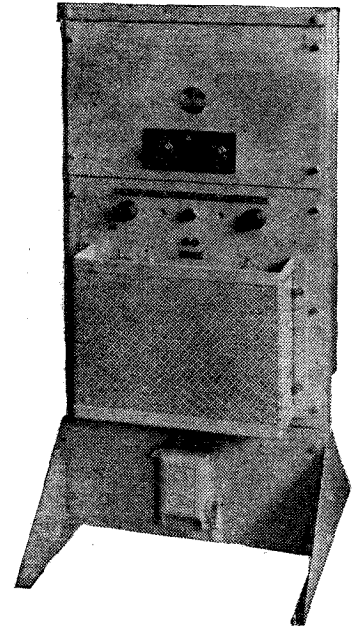


Marconiphone rack amplifier with dual turntable unit attached.

interchangeable plug and socket connections; (2) crystal microphone with stand, spring suspension and screened lead; (3) permanent-magnet moving-coil loud speaker with a short directional flare, built into a portable cabinet. The speaker impedance is 8 ohms. The filament current is supplied from a 30-AH 2-volt accumulator, the total consumption being 0.6 ampere. The HT consumption of 7 milliamps. is supplied by a 180-volt dry battery. The weight of the unit with batteries is 28 lb., and the loud speaker, with leads, etc., weighs 18 lb.

The P539 amplifier gives 15 watts output for 0.7-volt input, the overall amplification being 72 db. It has three stages, the power stage comprising two PX25's in parallel. Terminals are provided for six speakers, each of 15 ohms impedance, connected in

parallel, whilst tapings are provided for speaker resistances from 2.5 to 15 ohms. There are tone and volume controls. The amplifier weighs about 32lb.



Marconiphone 75-watt amplifier.

The demonstration equipment, Model EM5B, is self-contained and portable. It can be operated by a converter wound to run from a 24-volt car starter battery. A combined microphone and power amplifier is housed beneath the playing desk on which a gramophone turntable and pick-up are mounted. There are gramophone and microphone polarising current switch. The microphone can be mounted in a brooch to fit the coat lapel, or its stand can be fixed to the box. When the amplifier is fed from 200/250-volt AC mains, the output is 10/11 watts undistorted. The weight is 68lb. approximately. There are two models, ET1 and ET2, with single and double turntables and pick-ups, which work off either AC or DC mains. There is also available an eight-record automatic changer mechanism in place of the turntables.

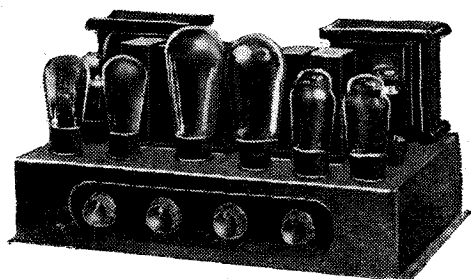
Marconiphone rack equipment provides for any desired combination of the following units: (1) Microphone amplifier; (2) 2- to 6-way microphone mixer; (3) special input panel; (4) control panel; (5) up to four P-501 amplifier units giving 40 watts; (6) up to three or four P-539 power amplifiers, each with 15 watts output; (7) output panel; (8) meter panel; (9) DA-100 amplifier, giving 75/80 watts; (10) E.T.1 electrically driven single turntable; (11) E.T.2 double turntable; (12) radio chassis. The height is 6ft. 6in., width 1ft. 8½in., and back-to-front measurement 1ft. 1in.

The 75-watt amplifier consists of two units: (a) the feed amplifier P-507, and (b) the power amplifier P-506. The former has two resistance-coupled MHL4 valves in cascade, followed by transformer coupling to two PX4 valves in push-pull, with transformer output to the power unit; the rectifier is one MU14. The power unit is a single output stage with two DA100 valves in push-pull. There is one GU1 rectifier and one DLS1 delay action tube, this being used in conjunction with a contactor to provide delayed switching of the anode current. Separate grid bias adjustment is provided for matching the anode feeds of the valves. There are volume and tone controls, the

**Public Address Equipment—**

amplification being 81 db. The Marconi-Phone Company also supply various types of baffle speaker, moving-coil units with metal flares, Reisz microphones and stands.

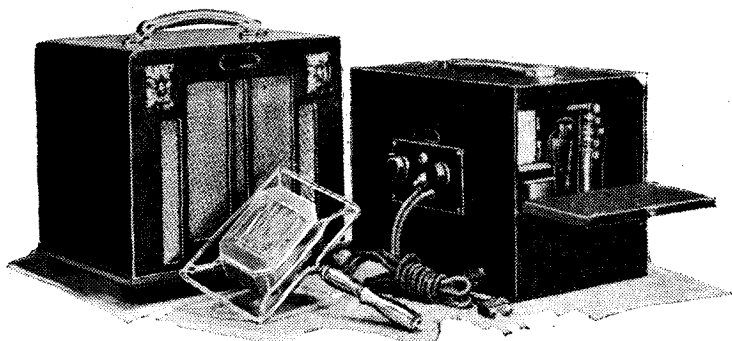
The M.A. SOUND SYSTEM includes a variety of amplifiers with outputs varying



M.A. Sound System chassis.

from 8 to 50 watts undistorted output. The AC/DC universal amplifier has an undistorted output of 8 watts. The standard input for mains amplifiers has two microphone channels and one gramophone channel, there being a mixer. The M.A. amplifiers have tone controls, and include push-pull output, adjustable bias potentiometers being provided for matching the output valve currents. Three types of loud speaker are available: (1) metal diaphragm unit with horn, input capacity 12 to 20 watts; (2) projector-type with 30in. aluminium flare, having an input capacity of 8 to 10 watts; (3) moving-coil units in wooden cabinets to take from 5 to 20 watts.

The PA apparatus produced by M.R. SUPPLIES is a universal AC/DC portable outfit consisting of Reisz-type microphone with leads and stand, amplifier giving 7 watts undistorted output and moving-coil



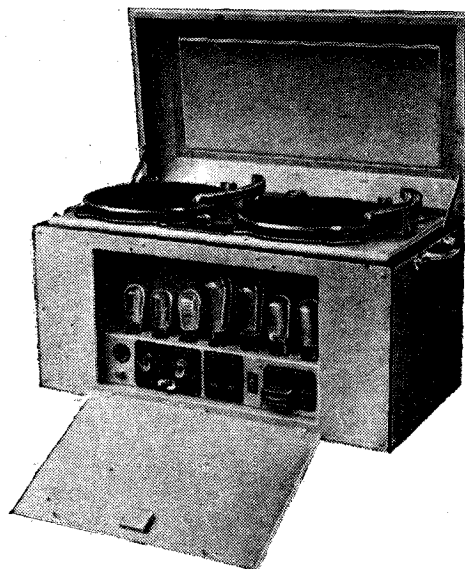
M.R. Supplies universal portable apparatus.

loud speaker in cabinet, or a Mono-Planar projection-type speaker can be supplied. The input valve of the amplifier is coupled to two pentodes in push-pull.

PARMEKO manufactures a large variety of amplifiers of varying power output from 6 up to 120 watts, together with a transverse current carbon microphone and a dual turntable console. The 30-watt amplifier is a four-stage unit, with two turntables. The first two valves are resistance-capacity coupled, and the third is transformer-coupled to two PX25A's in push-pull. The output impedance varies from 7.5 to 30 ohms. The input to the first stage can be a moving-coil, piezo-electric, or carbon microphone. By means of a key switch, a gramophone pick-up can be connected to the input of the second stage. Alternatively, a jack is provided for feeding in any other input, such as radio. The frequency response is uniform within  $\pm 2$  db. from 50

to 10,000 c/s. A gain control is fitted between the first two stages, and there is also a tone control. The amplifier works off the AC mains, 100/110 or 200/250 volts 50 c/s, the consumption being 160 watts.

The 90-watt amplifier is built upon the rack system and has four stages, namely, AC/HL valve resistance-capacity coupled to PX25 valve, choke-coupled to the driver stage, which is followed by two DA 100's in low-loading push-pull. The output impedance can be varied from 10 to 50 ohms, and the harmonic content does not exceed 5 per cent. There are tone and gain controls.



Parmeko 30-watt amplifier.

The amplifier works off AC mains, the consumption being 480 watts, and it is intended for use where exceptionally great volume is required. It can be supplied with high-gain pre-amplifier, so that direct operation from a microphone is possible. The overall gain is then 85 db.

This firm also manufacture a wide-angle PA loud speaker, which comprises a permanent-magnet driving unit to which is coupled a horn made of 14-gauge sheet aluminium, hand-beaten into logarithmic shape, and welded together in four sections. The speech-coil impedance is 7.5 ohms and the maximum input 10 watts, this giving a range of 300 yards under normal weather conditions, with an angle of spread of 90 degrees. A self-centring arrangement is used for the diaphragm, and



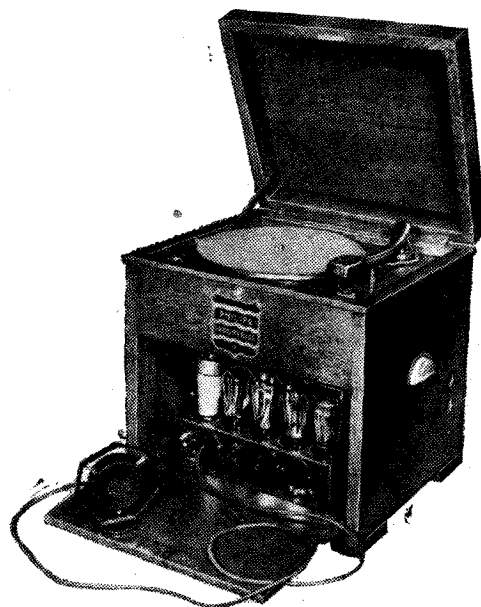
Parmeko wide-angle speaker.

the terminals are marked for phasing purposes. The second type of speaker marketed by Parmeko is a box-baffle type

moving coil unit, having a diaphragm 12in. diameter. The speech-coil impedance is 7.5 ohms and the power input 8 watts. The speaker unit can be supplied alone, or with its cabinet and connections.

A large variety of PA equipment for high or low power output is manufactured by PHILIPS INDUSTRIAL (PHILIPS LAMPS, LTD.), including a radio-gramophone amplifier suitable for hotels, country clubs, dance halls, swimming pools, etc. The equipment comprises a walnut cabinet incorporating an automatic record changer, enabling eight 10in. or 12in. records to be played without attention. Any record may be repeated or rejected by means of a switch. Microphone input for band repeating or "paging" purposes is included, so that either microphone, gramophone or radio amplification is available. Microphone announcements can be superposed on radio or gramophone reproduction. Any of these alternative outputs may be fed into a built-in amplifier unit which can be supplied in models giving up to 60 watts undistorted output. The apparatus works from AC mains.

There are also available a number of types of loud speakers for inputs from 6 watts to 20 watts. The larger type has a permanent magnet, and can be mounted on a baffle or a directional flare. The speech coil has an impedance of 28 ohms, and the speaker



Philips "Gramovox" multi-purpose unit.

can be supplied with an input transformer having a primary impedance of 500 ohms.

In addition there are microphones and microphone stands, turntable cabinets, and a "Gramovox" equipment specially designed for dealers. This has an electric turntable, pick-up, microphone, fading arrangement, and two moving-coil speakers with directional baffles. The output is 20 watts undistorted. The amplifier works off the AC mains. Philips also have a PA van available.

Two types of PA equipment are available from the PRISM MANUFACTURING CO. The Type AC/A/52 consists of microphone, two speakers, and AC amplifier with an undistorted output of just over 6 watts. The equipment is extremely compact. The AC/A/53 is a larger equipment with 15 watts output or 20 watts maximum, but is still conveniently portable.

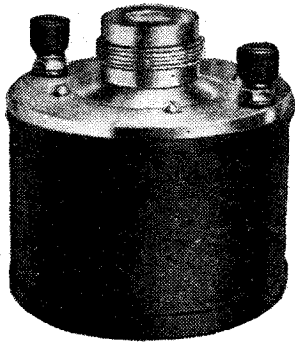
Two public address amplifiers are supplied by PREMIER SUPPLY STORES, one of 10 and the other of 20 watts, with



**Public Address Equipment—**

American pentode output valves in push-pull.

Among the productions of RESLO SOUND EQUIPMENT is the SU1 horn-type speaker,



Reslo permanent-magnet speaker unit.

with a permanent magnet unit, which is rated at 10 watts. A non-metallic diaphragm is used in conjunction with the moving coil. There is also the Reslo transverse current microphone complete with stand, and a dynamic microphone which is used in conjunction with a transformer, no pre-amplifier being necessary.

A number of PA microphones and amplifiers are supplied by R. A. ROTHERMEL, LTD. The microphones are the piezo-electric crystal type which require no polarising battery. The B2S microphone has an output level 66 db. below the datum of 1 volt/bar. The response characteristic is flat up to 6,000 c/s, thence rising to 12,000 c/s, the rise compensating for losses in associated equipment. Rothermel supplies pre-amplifiers to step up the output from the crystal microphone. The SS-PA105

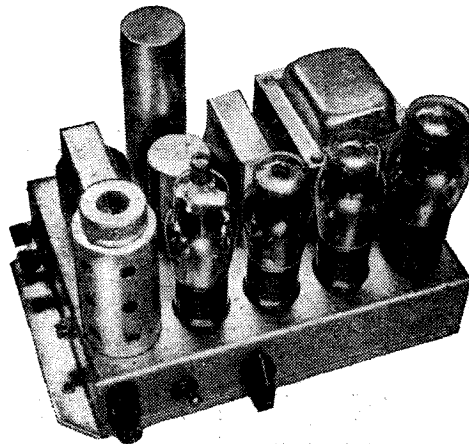
amplifier is a two-stage double push-pull type with which long microphone leads can be used. The output transformer is designed to ensure magnetic symmetry and inductive balance. This amplifier works from the AC mains and has an overall gain of 70 db. The frequency characteristic is flat within  $\pm 1$  db. from 30 to 12,000 c/s, and the output impedances 50, 125, 200 or 500 ohms.

Rothermel - Brush Type B2S piezo-electric microphone.



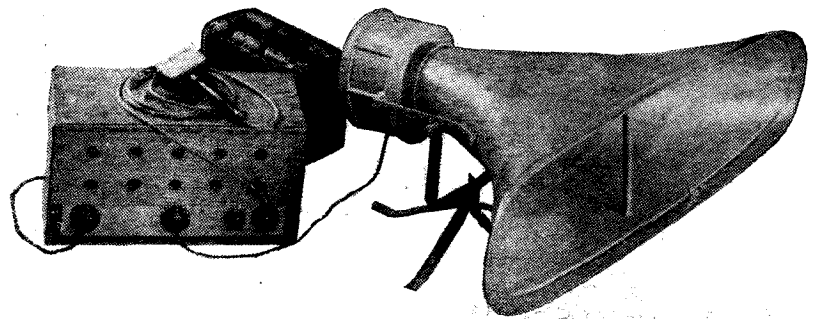
The GSVR2 amplifier is a combined pre-amplifier and power amplifier for use in conjunction with the D104 diaphragm type crystal microphone and the crystal gramophone pick-up. It is useful for small portable PA systems, works off AC mains, and gives 4 watts undistorted output. The weight is about 10 lb. The type W.6093R.A. public address amplifier, which also works off the AC mains, gives an output of 26 watts, the impedances being 2, 4, 8, 16, 250 and 500 ohms. The input

is arranged to suit various types of crystal microphones and gramophone pick-up (crystal), and provision is made for mixing. The main purpose of the amplifier is for conditions where the person speaking addresses the microphone directly. It is not intended for stage work where the performers are at some distance from the microphone.



Rothermel amplifier for use with crystal microphones.

A number of different types of PA amplifier and a crystal microphone are available



Savage battery-operated equipment.

from W. BRYAN SAVAGE, LTD. The 315 amplifier consists of an upright metal panel with a detachable grill protecting the valves, microphone/gramophone switch, volume

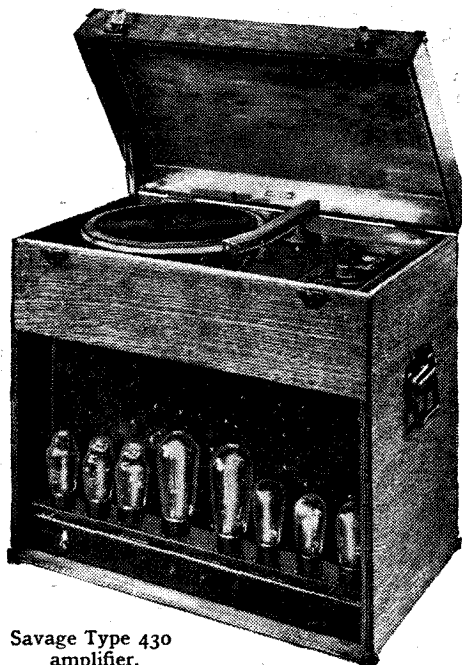
80 ohms. The 207B amplifier gives 7 watts undistorted output. It is worked from a 12-volt battery via a rotary converter included in the cabinet, the current required being 3.6 amps.

The 430 amplifier has an upright panel and is mounted in a wooden box complete with gramophone turntable, pick-up, microphone transformer with battery, and tone and volume controls. The output valves are two PX25A in low-loading push-pull. Screwdriver-controlled potentiometers are used for adjusting the bias on these valves. The output is approximately 30 watts undistorted. The gain is adequate for a carbon microphone, and by substituting a 40-mu triode for the 20-mu triode normally used in the first stage, a moving-coil microphone can be used.

There is also the Savage PA100 crystal microphone with a sensibly flat characteristic over the audible frequency range. It can be used to replace the average moving-coil or carbon microphone with but little modification to the input circuit of the amplifier. The standard model has an output impedance of 200 ohms, but the PA100 can be supplied to suit any other impedance between 10 and 1,000 ohms. The associated amplifier should have a gain of upwards of 80 db. The pre-amplifier is integral with the microphone stand, and requires 0.2 amp. at 12 volts.

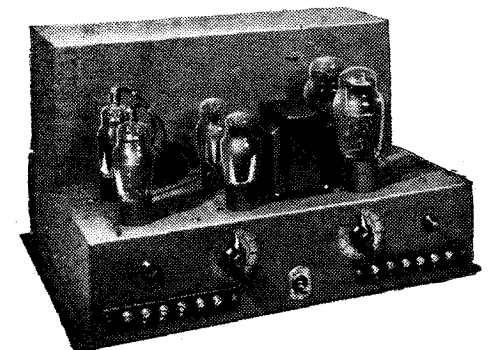
The mobile amplifying unit produced by SHAFESBURY MICROPHONES operates from a 6-volt car battery and embodies three push-pull stages. Anode current is supplied through a rotary converter; total consumption from the battery amounts to 8 or 9 amps. There is also a universal mains model, built up in three-unit form; all sections pack into the speaker flare, thus making a very convenient and compact unit for purposes of transport.

A high-power AC amplifier, rated at 38 watts output, employs low-loading push-pull and has an overall gain of 83 db; response is only 1 db. down at 50 c/s, and 2 db. down at 10,000 c/s. Microphones of the transverse current (including a new and inexpensive "junior" model) and ribbon



Savage Type 430 amplifier.

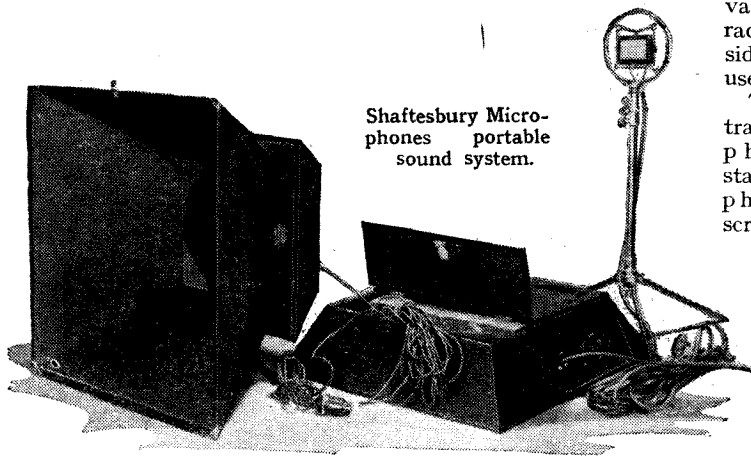
and tone controls; it has an output of 15 watts. The impedanceappings of the output transformer are 10, 20, 40, and



Shaftesbury Microphones amplifier.

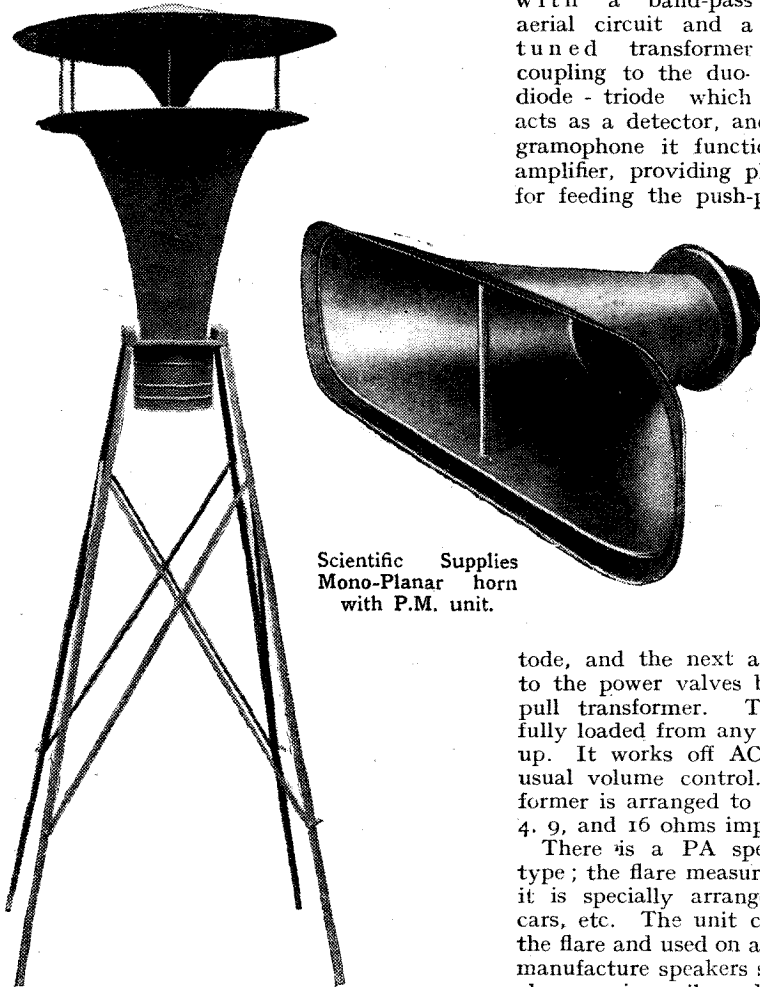
**Public Address Equipment—**

velocity types are also produced. There is a series of exponential horn speakers, the largest of which handles 25 watts.



Shafesbury Micro-phones portable sound system.

SCIENTIFIC SUPPLY STORES are manufacturers of PA amplifiers giving outputs from 2 to 20 watts, but their principal interest is in the production of a variety of horns for loud speakers. One of the models produced is intended to be placed amongst a crowd, preferably at the centre of the area to be covered. The sound is radiated equally



Scientific Supplies central radiating speaker.

in all radial directions, and is thrown downwards at a convenient angle. The inverted central diffusing baffle made by Scientific Supply Stores gives a more direct downward throw and is to be preferred where the speaker is suspended at a height, as, for example, when installed in a large ballroom with a high ceiling.

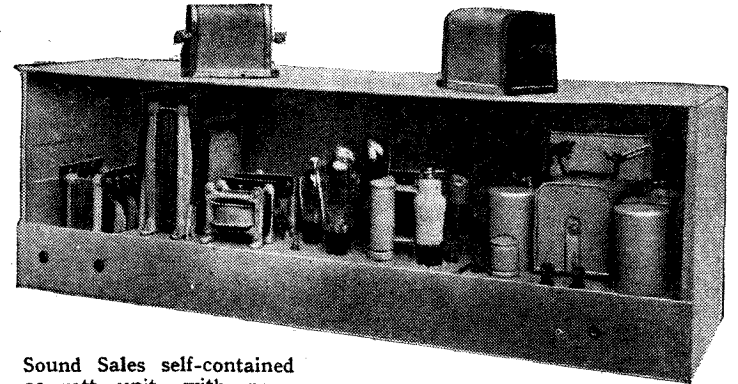
The twin baffle has a common throat to take a single cone unit and is mounted on a metal pylon. The fore and aft baffle is useful for the top of a van and enables the radiation from both sides of the cone to be used.

This firm also supply transverse PA microphones, microphone stands, and microphone transformers, screened or otherwise.

SOUND SALES, LTD., manufacture *The Wireless*

600-ohm grid transformer feeding a triode, resistance-capacity coupled to a phase-splitting transformer which drives two small power triodes in push-pull. These valves provide the power for driving two Class "B" triodes which feed the loud-speaker load *via* an output transformer. All push-pull transformers are designed to give a balanced output with equal phase shift on each half, whilst adequate decoupling in plate and grid circuits ensures stability and good frequency characteristic. For mains operation, a multiple plug connects all valve filaments in series *via* a voltage-regulating barretter across the mains supply. The HT supply is from two half-wave valves. Another amplifier manufactured by this firm

World Quality Amplifier (4-12 watts) for PA work. By the aid of an HF unit the amplifier can be adapted for use in schools. The receiver is a single HF stage with a band-pass aerial circuit and a tuned transformer coupling to the duo-diode - triode which acts as a detector, and on both radio and gramophone it functions as the first LF amplifier, providing phase reversal needed for feeding the push-pull amplifier. The



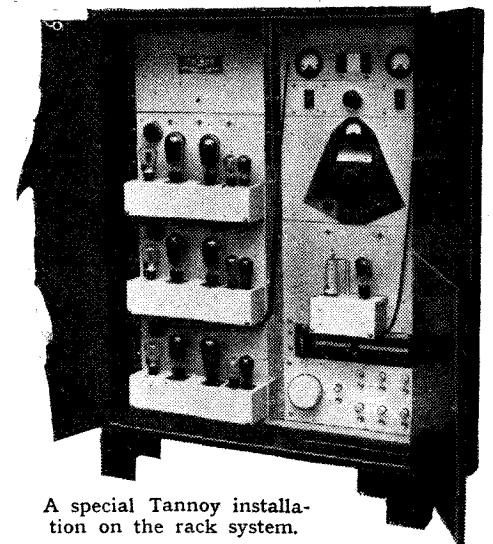
Sound Sales self-contained 30-watt unit, with new-type microphones.

latter is a two-stage double push-pull with resistance-capacity coupling, the output valves being PX4 or PX25. The 30-watt amplifier manufactured by this firm is based on the "low-loading" push-pull circuit. The output of 30 watts is obtained from two PX25A valves in push-pull. The first stage is a resistance - capacity-coupled HF pentode, and the next a ML4 valve coupled to the power valves by a choke-fed push-pull transformer. The amplifier can be fully loaded from any normal type of pick-up. It works off AC mains and has the usual volume control. The output transformer is arranged to match speakers of 2, 4, 9, and 16 ohms impedance.

There is a PA speaker of moving-coil type; the flare measures 45in. x 20in., and it is specially arranged for mounting on cars, etc. The unit can be detached from the flare and used on a flat baffle. This firm manufacture speakers suitable for hospitals, also moving-coil and transverse current microphones complete with input transformers.

The firm of TANNYOY PRODUCTS manufactures a range of amplifiers giving outputs from 10 watts to a kilowatt. The "G.U.B. 10" amplifier works off AC, DC, or a car accumulator, the output being 10 watts. The overall gain is 70 db. and the frequency characteristic is flat within 2 db. over the range 100 to 5,000 c/λ. The input is to a

is the G.M.12A. A 600-ohm input to grid transformer, fitted with a special shield to avoid hum, is connected to a W.30 screened grid valve, resistance-capacity coupled to an HL4 valve, resistance-coupled to a phase-splitting transformer, which drives two PX25's in push-pull. The output transformer is arranged to feed one or two 15-ohm speakers. The overall gain is 92 db. and the output 12 watts undistorted.



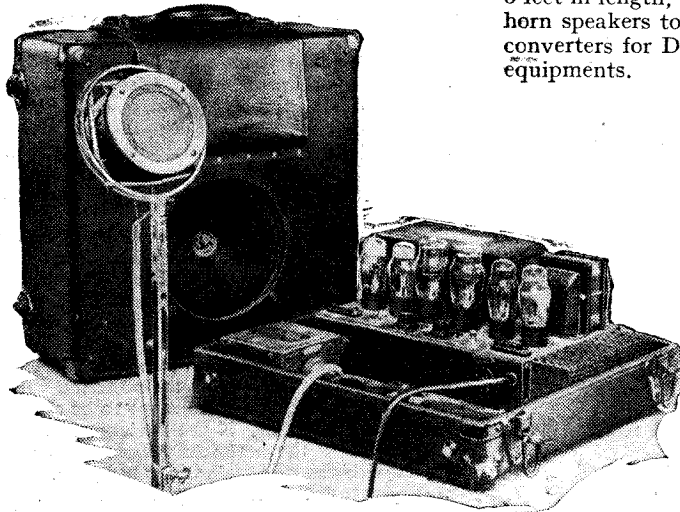
A special Tannoy installation on the rack system.

This firm specialises in the rack system, and also manufactures loud speakers of the horn and box-baffle types, the former including a flat horn which limits ground and sky losses.

The Operadio universal portable public address system giving 8 watts undistorted output, is a product of TRUVOICE, LTD. The equipment comprises (1) a moving-coil microphone with 25 feet of rubber-covered cable, plugs and stand; (2) an amplifier designed to work off 200/250 volts AC or DC;

**Public Address Equipment—**

(3) a moving-coil loud speaker having an 8-inch diaphragm complete with 25 feet of lead. The output impedance to the speaker



Truvoice battery-operated public address system.

is 5 ohms and the resistance of the energised field winding 5,000 ohms. The Type 60 portable PA system is somewhat similar, but gives 14 watts undistorted output. The battery Operadio model works off a 6-volt accumulator and has an output of 18 watts.

A variety of amplifiers for outputs of 3½ to 50 watts is manufactured by TRIX ELECTRICAL CO. The Model TP.242 gives 20 watts undistorted output. The first stage is an AC<sub>2</sub>/HL and the output stage 2 PM<sub>24</sub>D's in push-pull, the rectifier being a UU<sub>120</sub>/500. The output circuit is a 1/1 choke filter of 4,000 ohms impedance.

The higher power equipment is mounted on a rack which is arranged to take two output units. There are the usual meters, volume and microphone controls, etc.

This company also manufacture portable equipments for various PA purposes. An amplifier for AC/DC mains operation has automatic mains voltage control, and is supplied with a microphone, stand, and one or two loud speakers as desired. There is also a model which can be worked off a 6- or 12-volt car battery. The portable sound-film amplifier is a 3-stage unit, the output being 10 watts. The photo-electric cell output is



Trix Double T262 40-watt amplifier.

fed direct to the amplifier, no pre-amplifier being necessary. Polarisation for the photo-electric cells is provided, and there is a current supply from the amplifier for two exciter lamps at 10 volts 7.5 amp. each.

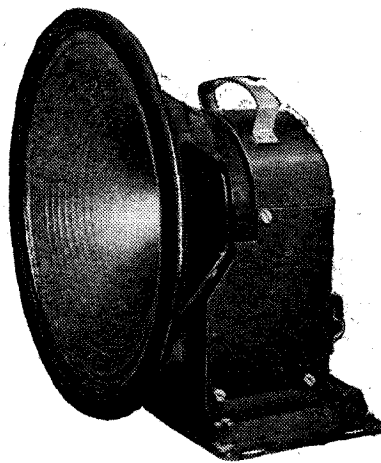
Trix Electrical also supply transverse

current microphones, microphone control box, gramophone turntable units, automatic record changer, loud speakers, baffle cabinets, directional baffles, exponential horn speakers with straight or curled horns up to 6 feet in length, permanent magnet units for horn speakers to carry 15 watts, and rotary converters for DC mains and battery-driven equipments.

**Loud Speakers  
for  
PA Work**

In the foregoing summary we have not referred to specialist makers of loud speakers primarily designed for or adaptable to PA requirements. The majority of the loud speaker manufacturers produce speakers of this type, and one or two should be mentioned as an indication of what is now available.

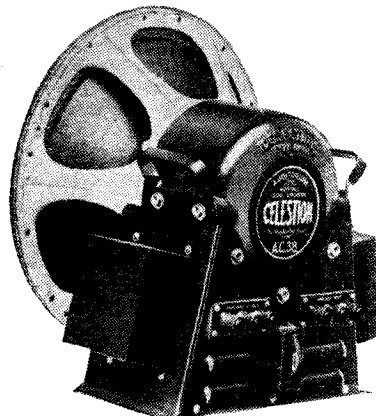
The ROLA G12 is a good example of a robust quality reproducer which lends itself to PA work. Mounted either on a flat baffle or in a short directional horn, it provides a moderately powered unit which can



Rola G12 energised loud speaker.

be instantly adapted to local requirements in any system of sound reinforcement. The normal field wattage is 18, and the 1¼ in. 9-ohm voice coil may be operated continuously with an input of 15 watts rising for peak intervals to 20 watts.

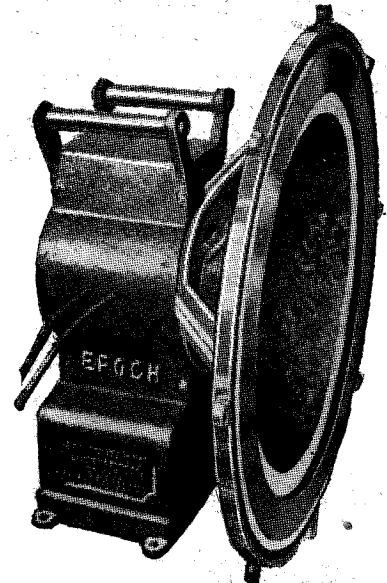
Another massively constructed cone diaphragm unit which is specially suitable for



Celestion Senior Auditorium AC model.

PA work is the CELESTION Senior Auditorium. It has an unusually high electro-acoustic efficiency, and the magnet system is of very generous proportions. A built-in rectifier is supplied with the AC model and conveniently placed lifting handles are a feature that will be appreciated by those engaged in installation work.

The EPOCH range of moving-coil speakers includes a number of models which are the outcome of many years' experience of PA requirements. The "Super-Cinema"



Epoch Super Cinema moving-coil loud speaker.

model, for instance, has a reinforced diaphragm of 18½ in. diameter driven by a 2 in. speech coil and is capable of handling 25 watts without distress. For indoor applications there is the 14 in. "Auditorium" model for which a workmanlike cabinet has been designed, and a special portable equipment unit with a capacity of 15 watts is also available. A variety of horn baffles is also provided by this firm, whose technical department is prepared to advise customers as to the best type for any given purpose.

Among speakers which have been specifically designed for outdoor PA equipments, those with short metal flares predominate. The GOODMAN'S Type PA24B is an example.

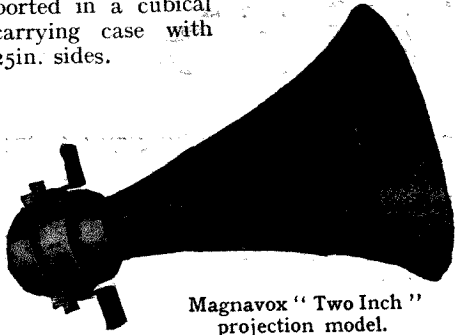


Goodmans Type PA24B public address unit.

It has a permanent magnet which is totally enclosed, and the one-piece aluminium flare is 25 in. in diameter. Of similar type but with an energised field, is the MAGNAVOX "Two Inch" Projection model. It derives its name from the diameter of the speech coil which has been made large to give good power handling capacity (25 to 30 watts). The flare diameter is 22½ in., and the unit may be dismantled and trans-

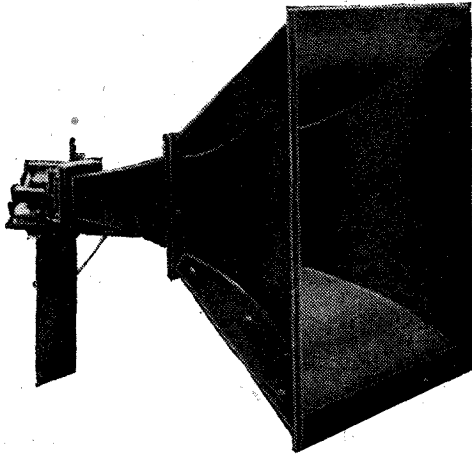
**Public Address Equipment—**

ported in a cubical carrying case with 25in. sides.



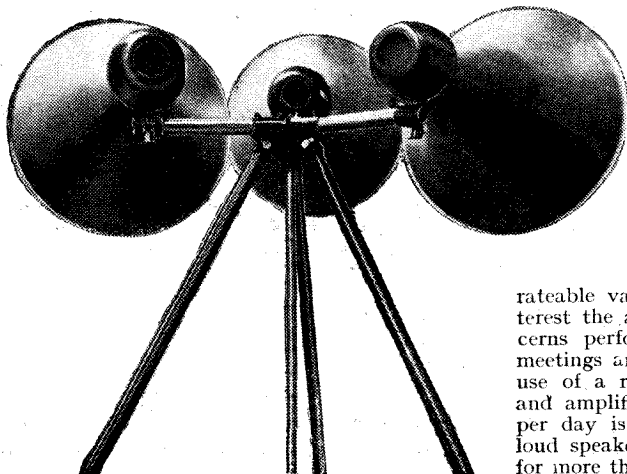
Magnavox "Two Inch" projection model.

One of the chief difficulties in PA work is to sustain the upper register, which is so essential for good articulation. A speaker which is well suited to cases of this kind is the HARTLEY TURNER. There are several types of diaphragm to choose from and it should be possible to fit special requirements with reasonable exactitude. The "Baffle" type of baffle box produced by this firm is also pre-eminently suited to PA work where the radiation from the back of the diaphragm is a frequent source of interference troubles.



Voigt loud speaker with 4ft. "Tractrix" horn.

The VOIGT loud speakers set a very high standard of quality for PA work, and their driving units are of the twin-diaphragm type with very powerful field magnets. For indoor work the "Tractrix" collapsible wooden horn with 4ft. flare gives excellent results, while for outdoor installations there is a special protected unit and an all-metal horn.



R. & A. sound projection unit on adjustable tripod.

For sports meetings and other events where a PA installation may have to be erected at short notice, a loud speaker system which can be rapidly adapted to the peculiarities of the site would be of the greatest value. This requirement is fulfilled by the sound projection system of REPRODUCERS AND AMPLIFIERS, LTD. An easily transportable tripod mast with telescopic legs carries three flare-type reproducers, each independently adjustable in a horizontal or vertical plane. The permanent magnet units with dust-proof gaps are completely enclosed at the back, and each unit has a power-handling capacity of 12 watts. Normally the tripod is self-supporting, but eyes are provided for guy ropes in case of adverse weather conditions. The height is adjustable from 5ft. 6in. to 11ft. 6in.

## Public Performance of Musical Works

### THE LICENCE POSITION

**N**OW that the employment of public address apparatus is increasing so rapidly it will not be out of place to remind users that in order to avoid infringement of copyright, it is necessary to obtain a licence before certain musical works are publicly performed, and this applies no matter whether the performance is a direct one, a broadcast relay, or is picked up and amplified through the usual public address equipment. Gramophone records, whether amplified or not, also come within the copyright ban.

Licences for the public performance of musical works are issued by the Performing Right Society, Ltd., of 33, Margaret Street, London, W.1. Contrary to the belief of many people it is not necessary for an admission fee to be charged before a performance comes under the designation of "public." A performance given to friends in a private house is not, of course, a public performance "within the meaning of the Act," but it is rather difficult to draw a hard-and-fast rule.

P.R.S. tariffs vary according to the type of premises at which a performance is given. The most expensive tariff applies to restaurants, cafes, etc., and these are sub-divided into three classes, the first comprising high-class restaurants in which dancing is permitted, the second, smaller premises not catering for dancing, and the third to coffee shops, etc. The tariff varies according to whether use is made of non-amplified gramophone records, amplified gramophone records, radio relays, radio relays plus non-amplified gramophone records, or radio relays plus amplified gramophone records.

A less expensive tariff applies to residential hotels and boarding houses, although they, too, must pay the higher tariff if they possess any dance hall or restaurant open to non-residents. The tariff applicable to these premises is graduated according to the number of bedrooms.

The third class of premises comprises public houses, which are graded according to their rateable value. The tariff most likely to interest the average user of PA equipment concerns performances at bazaars, fêtes, sports meetings and other casual occasions. For the use of a radio-gramophone or a gramophone and amplifier with one loud speaker, 7s. 6d. per day is charged, 10s. 6d. per day if two loud speakers are used, and 12s. 6d. per day for more than two loud speakers.

Apart from the above licence, which, as already mentioned, is applicable irrespective of

whether the performance is from gramophone records or otherwise, an additional licence must be obtained for the public use of most of the principal makes of gramophone records. This licence is issued by Phonographic Performance, Ltd., 144, Wigmore Street, London, W.1. Tariffs vary according to the type of equipment used, this being classified on a basis of cost.

For standard commercial public address apparatus, or approved privately constructed amplifiers not exceeding £200 in cost, the fees are 12 gns. for 12 months, £6 10s. for six months, and £3 10s. for three months. If non-standard apparatus is used, a circuit diagram and specification is required before a licence is granted.

This licence must be obtained by the owner of the apparatus, and enables him to quote an inclusive fee to the promoters of dances, etc., for installing the apparatus at their functions. Special fees are applicable to performances in restaurants, cafes, hotels and public houses, while temporary licences for special circumstances are considered on their merits. In all cases it is necessary for a licence to be obtained from the Performing Right Society also. If in any difficulty the best thing to do is to get in touch with the two authorities mentioned, who will give all the necessary information.

**Television Up-to-date.**—By R. W. Hutchinson, M.Sc. Pp. 184+ix, with 125 line drawings and 15 half-tone illustrations. University Tutorial Press, Ltd., 25, High Street, New Oxford Street, W.C.2. Price 2s. 6d.

**I**N this we have a really sound elementary book on television by an experienced author with exceptional ability for simple elucidation of complex subjects. Television, which embraces the fields of several branches of science, is indeed complex, and in this book we have one of the simplest and clearest expositions of the subject yet published. It is intended essentially for the beginner—it starts right from the beginning and no previous knowledge of electricity or radio is assumed. A feature of the book is its scientific accuracy, and the sequence is admirably arranged.

The first two chapters are given over to simple ideas concerning electricity, optics and radio waves, and the remainder to both low- and high-definition systems. In both cases the underlying principles are the same but they are much more easily explained in terms of L.D. mechanical methods. This fact is taken full advantage of by the author in leading up to H.D. cathode ray methods. Simple time-base circuits using gas discharge tubes or valves are explained, and the author probably omitted to include modern hard valve circuits in view of their complexity.

The book appears to be notably free from errors; only in one or two isolated cases is a minor exception noticeable. For instance, in the section on valves, in referring to negative grid bias it was not made clear that the grid potential is negative *with respect to the cathode or filament*; and in explaining valve amplification a liberty appears to have been taken in comparing the magnitudes of a change of anode *current* with a change of grid *potential* in an effort to simplify the explanation.

O. P.

## The QA Super

It is regretted that an error occurred in the practical wiring diagram of this receiver, for the negative terminal of the H50 rectifier was shown connected to chassis. Actually, the positive terminal should be joined to chassis and the negative to T4.



# HINTS and TIPS

## Practical Aids

### to Better Reception

IT is often very convenient to be able to switch on or off a mains-operated receiver from some remote point. A typical example occurs when an extension loud speaker is installed in another room.

#### Two-way Switching

Satisfactory relay systems which provide switching from any desired number of points have been evolved, but when control from a single point only is required the cost of such relays is hardly justified, and the most satisfactory plan is to employ two-way switching.

Although the wiring of a two-way switching system is common electrical practice it is not always understood by wireless amateurs, and so a diagram of the connections is given in the accom-

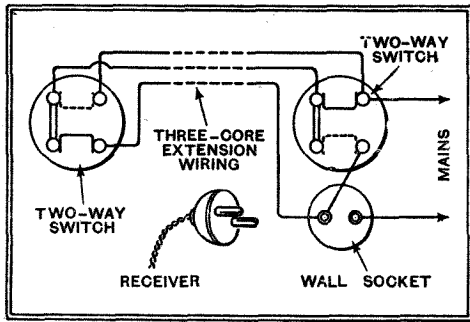


Fig. 1.—How to wire a remote switch for controlling the mains supply to a receiver.

panying Fig. 1. From this diagram it will be seen that a pair of two-way switches is required, and that the mains extension lead to the remote point consists of three separate wires (which may be combined in a three-core cable).

THE great improvement that has taken place in the manufacture of dry batteries is not generally appreciated, and that is probably why the possibilities of using them for supplying LT current for valves have been generally overlooked.

#### Dry-cell LT Batteries

One would not suggest, of course, that the ordinary dry cell is a serious competitor of the accumulator for a set in continuous operation, but for a receiver or any other apparatus that is intended for intermittent use it is entirely satisfactory.

There is, however, a definite upper limit to the amount of current that can economically be drawn from the cells. So far as small batteries of the type used for bicycle lamps and readily obtainable everywhere are concerned, this limit may be placed at about 0.2 or 0.25 amp.; for still lower currents a dry cell is even more satisfactory.

In a multi-valve receiver, even if the

greatest care be given to the choice of the valves, the maximum figure suggested will often be exceeded. In such cases the only practical way of using dry cells is to divide up the valves into groups, with a separate battery for each group.

NOW that short-wave and all-wave receivers are coming into such general use, the time seems opportune for drawing attention to the fact that they are likely to be adversely affected by an in-

#### Short Waves: The Earth Connection

different earth connection to a much greater extent than normal broadcast sets. High-resistance or straggling earth leads of abnormal length are likely to be responsible for hand-capacity effects, which considerably mar the pleasure of operating a receiver on the short waves.

SEMI-VARIABLE condensers of the compression type are mainly used nowadays for "tracking" the long-wave oscillator circuits of superheterodynes. In certain receivers (e.g., in the Variable Selectivity Four) it would appear that in some cases condensers having too high a maximum value are employed, with the result that

#### Compression Condensers—A Warning

proper circuit alignment cannot be obtained on the long waves.

The remedy in such cases is to strip the condenser and to bend the plates in such a way that more spacing will be provided when the pressure of the compression screw is released. Alternatively, the minimum capacity may also be reduced by connecting in series a fixed condenser; in the case of the receiver mentioned a value of about 0.0005 mfd. would be suitable.

THE best of aerial insulators cost only a few pence, yet some dealers seem to stock nothing but the cheapest variety, which are certainly one of the minor menaces to good reception.

#### Aerial Insulators

The main requirement of an insulator is that it should be self-cleaning. By this is meant that the inevitable deposit of soot and dust which it collects should be washed off by the first shower of rain, leaving the insulator clean and bright and with a surface that does not absorb water.

This is just where the cheap insulator fails. Its surface is to some extent porous,

and rain has the effect of washing some of the dirt into the surface of the insulator. A film composed of water and dirt will seriously impair the insulator properties.

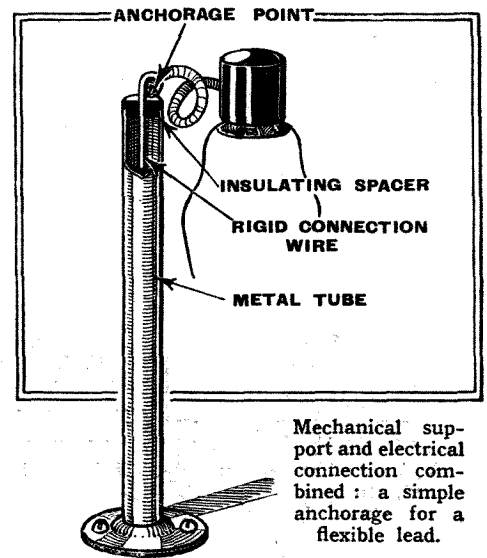
IN the internal wiring of a receiver, flexible connectors are used almost exclusively in positions where it is desired to make provision for more or less frequent disconnections or changing of connections. For permanent leads, rigid or

#### Flexible Leads

semi-rigid wiring is always preferable nowadays. As it therefore follows that a flexible lead will be handled, a certain amount of care should be taken to ensure that it may withstand bending strains without fracture.

Superficial examination of such a lead will show that the bared end of the wire at the point where it is soldered to the permanent connection is the most likely part to fail, as all bending stresses are concentrated at this one point. Although it is obviously desirable to provide some sort of anchorage to avoid this concentration of strain, the practice of doing so is by no means universal.

When the lead is not likely to be handled often, a simple anchorage will serve the purpose, but where a plug-and-socket system is used, perhaps as an alternative to mechanical switching in an experimental receiver, some thought should be devoted to the subject. Suitable wire



should be chosen, and the stresses may be distributed over a considerable length by the judicious use of rubber sleeves, etc.

The accompanying illustration shows a good example of commercial practice (the Marconiphone 345 receiver). The end of the flexible connector is soldered to the rigid lead, the end of which is then bent over to grip the insulated part of the flex.

# 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

## LOUD-SPEAKER MAGNETS

IT is found that the short or "stumpy" type of magnet, when made of highly-coercive alloys of nickel, aluminium, and iron, is liable to be adversely affected by conditions which are not harmful to other magnets. For instance, when a piece of soft iron is brought into contact with one of its sides, it is subject to a demagnetising action from which it does not recover when the iron is removed. In this way the strength of the magnet may be seriously impaired by repeated accidental contacts.

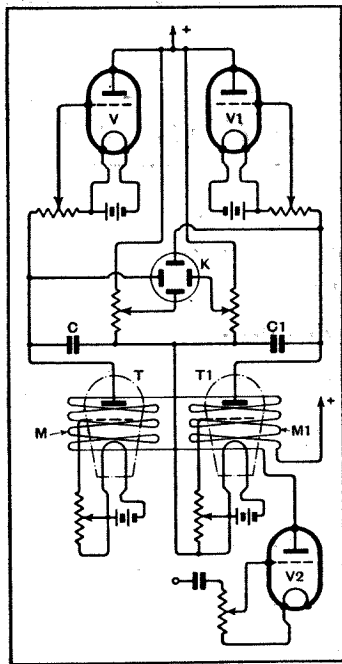
According to the invention the magnet is safeguarded from such losses by lining its sides with non-magnetic materials such as paper, synthetic resin, brass or aluminium.

J. Lucas, Ltd., and E. A. Watson. Application date June 19th, 1934. No. 440038.

## TIME-BASE CIRCUITS

THE gas-filled discharge tubes T, T<sub>1</sub> used to generate the line and frame scanning frequencies for television are "triggered" into action by applying the received synchronising impulses to external magnetising-coils M, Mr.

The condensers C, C<sub>1</sub> which apply scanning-voltages to the deflecting-electrodes of the cathode-ray tube K are charged up through



Circuit details of time-base.

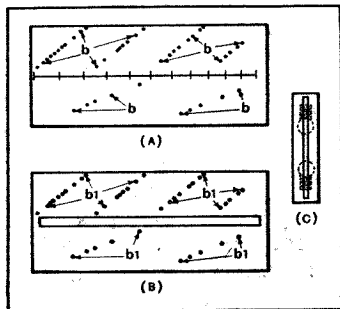
valves V, V<sub>1</sub>, and are then rapidly discharged, to produce the required saw-toothed oscillations, through the tubes T, T<sub>1</sub>. The latter are controlled by synchronising impulses applied to the grid of an amplifier V<sub>2</sub>, in the plate circuit of which are the windings M, M<sub>1</sub>. The resulting change of magnetic field ionises the gas in the tubes T, T<sub>1</sub> and so discharges the condensers C, C<sub>1</sub>.

Marconi's Wireless Telegraph Co., Ltd., and R. J. Kemp. Application date June 14th, 1934. No. 439813.

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

### TUNING INDICATORS

AN outside plate A of semi-transparent material, such as ivory, is marked along the centre line with a scale representing wavelengths, above and below which the names of the stations are printed in horizontal lines from the inclined points marked b. Be-



Station-named tuning scale.

hind is an opaque screen B with a central slot for the wavelength scale, and a series of apertures b<sub>1</sub> corresponding to the position of the points b. At the rear of both is a slotted cursor C containing two lamps, the upper of which is lit when the waveband switch is on the medium setting, and the lower on the long-wave setting. The cursor C is moved laterally by the tuning-control so that it lights up the name of the particular station that is being received, and shows the corresponding wavelength on the centre scale.

G. B. Kemp. Application date September 19th, 1934. No. 439905.

### A STABILISED MULTI-VIBRATOR

THE frequency generated by an oscillator of the multi-vibrator type, or by a Neon lamp circuit, is stabilised by coupling the master-oscillator drive to a tapped coil in the common plate circuit of the two cross-coupled valves, or in the common discharge circuit of a pair of Neon lamps. The disposition of the coil determines whether the controlled frequency is an "odd" or "even" harmonic.

V. J. Andrew (assignor to Westinghouse Electric and Manufacturing Co.) No. 2000685. (U.S.A.)

### TELEVISION OVER WIRES

IN a combined telephone and television system, the image of the caller is transmitted simultaneously with his speech over the line-wire, the image of the distant person being similarly made visible to the caller. Cathode-ray tubes of the Iconoscope type are used as transmitters, in combination with ordinary tubes using a fluorescent screen as receivers. Provision is made for the usual calling signals, and for indicating when a subscriber's line is "busy."

V. K. Zworykin. No. 2017883. (U.S.A.)

### DIRECTION-FINDING

A FRAME and vertical aerial are used in combination to give the well-known cardioid directional effect, and to indicate when the observer, say on an aeroplane, is "off course." The usual change-over switch is, however, arranged to bring each of the two earpieces of a headphone set alternately into circuit, instead of both earpieces at once. This allows the signal strength to be more easily and accurately compared.

A. Leib (assignor to Telefunken Co.) No. 2017909. (U.S.A.)

### CRYSTAL OSCILLATORS

WHEN grinding a piece of quartz down to a specified frequency, it sometimes happens that the grinding process is overdone so that the crystal will only oscillate at a frequency higher than that desired. It must then either be discarded, or else used only for a higher-frequency unit.

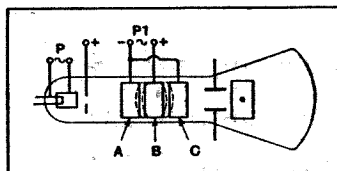
According to the invention, the initial error can be offset, and the crystal frequency made lower by cutting a groove in one or more of the walls of the crystal, the depth and size of the groove being definitely related to the degree of "lost" frequency to be recovered.

J. G. Beard (Assignor to Westinghouse Electric and Manufacturing Co.) No. 2018246. (U.S.A.)

### CATHODE-RAY TUBES

WHEN a gas-filled cathode-ray tube is used for television, there is a tendency for the size of the spot of light on the screen to vary with the strength of the applied signal voltage, instead of remaining constant throughout. To offset this, and ensure the projection of a sharp image, a set of electrostatic focusing-electrodes is inserted in the path of the electron stream between the anode and the first pair of deflecting-plates.

The focusing-electrodes consist of three rings A, B, C, of which the middle one is given a fixed positive bias relative to the other two. The signals are ap-



Showing positions of the focusing electrodes.

plied in part at P between the cathode and control cylinder, and in part at P<sub>1</sub> so that there is a varying potential between the centre ring B and the two outer ones A, C. The resulting curved field of force (shown in dotted lines) fluctuates with the signal voltage and brings the spot of

light to a sharp focus at all times, irrespective of changes in the intensity of the applied signals.

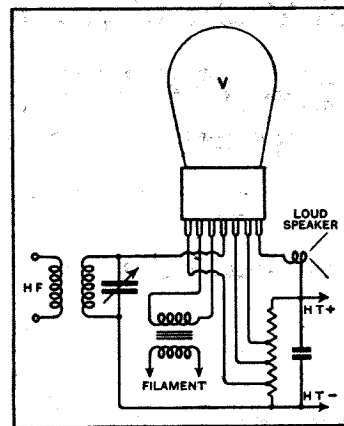
Telefunken Ges fur drahtlose Telegraphie M.B.H. Convention date (Germany) August 2nd, 1933. No. 439990.

IN a cathode-ray tube designed to project television pictures larger than 10 by 15 centimetres, the difficulty of preventing what is known as "trapezoidal" distortion increases, and cannot be overcome by widening the space between the deflecting-electrodes, or by screening them. According to the invention the difficulty is obviated by using magnetic control for the framing or low-frequency electrodes, and electrostatic control for the line-scanning electrodes. Since the magnetic and electrostatic fields do not in this case interfere with each other, the resulting image on the fluorescent screen can be kept truly rectangular in shape.

Radio Akt. D. S. Loewe. Convention date (Germany) June 27th, 1933. No. 440106.

### "IONIC" AMPLIFIERS

RELATES to gas-filled valves of the kind which can be used to amplify wireless signals



Circuit using an Ionic valve.

since they give a straight-line response between input and output, instead of the usual "spill-over" discharge. This result has been obtained by a particular spacing of the screening and control electrodes in a gas-filling of mercury vapour.

In order to improve the action of such valves, and at the same time to avoid the necessity of using closely set electrodes, the mercury-vapour filling is now replaced by a mixture of cadmium (which has a relatively low vapour-pressure) and mercury. This increases the "cathode-fall space" within which the grid exercises an effective control over the cathode emission. The Figure shows a single-valve loud-speaker circuit utilising a gas-filled Ionic valve. V which operates simultaneously as a high-frequency amplifier, detector and LF power stage.

S. Ruben. Convention date (U.S.A.) December 16th, 1933. No. 439879.

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

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## Editorial Comment

# The Broadcasting Committee's Report

Comments, and an Invitation to Readers

**W**ITH the publication in last week's issue of a summary of the Broadcasting Committee's Report we undertook to comment more fully this week on the proposals which have been put forward to the Government regarding the future conduct of broadcasting in this country.

An examination of the Report gives a first and a final impression that the task has been admirably carried out and the results of the investigation condensed into what is a surprisingly compact report, when we take into consideration the very wide terms of reference of the Committee and the enormous amount of evidence put before it, all of which had to be sifted and digested.

The Report should be a matter of very considerable satisfaction to the present Governors of the B.B.C. and to Sir John Reith, as well as to the whole staff. Praise and wholehearted endorsement of the policy which has hitherto guided the actions of the B.B.C. is liberally scattered through the report, whereas criticisms are few and far between, and even where criticism has been indulged in, it is in most cases not a reflection upon anyone connected with the organisation at present, but rather a question of putting the finger on some aspect of the organisation which is peculiarly exposed to the risk of error of judgment.

### Spokesman in the House

The proposal that broad questions of general policy should be the responsibility of a Cabinet Minister is one which has already come in for a certain amount of criticism from different

quarters, but we are glad to find that the Governors of the B.B.C. themselves welcome this proposal, and readers will remember that it is a suggestion which *The Wireless World* first put forward a number of years ago and has repeatedly recommended. Some fears have been expressed that it would tend to make the B.B.C. too much of a Government Department, but the form in which the recommendation is put forward in the Report, coupled with the fact that the Committee elsewhere in the Report lays special stress on the need for independence of action by the B.B.C. in most matters, indicates, we think, that fears of this kind are being prematurely expressed. Hitherto, whenever objections have been raised on controversial actions of the B.B.C., indignation has been aroused because there has been no channel through which to make complaint, except to the B.B.C. themselves. Now that a proper means of approach is recommended we believe that its adoption will provide just that kind of safety valve which is so badly needed, and the mere knowledge that complaints can be properly voiced will, we think, tend to lessen the number of them.

### More Revenue

The proposal that the B.B.C. should receive a larger proportion of the licence fee is one which will be universally endorsed, and it comes as no surprise, since the adoption of any other attitude on the part of the Committee seemed most unlikely.

The taking over of relay exchanges by the Post Office is another recommendation which was generally expected. It will be remembered that when these exchanges were licensed

**Editorial—**

the licence was always issued conditionally on the service being taken over by the Post Office at a later date. More and more the exchanges have tended to become identified with the Post Office telephone practice in the distribution of wires and in the general organisation, and it has always seemed inconsistent that, whereas broadcasting was regarded as best served as a monopoly, rival organisations in the way of relay exchanges should continue independently. We hope that the change, if the recommendations are adopted, will enable relay services to become complementary to broadcasting, rather than competitive.

**Empire Broadcasting**

It is gratifying to find the Committee so enthusiastic concerning the Empire Broadcasting Service and expressing themselves as anxious that the service should be extended and strengthened. We naturally take pride in the fact that an Empire Broadcasting Service was first suggested many years ago by *The Wireless World* and that, although our early efforts to persuade the B.B.C. to build the first station met with successive rebuffs, persistence was in the end rewarded. We look forward to this service becoming of increasing benefit to the Empire and, through the Empire, to the whole civilised world, and the recommendation now put forward that Empire Broadcasting should not be confined to our own language will strengthen its aims.

**Electrical Interference**

The subject of electrical interference, another matter on which we have for some years had a good deal to say, also comes in for special mention in the Report. The Committee urge the necessity for haste in taking steps to eliminate, as far as possible, the distressing effects of electrical interference with broadcast reception and recommend that, if necessary, statutory powers to protect the listener should be sought. This is, we believe, the first occasion on which so direct a recommendation to the Government to introduce legislation on this question has been made, and we hope that legislation, which we have always put forward as the only fair means to adopt for suppressing this nuisance, will not be long delayed but that the recommendations of the Committee will be acted upon with as much despatch as possible.

In addition to the recommendations contained in the Report, there are some proposals put forward which are

in the nature of suggestions for the consideration not only of the B.B.C. but of the radio industry. These are put forward in the form of suggestions rather than recommendations, no doubt because the Committee recognised that it would have been outside their terms of reference to attempt to dictate what the radio manufacturers should, or should not, do. Nevertheless, because broadcasting is, by its very nature, intimately associated with the means available to the public for listening to the broadcasts, it is, perhaps, only natural that references to the receiving side should crop up in the Report.

The first reference of importance of this kind occurs in connection with school broadcasting, where the Committee suggest that a set might be specially designed for school use and widely adopted by local educational authorities. The present system, as readers will be aware, is for a school's committee to sit in judgment on types of receivers submitted by manufacturers and decide which of these can be included on their list of sets recommended as suitable for school broadcast reception. The Report does not mention, and the Committee may, perhaps, have been unaware, that prior to this arrangement designs were got out by the B.B.C. for types of sets which they regarded as suitable for school purposes. But the design of receivers for broadcast reception is not one of the ordinary activities of the B.B.C. engineering staff, and it is not surprising, therefore, that these designs were quickly superseded and that the schools themselves preferred to make their choice from amongst the commercial sets available, or from designs which have appeared from time to time, say, in *The Wireless World*.

The conditions of reception in schools vary so widely, as also do the funds available for the purchase of sets, that any attempt to standardise types of receivers on the lines proposed would, we think, be foredoomed to failure, and quite apart from this consideration, we doubt whether it is desirable that any set should be put out as a B.B.C. schools receiver lest it should come to be regarded as a standard, whether or not its efficiency compared favourably with other sets available.

Another suggestion put forward is that in order to bring broadcast receivers to lower price levels and put them within the means of a larger number of people, the manufacturers should consider producing receivers to a standard design, as has been done, according to the information of the Committee, in some countries abroad.

No doubt the information they received was in regard to the "People's Receiver" produced in Germany, which is a standard specification manufactured by a number of firms in Germany to sell at a low fixed price. The Committee is not, we think, to be congratulated upon this suggestion. In Germany, it must be remembered, this standard design was got out at a time when the authorities were extremely anxious to encourage the people to listen to broadcasting in order to be kept in touch with Government views and instructions. There is no such urge, as far as we are aware, in this country at the present time. It would be a very difficult matter to standardise a receiver for production by all manufacturers unless some form of dictation to the industry, such as can be applied in Germany to-day, were possible here.

**Another Objection**

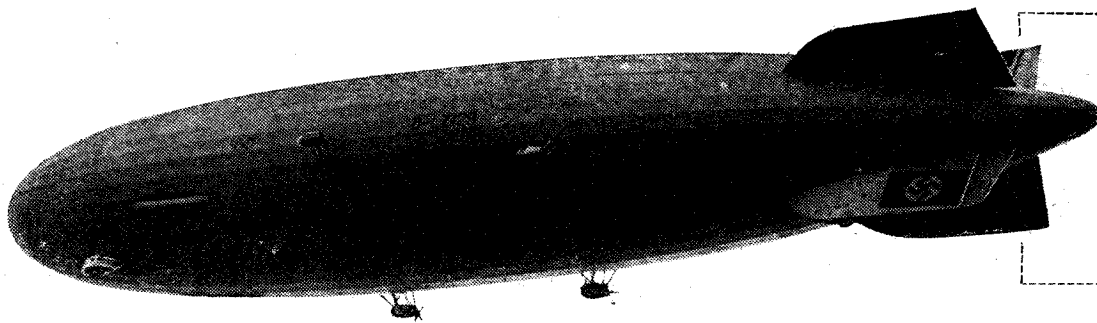
One of the greatest objections to any attempt at standardisation is that it is an encouragement to the public to accept that standard and cease to aim for anything better. In this country we have been striving to make broadcast reception in the home as ideal in quality as possible. The moment we introduce standardisation of sets we shall discourage improvements, and listeners will accustom themselves to accepting the standard set as good enough, even though it must unquestionably be a compromise.

Standardisation of receivers can only, we believe, be permissible in very exceptional cases, and we have ourselves recently put forward the suggestion that there is a case for a standard set for export to the Empire, where it is desirable to reduce competition between manufacturers and where standardisation would have an enormous advantage in the matter of stocking replacement parts. As far as this country is concerned, we hope that no thought of standardisation such as the Committee propose will ever be seriously entertained.

**Invitation to Readers**

There are many matters dealt with in the report which we have not touched upon in these comments, but we think that it would be of the greatest interest to all listeners to have the personal opinions of readers on any points in connection with the Report on which they would like to comment. We suggest that letters addressed to us should be kept as brief as possible, in order that we may publish a wide variety of opinions.





MONDAY'S  
BROADCAST  
FROM LZ 129 ON  
MAIDEN VOYAGE

# Tune in the Zeppelin

**Z**EPPELINS are rare birds, and the start of the new LZ 129 on Monday next on her first voyage from Germany to South America gives British listeners an opportunity to pick up a unique broadcast, either on short waves from the ship or *via* one of the German broadcasting stations.

The airship's Telefunken radio apparatus is of the most modern all-wave type, both for transmission and reception. On a trial flight in March communication was established on 24 metres with the U.S. Coast station at Chatham, a distance of 4,300 miles, on both telegraphy and telephony.

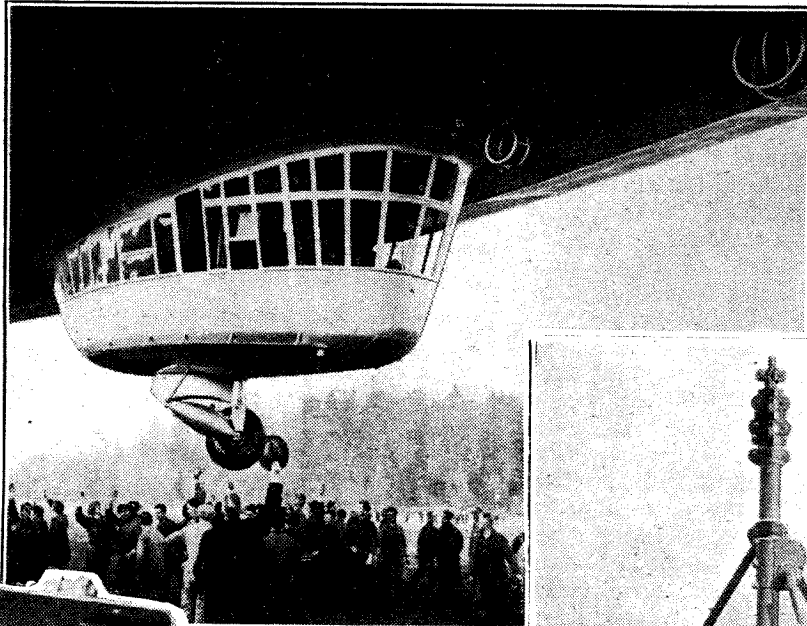
The long-wave transmitter covers a wave-range of from 575 to 2,700 metres, employing 200 watts for telegraphy and 125 for telephony, and the aerial consists of two trailing wires, 500ft. long. No carrier wave is discernible, as radiation occurs only at the moment of transmitting.

The short-wave transmitter uses 200

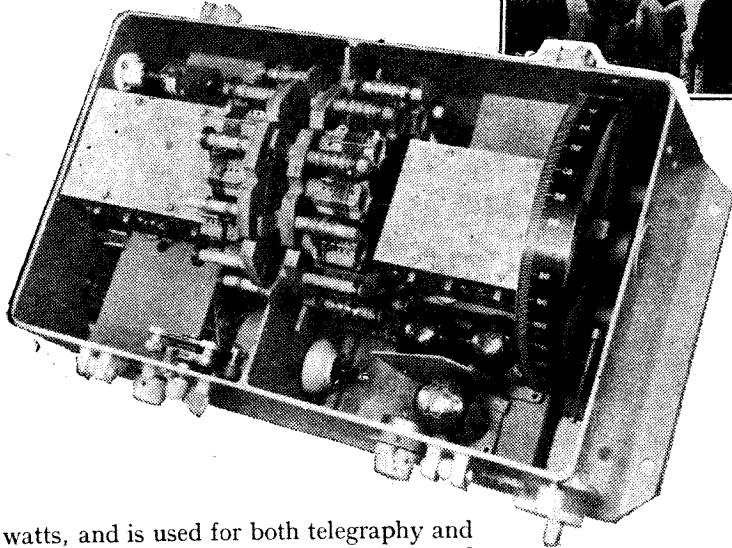
Two "blind" navigation receivers form part of the Zeppelin's elaborate direction-finding equipment. For landing purposes three wireless beacons operate on the aerodrome. By means of automatic triangulation,

sequent broadcasting in the evening programmes.

Short-wave listeners may reasonably expect to pick up LZ 129 on 24 metres or thereabouts during the next two or three



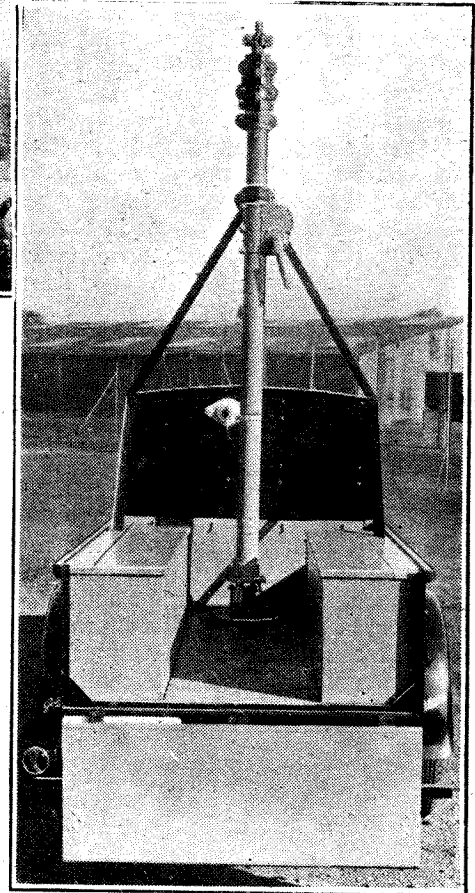
A close-up of the navigation cabin showing the loop aerials for direction-finding. The lower picture shows one of the mobile marker beacons with its telescopic mast.



Chassis of one of the Telefunken 15-20,000-metre receivers installed on the new Zeppelin. There are ten wave stages in this 4-valve "straight" set.

tion, the course of the ship is shown on instruments in the control cabin, and it is possible to come down safely in extremely bad conditions of visibility.

At the time of going to press the broadcasting arrangements are not complete, but it is understood that the Reichsrundfunk organisation is sending an announcer and an engineer as passengers on the voyage. Either a running commentary on the early stages of the trip will be broadcast direct to German listeners or records will be made for sub-



watts, and is used for both telegraphy and telephony on wavelengths between 17 and 70 metres. The short-wave aerial can be wound in or out to adjust it to exactly a quarter of the wavelength in use.

Reception on short and long waves is carried out by two Telefunken all-wave receivers covering a wave-range from 15 to 20,000 metres. They derive current from batteries, while the transmitters are supplied from the airship's own generators.

days. The fact that short waves are being used is of first importance. It may be possible to follow the flight of the ship for a considerable distance across the Atlantic.

# Noise Elimination

AN IMPORTANT AMERICAN DEVELOPMENT

ONE of the greatest difficulties encountered in reception is noise; not the gentle hiss introduced by the receiver itself, but the crashes and bangs caused by atmospherics and electrical machinery. In this country atmospherics are rarely very troublesome in broadcast reception, but the increasing use of electrical apparatus is leading the second cause of noise to assume very serious proportions indeed. Hitherto the only remedy has lain in prevention, for no cure at the receiver has been known. This has been an unsatisfactory state of affairs because in very many cases the apparatus responsible for the interference has been outside the control of the sufferer. Unable himself to take the proper remedies, his only course has lain in an endeavour to persuade the owner of the offending gear to fit interference suppressors, and if this failed his only resort was for the Post Office to appeal to the offender.

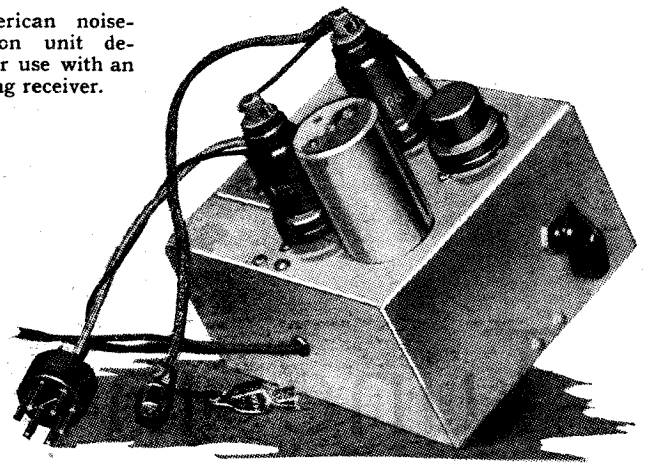
News is now forthcoming of a system which enables some forms of noise to be eliminated or greatly reduced in the receiver itself. No claim is made that it will prove effective in silencing all types of noise, but it is claimed that tests have shown it to be capable of giving an improvement in the signal-noise ratio of the order of 30 db., which is often quite sufficient to make the difference between good reception and unintelligibility.

## The Characteristics of Noise

The system is one developed in America by James J. Lamb, and described in the February issues of both *Q.S.T.* and *All-Wave Radio*. It depends for its operation on the characteristics of many forms of noise. It can be shown that much of the interference with radio reception is caused by sudden peaks of very short duration. Referring to Fig. 1 (a), in a typical case the signal may be constant at the amplitude shown, but the noise may consist of pulses lasting no more than one-thousandth of a second and of very varying amplitudes. The average amplitude of the pulses may be much less than that of the signal, but occasional peaks may be stronger, even as great as twenty times the signal strength.

At first sight one would not expect even

An American noise-suppression unit designed for use with an existing receiver.



*ANY method of combating local interference and atmospherics which offers reasonable promise of fulfilling the claims made for it is sure of a welcome reception among all classes of wireless enthusiasts, be they amateur or professional. While no claim is made that the new American development described in this article will suppress all types of noise, it is stated to be capable of greatly reducing some of the more important kinds, and the system employed is simple.*

large peaks of such short duration to have any great audible effect, and this might be true if it were not for the way in which the receiver responds to them. In general, the original waveform is not maintained

in the receiver; two effects may occur which profoundly change the character of the interference. In the first place, shock-excitation may occur, which means that the momentary pulse of interference may cause a tuned circuit in the HF, IF or LF stages, or even the loud speaker to oscillate at its natural frequency. Secondly, the large amplitude of the peaks may overload one or more valves and cause grid current to flow. Owing to the relatively high time constant of many circuits, the effects of grid current persist much longer than the pulse giving rise to the current, and while it lasts the operation of the set is greatly affected.

Because of these two effects, the duration of the pulses is greatly prolonged in the receiver and a truer picture of the audible effect is given by Fig. 1 (b), in which the minor noise below the signal level has been omitted. The system which has been devised for reducing the noise operates by silencing the receiver during the pulses of noise only. It is best thought of as a very rapidly acting AVC system which is only operated by those noise peaks which are stronger than the signal and which is introduced into the receiver at a point before that at which either shock-excitation or overloading are likely to occur.

## The Suppressor Circuit

It is then easy to visualise what happens. When a noise pulse comes along, this AVC circuit generates a large bias almost instantaneously and this greatly reduces the gain of the IF amplifier. As soon as the pulse has passed the bias drops back to normal and reception continues. Actually, instead of the noise, a series of "holes" in the signal is obtained, as in Fig. 1 (c). If this were all, the audible effect might be nearly as bad as that of the noise, but the important part to notice is that the duration of these "holes" is

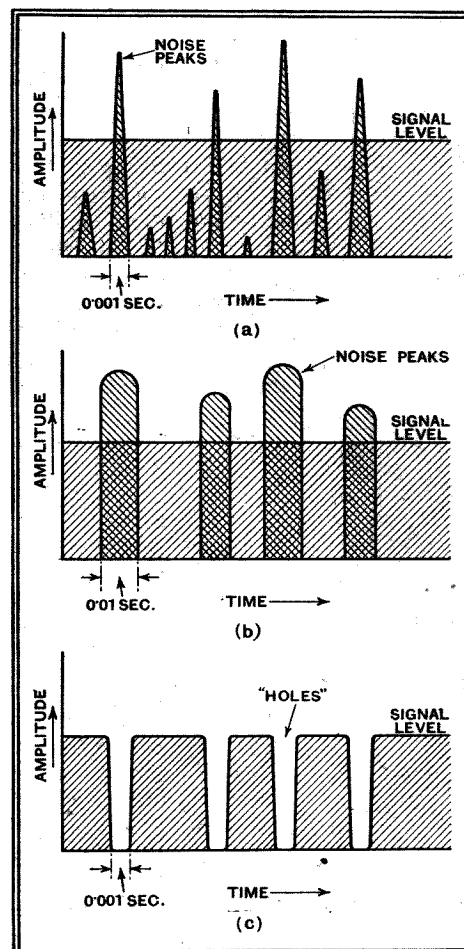


Fig. 1.—The characteristics of noise in relation to the signal are shown at (a), while the relationship as modified by the ordinary receiver is indicated at (b). The introduction of the noise suppressor circuit is shown at (c) and it can be seen that the removal of the noise momentarily suppresses the signal, but this is not audible.

**Noise Elimination—**

little, if any, greater than that of the original noise pulse, and the effect of the receiver in prolonging the pulses is overcome. Actually, it is claimed that the "holes" are inaudible.

The method of obtaining the action is by no means complicated, although it naturally demands additional apparatus. The recommended circuit is shown in Fig. 2, and the valves V1 and V2 form the second IF stage and detector of a typical superheterodyne. Save for the type of valve used for V1, this portion of the equipment is conventional. The IF input is applied to the grid of V1 from the transformer T1, and AVC bias through R1 with the decoupling condenser C1. Initial grid bias is derived from the cathode resistance R3, which has the usual by-pass condenser C3, while the screen-grids are fed through the voltage-dropping resistance R2. The anode circuit is coupled to the push-pull diode detector V2 by means of the transformer T2 having a tuned primary. The detector load resistance proper is R5, and R4 and C4 act as the usual IF filter. The voltage developed across these resistances as a result of rectification is applied through the filter R6 C5 as AVC bias to the controlled valves. The AVC system is non-delayed following the usual American practice.

The valve employed for V2 is the type 6L7, and is one developed primarily for frequency-changing purposes; it is really a hexode with the addition of a suppressor-grid between the outer screen-grid and the anode. When used as an amplifier it has two advantages over the ordinary HF pentode—a much lower grid-anode capacity, and an additional electrode by which its mutual conductance can be varied. This additional electrode is the third or injector grid, so called because it is the grid which is coupled to the oscillator when the valve is used as a frequency-changer, and the application to it of a negative bias reduces the mutual conductance.

Consider now the noise-suppressing portion of Fig. 2. This comprises the two valves V3 and V4. The former is an HF pentode of the non-variable-mu type connected as an IF amplifier and fed in parallel with V1 from the transformer T1. It is coupled to the noise detector V4 by the transformer T3. This detector is of the push-pull type and is provided with a load resistance R7 and by-pass condenser C6. The HF choke and C7 form a filter, having a very small time constant, for the elimination of IF currents in the output. Initial grid bias for the amplifier

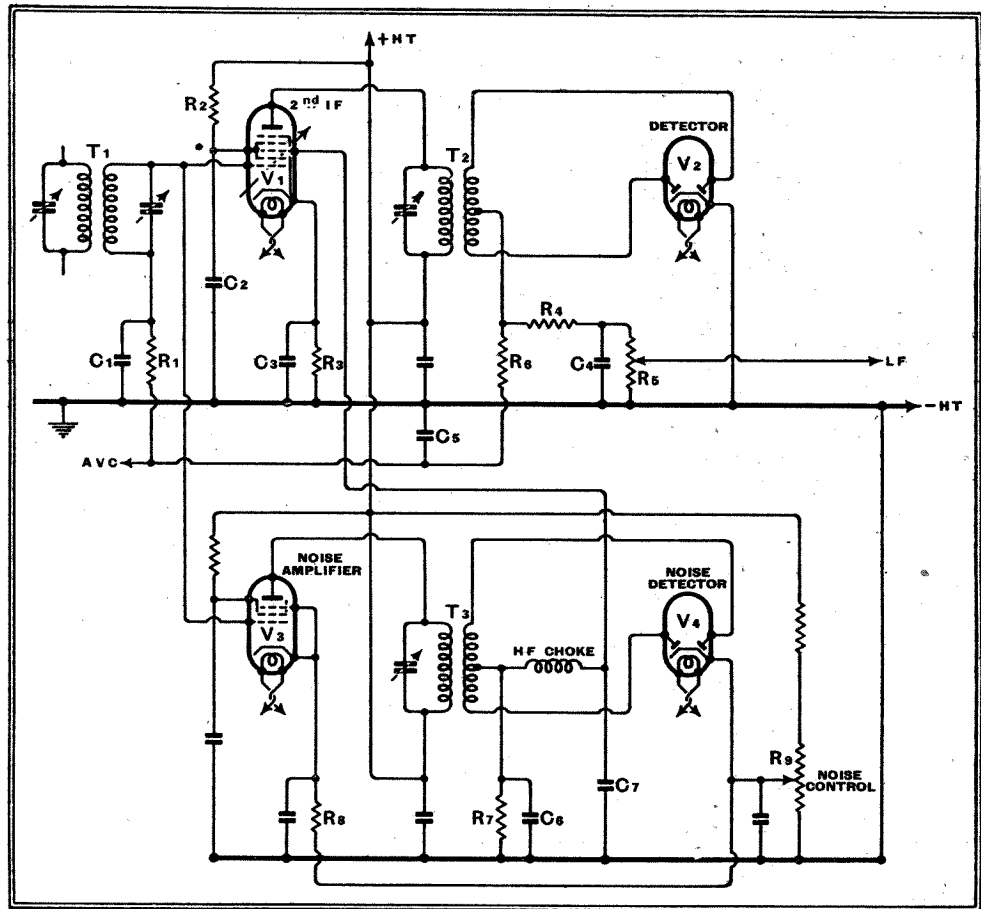


Fig. 2.—The circuit arrangement used for the noise suppressor. V1 and V2 are the second IF and detector valves of the receiver and V3 and V4 the additional valves in the noise suppression circuit.

V3 is provided by the cathode resistance R8, but additional bias can be applied to this valve and also to the diode detector V4 by means of the potentiometer R9, which acts to control the level at which the system operates. V3 is also controlled from the ordinary AVC circuit.

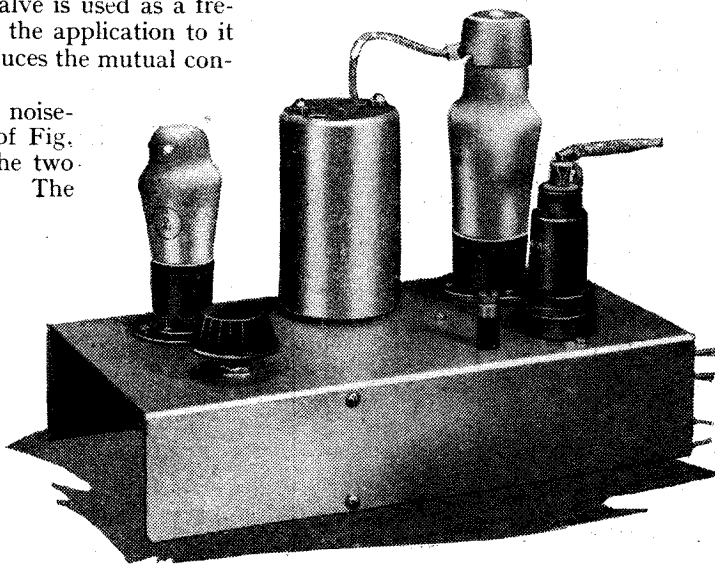
Now when noise is absent and V3 and

V4 are heavily biased, only V1 and V2 function, but they operate in a normal manner, and the gear is really no different from an ordinary set. Under this condition, if the bias on V3 and V4 is reduced by the adjustment of R9 a point will be found at which signal strength decreases, for then V3 gives greater amplification, the input to V4 is sufficient to overcome the delay voltage, and a potential consequently appears across R7 and is communicated through the HF choke to the injector grid of V1 and so lowers its amplification. If the signal is modulated distortion will appear before this point is reached, for the noise circuits will be operated by the peaks of modulation. The correct setting for R9, therefore, is the one giving a bias very slightly greater than that at which distortion just appears.

**Noise Reduction**

When a pulse of noise comes along of greater amplitude than the signal with its modulation, it sets up a potential across R7, and bias is applied to the injector grid of V1, reducing its amplification or rendering it inoperative according to the amplitude of the original impulse. The noise consequently does not reach the signal detector V2 in anything like its original intensity. During the period of the pulse, the signal does not reach the detector either, but if the pulse is short enough and the time constant of the noise circuits is sufficiently low, the momentary lapse of the signal is stated to be inaudible.

The use of push-pull detection in the noise circuit is an important help in obtaining a low time constant, and the transformer T3 must be constructed with a



An experimental unit, built on the lines described in this article, which was made and tested in *The Wireless World* laboratory.

V4 are heavily biased, only V1 and V2 function, but they operate in a normal manner, and the gear is really no different from an ordinary set. Under this condi-

**Noise Elimination—**

tuned circuit of low Q (=ωL/R). A high dynamic resistance is naturally advisable, and this means that a very high value of inductance is called for.

With the American valves employed by the originator, the following values for the important circuit constants are recommended:—R8, 350-1,000 ohms; R7, 100,000 ohms; C6, 0-250 mmfds.; C7, 50 mmfds.; R9, 5,000 ohms. Other components are given the customary values. The valves used are: V1, 6L7; V2, V4, 6H6; and V3, 6J7.

**Morse Reception**

Although the system probably finds its greatest application in telephony it is also useful in CW morse reception, and the advantages claimed for it would point to its being one of the most important developments of recent years. Some of the tests described in the issue *QST* already referred to are worth repeating here. The receiver was employed in the same room as a spark coil, and the interference caused by this was so great that all signals were unintelligible. When the noise circuits were brought into operation, however, intelligible reception of all signals was obtained, even when the background

did not disappear entirely. Some tables show that in the case of telephony the reduction in noise is of the order of 30 db., while in CW reception the improvement is about 20 db.

No claim for the complete suppression of noise under all circumstances is made for the system, but if an improvement in the signal-noise ratio of as much as 30 db. can be obtained, the money invested in the two extra valves and few additional components is likely to be money well spent. The arrangement is particularly effective in suppressing ignition noise, and as this is very prevalent in short and ultra-short wave reception it should prove of wide application.

**QA Super Transformer**

A TRANSFORMER designed for feeding the AVC HT supply of the QA Super has been received from British Television Supplies, Ltd. Its secondary is rated at 175 volts 5 mA., and the primary is wound for 4 volts. On test the output was found to be exactly in accordance with this rating, while the primary current on load was 0.63 ampere. This figure is commendably low, and the transformer can be recommended with every confidence for use in this receiver. It is priced at 10s. 6d.

**The Radio Industry**

THE Northampton Polytechnic Institute, St. John Street, London, E.C.1, have issued a prospectus of a new Junior Technical Day School for Instrument Making and Horology, which is to be opened after Easter. A three-year course of instruction is to be provided for boys proposing to enter the scientific instrument making trades.

For several years past, public address work at the famous Sheffield Cutlers' Feast has been carried out by John Ritley and Son, 281 and 283, Attercliffe Common, Sheffield, 9. Cutlers' Hall has marble walls devoid of any relief and so echo difficulties are serious. To overcome these troubles, a large number of special low-power speakers are placed on the tables and mounted to form part of the decorations.

Prize winners in the recent Pertrix "Long Life" competition had H.T. batteries in service for periods ranging from 66 months to 35 months.

A recent technical publication of the International Tin Research and Development Council, Manfield House, 378, Strand, London, W.C.2, deals with the hot-tinning of copper.

The British "Wireless for the Blind" Fund, 226-8, Great Portland Street, London, W.1, are appealing for a further £2,000. A new design of set, mains-operated and fitted with moving coil speakers and Braille tuning scales, is now being produced by Burne-Jones and Co., Ltd., for the use of the blind.

**SUMMARY OF SETS TESTED AND REVIEWED BY THE WIRELESS WORLD**

For the convenience of potential purchasers of manufacturers' receivers, the following list has been compiled of sets reviewed in the pages of *The Wireless World* during the last 6 months. This list will be supplemented from time to time with the details of future reviews.

It is possible to give only a brief summary here, and readers are referred to issues, dates of which are given in the last column, for the full reviews.

Maker.	Set.	Type.	Circuit, Valves excluding rectifier.	Wave Ranges.	Price.	Reviewed.
Murphy Radio, Ltd.	A28C	Console	Superhet 8 (A)	M, L	£ 21 15 0	1935. Oct. 4th
London Electric Appliances, Ltd.	Wayfarer	Portable	Straight 4 (B)	M, L	5 5 0	" 11th
Aerodyne Radio, Ltd.	Aeromag	Table	Superhet 6 (A)	M, L	24 3 0	" 18th
Burndep, Ltd.	All-Electric	Table	Straight 3 (U)	17-50 m., M, L	10 10 0	Nov. 1st
Philips Lamps, Ltd.	575A	Table	Superhet 5 (A)	S, M, L	19 8 6	" 8th
City Accumulator Co., Ltd.	"Austin" Super Six	Table	Superhet 5 (A)	M, L	17 17 0	" 15th
Prism Manufacturing Co.	Radiogramophone	RG	Straight 6 (A)	M, L	47 5 0	" 22nd
Charlton Higgs (Radio), Ltd.	A56R	Table	Superhet 4 (A)	M, L	12 1 6	" 22nd
Radio Gramophone Development Co., Ltd.	R.G.D. 704	RG	Superhet 6 (A)	M, L	57 15 0	" 29th
Gramophone Co., Ltd.	H.M.V. 370	RG	Straight 3 (A)	M, L	16 16 0	Dec. 6th
Ever Ready Radio, Ltd.	5003	Table	Superhet 4 (A)	M, L	14 14 0	" 6th
Air King Radio	213	Table	Superhet 8 (A)	14-52, 175-565, 930-2,250 m.	21 0 0	" 13th
Universal High Voltage Radio, Ltd.	Hylvoltstar Ten	RG	Superhet 9 (U)	13-33, 28-73, 200-560, 800-2,200 m.	36 15 0	" 13th
E. H. Scott Radio Laboratories, Inc.	Hi-Fidelity All-Wave	Chassis	Superhet 19 (A)	13.3-31.6, 30-75, 196-556, 810-1,940 m.	145 0 0	" 20th
F. C. Heayberd & Co.	4-Point	Table	Superhet 4 (A)	M, L	14 14 0	" 20th
Dominion Radio	Short-Wave Superhet	Chassis	Superhet 8 (A)	8.8-16.3, 15.5-31.1, 30.5-59.5, 58.5-186, 200-550 m.	35 0 0	1936. Jan. 17th
Phileo Radio and Television Corp. of Gt. Britain, Ltd.	2620	Table	Superhet 5 (A)	16.6-52.6, 174-547, 857-2,068 m.	17 17 0	" 24th
United Radio Manufacturers, Ltd.	Invicta FS36	Table	Straight 3 (B)	90-220, 220-550, 1,000-2,000 m.	9 19 6	" 31st
Degallier's, Ltd.	Challenger 8	Table	Superhet 7 (A)	12-39, 36-108, 180-550, 850-2,050 m.	13 13 0	Feb. 7th
Ferranti, Ltd.	All-Wave Superhet	Table	Superhet 3 (A)	19-51, 200-550, 900-2,000 m.	13 18 0	" 14th
Marconiphone Co., Ltd.	345	Table	Superhet 5 (A)	16.5-50, 47-140, 185-560, 750-2,200 m.	18 7 6	" 28th
Gramophone Co., Ltd.	H.M.V. 445	Table	Superhet 5 (A)	M, L	13 13 0	Mar. 13th
McCarthy Radio, Ltd.	S6AW	Chassis	Superhet 5 (A)	17-52, 200-550, 800-2,000 m.	7 0 0	" 27th

Abbreviations: RG = radiogramophone; A = AC; U = Universal; B = Battery; S = Short; M = medium; L = long.



# CURRENT TOPICS

## Kaunas: 100 Kilowatts?

**K**AUNAS, the Lithuanian station, whose only claim to fame has been the possession of the highest broadcasting wavelength in Europe, viz., 1935 metres, will soon step into the limelight with a new transmitter working on 50 kilowatts, capable of being raised to 100 kilowatts.

## 10-kW Television from Paris

**T**HE French television transmitter will assume permanent shape within the next few days with the completion of a new building beside the south-eastern pillar of the Eiffel Tower. A 10-kW transmitter has been installed to replace the existing temporary 1-kW plant.

## Short Waves from Schenectady

**S**TATION W2XAF at Schenectady announces that on and after April 1st until further notice the short-wave schedule will be as follows:—

W2XAD (19 metres) 15.00 to 19.00 (G.M.T.) daily, including Sundays.

W2XAF (31 metres) 21.00 to 05.00 (G.M.T.) daily, including Sundays.

## Woman Broadcast Director

**P**OLAND'S Empire station is in regular operation with the call-sign "SPW-Warsaw," and a wavelength of 22 metres. Transmissions are on Mondays, Wednesdays and Fridays from 16.30 to 17.30 (G.M.T.), the programme consisting of national music and talks. The station is intended to serve Polish nationals in America and the Far East. The Director of the station is Mlle. Irena Skowornkowna.

9.58 p.m.

**H**ERR TUSCHINCK, of Essen, recently sent a donation to the Cologne station's Winter Help Fund, promising to present a layette to any baby born in the Cologne region at 9.58 p.m. on March 10th. Applicants, or rather their parents, were requested to show a doctor's and registrar's certificate. Within two days twenty-eight substantiated claims were received, and Herr Tuschinck is considerably the poorer.

## Hospital Appeal for 'Phones

**U**NWANTED headphones would make a welcome gift to the Sutton and Cheam Hospital, Sutton, Surrey, which is anxious to complete its wireless

installation. Offers will be gratefully received by Mr. S. S. Woodley, Secretary of the Appeal Committee.

## Wabtsarcfasbnc Certificate

**A**MERICAN amateurs sporting the letters WAS have "worked all States." Our contemporary Q.S.T. reports that a message recently received following the announcement of the formation of the W.A.S. Club reads as follows: "Please issue me a WABTSARCFASBNC certificate."

Investigations by the Q.S.T. chief cryptographer disclosed that the mysterious letters stand for "Worked All But Three States And Received Cards From All States But Nine Club."

Hi!

## Wireless-controlled 'Planes

**W**IRELESS controlled aircraft are being used in increasing numbers by the Services. The Air Ministry has just placed an order for a big fleet of special "Tiger Moths" which, when fitted with wireless receivers in place of pilots, are known as "Queen Bees." They will probably be used as targets for anti-aircraft gunnery.

Other possibilities are the fitting of automatic cameras for experiments in photographic reconnaissance.

is confirmed by the experience of the Paris station, which punctuates its programmes with the lively air, "La Belle Aventure." Critics state that this air most unbecomingly preceded the report of the funeral of King George, and was also an inappropriate prelude to the grave Locarno speech of Premier Sarraut.

## Submarine Relay

**I**TALIAN stations have just broadcast the celebration of Mass conducted by the Archbishop of Taranto on board a submarine. The vessel was submerged during the service, which was held in commemoration of soldiers killed in Abyssinia.

## Lt.-Col. Disney

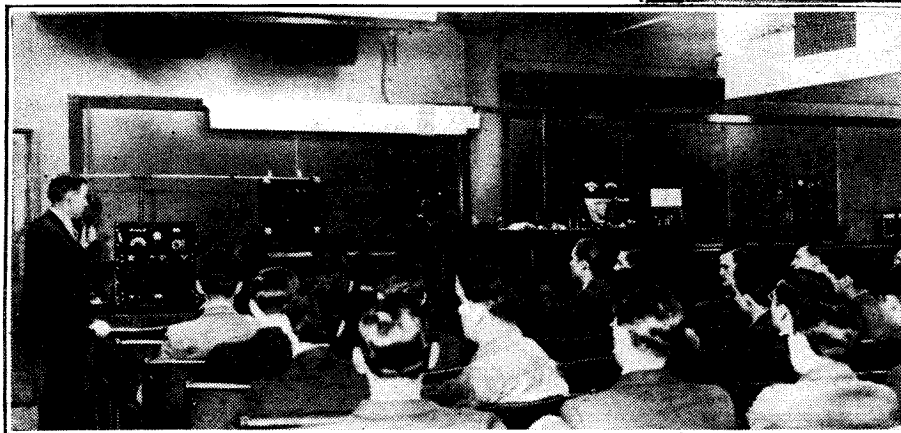
**T**HE newly created post of Director of Production at the Air Ministry is to be filled by Lt.-Col. H. A. P. Disney, who now holds an important appointment with Messrs. E. K. Cole, Ltd. He is experienced in patent and contract matters.

Col. Disney, who is forty-two, served in the Royal Flying

## EVENTS OF THE WEEK IN BRIEF REVIEW

### Ideal Home Exhibition

**T**O wireless enthusiasts one of the most interesting features of the Ideal Home Exhibition, which opened at Olympia on Tuesday last, is "Chrissie," the mechanical cow, which strolls about Portcullis Avenue where the Scientific Dairy Farm is in operation. Chrissie, whose voice has been given to her by a well-known wireless firm, tells at each stage what is being done and why. She answers questions, and



LECTURES via ultra-short waves are now conducted at New York University, professors being enabled to address several classes simultaneously.

## Another Radio Palace

**A**USTRIA'S new "Broadcasting House" is, we learn, to be "an enormous edifice" of seven stories, built in the centre of a great park. The studios will be installed in three separate pavilions linked by bridges. It is to be completed in 1938.

## Too Gay

**T**HE B.B.C. wisdom in selecting a non-committal interval signal like "Bow Bells"

Corps during the War, and in 1919 joined the Western Electric Co., Ltd. Later he held important posts with Standard Telephones and Cables, Creed and Co., Kolster-Brandes, the International Telegraph and Telephone Co., and other well-known organisations.

## New N.B.C. Organ

**A** NEW pipe organ designed especially for broadcasting has been opened in the Chicago studios of the National Broadcasting Co. of America.

occasionally responds to railway.

The new speaking clock will be found at the Post Office exhibit. It will be remembered that the record for this clock was made by Miss Ethel Cain, the "girl with the golden voice."

The elaborate public address installation has been carried out by the Marconi Co., thirty-five loud speakers being used to cover the entire exhibition. The amplifiers consume over 2,500 watts.

# ULTRA-SHORT-WAVE

## The Problem of the Frequency-changer

By W. T. COCKING

**N**OW that the time is fast approaching for the commencement of ultra-short wave broadcasting from Alexandra Palace, interest in the necessary receiving equipment is rapidly growing. The transmissions will not, of course, be confined to television, for sound broadcasting will take place as well, and indeed is likely to precede the vision. It is understood that these transmissions will be of very high quality, so that reception on these wavelengths will commend itself no less to the seeker after faithful reproduction than to those interested in the purely television transmissions.

The wavelengths employed will be of the order of 7 metres, and as the corresponding frequency is about 43 mc/s, it is easy to see that the problems of receiver design are very much greater than in the case of ordinary broadcasting. Moreover, owing to the rapid attenuation of waves of this order, a highly sensitive set is necessary for good results. Exactly how sensitive a set must be can hardly be decided until the transmitters are actually in operation, but there seems no doubt that for reception at 20 miles or so the sensitivity will have to be at least as high as that needed on the medium waveband for general Continental reception.

A simple set of the super-regenerator type will undoubtedly give good results, but up to the present it fails on the score of quality. The distortion introduced is considerable on sound, and far too great to be tolerable on vision. The simple reacting detector fails on the grounds of insensitivity and difficulty of tuning. We are, therefore, left with the straight HF set and the superheterodyne. The former is by no means impossible on these wave-

lengths, even with ordinary valves, but it is quite difficult to obtain the required amplification and many stages are necessary.

At the present day, therefore, the superheterodyne offers the simplest and most reliable reception. The design of suitable apparatus, however, is by no means straightforward, and all sorts of unsuspected snags crop up when new apparatus is first tried out. Most of the difficulties arise in the frequency-changer, and it is to this portion of the set, therefore, that most attention will be devoted in this article.

ing; that is, in maintaining independence of tuning of the signal and oscillator circuits. Another great bugbear of ultra-short-wave operation is parasitic oscillation.

### The Oscillator

Whatever type of frequency-changer be used, an oscillator is necessary. The reaction coil type, so widely used on the broadcast bands, is usually quite unsuitable for wavelengths below 12 metres or so, and it is customary to employ the Hartley circuit. This is shown in

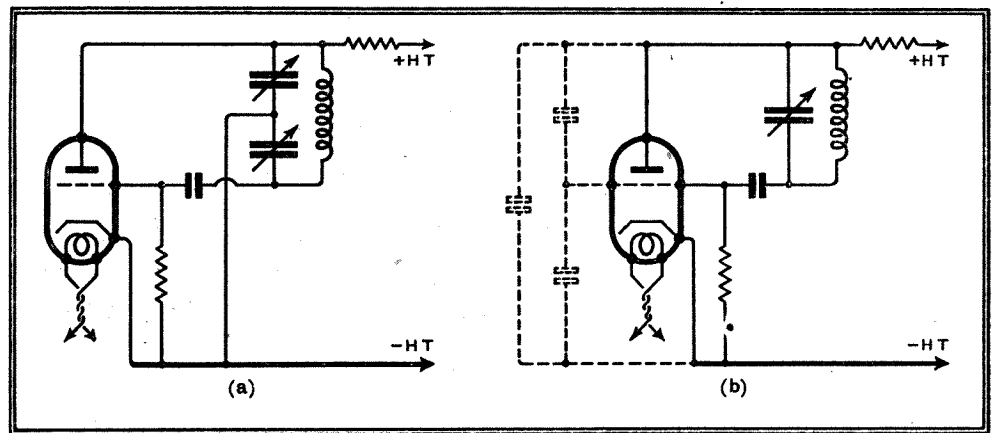


Fig. 2.—The Colpitt's oscillator employing a split-condenser is relatively free from parasitic oscillation. On ultra-short waves, the split condenser is unnecessary for the same effect is obtained by the valve capacities.

At one time or another the writer has tried out most forms of frequency-changing on ultra-short wavelengths and he has found only one which can be considered really satisfactory. Although good results can be secured from the push-pull heptode system they do not compare with those given by a properly used triode-hexode. Actually, it is not difficult to obtain an efficient frequency-changer, for most systems can be made to give good results in this respect. The difficulty lies in obtaining both efficiency and freedom from pull-

Fig. 1(a) and it is a ready oscillator. Its great drawback, however, is that it is very liable to oscillate at two different frequencies at one and the same time! The primary mode of oscillation is quite straightforward, but the secondary mode appears to come about at a frequency determined by the two halves of the coil tuned by their self-capacities. At this parasitic frequency the circuit resolves itself into a tuned anode-tuned grid oscillator, as shown in Fig. 1 (b).

Because of this the writer has found that circuits which do not require the use of a tapped coil in the oscillator are far less prone to parasitic oscillation. The Colpitt's oscillator (Fig. 2 a) is one of these, and the necessary tapping point on the tuned circuit is provided on the condenser instead of the coil. A split tuning condenser is used, and as it stands the circuit is suitable for any wavelength. On ultra-short wavelengths, however, a split condenser is not necessary, for the valve capacities are comparable to the tuning capacity and can themselves be used to provide the tapping point. This is readily seen from Fig. 2 (b), from which it can be seen that the grid-anode capacity is merely additive to the tuning capacity.

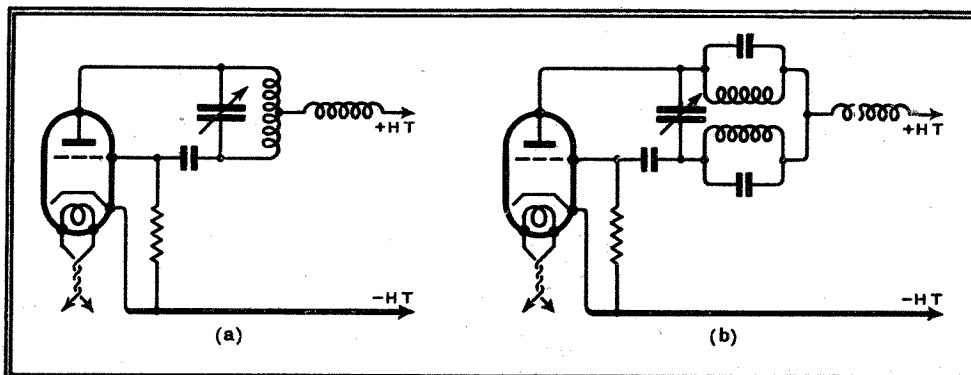


Fig. 1.—A typical Hartley oscillator is shown at (a) and at (b) the effective circuit from the point of view of parasitic oscillation.

# SUPERHETERODYNES

ONE of the greatest difficulties in ultra-short wave reception lies in the frequency-changer, for hitherto an efficient and reliable frequency-changer has been very difficult to secure. The problem is reviewed in this article and an arrangement is described which practical experience has shown to be highly satisfactory.

The tuned circuit, however, is shunted by the anode-cathode and grid-cathode capacities in series, and their junction at the cathode forms a tapping point on the tuned circuit.

In practice, the writer has found this oscillator circuit very reliable and exceptionally free from parasitic oscillation. Moreover, the stray capacities thrown on to the tuned circuit are very small, and it is consequently possible to build an efficient tuned circuit and to obtain quite a large amplitude of oscillation.

## The Triode-Hexode

Now having obtained a satisfactory oscillator circuit, it is necessary to employ it properly if a good frequency-changer is to result. In order to avoid pulling it is necessary for the coupling between the signal and oscillator circuits to be as nearly as possible electronic only. In practice the writer has found the triode-hexode to be the most satisfactory.

The circuit arrangement is shown in Fig. 3, and an X41 valve has been used with entirely satisfactory results. This valve requires an oscillator voltage of about 12 volts, but no difficulty has been found in obtaining this; actually, with a good tuned circuit, it was readily possible to obtain double this figure. A suitable value for the grid leak R3 is 50,000 ohms with a grid condenser C6 of 0.0001 mfd.

The amplitude of oscillation can be controlled by the resistance R4, and with 250 volts HT and a good tuned circuit, 75,000 ohms is a satisfactory value. The condenser C7 should have a value of about

25 mmfds. depending on the tuning range required. The coil L3 also depends on the band required, but for 7 metres about 10-12 turns of No. 15 enamelled wire is right when the diameter is  $\frac{1}{2}$  in. and the length  $1\frac{1}{8}$  in.

The signal-frequency circuits are conventional, save for the tapping on L2. Actually, L2 should have about 2 turns more than L3 and C1 the same capacity as C7. Tapping the hexode-grid down L2 results in a big reduction in the stray

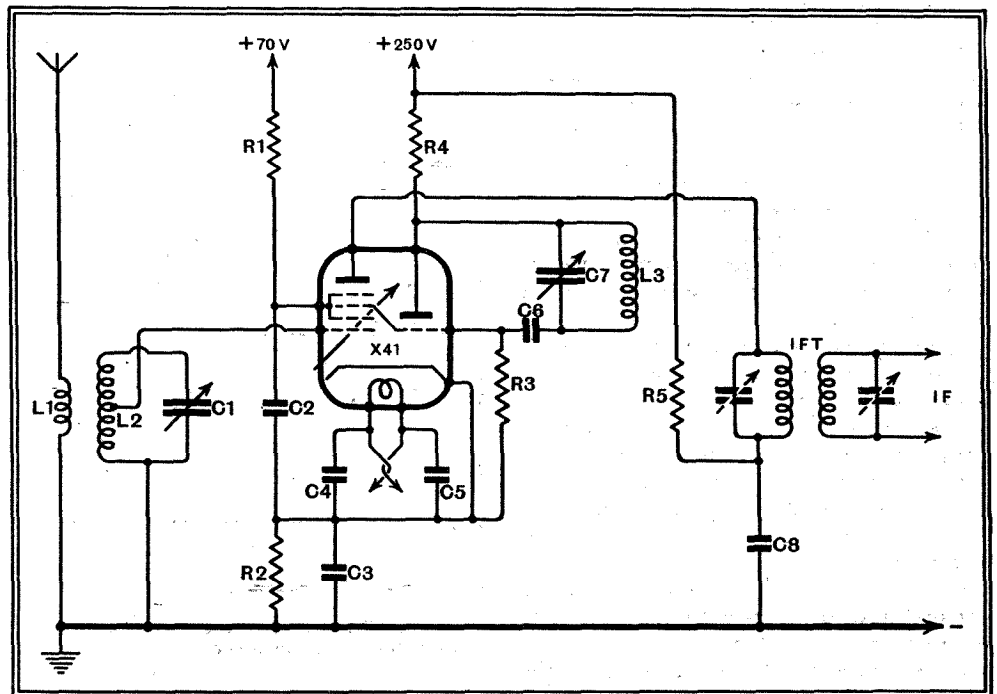
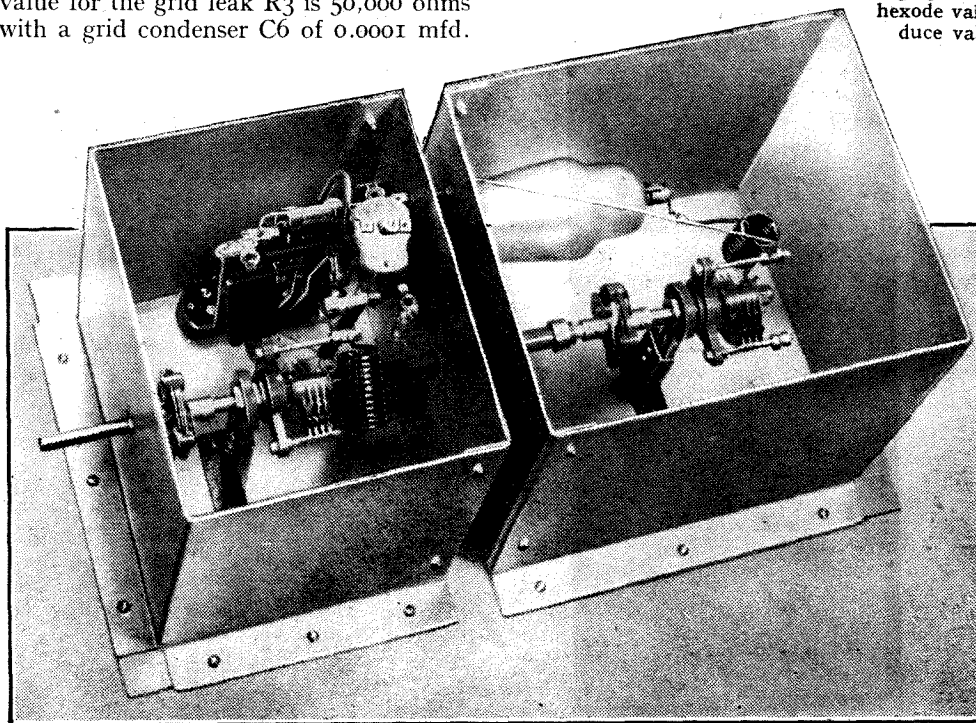


Fig. 3.—A practical frequency-changer embodying a triode-hexode valve. The signal-frequency circuit is tapped to reduce valve damping and to reduce the circuit capacity.



An experimental model of the triode-hexode frequency-changer. The oscillator components are contained in the left-hand screening box.

capacity thrown on this tuned circuit, and it considerably sharpens the tuning. This is because the input impedance of a valve is quite low on ultra-short wavelengths; consequently increased sensitivity results from correctly placing the tapping. The optimum point is about one-quarter the way down the coil, but the loss of sensitivity when using a centre-tap is small, and tuning is much sharper.

The aerial coupling coil L1 depends upon the aerial. With a resonant aerial, about 2 turns loosely coupled to the earth end of L2 is satisfactory, but if an ordinary broadcast aerial is used, as many as 4 or 5 turns overwound on the earth end of L2 may be needed.

## The Circuit Arrangement

On ultra-short wavelengths, the mere fact that the circuit is correct is no guarantee of good results. Great care must be exercised in the choice of components and their layout, and also in the disposition of the wiring. Referring to Fig. 3, the by-pass condensers C2, C4, C5 should be

**Ultra-short-wave Superheterodynes**

of the mica type, and a capacity of 0.0005 mfd. is suitable; C3 and C8, however, should be 0.01 mfd., but still of the mica type. In general, C2, C4, C5, C3 and R2 should be joined together at a single point only, the cathode of the valve, while C3, R2, C8, C1 should also be joined together at a single point and earthed to the screening at one point only.

A satisfactory method of construction has been found to lie in the use of two screening boxes, one enclosing most of the valve and signal-frequency circuits and the other the valve holder, oscillator circuits, and decoupling components. The two screening boxes are connected together at one point only and otherwise insulated. It is possible that some reduction in screening would be possible without deleterious effects, but in spite of these precautions a slight degree of coupling between the signal and oscillator circuits exists. This is not sufficient to cause noticeable pulling, but it has the effect of reducing the efficiency of the frequency-changer on one beat. Thus, results are entirely satisfactory with the oscillator tuned to a higher frequency than the signal, but there is quite a large drop in efficiency when it is tuned to the lower frequency beat.

In the avoidance of undesired effects, the wiring plays a great part, and it is particularly important to keep the anode leads of the hexode short. The total wiring from the anode to the IF transformer, and from the transformer through C8 and C3 back to the cathode, must be as short as possible. The screen decoupling leads must also be short, but this is usually easy, for C2 can be soldered directly to the appropriate legs of the valve holder.

In addition to the above, the whole assembly must be mechanically rigid and the oscillator HT supply well smoothed. If this is not done, the oscillator frequency is unlikely to be steady. Any trace of wobble in the oscillator output must be avoided if the IF amplifier is at all selective, for it renders speech almost unintelligible. It is for this reason that ultra-short wave converters for use with ordinary broadcast receivers require extraordinary care in design if they are to prove satisfactory. It is unwise, therefore, to aim at high selectivity in the IF amplifier, and, in fact, it is quite unnecessary. A band width of about 40 kc/s is entirely satisfactory for sound reception and permits the use of an intermediate frequency of about 5 mc/s (60 metres).

When a fair amount of LF amplification is used, two IF stages at this frequency give all the gain that is likely to be needed for most purposes, and with the frequency-changer described form a very satisfactory receiver. There are, of course, many modifications which can be made, and when extreme sensitivity is required, it might be advisable to precede the frequency-changer by an HF stage, and, as this would introduce a further tuned circuit, it would greatly reduce any tendency to second-channel interference.

**DISTANT RECEPTION NOTES**

I HAVE to thank a Bristol reader for a particularly interesting letter on a subject which I raised recently in these notes. Readers may remember that I mentioned that my house stands in one of those deep, narrow Chiltern valleys which run roughly from south-east to north-west. The blanketing effect of the hills on the one side seems to offer a fairly good explanation of the reason for my not being able to make much of Lahti, though this station is pretty well received in many other places. But I expressed surprise that the other range, which runs almost at right angles to a straight line between my aerial and any part of the United States, does not place me in a similar "wireless shadow," so far as American stations are concerned. My correspondent suggests that radiations from the United States, following a great circle path, would reach my aerial from a north-westerly rather than a south-westerly direction, and that there would therefore be no screening from the hills.

I am not sufficiently versed in the mysteries of navigation to know just how a great circle path from, say, Chicago to a point twenty-five miles north-west of London would run. Perhaps readers whose business takes them down to the sea in ships will confirm my correspondent's suggestion

that the apparent screening would entirely fail to screen. I should mention, by the way, that he asks me to take a bearing next time I find that American stations can be received on a portable set with a frame aerial. This would, of course, show from which direction the signals were arriving. I will certainly do so if and when the amazing conditions for transatlantic reception that prevailed some years ago are repeated.

I have to thank another correspondent who hails from the County of Forfar for a report on reception of the three big German stations, Breslau, Berlin, and Königsberg, which were recently conducting synchronised working on 356.7 metres. He tells me that the effect was very much the same as that produced by the wavelength partnership of the London, North and West Nationals on 261.1 metres. At odd moments reception proved quite good, but this state of affairs was of very short duration, being followed by a period in which the worst kind of "jumbling" took place. This, he suggests, may be due to the different distances traversed by the three sky waves.

Radio-Béziers is shortly to remove to the neighbourhood of Paris. I understand that it has been acquired by one of the Paris evening newspapers. Paris will thus have three "newspaper" stations, the other two being the Poste Parisien and Radio-Cité. One would have thought that the endeavour of M. Mandel, the French Minister of Posts, Telegraphs and Telephones, would be to reduce the number of privately owned stations, now that the Ferrié scheme is nearing completion. A fact that may have influenced him in giving permission for yet a further station to operate in the Paris neighbourhood is that both Radio-Paris and the National short-wave transmitter are to move before long to positions some way from the capital but near the middle of the country.

Kaunas is a station that comparatively few listeners in this country ever hear. This is due partly to the fact that it is separated by only five kilocycles from Hilversum No. 1 and Brasov, which share the 1,875-metre wavelength, and partly because its output rating is only 7 kilowatts. The Government of Lithuania has decided to scrap the present plant and to build a new 100-kilowatt station. This should be in action within twelve months, and if only the new Kaunas can move down a few kilocycles (or up a few metres) its transmissions may be very well heard over here. D. EXER.

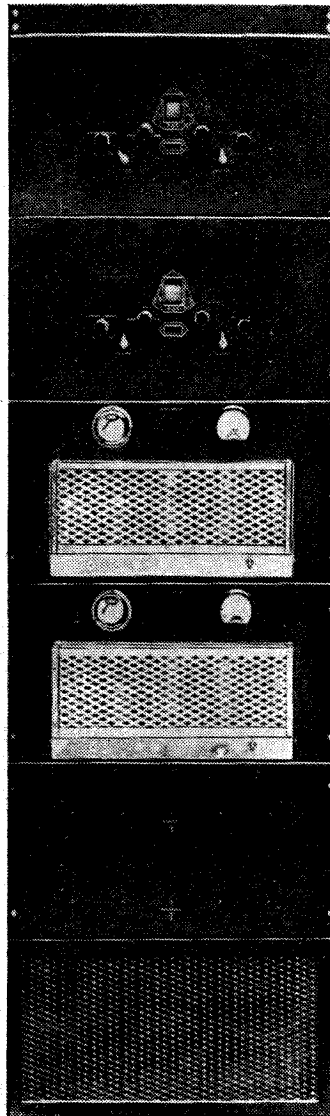
**High-quality PA Gear**

Although the Radio Gramophone Development Company is best known for high-quality apparatus of the type suggested by its title, the firm also produces a number of specialised instruments for general amplifying and public-address purposes.

Starting at the logical point—the input end—there are two types of crystal microphone, with accessories such as stands and mountings. A three-stage R.C.C. pre-amplifier specially designed to work with these microphones is also produced.

The general-purpose 18-watt amplifier, type PW18, employs a resistance-coupled paraphase system, and is fitted with independent tone controls for adjusting the balance of high and low frequencies.

Full advantage is taken of the flexibility of the rack system in the R.G.D. rack amplifiers, in which apparatus of various kinds (including high-quality R.G.D. radio chassis) can be combined for meeting any special requirements.



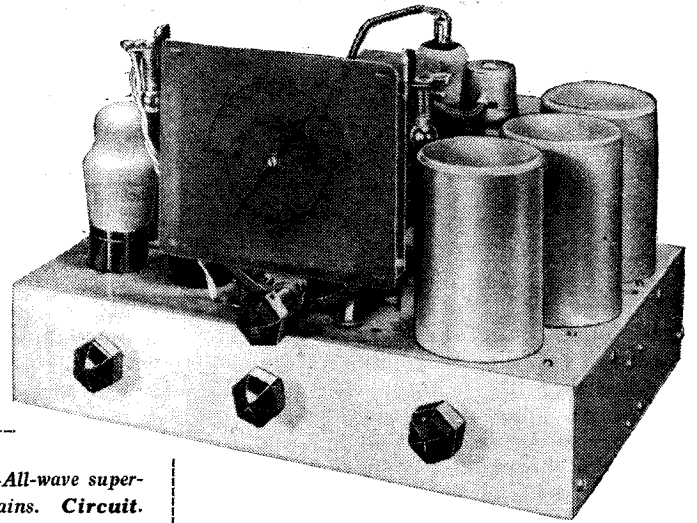
Versatile R.G.D. amplifying rack, with provision for radio reception.



# McCarthy

## TYPE S6AW

### A Moderately Priced All-wave Receiver with a Lively Performance



**H**OWEVER well the public may be served by the standardised productions of the radio industry, there will always be many to whom the idea of possessing a receiver of individual character will appeal with considerable force. When trying to arrive at a decision regarding the choice of a suitable instrument it often happens that one is attracted by the radio performance of a certain make of set, but dislikes the style of the cabinet or the particular brand of tone associated with the loud speaker which has been standardised by the makers. On the other hand, starting with one of the McCarthy chassis, and there is a wide range of choice for every requirement, it should be possible to build up a complete receiver which will in some measure reflect the taste of the individual in matters of cabinet design and quality of reproduction.

In view of the increasing interest in short-wave reception, the chassis chosen for review was the Type S6AW. This is an AC superheterodyne with three wave-ranges, one of which covers the band from 17 to 52 metres on which the majority of the interesting short-wave broadcast programmes are to be found. The design of the circuit is thoroughly up to date, and includes an interesting method of obtaining inter-station noise suppression.

In the interests of good selectivity on the medium and long wavebands, an inductively coupled band-pass filter is used in the input circuit. There are alternative sockets for the aerial connection, and the

**FEATURES.**—*Type.*—All-wave superheterodyne chassis for AC mains. **Circuit.**—Octode frequency-changer—var.-mu pentode IF amplifier—triode muting valve—double-diode-triode second detector—pentode output valve. **Full-wave valve rectifier.** **Controls.**—(1) Tuning. (2) Volume and on-off switch. (3) Noise suppression. (4) Wave-range. **Price.**—£7 (including valves but excluding loud speakers). **Makers.**—McCarthy Radio Ltd.

one which includes a small fixed condenser will probably be found to be best for all-round use. The direct connection (A2) will give an increase of signal strength on the long waves for remote parts of the country.

A single-tuned circuit is used instead of the band-pass filter on the short wave-range. There is no direct connection to the aerial, so it must be assumed that strays are sufficient to transfer energy to the circuit at the high frequencies concerned.

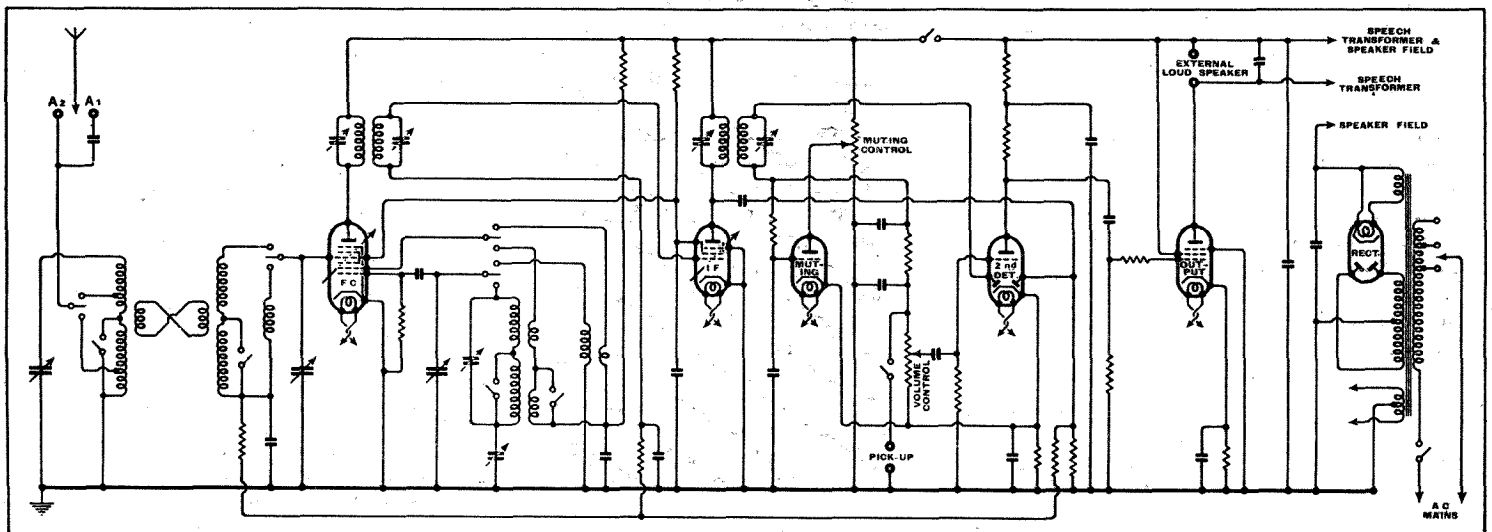
#### Noise Suppression

The frequency-changer is an octode, and this valve and the variable-mu pentode IF amplifier are AVC controlled through suitable decoupling from the main line. The connections to the double-diode-triode second detector and LF amplifier follow conventional practice, but the

method of obtaining inter-station noise suppression is of more than usual interest.

A separate triode "muting" valve has been included for this purpose. Its anode is supplied with a positive potential through a potentiometer connected across the main HT supply, and its cathode is connected to the cathode of the second detector valve. The grid is connected through a resistance to the high-potential end of the signal diode load resistance, so that under conditions of no signal the grid of the muting valve will be practically at zero potential, and a current will flow through the valve depending upon the setting of the muting control. As this current passes through the cathode resistance of the second detector stage, the bias of this valve, which determines not only the operating conditions of the LF amplifier, but also the delay voltage for AVC, will be increased. The advent of a signal will cause a negative potential to be applied to the grid of the muting valve, which will reduce the current through that valve and so reduce the bias on the LF amplifier to the normal operating value. At the same time the AVC delay voltage will fall, and this will result in an extension of the range of control.

Resistance-capacity coupling is employed between the second detector valve and the output stage, which is a pentode



Complete circuit diagram. The separate valve used for automatic noise suppression also varies the AVC delay voltage.

**McCarthy Type S6AW—**

designed for an undistorted output of 3 watts. The output connections to the loud speaker are arranged so that the field may be used for smoothing, a DC resistance of 2,500 ohms being required in the field. Should it be desired to use a permanent-magnet loud speaker a smoothing choke with the required DC resistance must be used as a substitute for the field.

One of the first things to receive attention when testing the set was the action of the muting control, and we have no hesitation in awarding full marks for the performance of this feature. The point at which the noise suppression comes into action can be adjusted to a nicety by means of the manual control, and when a station is found which is strong enough to open up the circuit at the setting of the control which has been chosen, it makes its entry smoothly without any sign of instability or sideband distortion at the fringes of the band over which the control is effective. It has not been found neces-

sender could be easily cleared of interference from Droitwich and Radio-Paris when the latter stations were both giving musical programmes, but some sideband interference found its way through on the deeper modulation of speech. There was a compact group of second-channel whistles on the long waveband in the region of 1,150 metres, and one of these images was found to carry modulation from the London Regional station. The medium waveband, on the other hand, was quite free of second-channel interference.

**Short-wave Reception**

The set gave excellent results on the short waveband, and good reception was obtained from W8XK on 19.72 metres. All the European short-wave broadcast stations came in with a signal strength comparable with the performance on the medium waveband, and the smooth action of the slow-motion tuning dial will relieve the listener of any feeling that tuning is

a Magnavox Model 152, and an excellent impression of good bass response was obtained with a two-foot square, flat baffle. There was good body of tone in the middle register, and sufficient top to provide the necessary balance without undue harshness. No variable tone control is fitted in the receiver, but this hardly seems necessary in view of the results obtained. The construction of the chassis throughout is sound, and if every single component does not carry the name of a nationally known manufacturer that does not necessarily imply that the set will give other than a consistent and reliable performance. The slight background with the aerial disconnected is in-itself an indication of the satisfactory quality of resistances and other vital components.

**NEW BOOKS**

**The Superheterodyne Receiver**, by Alfred T. Wits, A.M.I.E.E. Second edition, 160 pages. Published by Sir Isaac Pitman & Sons, Ltd., 39, Parker Street, London, W.C.2. Price 3s. 6d.

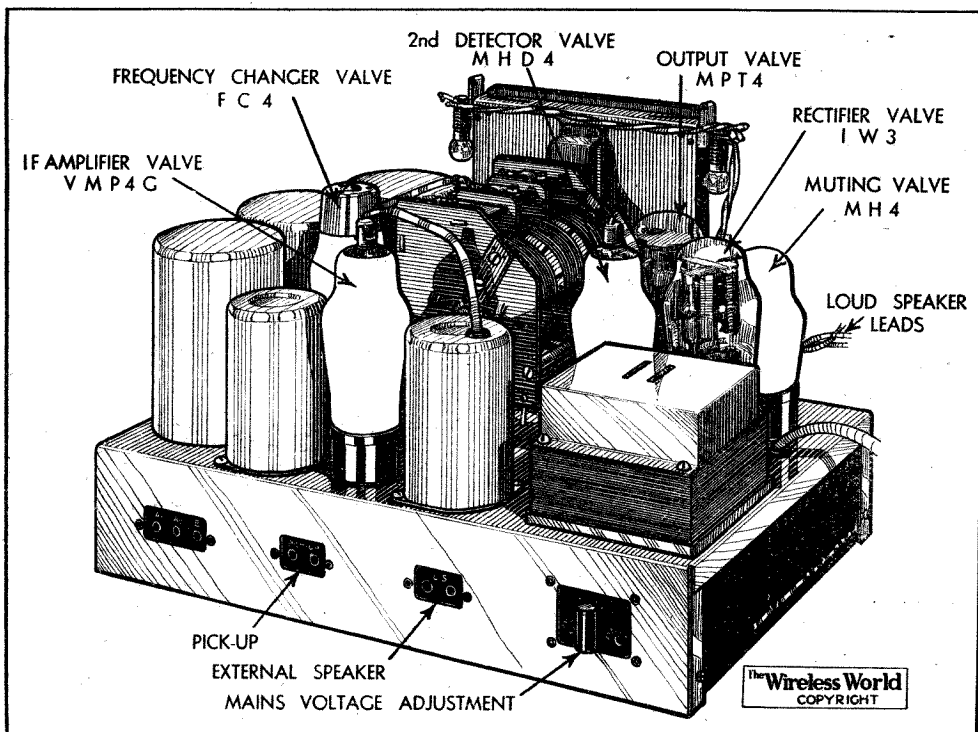
IN this book the whole field of the superheterodyne is well surveyed in a non-mathematical manner, and, in particular, the important subject of frequency changing is adequately treated. Advantage has been taken of the publication of a new edition to include fresh material, with the result that such recent innovations as triode-hexode frequency changers and variable selectivity are described, while a chapter has been added dealing with receiver maintenance. The book is up to date and remarkably free from errors. W. T. C.

**The New Acoustics**, by N. W. McLachlan, D.Sc., M.I.E.E. Pp. 166, with 100 illustrations. Oxford University Press, Warwick Square, London, E.C.4. Price 7s. 6d.

PRIOR to the war the science of acoustics had entered a region of the doldrums. As far as the mathematical basis was concerned it is true that the theory of propagation had been worked out in great detail by Rayleigh, and his treatise still stands as the classical work of reference on the subject. Apart from a few attempts to improve the acoustics of public buildings, however, the applications of this Cinderella of the sciences to human needs were few and far between.

The war period may be regarded as the turning point in its history, and the author gives an interesting account of the influence of the anti-submarine campaign on the development of acoustics from a pure to an applied science. The advent of broadcasting, and later of the talking film, are noted as important landmarks in the rise of a vast new industry, and the principles of operation of all the new devices associated with these activities are described lucidly but without resort to the use of mathematical symbols. Chapters are also devoted to the problems of sound analysis, the behaviour of the ear, and the design of deaf-aids.

A useful bibliography is included, but this book is no mere collection of extracts, for the author writes from first-hand knowledge of nearly every aspect with which he deals. Not only will this volume serve as an admirable introduction to the subject for newcomers, but it will also prevent practitioners in one or other of its many branches from developing too parochial an outlook. F. L. D.



The chassis is supplied complete with valves and ready for fitting in a cabinet. If a permanent-magnet speaker is used a separate 2,500-ohm smoothing choke will be required.

sary to supply the muting circuit with a long time-constant in order to achieve this result, and there is no fear of missing a station if the tuning control is rotated at a normal speed. The sensitivity of the set and its general briskness on all three wavebands cannot fail to give satisfaction. We were impressed by the exceptionally good performance on the medium-wave stations which are normally receivable in daylight on a superheterodyne of this type, the volume and the signal-to-noise ratio being rather of the standard which one would not normally look for until after dark.

As regards selectivity, the spread of the Brookmans Park transmitters in Central London amounted to not more than  $1\frac{1}{2}$  channels on each side of their normal setting. On the long waves Deutschland-

critical on this range. As there is but a single-tuned circuit in the aerial it is only to be expected that double tuning points are found on the short waverange, but once one is aware of this fact there is no reason why any confusion should arise as to the identity of any particular station. The tuning dial is calibrated in wavelengths, and a few representative stations on the medium and long waveranges. We understand that the dial shown in the title illustration of this article is now obsolete, and that future sets will be fitted with an illuminated glass scale.

The chassis is supplied complete with escutcheon plate, knobs, mains cable and adaptor, and, of course, valves, but the loud speaker is an extra. The speaker supplied with the set for test purposes was

# 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.

## More Sensitive Crystal

**N**OWADAYS we expect—and most of us get—such a strong signal that adventitious aids to sensitivity are hardly necessary, so far as crystal detectors are concerned. Indeed, it may be argued that signals are not worth listening to with a crystal set unless they are really strong.

However, there is another point of view, and it cannot be denied that the interest of such a set is increased by making every effort to obtain the utmost possible sensitivity.

This point is raised by a prospective constructor of the "By Request" crystal receiver, recently described in this journal, who asks whether it would be possible to increase sensitivity by fitting a local battery and potentiometer for polarising the detector, and, if so, how the necessary additions may be made to the published design.

The sensitivity of the zincite-tellurium combination in the receiver may be appreciably increased by fitting a two-cell battery and potentiometer in the manner shown in Fig. 1. The resistance of the potentiometer is not critical; any value large enough to prevent a heavy drain on the battery will do, but if its resistance is

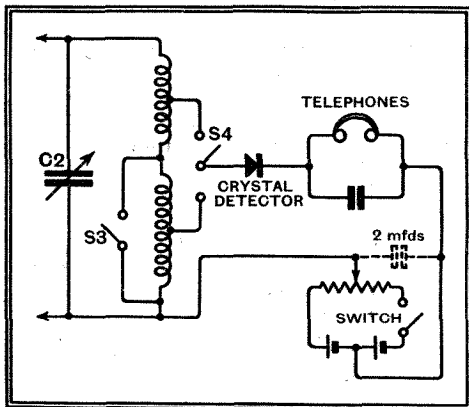


Fig. 1.—Applying a fractional voltage to the detector of the "By Request" crystal set in order to increase its sensitivity to weak signals.

high enough to be comparable with the impedance of the phones, a 2-mfd. by-pass condenser should be connected in the manner shown in dotted lines.

It should be made clear that this addition is only recommended for weak signals; strong signals of a sufficient amplitude to carry the working point of the detector well beyond the bend of its characteristic curve will not be affected.

## Checking the IF Amplifier

**A** READER who has built an IF amplifier in the form of a separate unit is not altogether satisfied that the various circuits are properly trimmed and coupled. He has therefore borrowed an oscillator (working at intermediate frequency) and a microammeter for insertion in the second detector

circuit, and wishes to obtain, with the help of this apparatus, some idea of the overall response of the amplifier.

As we gather that the oscillator is not closely calibrated, it is suggested that our querist will probably have to satisfy himself by visualising roughly the form of the response curve by noting the changes of rectified current that take place as oscillator tuning is slowly and steadily varied through the point of resonance. With a little practice and patience it is quite easy by these

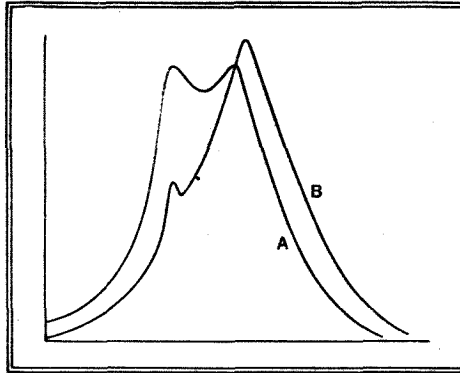


Fig. 2.—Without elaborate apparatus, it is possible to judge whether the response of an IF amplifier approximates to the ideal curve A, or if misalignment is producing a curve like B.

means to form a useful opinion as to whether everything is in order. If so, the change in current will vary in a way that might be represented graphically by curve A in the accompanying Fig. 2. Current will rise rapidly up to a maximum, then remain constant or perhaps fall slightly for an appreciable period of time, finally dropping back to zero with the same suddenness as the initial rise.

An incorrectly aligned amplifier will have a lopsided response curve like that shown at B; in practice the kink is generally quite clearly perceptible.

## Screened Aerial Transformers

**A** QUERIST asks us to give him a little guidance in the winding of an aerial-to-receiver transformer for use in conjunction with a screened down-lead. This matter is rather too complex to be dealt with exhaustively, but as our querist is apparently willing to devote a certain amount of time to experiments, the following suggestions should help him.

Tight coupling between the primary and secondary winding is necessary, and the secondary may have the same number of turns and be of the same diameter as the primary winding of the aerial-grid transformer in the set. We cannot be so definite about the primary winding, as this will depend on the impedance of the aerial; as an approximation, however, this winding

will require, perhaps, three times as many turns as the secondary.

## High-capacity Condensers

**S**OME time ago we suggested to a querist, who wanted an 0.001-mfd. condenser, that his best plan was to use a standard 2-gang condenser with rotors and stators connected in parallel. A similar suggestion seems to fit the case of another querist, who now wants a condenser of 0.0015 mfd. for use in an audio-frequency circuit; in this case, of course, he will use a "paralleled" 3-gang condenser.

It is worth while pointing out that in these cases where the built-in trimmers will presumably not be required, they should be removed bodily. By doing this the minimum capacity will be appreciably reduced, giving a gain in effective capacity range.

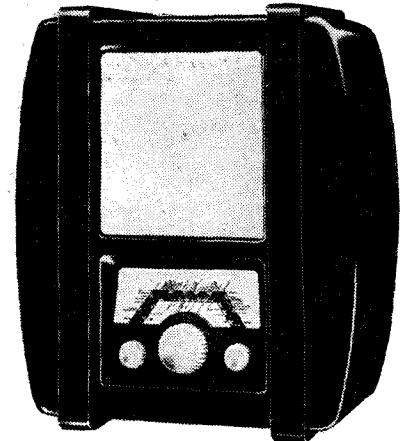
## NEW EKCO SETS

### Battery and AC/DC "Straight" Receivers

**H**OUSED in moulded cabinets of new design, these recent products of E. K. Cole, Ltd., make use of "straight" HF-det-LF circuits with pentode valves of appropriate type in all three stages. Iron-cored coils with Litz windings are employed in the tuned circuits, and an interesting feature of the aerial circuit is an equalising device for matching to aerials of all types.

In the battery receiver the output stage is automatically biased, and the set will work satisfactorily down to 60 volts HT.

The indirectly-illuminated "Edgeon" tuning dial is calibrated in wavelengths and



The Ekco Type "37" receiver is available for either battery or AC/DC mains operation.

station names, and reaction in both models is pre-set, so that there is virtually single-knob control.

The price of the universal set (Model AD37) is 8½ guineas, and of the battery set (Model B37) 6½ guineas.

## The Wireless World INFORMATION BUREAU

**T**HE 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 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.

# Listeners' Guide



A NEW and rich vein—tragic, comic, ecstatic, and melancholic by turns—has been struck by the B.B.C. in featuring the lives of the great composers. Few more propitious topics could have been chosen for broadcasting, for the lives of nearly all composers are "colourful." They are not as other men; they catch no trains before mid-day; they feast one day and fast another. The great masters, in fact, behaved very much as if they had been consciously preparing material for Gordon McConnel, who is in charge of next Sunday's broadcast, "Puccini—The Man and His Music" (Nat., 9). This should be as successful as the recent feature, "The Life of Verdi."

Mr. McConnel's task has been singularly difficult, as, owing to the extreme closeness and skill with which Puccini followed the libretti, it is not easy to detach excerpts more or less complete in themselves. There will, however, be selections from "Madame Butterfly," "La Bohème," "Manon Lescaut," "La Tosca," and "Turandot." Eva Turner, the Covent Garden soprano, and Dino Borgioli, the operatic tenor, are taking part, supported by the B.B.C. Theatre and Variety Orchestras, Stanford Robinson conducting.

This should be one of those rare broadcasts which please highbrow and lowbrow alike.

## GRAND NATIONAL

If the University Boat Race affords the best sporting broadcast of the year, the Grand National is a close runner-up. The race to-day (Friday) begins at 2.50, and the

"FIRST TIME ROUND." A scene at the famous Becher's Brook, taken during last year's race. A running commentary on the Grand National will be given at 2.50 to-day (Friday) by Messrs. R. C. Lyle and W. Hobbiss (Nat.).

commentary will be given in two parts: Mr. R. C. Lyle, on Messrs. Topham's private stand, will be in charge of that part of the course on the Grand Stand side of Becher's and Valentine's Brooks to the Canal Turn. From this famous jump, which all horses have to pass and turn immediately, Mr. W. Hobbiss will describe the race to the end, including the run in.

All should be well this year from a radio point of view if the race is free from its greatest bugbear—fog, which has interfered with more than one running commentary in the past.

## GERMAN LIEDER

ELENA GERHARDT, the famous German lieder singer, comes to the National studio at 7 on Sunday with Helen Perkin (pianoforte) to sing songs by Schumann, Tchaikowsky and Hugo Wolf. The Wolf "Eichendorff" lieder will also be sung by Herbert Heyner in the "Foundations of Music" from March 30th to April 3rd.

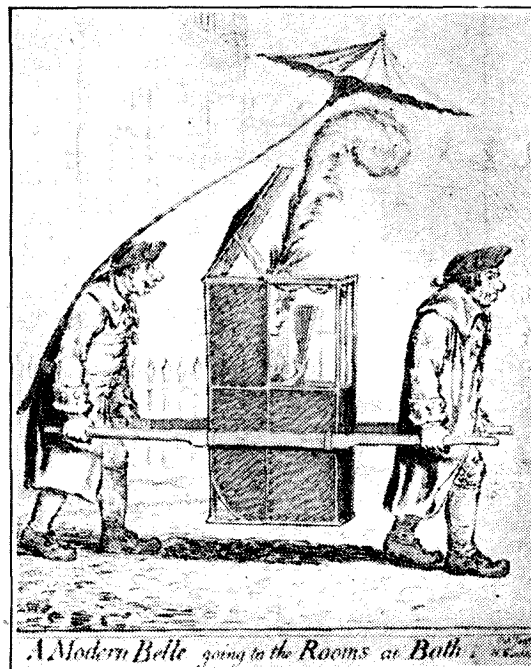
## NIGHTCAPS

THE new era of sober music late at night is inaugurated this week, beginning on Monday on the Regional wavelengths with a harpsichord recital at 11.40 p.m. by John Ticehurst. On Wednesday John Hunt will give a pianoforte recital at the same hour, and Thursday's similar feature will be "The Almightiness of Faith," a Chinese musical poem.

## IN THE DAYS OF BEAU NASH

EDITH SITWELL'S well-known book, "Bath," is the principal source of the interesting feature programme, "Bath and the Beau," which provides a late evening programme on Wednesday (Nat., 10.35). The story covers the arrival of Beau Nash at Bath in 1702 to his death there in 1761. Balliol Holloway will play the part of this extraordinary person, who came to the city friendless and socially non-existent and rose to a position that caused princes to compete for his nod and duchesses to fear his frown.

BATH. An eighteenth-century cartoon which sets off the atmosphere of the famous city when Beau Nash held his court. "Bath and the Beau" is the title of Wednesday's feature programme at 10.35 (Nat.).



A Modern Belle going to the Rooms at Bath.

As a background to the life of the great city in its heyday, thronged with fashionable folk from royalty downwards, there will be music from the works of Couperin, Haydn, Mozart, and, strangely enough, Prokofiev.

Ostensibly the visitors came

"to take the waters," but in reality to flirt, gamble, and indulge in intrigue.

## APRIL FOOLS' DAY

"APRIL FOOLISHNESS" is Leonard Henry's feature for 10 p.m. on April 1st (Reg.). He describes it as an effervescent epic. It would be April foolishness to miss it.

## MONDAY AT 10

MISS STANSFIELD, born in Rochdale in 1898, is to have the Regional wavelengths to herself from 10 to 10.20 p.m. on Monday. And who is Miss Stansfield? None other, of course, than Gracie Fields, the doyenne of British comedien-nes. Fresh from her South African tour, she will travel straight from the docks at Southampton to Broadcasting House to describe some of her more amusing experiences in the Southern Hemisphere.

"Our Gracie" was first introduced to the public from the stage of the Rochdale Picture Palace in 1911. She made her first appearance in revue in

1915 in a production called "Yes, I Think So." Everybody else thought so, too, and since then she has never looked back.

## OPERA ABOUT ROSSINI

MODERN composers receive more kicks than ha'pence, so it



# for the Week

## Outstanding Broadcasts at Home and Abroad

### HIGHLIGHTS OF THE WEEK

FRIDAY, MARCH 27th.

Nat., 8, Radio Play: "The Ringer" (Edgar Wallace). 11.15, Billy Cotton and his Band.  
Reg., 8, Stainless Stephen. 8.20, Fred Hartley and his Novelty Quintet. 9, B.B.C. Orchestra.

Abroad.

Rome, 7.45, Operetta: "Wiener Frauen" (Lehar).

SATURDAY, MARCH 28th.

Nat., Saturday Magazine. 8.30, Variety. "Henry Hall's Hour."  
Reg., 8.30, Edric Cundell's Chamber Orchestra. "Troise and his Mandoliers."

Abroad.

Paris, P.T.T., 8.15, Opera: "The Magic Flute" (Mozart), relayed from the Opera.

SUNDAY, MARCH 29th.

Nat., Worthing Municipal Orchestra. 9, "Puccini—the Man and his Music." "Leslie Bridgewater's Harp Quintet."

Reg., London Palladium Orchestra. 9, "The Spice of Life" (Bruce Lockhart). "Sunday Orchestral Concert, conducted by Adrian Boult."

Abroad.

Strasbourg, 8.15, Relay from the Opera-Comique, Paris.

MONDAY, MARCH 30th.

Nat., 8, Moore's Irish Melodies (B.B.C. Singers). "America Calling" (Eddie Pola programme). "B.B.C. Orchestra, conducted by Sir Granville Bantock."

Reg., B.B.C. Dance Orchestra. 10, Gracie Fields.

Abroad.

Munich, 7.10, Military Marches and Soldiers' Songs.

TUESDAY, MARCH 31st.

Nat., 8, Music from the Movies. "Piano Recital by Clifford Curzon. "Conquest of the Air."

Reg., 8, "Savitri," by Gustav Holst (from Midland). "America Calling."

Abroad.

Konigsberg, 7.10, Opera: "Hanneles Himmelfahrt" (Graener).

WEDNESDAY, APRIL 1st.

Nat., Eddie Carroll and his Music. 8, B.B.C. Orchestra at Glasgow. "Bath and the Beau."

Reg., Northern Variety. 9, "Tzigane"—a gramophone recital. "April Foolishness"—Leonard Henry.

Abroad.

Frankfurt, 7.45, "Laughing April"—concert of Spring Music.

THURSDAY, APRIL 2nd.

Nat., 8, Café Colette Orchestra. "Recital by Parry Jones (tenor) and John Ireland (pianoforte)."

Reg., 8, "Burke and Hare," Laurence Gilliam feature. "B.B.C. Dance Orchestra."

Abroad.

Kalundborg, 7, Bach's St. Matthew "Passion," with full orchestra and soloists.



"OUR GRACIE." The doyenne of British comediennes comes to the microphone on Wednesday (Reg.) to describe amusing experiences during her recent South African trip.

is refreshing to make acquaintance with one of their number, Herr Paumgartner, whose new comic opera, "Rossini in Naples," has been received with tumultuous applause. Beromunster is to relay it from the Municipal Theatre, Zurich, at 6.50 to-night.

An Italian version of a German opera will be a distinct novelty to-morrow evening when Rome offers Wagner's "Tristan and Isolde" at 7.35.

The famous Raugel Choir and Orchestra are taking part the same evening in the Radio-Paris broadcast of Aubert's fairy-opera, "La Forêt Bleue," at 8.45.

Moscow has not yet announced the title of its operatic relay at 4.30 on Sunday, but there is to be an English commentary, so the transmission should be worth tuning in. These performances from the State Opera are always noteworthy, giving, as they do, the best of modern music as well as the classics.

### THE BEST LIGHT OPERAS

No broadcasting week is complete without at least one Johann Strauss operetta from the Continental stations. This time it is the bold bad "Gipsy Baron," who will hold forth on Brussels No. 2 at 8 to-morrow (Saturday).

For its operetta programme at 8.45 on the same evening Radio Normandie gives us lengthy excerpts from two perennials—Oscar Straus' "A Waltz Dream" and Lehar's "Merry Widow."

French operetta gets a hearing on Tuesday in the Strasbourg transmission at 8.15,

when Goublier's "La Cocarde de Mimi Pinson" will be produced in the studio.

### "ARISTOCRATES"

Moscow offers a play in English at 9.5 on Monday. It bears the intriguing title "Aristocrates," which suggests all kinds of possibilities.

### LIARS

The B.B.C. might consider purchasing the translation rights of a most promising play which Berlin (Deutschlandsender) is offering at 8 on Wednesday. The title is "Classic Lies and Liars through the Ages." It is understood that the programme is not concerned solely with politicians.

### PICKWICK ON THE PIANO

LEIPZIG is celebrating the "birth" of Mr. Pickwick on Tuesday at 3.30 with "Pick-



IN HENRY HALL'S HOUR. Elizabeth Scott, the new "straight" soprano, who is now a member of the B.B.C. Dance Orchestra. She will be heard to-morrow in the 11 to midnight programme.

wick," a cycle for pianoforte (Walter Niemann) played by the composer.

### "PASSION" MUSIC FROM DENMARK

THE biggest event in the Danish musical year is to be broadcast on Thursday and Friday (April 2nd and 3rd). This is Bach's "Matthew Passion," the first part of which will be relayed from Kalundborg and other Danish stations from 7 to 9 on Thurs-

day, the second part following on Friday. The conductor will be Herr Fritz Busch, and the soloists will be internationally famous stars, including Erika Rokyta (State Opera, Vienna), Enid Szanthe (State Opera, Vienna); Koloman v. Pataký (Vienna); Alexander Kipnis (Vienna), and Henry Skjar (Royal Theatre, Copenhagen).

### GERMAN-GREEK

THE Berlin station's German-Greek evening, which was postponed owing to the death of King George, will be broadcast to-night (Friday) at 7.10. Greek folk songs are to be a feature, together with addresses by Herr Rosenberg and the Greek Ambassador in the German capital.

### A "SOFT" BAND

THE popular impression that all Danish dance bands are "hot" will be modified in the case of listeners tuning in Axel Petersen's "soft" dance band, which will be relayed from the "Nimb" restaurant, Copenhagen, at 10 on Saturday. Mr. Petersen concentrates on sweet music with a minimum amount of heat.

### HITLER TO BROADCAST?

TO-DAY and to-morrow German transmissions will be largely devoted to election

broadcasts. To-morrow afternoon (Saturday) there is to be a political mass meeting in the Cologne region, relayed by all stations between 3 and 5 o'clock, and it is probable that Herr Hitler will speak. Records of the meeting will be relayed from 7 to 9 on the same day.

Sunday is Election Day in Germany, and from 5 p.m. onwards all stations will be broadcasting the results in the intervals of light musical concerts.

THE AUDITOR.

# Letters to the Editor

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

## Five-metre Reception

**D**URING the afternoon of March 4th last I received five-metre signals from the U.S.A., and would be interested to learn if this is the first occasion on which signals on this wavelength have been heard in England.

Whilst I did not identify the station, the letters WJ formed part of the call-sign. The transmission was apparently of broadcast matter, not amateur experimental, for I heard an announcement that popular songs of the past and present would now follow. This was at 3 p.m. Songs heard were, "After All I Have Done For You," "Rock-a-by-Moon," then a fade-out occurred until 3.45 p.m., by which time a talk on cooking was in progress. At 4.15 p.m. an organ was heard playing the "Wedding March," then followed more talks; but signals were by now very weak. All voices were obviously American.

The receiver used was a single-valve super-regenerative type. I should be interested to know if anyone can identify the station from the particulars given.

Bournemouth. J. WATTS.

[Five-metre signals from the U.S.A. have been recorded previously in this country, one occasion being on January 10th of this year, when an English amateur, G2MV, reported having heard American W2JM.—  
EDITOR.]

## Reception of Australia

**I** THINK that Mr. J. D. Pickering, of Cottesloe, W. Australia, who wrote in your last issue concerning VK3LR, must have translated his times from Australian time to G.M.T. incorrectly.

Every morning for the last few weeks I have enjoyed programmes from VK3LR in my bath, as I have a loud speaker in the bathroom connected to my H.M.V. Model 480 short-wave receiver.

Apparently this station starts transmitting gramophone records at about 8 a.m. G.M.T., and usually links up with the Melbourne programme at about 8.15.

The characteristic drawl of the announcer's voice stating "This is VK3LR, Lyndhurst, Australia," has become very familiar to me, and the station can be received with such regularity that the reproduction of English gramophone records broadcast from Australia has, for the past week or two, been entertaining me whilst shaving instead of similar records transmitted from Fécamp.

London, E.C.1. RICHARD ARBIB.

## The Magnavox "Duode"

**I** WAS very interested in the article on the "Magnavox Duode Speaker" published in the March 6th issue. While I realise that this speaker is a step in the right direction, I find it hard to agree with some of the statements made in this article.

Mr. Dempster says: "Obviously, the ideal is one speaker to reproduce the whole frequency range." However, supposing such a speaker could be made, surely it would not be ideal, in that the source of sound would be coming from such a limited

area compared with the original source, say an orchestra.

It follows, therefore, that in order to get ideal reproduction we must increase the area from which the sound is produced; this is most easily done by using two loud speakers.

I have listened to a combination of speakers, the larger of which (10-inch cone) handled frequencies from 50 to 2,000 cycles, the smaller one (7-inch cone) from 2,000 to 8,000 cycles (these figures are only approximate). The reproduction was extremely good and, provided one was not unreasonably close to them, there was no indication that a special effort had been made to include the top. This may have been due to the fact that the smaller speaker handled a portion of the middle frequencies as well as the top, and was not, therefore, essentially a tweeter.

D. I. FAIRHURST.

Ampleforth College, York.

## Hill and Dale Recording

**T**HE Editorial comment in your issue of March 6th is timely. Improvement in the quality of recording must not be held up any longer for commercial reasons. When commerce becomes a bar to progress something is wrong with commerce.

Might I suggest that the gramophone companies should introduce hill and dale recording through the medium of the limited issues of the various societies? I write as a member of the Delius and Sibelius Societies, and I, for one, would gladly invest in a suitable pick-up if future volumes of these societies were to be recorded on the hill and dale system. The members of these societies are known by the recording companies, and it would be a simple matter to ascertain how many of them use electric reproducers and would be prepared to modify their equipment to suit the new system. It is a sin that these records of unique and lasting value should be recorded by a method with such inherent limitations as that now in universal use.

PATRIC STEVENSON.

Ballymoney,  
Co. Antrim.

## Programme Distribution

**I**N answer to your request for readers' views on the subject of alternative programmes, I should like to point out that the only time when even the most modern, powerful receivers can receive more than two or three of the B.B.C. transmitters is after sunset, which means only a very small part of the day in summer time. And even then electrical interference, if present, is an overwhelming obstacle to the best receivers. We have it here, and I have no doubt we are not the only district. In these localities the local Regionals, and probably Droitwich, are the only ones that can rear their heads sufficiently high above the "fog" to make themselves heard.

Another point is this: it is all very well for wireless technicians, who are wrapped up in the latest receiver designs, to propose that everyone all over the country should listen, say, to Scottish Regional every time they want to hear talks, or to West Regional when they want variety; they have probably forgotten that the great majority of listeners still use simple

"straight" sets, and that many would not bother getting distant stations, even if they could.

In my opinion, the best way the B.B.C. can improve its scheme of alternatives is as Mr. L. J. Fryer suggests in your issue of February 14th, that is, provide an alternative to the 6 o'clock news.

Oxfordshire.

R. G. UPTON.

## Television and Motor Car Interference

**A**MONG the various difficulties to be surmounted before television can be regarded as a thoroughly established service is one that I believe will be more serious than is generally admitted. I refer to motor car interference.

The great majority of people in general, and probably a still greater majority of potential "telev viewers," are situated where motor traffic is more or less abundant. Even in "quiet" suburban roads, where there is not much through traffic, there are usually cars going in and out of private garages, and each one of these is equivalent to many passing cars, because of the longer duration of the interference, particularly when one has (as I have) neighbours who indulge in prolonged warming-up.

The strength of this interference, as obtained on a receiver of moderate sensitivity, covering a far narrower band of frequencies than is necessary for television, is obviously enough to make a very bad mess of a picture unless the vision field strength is exceptionally great.

The view is held in responsible circles that, as the interference can be eliminated by fitting suppressors to the cars, the problem is after all not really very formidable. If one is looking far ahead, conceivably not. But, if adequate suppressors are to be fitted to all motor vehicles in the country, it would be a conservative estimate of the cost to put it at equality with the entire net annual revenue of the B.B.C.

Now if the B.B.C. finds it worth while to announce periodically the number of hundreds of successful prosecutions for failing to take out a wireless licence, it is presumably because some such stimulus is needed to make people pay up. And if so many are reluctant to take the trouble to go to a post office and pay 10s. for a whole year's programmes, would they make a headlong rush to put their cars into the hands of a suitably equipped service station and to pay a larger sum, for which they would not only get nothing in return, but would lose a certain amount of engine performance?

The drop in performance *might*, in fact, be negligible. But psychologically the mere rumour is enough. The only way to make motorists fit suppressors willingly would be to launch a tremendous advertising campaign stressing their anti-knock easy-starting low-consumption properties. So strong is the power of suggestion that testimonials would pour in!

The number of telev viewers in the critical early period will be negligible in comparison with the number of motor vehicle owners. And it is likely to remain negligible so long

as interference is acute—thereby establishing a vicious circle. Even the millions of pounds necessary to fit suppressors throughout is a sum that is constantly being spent many times over by motorists in their own interests. But it is a fundamentally different matter to ask them to spend millions for the benefit of a few enthusiasts around London.

Fortunately there is reason to believe that the problem can be largely solved at the receiving end by suitable aerial design. Anybody who is prepared to put down the price of a television set is also the most likely person to be willing to pay for interference suppression.

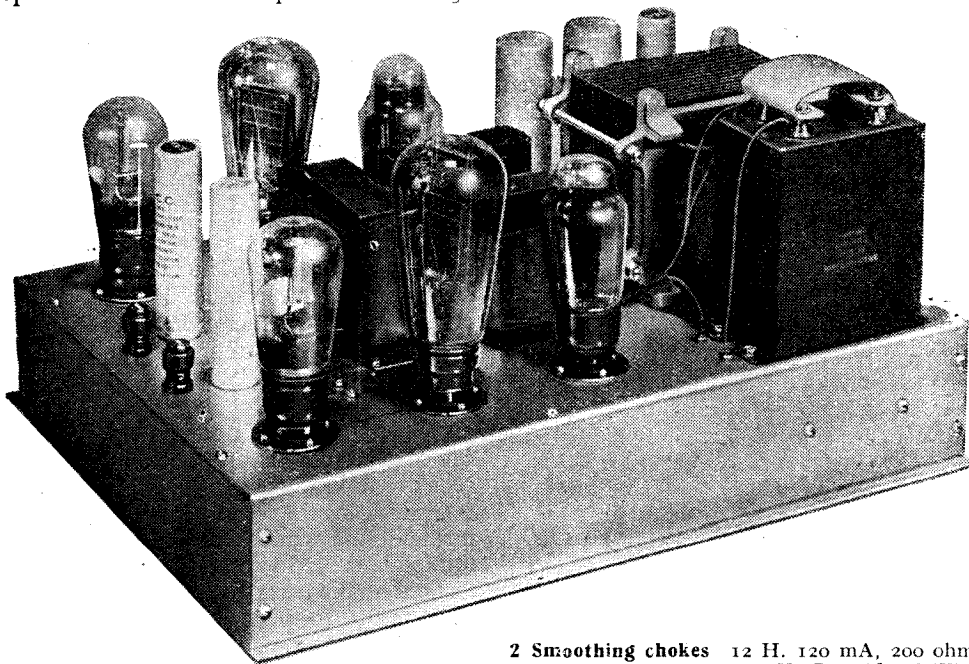
M. G. SCROGGIE.  
Bromley, Kent.

In Next Week's Issue

**Wireless World PA Amplifier**

**A High-quality 12-Watt Amplifier and Feeder Unit**

THE undistorted output of an amplifier has a great bearing on the quality of reproduction obtainable, and when the volume must be greater than that normally suitable for domestic needs an output of at least 12 watts is called for. With a figure of this order it is possible successfully to operate several loud speakers at large



volume, and small, public-address work may be undertaken.

Push-pull amplification is used in both the output and penultimate stages of the amplifier, and resistance-capacity coupling is employed throughout. The amplification included is high enough to permit the less sensitive types of pick-ups and microphones to be used, and a wide-range tone control enables the reproduction to be suited to any circumstances. In this way, correction for sideband cutting can be secured when reproducing radio and increased bass response for gramophone work. This tone control is fitted to the feeder unit, and its use is not confined to the PA amplifier, but can also be employed with the Push-Pull Quality Amplifier.

**LIST OF PARTS**

*After the particular make of component used in the original model, suitable alternative products are given in some instances.*

**AMPLIFIER.**

- 1 Mains Transformer, Primary; 200/250 volts 50 c/s. Secondaries; 4 volts 2.5 amps. C.T., 500-0-500 volts 120 mA, 4 volts 2 amps. C.T., 4 volts 2 amps. C.T., 4 volts 2.5 amps. C.T., 350-0-350 volts 120 mA, 4 volts 9 amps. C.T., with screened primary.

London Transformer Products L.608  
(All Power Transformers, Bryce, Chaliis, Heyberd, Partridge, Savage, Sound Sales, Vortexion.)

- 2 Smoothing chokes 12 H. 120 mA, 200 ohms N. Partridge WW12
- 1 Smoothing choke 36 H. 120 mA, 500 ohms N. Partridge WW36  
(Bryce, Davenset, Ferranti, Heyberd, Sound Sales, Varley, Vortexion.)
- 7 Valve holders 5-pin (without terminals) Clix Chassis Mounting Type V1

**Fixed Condensers**

- 2 4 mfd. 1,000 volts DC working T.C.C. 111
- 2 0.1 mfd. Mica, 500 volts DC working T.C.C. 340
- 2 0.1 mfd. Tubular T.C.C. 250
- 2 8 mfd. 500 volts peak working, Electrolytic T.C.C. 902
- 1 4 mfd. 500 volts peak working, Electrolytic T.C.C. 902
- 2 8 mfd. 450 volts peak working, Electrolytic T.C.C. 502
- 2 50 mfd. 50 volts DC working, Electrolytic T.C.C. 521
- 2 250 mfd. 12 volts DC working, Electrolytic T.C.C. 501  
(Dubilier, Ferranti, T.M.C.-Hydra, Peak, Polar-N.S.F.)

**Resistances**

- 2 100 ohms ½ watt Bulgin HW37
- 4 1,000 ohms ½ watt Bulgin HW3
- 2 10,000 ohms, ½ watt Bulgin HW15
- 2 25,000 ohms ½-watt Bulgin HW20
- 2 250,000 ohms ½ watt Bulgin HW28
- 2 500,000 ohms ½ watt Bulgin HW31
- 1 500,000 ohms 1 watt Erie
- 2 500 ohms 3 watt Claude Lyons
- 1 300 ohms 20 watt Bulgin PR1  
(Amplion, Bryce, Dubilier, Graham Farish, Ferranti, Claude Lyons, Polar-N.S.F.)
- 1 3-pin plug and socket Belling-Lee 1119
- 1 5-way connector Bryce
- 1 Fuseholder complete with 3 amp. fuse Belling-Lee 1045
- 4 Shrouded terminals, Input (2). LS (2). Belling-Lee "B"

**Miscellaneous:—**

- 6 length systoflex, 2 ozs. No. 18 tinned copper wire, etc. Screws:—4 2BA ½in., 34 6BA ¼in., 22 4BA ¼in., 12 6BA ¼in., all with nuts and washers.

Metal baseplate with mounting screws B.T.S.

**Valves:—**

- 2 MHL4, 1 MU12 Osram or Marconi
- 2 PP5/400 Mazda
- 1 460BU Cossor

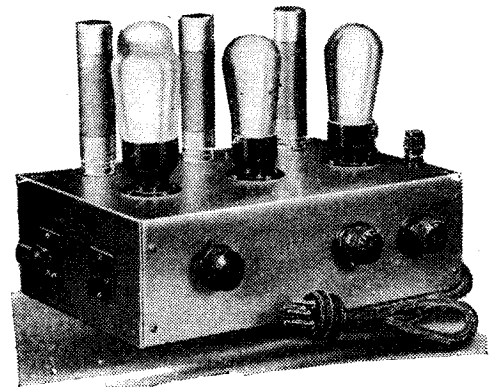
**FEEDER UNIT**

- 1 Tone correction choke B.T.S. WW1
- Fixed Condensers**
- 1 0.015 mfd. Tubular T.C.C. 300
- 1 0.05 mfd. Tubular T.C.C. 250
- 2 0.1 mfd. Tubular T.C.C. 250
- 1 0.25 mfd. Tubular T.C.C. 250
- 1 0.5 mfd. Tubular T.C.C. 250
- 3 50 mfd. 12 volts DC working, Electrolytic T.C.C. "AT"
- 3 8 mfd. 450 volts peak working, Electrolytic T.C.C. 504  
(Dubilier, Ferranti, T.M.C.-Hydra, Peak, Polar-N.S.F.)

**Resistances**

- 3 2,000 ohms ½ watt Bulgin HW5
- 1 3,000 ohms ½ watt Bulgin HW7
- 8 50,000 ohms ½ watt Bulgin HW23
- 1 500,000 ohms ½ watt Bulgin HW31
- 1 2 megohm ½ watt Bulgin HW34  
(Amplion, Bryce, Dubilier, Graham Farish, Ferranti, Claude Lyons, Polar-N.S.F.)

- 1 Volume control 0.25 megohm + 0.25 megohm Dubilier "Fadover"
- 1 4-way connector, light type Bryce
- 1 5-way cable with twin 70/36 leads and 5-pin plug Goltone
- 3 Valve holders 5-pin (without terminals) Clix Chassis Mounting Type V1
- 2 Switches, Double-pole, five-way, with knobs B.T.S. C125
- 2 3-pin plugs and sockets Belling-Lee 1119
- 3 Shrouded terminals, Output (2) Earth Belling-Lee "B"



**Miscellaneous:—**

- 2 lengths systoflex, small quantity No. 18 tinned copper wire, etc. Screws:—16 6BA ¼in., 2 4BA ¼in., all with nuts.
- Metal baseplate with mounting screws B.T.S.
- Valves:—**
- 1 41MH, metallised Cossor
  - 2 D4 Ferranti

# UNBIASED

*Click Click Click . . .*

I LITTLE thought that the evil day would ever dawn when I should be compelled to number myself among those callously selfish individuals so devoid of decent feeling as to permit electrical apparatus under their control to interfere with broadcasting. It is not, however, for want of trying that I have so far failed to find a cure for the trouble; indeed, in my efforts to quell the disturbance I have, literally speaking, almost immolated myself on the altar of duty, having very nearly roasted myself to death during my ex-

haustive and exhausting experiments. The trouble was first brought to my notice by a neighbour who is addicted to the reprehensible practice of listening to the American stations in the small hours of the morning, when most civilised people are in bed. The interference concerning which he sought my aid consisted of a clicking noise, just as though somebody were constantly opening and closing a switch. It usually lasted from midnight to breakfast time, and occurred only on very cold nights. But the curious feature of the whole business was that every time I went round to his house to listen for the noise it was conspicuous by its absence, just as though it knew I was coming; indeed, but for the fact that the complainant was a member of the Cloth, I should probably have viewed his story with suspicion. The true reason why the trouble invariably failed to turn up when I was waiting for it never crossed my mind for one moment.

## Dairymen as Detectives

Eventually I got in touch with the managers of the various local dairies, who all owe me a debt of gratitude for services rendered in a matter about which I will tell you at a later date. I induced them to arrange for their roundsmen to employ the time-honoured method of obtaining information from the maids in the various houses of the district, the particular information which they were told to obtain being what nocturnal electrical devices were employed in the houses on their rounds. Only apparatus of a rotating or vibrating nature, I said, need be considered, ordinary heating and lighting devices being obviously not guilty of the interference.

If one of the milkmen—the one whose round included my own establishment—had not exceeded his instructions in an over-zealous moment, these lines would probably never have been penned. Under the mistaken impression that he had to

gather in details of the private lives of his customers he pressed his suit almost to the shadow of the breach of promise court. The result was that my maid parted with the information that, having become old and well stricken in years, I had begun to feel the need of synthetic heat at night, and that I had therefore recently taken to using an electric blanket in addition to my customary night-cap and bed-socks.

I was by no means pleased when the disclosure of this confidential piece of information was brought to my attention,

but my annoyance was swallowed up in dismay when a simple test led to the

discovery that my blanket was the whole cause of the trouble. It appears that these devices contain thermostats to prevent their over-heating, and it was the opening and closing of these during the night which caused the disturbance.

Unfortunately, the application of the customary suppressors to the wall-plug to which the blanket was connected proved quite ineffective, and eventually I decided to cut the thermostats out of the circuit altogether, thinking they were probably an unnecessary refinement. All went well when I first retired to rest. My sleep was badly troubled, however, by a grotesque nightmare in which I dreamed that I had passed away, and suddenly I awoke to find myself nearly roasted alive and well basted with perspiration.



Gathering in details of private lives.

The result is that, in the interests of my fellow wireless enthusiasts, I have been reluctantly compelled to forgo the use of my blanket and to shiver at night until some sympathetic genius finds a way of producing an article which dispenses with the use of thermostats without, at the same time, subjecting its owner to the risk of ante-mortem cremation.

## Sun-Operated Clock

INVENTORS are hard-working people, ever on the look-out for fresh opportunities to benefit their fellow men, and for this reason have always commanded my



In the garden of my ancestral home.

profound respect. I have already paid tribute in these columns to the radio manufacturer who first made two loud speakers do the work of one, and I have praised the originators of even more brilliant ideas for using up the glut of raw materials which, we are told, is at the root of all our economic distress.

Now, however, comes the greatest genius of all, hailing, as I scarcely need say, from that great land on which the statue of Liberty has permanently turned her back. Briefly, the invention is that of a clock which keeps perfect time "without," says the inventor, "the necessity of such cumbersome contraptions as synchronous motors and powerful generating stations," by which I presume he means our old friend the AC mains clock.

## How it Works

This remarkable timepiece derives all its motive power from the sun, which apparently accounts for its very accurate time-keeping properties. The sun shines on a battery of photo-electric cells, this generating the necessary energy for operating the clock mechanism through the medium of a powerful "toob" amplifier. As no mention is made of how the "toob" amplifier gets its HT and LT supplies, one can only assume that further photo-electric cells are used to supply these.

Geared to the clock mechanism is a turntable on which the photo-cells are rotated in order to keep the sun accurately focused on the lenses associated with them. Apparently these lenses are of a very narrow-angle type, so that if the mechanism tends to vary ever so slightly in its speed the sun's rays fall on auxiliary photo-cells which immediately adjust matters; hence the accuracy of the time-keeping.

While, as I have already stated, the whole outfit commands my most profound admiration, I frankly cannot see that it has any advantages over the older type of sun-controlled clock which some of us have in our old-world English gardens; but then I suppose that they don't have any of this old-world business in the land of hustle. Personally, I prefer the idea which I tried to patent in the days of my youth, namely, the fitting of a dial and pointer to the head of a sunflower growing in the garden of my ancestral home. I need not explain that my sunflowers always turned their gaze towards the sun.



# BROADCAST BREVITIES

By Our Special Correspondent

## Henry Hall's Enlarged Orchestra

WHEN Henry Hall conducts the "Queen Mary" band across the Atlantic he will be leaving behind him one of the best dance bands in Britain, if not in Europe and America. That was the impression I took away from the Maida Vale studios last week.

"Actually," Mr. Hall told me, "I now have two bands in one, for the string section is self-supporting, owing to the addition of another violinist, a violoncellist, and a viola player."

## Not Forgetting the Vocalists

Another newcomer is a trombonist, making a total of twenty-one players.

And did I not mention Vivienne Brookes? And Elizabeth Scott? And the "Three Sisters"? And Bert Yarlett?

You should see how they enjoy singing, and how obedient they are when the control man signals through the window. By the way, I discovered that when a crooner says that there are tears in his or her eyes, he or she means it. Hence the wire mesh on the ribbon mikes.

## Strong Television Signals

THE strength of the present Baird transmissions from the Crystal Palace augurs well for the radiation properties of the plant at the Alexandra Palace. A friend picking up the audible television signals at Rayner's Lane, Middlesex, at least 16 miles from Sydenham, tells me that the high-definition whistle (much higher, by the way, than the 30-line whistle) comes in at "phone - on - the - table" strength.

## A Better Bournemouth

A TRUSTED sleuth tells me that he has seen with his own eyes a B.B.C. mobile transmitter roaming the Isle of Wight. From this only one deduction can be drawn, viz., that Sir Noel Ashbridge's department is getting anxious over the ominous quiet on the South Coast. Reception down there is very bad; Bournemouth station is a mockery, and the new French Regionals are becoming so powerful that South Coast residents are beginning to talk with a Gallic accent.

## Thank You, M. Mandel!

The B.B.C. may not always respond to the urge of inland listeners, but when the Corporation's monopoly is threatened by the attractiveness of programmes abroad, Portland Place gets really anxious.

If Bournemouth gets a new Regional transmitter she should thank that energetic Frenchman, M. Georges Mandel, Postmaster-General of the République Française, who has "projected" French broadcasting across the Channel.

## Protests

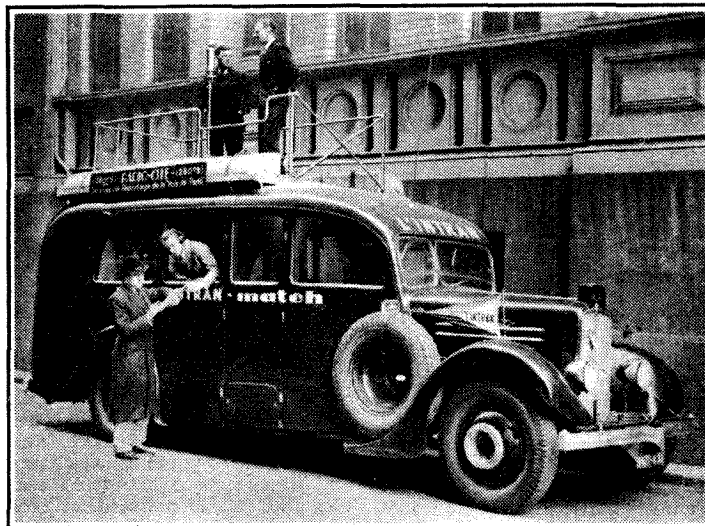
I LEARN that quite a number of letters of protest were received by the B.B.C. following Mr. Alistair Cook's recent gramophone recital of American hobo songs, the cause of complaint being a tramp song with the title "Hallelujah, I'm a bum!" The use of the word "Hallelujah" in any but a reli-

cent use of its opportunities. There was almost "the Nelson touch" in Sir Stephen Tallents' handling of the situation on the Monday night the report was issued.

## Quick Work

Copies of the report were available at the G.P.O. at 5.45 p.m.; at 6 p.m., before the critics had time to level their own guns at the report, Sir Stephen was opening his B.B.C. Conference at Broadcasting House, firing broadside after broadside while the Pressmen, looking very wise in the difficult circumstances, tried to keep pace.

As a result the newspapers



FRENCH "FLYING SQUAD."—Unlike the B.B.C. recording vans, which confine their activities to this country, this Radio Cité (Paris) car has visited Geneva, Rome, Madrid, Leipzig, and many other Continental cities. It is here seen during its visit to London last week to "report" the League Council meetings for Paris listeners.

gious context always brings down the wrath of a certain section of listeners.

This incident was preceded by only a few days by another avalanche of objections to the "jazzed-up" version of certain of Handel's works—including the "Hallelujah Chorus"—which was injudiciously allowed to be given in a variety programme.

The result of all this is that more care will be exercised in future.

## The B.B.C.'s Opportunities

WHETHER or not the B.B.C. should have been allowed to criticise the Ullswater Report almost before it became public property and before it could be discussed in Parliament may be open to question.

But there can be no question that the B.B.C. made magnifi-

cent day showed a pardonable bewilderment, some siding with the Ullswater Committee and others obviously swayed by the official gravity of the B.B.C.'s rejoinder. As a counter stroke it was beautifully timed.

## A Tight Fit

THE comparatively recent studio enlargements at Birmingham prove to be inadequate to cope with a forthcoming broadcast by the Birmingham Police Band.

This combination of no fewer than 62 players has been booked to give a concert from Midland Regional on April 14th. It is just possible to get 62 players in the big B.B.C. studio at Birmingham, but when they are a police band and when they play "all out" in such a comparatively small room the acoustic effect is far from satisfactory,

and even the new ribbon microphones with which all Birmingham studios have just been equipped can't do anything to cope with the brassy blare.

## Calling It an "O.B."

So the engineers have booked a large hall in the Deritend district of the city, and from there the concert will be delivered, as an "O.B."

Incidentally, there are 40 brass bands on the auditions waiting list at Birmingham!

## That I.O.M. Station

EVERY little while, but more especially when the sap is rising, we hear rumours of a projected giant broadcasting station in the Isle of Man. Always it is to cost a fabulous sum and always it will guarantee gargantuan reception in Skibbereen, Pudsey, Heckmondwike and other places which apparently are only waiting for gargantuan reception from the Isle of Man to fill the cup of human happiness.

## "Extremely Unlikely"

Unfortunately, or fortunately, it is extremely improbable that broadcasting will take place from the land of tailless cats.

I asked a high official in the Post Office (London) whether the Postmaster-General would be likely to grant a licence to a sponsored-programme station in the Island, and he replied with a vehemence which in Post Office circles is usually reserved for persons asking: Will this parcel reach Australia by Tuesday?

"I think it extremely unlikely," he said.

## Chinese Cracker . . . .

THE real "Silly Season" is, of course, in August and September; this is only the Little Silly Season, specially arranged for writers who find the other season all too short.

The most promising effort this year is: "British listeners are to have regular programmes from China." According to the writer, the B.B.C. are to take advantage of a new radio-telephony link between London and Shanghai by arranging "frequent relays of the Chinese programmes."

## . . . . Fizzles Out

Quite by the way, the B.B.C. informs me that Chinese programmes have not even been discussed at Broadcasting House.

Who wants regular Chinese programmes, anyway? There is enough electrical interference already.

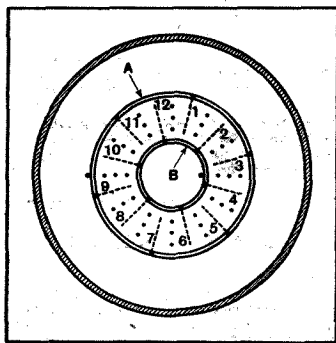
# Recent Inventions

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

**DIRECTIONAL WIRELESS**  
**I**N order to avoid any distortion of the directional field, either in transmission or reception, the wires of an Adcock aerial are supported symmetrically from a conducting mast, which is insulated at its base and serves at least in part as a radiator. The bottom end of the mast is connected to the transmitter-hut by screened feed-lines, whilst the receiving wires are connected through buried low-capacity conductors to a central point under the hollow concrete base of the mast. From here the signals are fed by a four-wire transmission line to the DF receiving-hut.  
*Marconi's Wireless Telegraph Co., Ltd., and S. B. Smith. Application date June 27th, 1934. No. 440361.*

**SHORT-WAVE GENERATORS**  
**T**HE principle of the Barkhausen-Kurz and similar methods of producing very high frequencies may be described as one of building-up and destroying space-



Disposition of grids and anodes in valve.

charges inside the valve. In such cases the output is limited by the amount of power which can be dissipated on the grid, and for this reason it is usual to connect up a number of such valves in parallel. But it then becomes difficult to make the system truly symmetrical.

The figure shows a cross-section through a valve in which a number of grids 1-12 are mounted radially inside a single bulb, together with a similar number of cathodes, the latter being indicated by the rows of three dots. Each cathode consists of two outer emitters with a centre earthed rod which acts as a space-charge grid. The electrons surge in and out of the grids as in the Barkhausen-Kurz oscillator, each cathode acting as the emitter for one grid and as a repelling or braking electrode for the electrons from the next cathode. The grids are connected alternately to the inner and outer supporting rings A, B, so as to feed them in push-pull.

*Telefunken Ges fur drahtlose Telegraphie m.b.h. Convention date (Germany) July 21st, 1933. No. 440378.*

**TRANSMITTER CIRCUITS**  
**T**WO or more accurately-related frequencies are radiated simultaneously from a single aerial, and

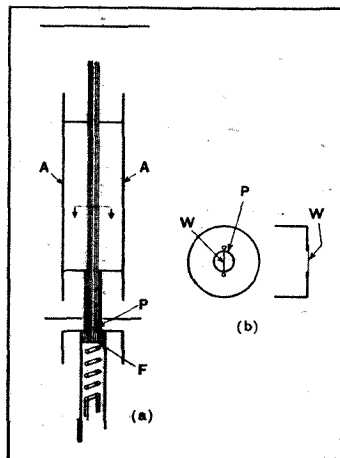
are used either to stabilise the frequency of a number of associated broadcast transmitters, or to control other distant apparatus.

The radiated frequencies are produced by heterodyning say a carrier wave P with a frequency Q which is half the desired frequency-difference. The resulting sidebands are then separated, amplified, and radiated after the original carrier-wave P has been suppressed.

*J. H. Hammond Jr. No. 2018356. (U.S.A.)*

**CATHODE-RAY RECEIVERS**  
**W**HEN modulating the electron stream of a cathode ray receiver it is found that the signal voltage applied to the control grid tends to alter the size of the spot of light thrown on to the fluorescent screen in an undesirable manner, so that a "streaky" effect is produced.

To avoid this source of trouble, the signal voltage is applied in such a way as to vary the distribution of the electrons near the centre of the beam only. This produces the required light-and-shade effects, whilst the diameter of the beam is maintained constant. Fig. (a) shows the gun part of a cathode-ray tube in which the electrons from the filament F are drawn by the anode A through an aperture P in the control grid. According to the invention the aperture P is bridged by a fine wire W (shown enlarged in Fig. (b)) which has the effect of cutting a slice out of the centre of the beam. The apparent size of the wire W, i.e., its effect on the beam, varies with the signal voltage, thus regulating the number of electrons which reach the



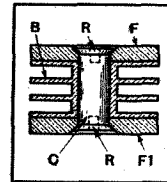
Gun part of cathode ray tube.

screen without altering the actual size of the spot. The "shadow" cast by the wire is too small to have any detrimental effect on the detail of the picture.

*Marconi's Wireless Telegraph Co., Ltd. Convention date (U.S.A.) May 30th, 1933. No. 440390.*

### POWDER CORE TRANSFORMERS

**A** HIGH-FREQUENCY transformer consists of an upper and lower flange F, Fr, a centre core C, both made from a moulded mass of magnetic particles which are insulated from each other, and a former B of insulating material to take the windings. The centre core is made as a



Section through iron-cored transformer.

straight cylinder, the ends of which are heated, after they have been threaded through the top and bottom flanges, and then spread out like a rivet to lock the parts together. Recesses R are made in both ends of the core C so as to adjust the magnetic content of the core and therefore the effective inductance of the windings.

*R. Bosch, Akt. Convention date (Germany) April 28th, 1934. No. 440468.*

### THERMIONIC VALVES

**T**HE space-charge or accumulation of electrons in the neighbourhood of the cathode of a thermionic valve is largely avoided by making the cathode in the form of two strip-shaped wires, set parallel to each other and edge-on to the anodes, and inserting a common space-charge grid in the space between them. The grid is also a broad strip of wire, set in the same plane as the two cathodes. The two anodes are rectangular in shape. The valve may be used as a rectifier of two-phase or polyphase current, or as a generator, amplifier, or receiver of ultra high-frequency oscillations.

*N. V. "Meaf." Convention dates (Germany) January 9th, and 13th, 1934. No. 440146.*

### TELEVISION VIEWING SCREENS

**T**HE received picture is made visible on the screen of a cathode-ray tube, at least in part, by the incandescence produced by the bombardment of the electron stream. The visibility is enhanced by also making use of fluorescence and phosphorescence. It is stated that the fluorescence or phosphorescence is effective in bringing out the half-tones, whilst the high lights are produced chiefly by incandescence.

The incandescent coating is of finely-divided carbon with or without platinum black or spongy platinum.

The fluorescent material may be of barium-platino-cyanide mixed with zinc sulphide for phosphorescence. The incandescent substance is carried by a lattice spaced slightly apart from the other lumi-

nescent materials, so as to safeguard the latter from overheating.  
*J. L. Baird and Baird Television, Ltd. Application date October 13th, 1934. No. 440386.*

**I**T is important when preparing the fluorescent material used for the viewing-screen of a cathode-ray tube that there should be a relatively short period of "after-glow"; also that the fluorescence should not have any pronounced tint, but should be as close as possible to natural white light.

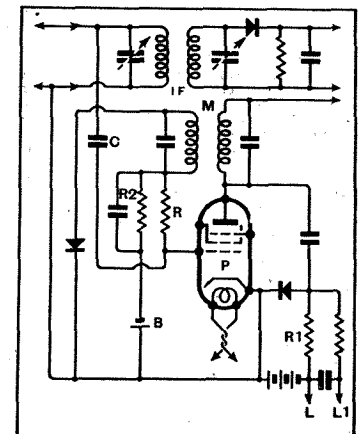
According to the invention the screen is prepared from a mixture of cadmium and zinc sulphides which have been freed from the very last traces of copper, silver, or other impurities. A purity of one in ten million is specified. Traces of silver and copper are then added in precise quantities, and the mixture is finally calcined and crystallised.

*J. D. Riedel—E. de Haen Akt. Convention date (Germany) July 22nd, 1933. No. 440350.*

### AUTOMATIC VOLUME CONTROL

**T**HE bias applied to a control valve is made to depend upon the closeness to which the set is tuned to a desired carrier-wave, so that although undesired interference and background noise are severely cut down, the signal, when accurately tuned in, is amplified to a greater extent than usual.

The control grid of the pentode



AVC circuit of specification 440494.

P is fed with voltage from the intermediate-frequency circuit IF through a condenser C and resistance R, the rectified DC voltage being fed back from R1 via the leads L, L1 to the grids of preceding valves. A circuit M sharply tuned to the intermediate frequency, is coupled as shown to the anode circuit of the pentode. As the set is brought into resonance with the desired signal, the circuit M develops an appreciable voltage across the resistance R2. When this exceeds the "delay" voltage from the battery B, the gain of the pentode P is cut down, and the amplification of the desired signal is thereupon less severely controlled.

*Murphy Radio, Ltd., and L. A. Moxon. Application date July 2nd, 1934. No. 440494.*