



# The Wireles 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

### Reception Under the New Conditions

*When Droitwich Becomes the National*

**I**T is perhaps not sufficiently widely appreciated that when the new long-wave station at Droitwich takes over from Daventry next year, a material change will take place in reception conditions under the B.B.C. programme distribution arrangements which will coincide with the inauguration of that station.

Taking London as an example, here we now have alternative programmes both emanating from Brookmans Park and both on the medium band; signal strength is more or less equal for both and a comparatively small alteration in tuning of the receiver gives us one station or the other.

When Droitwich on long waves becomes the National transmitter, and Brookmans Park provides only the Regional programme on one wavelength on the medium band, the change in reception conditions is likely to be widely felt. It is well known, for instance, that small aerials, such as are often installed indoors, are very inefficient for the reception of long waves, and whilst such aerial arrangements may suffice at present for reception in the service area of Brookmans Park for the alternative programmes, they will not necessarily do when the alternative programme is transferred to long waves. Again, many sets which give adequate selectivity on the medium-wave band fail to receive on long waves without overlapping of stations.

So long as we can be sure that the new long-wave station is going to replace the National medium-band transmitters in different parts of the country with a satisfactory service,

we can feel reasonably content with the new proposals, but it must be expected that contentment in many cases will only come after rather drastic alterations to the listener's receiving arrangements.

### Background Mystery

*A Matter for the B.B.C.*

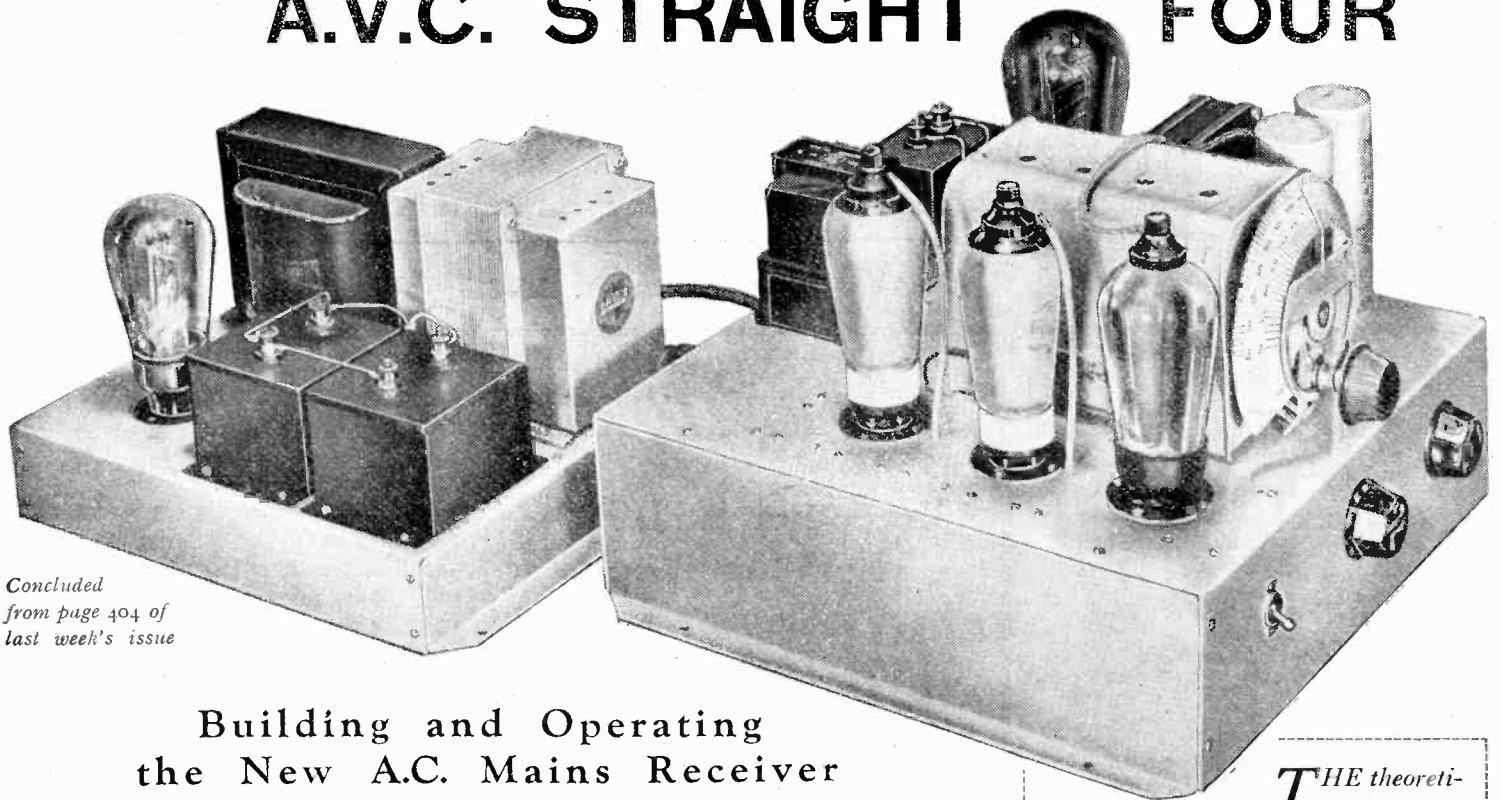
**A** NOTE appeared in a recent issue under "Broadcast Brevities" drawing attention to the frequent presence of a background of speech or music coming from the Regional transmitter, Brookmans Park, when the set is tuned to the National. This paragraph has produced so many letters from readers that it would seem to be a matter deserving of close investigation by the B.B.C. engineers. The letters are, for the most part, from readers who have obviously a good technical knowledge and wide experience and are well aware of the effects produced by cross-modulation, which is the explanation which the B.P.C. has put forward to some of them when they have made enquiries as to the cause. We feel fairly confident that if cross-modulation were the reason, most of these readers would have been aware of it.

If the B.B.C. engineers are satisfied that induction between lines is not the cause, it would seem necessary to look elsewhere for an explanation. As a pure conjecture, we might suggest that a common earth at the transmitters might be responsible.

Whatever the reason, it is an intensely irritating phenomenon. Whilst a few listeners would be interested in knowing the cause of the trouble, the vast majority of the B.B.C.'s audience care little for the cause, but would welcome elimination of the effect.

## The Wireless World

# A.V.C. STRAIGHT FOUR



Concluded  
from page 404 of  
last week's issue

## Building and Operating the New A.C. Mains Receiver

**T**HE layout of the components of any receiver is a matter of importance, but this particularly the case with a two-H.F. straight set, otherwise serious difficulty from instability may be found. In order to facilitate the retention of that layout which has been found experimentally to be the best, therefore, the receiver is constructed on a metal chassis which is obtainable with all holes ready drilled. There is thus no possibility of error in positioning the components, and the drawings which accompany this article will serve as an aid in identifying the various holes.

It is important to remember that the coil assembly must be mounted before the gang condenser, and the two 1 mfd. condensers C16 and C19 before the L.F. transformer. The remaining components, however, may be screwed down in any convenient order. The fixing bolts are used for earth connections in many cases, and the frame of the gang condenser is earthed only by its contact with the chassis. Good connections at all these points are very important, and as the chassis is cellulose finished it is a wise plan to scrape off the enamel beneath the bolts in question, and not to rely entirely upon the screws cutting through of their own accord. The gang condenser is particularly important, and here a good connection at all four of the mounting legs is essential.

Apart from these points, no special difficulty should present itself, and the wiring is quite straightforward. As far as possible, this should be carried out in the manner of the original receiver, and it is

essential that grid and anode leads be kept short and well away from one another, otherwise instability will be inevitable. No. 20 or No. 22 gauge wire will be found most convenient for wiring, and if desired may be used throughout. A somewhat more rigid construction, however, will be obtained by using No. 16 gauge for a few leads, of which the chief are the earthing connections to the fixed condensers. Certain leads are screened, and it is important that the correct material be used; large diameter metal braided sleeving should be employed with a thin internal wire, not thick rubber covered metal braided leads nor motor-car type armoured cable.

### The Loud Speaker

It should be pointed out that although most of the components screwed to the chassis are at the same potential as the chassis, in one or two cases insulation is required. The aerial terminal and one of the pick-up terminals must be insulated by using the washers supplied with them. The 30-ohms Hum-Dinger R20 must also be insulated from the chassis, otherwise a short-circuit of the output valve grid bias will result, with a detrimental effect on the output valve.

The loud speaker used with this receiver must have a field resistance of 5,000 ohms and be rated for a field current of 50 mA. It should also have a 6-watts power handling capacity, and be suitable for matching the P.P. 5/400 output valve which requires a load impedance of 2,700 ohms. The Baker's Selhurst Radio Speaker specified meets all these requirements and has

**T**HE theoretical considerations underlying the design of "The Wireless World" A.V.C. Straight Four appeared in last week's issue, and the present article deals with the construction and initial adjustment of the receiver. Some notes upon the performance to be expected are also included.

a bass response unusually free from resonances; moreover, the high frequency response is maintained at an even level up to at least 5,000 cycles. Since the speech coil is of the high impedance type, and a choke-condenser output circuit is used, no output transformer is required.

It should be pointed out that the cone develops quite a large amplitude of vibration at low frequencies, and in consequence, there is a possibility of acoustic reaction between the speaker and the receiver if both are mounted on the same cabinet. Such reaction, of course, would introduce a bass resonance, or in a bad case, a sustained howl. It is a wise plan, therefore, to mount the receiver chassis upon blocks of sponge rubber so that it can float freely.

When first setting up the receiver, some check on the voltages and currents should be made, and this should be done with the Local-Distance switch set to distance and with the set tuned to no signal. The anode potential of the H.F. valves, measured between the chassis and the valve anodes, should be about 190 volts, and the screen potential about 100 volts.

THE WIRING DIAGRAM OF THE RECEIVER

The A.V.C. Straight Four

The grid bias of these valves, measured between the chassis and cathodes, should be about 2.6 volts and the anode current about 3.7 mA. In the case of the detector, the measured anode voltage will be about 24 volts only, while the screen potential is about 120 volts. When a signal is tuned in, the anode voltage rises considerably. The no-signal anode current is about 8 mA, and falls on tuning in a station to such a degree that on a local station it may drop to 4 mA. A milliammeter connected in the anode circuit of this valve, therefore, can be used as a tuning indicator. The output valve passes an anode current of about 58 mA, and the voltage measured between the chassis and the valve anode is 410 volts; the bias between the chassis and the slider of R20 is 28.5 volts. The speaker field current should be about 48 mA. It must not be expected, of course, that these figures will be reproduced exactly in different receivers, and the results obtained will necessarily depend somewhat upon the meter employed; nevertheless, quite good agreement should be found.

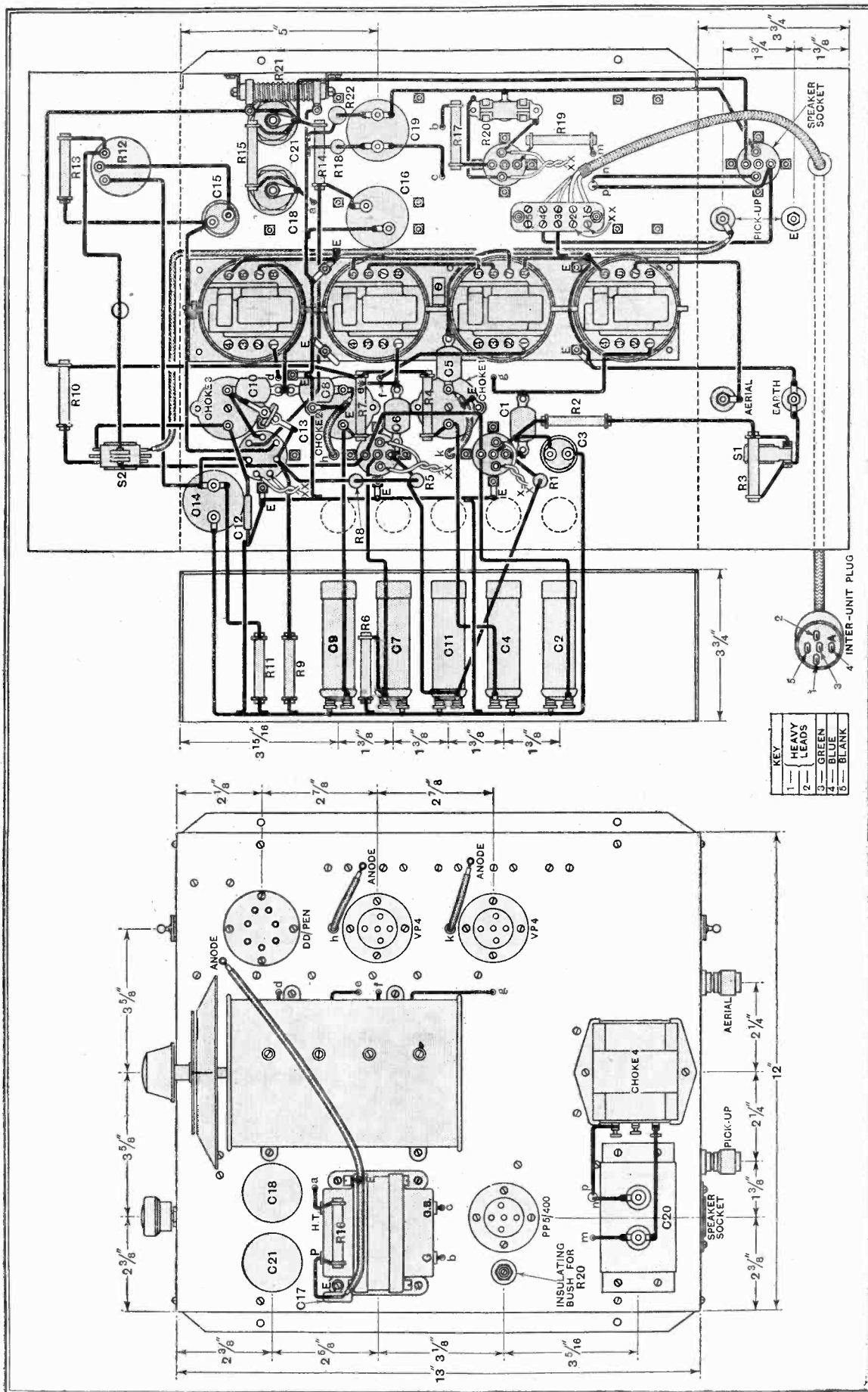
Gramophone Operation

Since the radio-gramophone switch is arranged to open-circuit the screen supply on gramophone, there will be no break-through of radio signals. The manual volume control is operative on gramophone, so that a pick-up is the only additional apparatus required. The volume control, however, is of higher resistance than that needed by many pick-ups, for this is dictated by the radio requirements. It may be found necessary, therefore, to shunt the pick-up with a resistance in order to maintain the correct tone. This is best found experimentally, but a resistance value of some 50,000 ohms to 100,000 ohms will meet most cases.

On radio the chief adjustments necessary are those to the ganging. This should be carried out at a low wavelength and on a very weak station, unless a milliammeter is available to

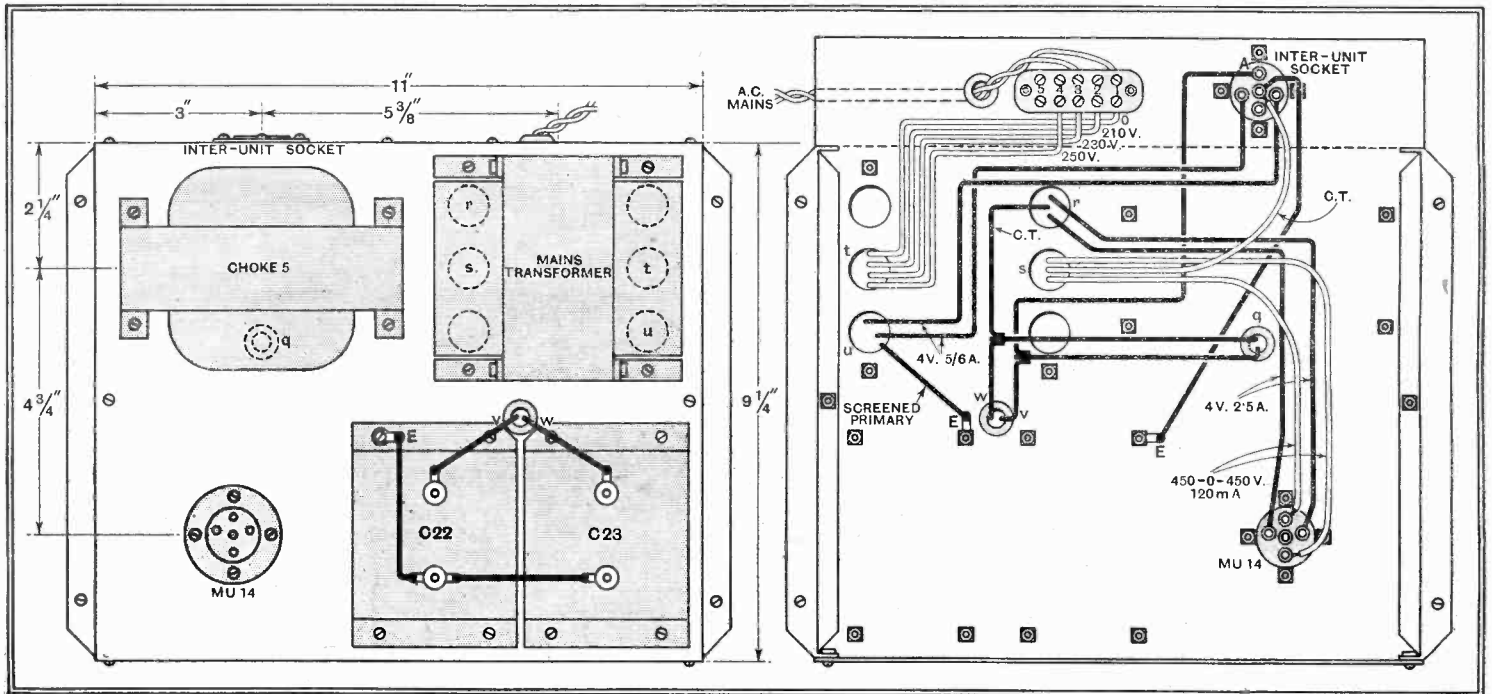
act as a tuning indicator. It is useless to attempt to gang on a strong signal without a meter, since the action of A.V.C. will make the optimum trimmer

settings very difficult to determine. Trimming is carried out for maximum signal strength, whether as indicated by the ear on a weak signal or by minimum anode



The greater part of the wiring is carried out on the underside of the chassis, and but few wires pass through to the upper side.

PRACTICAL WIRING PLAN OF THE ELIMINATOR



The wiring of the mains unit is extremely simple and it should be noted that both the mains transformer and the choke are fitted with leading-out wires instead of terminals

current of the controlled valves—the DD/Pen and the two H.F. stages.

Having tuned in some station on a wavelength below 250 metres, adjust each trimmer in turn for maximum signal

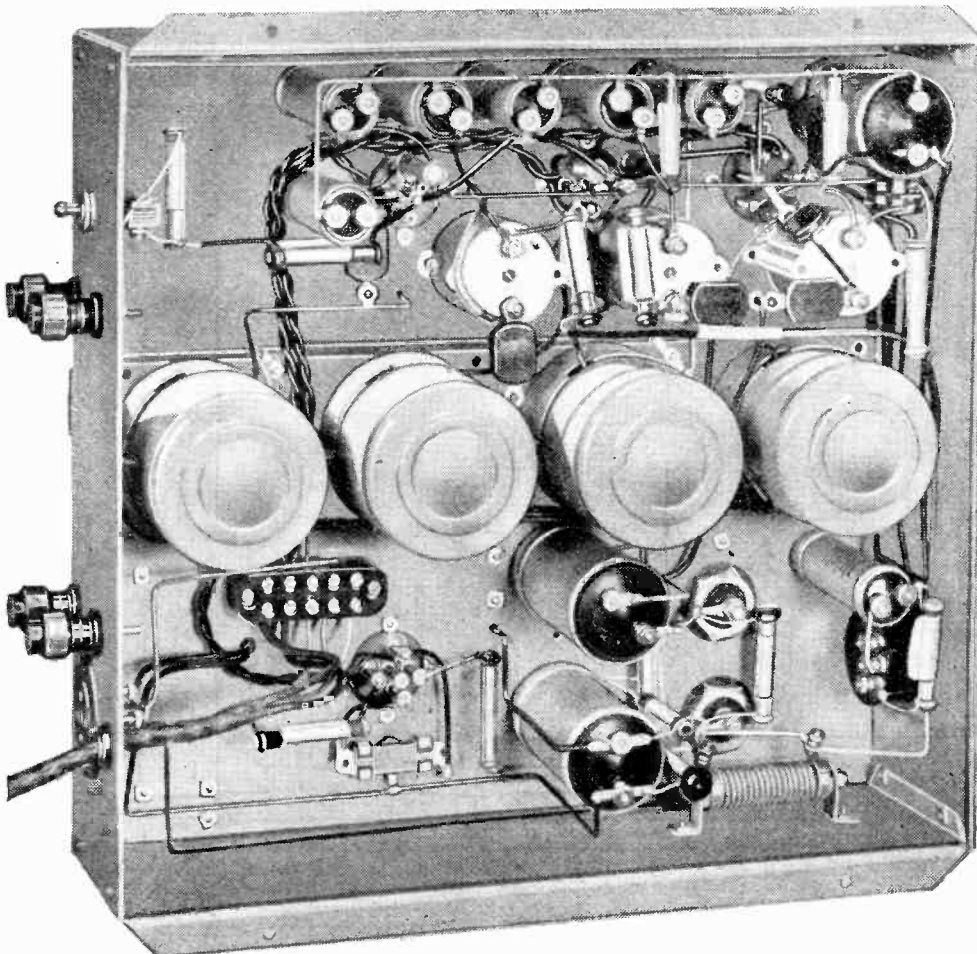
strength. If it be found that this leads to one or more trimmers being fully screwed home or fully unscrewed, the capacities of all other trimmers must be reduced or increased respectively. If a

very low wavelength station cannot be obtained at the first attempt, a rough adjustment of the ganging should be made on a higher wavelength station, after which no difficulty should be found in tuning in a station on a really low wavelength. The dial is calibrated in wavelengths, but whether this holds good in practice depends upon the precise values of trimmer capacity used in ganging. Small adjustments to correct for this are probably most conveniently made by slightly slipping the dial on the condenser shaft, but if the discrepancies are large a combination of this with the reganging of the circuits for different trimmer capacities will probably enable correction to be obtained.

Performance

The only further adjustment required is to R20, which must be set to the position of minimum hum. Distant stations spaced by 9 kc/s should be receivable clear of one another except for a certain amount of sideband splash which is inevitable in any receiver which reproduces the upper audible frequencies.

The receiver has been tested in the heart of London and gave a very good account of itself. The spread of the local stations was confined to two or three channels, and on the long waveband it proved easily possible to receive Deutschland-sender clear of Daventry National and



An underview of the receiver chassis. It will be noted that the coils are mounted directly beneath the gang condenser in order to keep the connecting leads as short as possible.

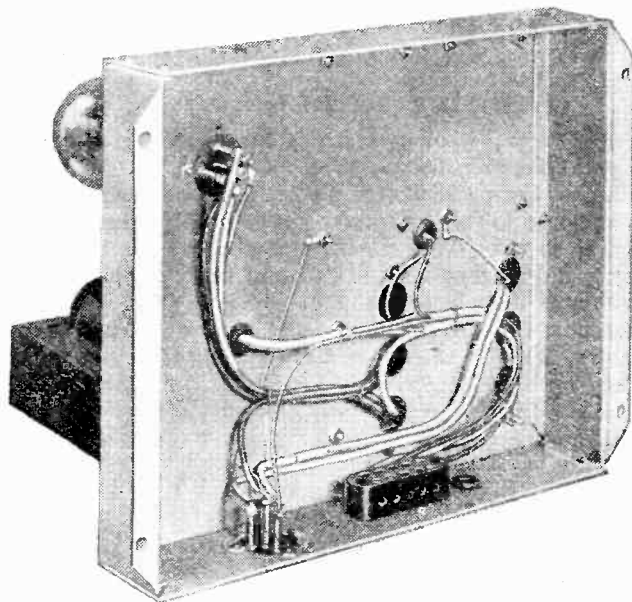
A full-size blue print combining the wiring diagrams of the receiver and power-unit is available from the Publishers. Price 1/6, post free.

**The A.V.C. Straight Four**

Radio-Paris, although it is a much weaker signal. The sensitivity proved adequate for most requirements, and with a reasonably efficient aerial should permit good reception of all the stronger Continental stations. It is not so high, however, as to necessitate the inclusion of an inter-station noise suppressor, and the Local-Distance switch is intended only for local reception. Automatic volume control has a sufficiently wide range of action to counteract the volume variations of fading, provided, as always, that the signal does not fade so badly that it falls below the A.V.C. threshold. The range of control, however, is not sufficiently great to keep local stations at the same level as the Continental, so that if the locals appear stronger than other stations, it should not be thought that A.V.C. is not functioning correctly. The use of the Local-Distance switch, or a slight readjustment of the setting of the manual volume control will correct for this.

The quality of reproduction was found on test to be of a high order and the volume adequate for all normal requirements. Mains hum was completely absent, in spite of the unusually good bass response. Incidentally, it should be pointed out that if full advantage is to be taken of the bass response, it is necessary for the speaker to be fitted with a large baffle or be used in a cabinet of large dimensions. If hum is to be avoided, it is necessary to keep the eliminator unit away from the receiver; in particular, at

some distance from the L.F. transformer. In general, therefore, the receiver should be mounted on one shelf of a radio-gramo-



This view of the mains unit shows the few connections that are needed. A connecting block is fitted for the mains leads.

phone cabinet, with the loud speaker and eliminator on another.

It will be as well to point out here a slight discrepancy between the circuit and the practical wiring diagrams. The resistance R10 is shown in the former as connected on the screen side of the switch S2, whereas on the latter it appears between the switch and the H.T. line. This has no effect on the performance of the set, and whichever way it be wired it will function equally well.

*A sample receiver built to the specifications described in this article will be available for the inspection of readers at 116, Fleet Street, London, E.C.4.*

speaking, of course, of the set) whilst searching for European stations, and for listening to transatlantic transmissions it is a heaven-sent boon. Tone-control, the next big advantage of up-to-date sets, makes all the difference in the world to one's reception of both Continental and American broadcasts.

**American Wonder Station**

Reception of both North and South American stations is now wonderfully good, and appears to be getting better as week follows week. On good nights stations such as WCAU, WKAQ, WTIC, and WBZ are as easy to find as Continentals, and they come in so strongly and steadily that one can listen with real pleasure to the programmes that they are sending out. The world's wonder station is WIOD of Miami, Florida, which has a genuine output power rating of 1 kilowatt. I first heard this station five or six years ago. When I was rash enough to mention the fact in print I was called all kinds of things, though none of my correspondents suggested George Washington as an appropriate pen-name. Since then thousands of listeners have recorded reception of WIOD not as a whisper, but at full loud-speaker strength. When conditions are at all favourable WIOD can be as strong as, say, Florence and Heilsberg. WIOD's one kilowatt does not belong to the same family as Fécamp's official 700 watts. The Federal Radio Board keeps a close watch on power outputs, and drops like the proverbial ton of bricks on any station engineer who exceeds the permitted rating.

On the long waves conditions are none too good at the moment. Radio-Paris and Zeesen are the best stations, with Warsaw, Motala, and Kalundborg as runners-up. On the medium waveband Vienna, Rome, Lyons Doua, Langenburg, Leipzig, Strasbourg, the Poste Parisien, Breslau, Heilsberg, Hörby, and Trieste are the most reliable.

D. EXER.

**DISTANT RECEPTION NOTES**

**The Boon of Automatic Volume Control**

READERS have probably noticed a considerable increase in the volume obtainable from Strasbourg—or perhaps it would be better to write that a good deal more use has to be made of the volume control when Strasbourg is being received. I understand that Strasbourg is now using about three times the power with which the station is officially credited, and that a further increase to 75 kilowatts is to take place within the next few weeks. It was probably on account of the alterations that are being made that Strasbourg indulged now and then in silent nights.

There is no question that both Mühlacker and Munich are now using their old transmitters with a power rating of 1.5 kilowatts in both cases. Why they should have continued using high power for so long after the official date of the closing down of the big stations I cannot say, but there is no doubt that they did so, for no diminution of the field strength of either was noticeable.

Kalundborg appears to be using very much less than its full 60 kilowatts. During the daytime it is not, as a rule, so well heard

now as in the days when it was a mere 8-kilowatt station.

Those who have not automatic volume control are doubtless making the discovery that fading is appearing once more. Curiously enough, it is at its worst at present in the middle of the medium waveband. The stations that have been chiefly affected are Toulouse Midi, Leipzig, and Athlone. It has not yet been of the very violent kind in which the transmission becomes horribly distorted, as it drops towards the minimum and sometimes disappears altogether for some seconds. Actually, there has so far been nothing that the automatic volume control cannot take charge of quite satisfactorily, though it is probable that fading of the severer kind will be in evidence, particularly towards the bottom of the medium waveband, during the next week or two.

Never has the long-distance enthusiast been so well equipped for indulging in his hobby as he is this year. Automatic volume control, besides counteracting fading to a great extent, also prevents blasting (I am

**New B.B.C. Wavelengths**

THE B.B.C. announces that in accordance with the Lucerne Wavelength Plan the following will be the frequencies and wavelengths to which the British transmitters will change on January 15th, 1934:

| Station.                | Kc/s. | Metres. |
|-------------------------|-------|---------|
| Daventry National (5XX) | 200   | 1,500   |
| North Regional ..       | 668   | 449.1   |
| Midland Regional ..     | 767   | 391.1   |
| Scottish Regional ..    | 804   | 373.1   |
| London Regional ..      | 877   | 342.1   |
| West Regional ..        | 977   | 307.1   |
| North Regional ..       | 1,013 | 296.2   |
| Scottish National ..    | 1,050 | 285.7   |
| Belfast ..              | 1,122 | 267.4   |
| London National } ..    | 1,149 | 261.1   |
| West National } ..      | 1,149 | 261.1   |
| Aberdeen ..             | 1,348 | 222.6   |
| Newcastle ..            | 1,429 | 209.9   |
| Plymouth } ..           | 1,474 | 203.5   |
| Bournemouth } ..        | 1,474 | 203.5   |

The B.B.C. is attempting to make other arrangements for Aberdeen, and, therefore, the wavelength on which this station will work, as shown above, may be modified.

It will be noticed that, with the possible exception of Bournemouth, the changes in the wavelengths of the British transmitters are small.\*

\* A special announcement concerning further changes in the B.B.C. wavelengths appears in "Broadcast Brevities."

# UNBIASED

By  
FREE GRID

## Solving the Dial Problem

THE Editor's stern remarks the other week (Opus No. 740, Nov. 3rd, 1933) castigating the set manufacturers on the general awkwardness of their knob and dial layout interested me exceedingly, for it showed that I have at least one faithful reader. For I see by reference to back numbers that it was upwards of two years ago that I commenced hammering away at this problem, and now that he has joined me there are hopes that something will be done about it.



Fig. 1.—Before and . . .

Not that the Editor and I are playing a lone hand in this game, for our correspondence bags have revealed otherwise, at least two readers and a rather doubtful third being in agreement with us.

One of the two stalwarts I have mentioned, a well known R.A., is, in fact, so enthusiastic about the whole matter that he has sent me in two sketches, the first of which shows him in the agonies of tuning—or rather, attempting to tune—a console receiver by a well-known firm whose name is a byword for the sort of thing shown in Fig. 1.

The two sketches are really illustrative of a sort of "before and after" business, as Fig. 2 shows the solution of the problem at which he has finally arrived, and which he warmly recommends to readers. I myself have not the slightest hesitation in strongly endorsing his advocacy of this method, for although I shall maintain my campaign with the stubbornness for which we English are so justly famous, I really know in my heart that I am only beating my head up against a brick wall to expect the manufacturers to do anything about it.

I have not received permission to publish reproductions of these two sketches, nor to raffle the signed originals, although I have done the first and propose to do the second very shortly in aid of the Free Grid Christmas Charities Fund which, by the way, will soon be opened for public subscription.

## Dressing to Suit

I AM very pleased to learn of the dress suit edict recently issued by the B.B.C. It is now commanded that all performers, save those taking character parts, must wear dress suits, while the latter must dress and make up for their rôles with as much care as if they were going to appear on the stage. "Dress suits," said a well-known B.B.C. official in an interview, "key up a performer."

I fully agree. From the very beginning I have always made it a rule to don full morning or evening dress before sitting down to write my weekly notes, and I have invariably found that the quality of my work suffers visibly on those occasions when some emergency has caused me to leave off my collar and tie.

Just lately I have been even more particular, and am cultivating the habit of dressing for the particular item concerning which I am writing, and, in addition, to acquire as much local colour as I can. Thus, when writing a recent paragraph about boxing, I not only stripped to the requisite degree, but even assumed the recumbent position so beloved of some of our heavyweights.

## Spice of Life

WHILE enjoying many of the talks provided by the B.B.C. I must confess that I am not infrequently bored by the foolish vapourings of speakers with whose opinions I disagree. "Audi alteram partem" is the motto which appears on my family coat of arms, and it is high time, I think, that the B.B.C. adopted it in place of their present one, whatever it is.



Fig. 2.—. . . after.

Instead of permitting so-called leaders in politics and other matters to come to the studio and deceive us with half-truths, surely it would be better to carry the microphone to Hyde Park and hear vox populi naked and unashamed. One can obtain in the short space of an hour more really startling information there, to say nothing of entertainment, than the

B.B.C.'s band of timid milk and water so-called controversial speakers are capable of giving in half a life-time.

In Hyde Park there is infinite variety, which the B.B.C. could bring into our homes by the simple expedient of having a microphone fitted at every speaker's platform and flitting from one to the other by means of the ever-handly stud switch. Thus there would be something to offend everybody, no matter what the colour of his shirt or flag, and after all, is not the taking of offence the very spice of life to the average citizen?

## This Sun Bathing

THE great sport in Brighton at the present moment is, it seems, attempting to pick up the wireless messages radiated from Police Headquarters to the various constables in that district who, as most people know, now carry radio sets complete with call bell inside their helmets.



To one part of the beach.

Much difficulty it is stated, has been experienced in finding out the exact wavelengths on which these transmissions take place. This is surely rather a bitter commentary on the degenerate times in which we live, for in my young days nothing would have been thought of knocking off a policeman's helmet and investigating the matter at first hand.

What really does perturb me, however, is a letter from an acquaintance in that area who tells me that real trouble is brewing for the local police, insomuch that certain irresponsible practical jokers have conspired together to construct a transmitter to send bogus messages to the constables in question.

The idea is to get the whole of the police force up to one part of the beach by means of a spurious transmission relating to a sunbather, thus leaving the town to the mercy of any bandits who may be minded to execute a smart smash-and-grab raid.

Whether this be irresponsible practical joking or an underworld plot, as my acquaintance suggests, I think all licence holders should band themselves together to stamp out this threatened menace to the good name and amenities of this Naples of the North.

# Practical HINTS AND TIPS

IT is easy enough to connect in series a chain of valve heaters or filaments when all take the same heating current. But, if valves of mixed L.T. ratings are to be used, various expedients must be adopted in order that some of the elements may not be overrun or under-heated; in practice it is usual to connect a parallel resistance across each heater or group of heaters taking less than the maximum current.

## Supplementary Heating Current

using anode current as a supplement to the ordinary heating current might have other useful applications.

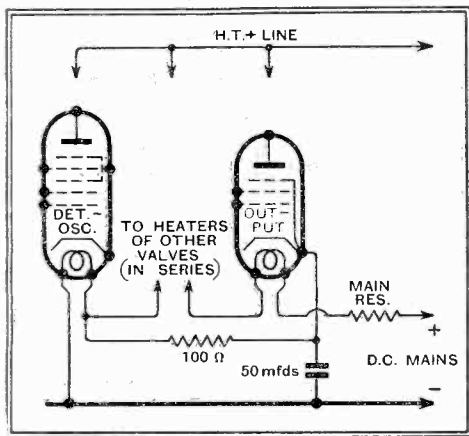


Fig. 1.—Combining 0.3 and 0.25 amp. valves in a D.C. set. Anode current of the output valve flows through the heater of the detector-oscillator.

Other ways of overcoming this minor difficulty have been described from time to time, and now a particularly ingenious solution of the problem is put forward by a reader who is using it in a D.C. mains superheterodyne. His problem was to employ a 6A7 pentagrid frequency changer (with a heater requiring 0.3 amp at 6.3 volts) in series with ordinary British D.C. valves requiring 0.25 amp only. The 6A7 valve therefore requires 0.05 amp (or 50 milliamps) more than the remaining valves.

Now for the solution of the problem. All the heaters are wired in series in the ordinary way, but the cathode circuit of the output valve is so connected that the anode current of this valve is diverted through the heater of the 6A7 valve, and is thus additive to that normally flowing in the heater circuit. As the output valve is a DPT, passing an anode current of 40 milliamps, the frequency changer is working at almost its full rated current, and results are stated to be excellent.

Fig. 1 shows the circuit arrangement actually employed, bias for the output valve being obtained from the drop in voltage across the 100-ohm resistance in series with the heater of the 6A7. By using a 50-mfd. dry electrolytic by-pass condenser in the position shown, the output grid circuit is effectively decoupled, and apparently hum is avoided.

It seems probable that the principle of

## AIDS TO BETTER RECEPTION

using anode current as a supplement to the ordinary heating current might have other useful applications.

A SCIENTIFICALLY designed low-pass filter, such as that described in *The Wireless World* of November 10th, adds considerably to the number of stations that can be received without interference; at the same time, it does not seriously affect quality of reproduction, but can always be switched out of circuit when receiving stations not subject to interference.

### Anti-Heterodyne Filter

It is generally, and probably rightly, considered that this type of filter is mainly applicable to highly sensitive long-range sets, although it would undoubtedly improve the performance of many others. Take the "local station" type of receiver, in which everything has been sacrificed to quality, and which will normally have an exceptionally good high-frequency response; this type of set is usually so insensitive that it seldom suffers from intelligible interference from other stations, but after dark reproduction is often marred by a continuous high-pitched whistle. This whistle, due to heterodyning by a distant station operating in the adjacent channel, may not be very strong, but is nevertheless annoying; its presence is a testimony to the good high-note response of the receiver, provided both local and interfering stations are on their proper wavelengths.

Here is a case where the whistle filter is invaluable. When interference of the type under consideration becomes evident, it can be switched in a moment, but the characteristics of the set are not permanently impaired, as full advantage may be taken of its exceptional high-note response as soon as the interference disappears.

Many of these high-quality sets include resistance-coupled L.F. amplifiers, to which the filter should be fitted in the manner shown in Fig. 2. It is desirable that the detector valve should have an impedance in the order of 10,000 ohms, and that the coupling resistance should be

of the same value; alterations to satisfy this requirement may generally be made to existing sets without impairing performance in other directions.

A diode detector requires a load of high ohmic resistance, and so the filter unit cannot well be used in direct association with it. Where this form of rectification is employed, it is best to place the filter after the L.F. amplifier which immediately succeeds the diode.

IT is fortunate that breakdowns of insulation between the heater and cathode elements of indirectly heated valves are becoming more rare. Faults of this nature are by no means easy to trace, partly because the defect may manifest itself only after the valve has been working for some time, and is in consequence fully warmed up.

### Testing Indirectly Heated Valves

It is probably most satisfactory, when a defect of this nature is suspected, to test the valve *in situ* rather than to remove it and to set up a special testing circuit. Almost all indirectly heated valves are now biased by the insertion of a resistance in the cathode lead; if there has been a breakdown of heater-cathode insulation, this resistance will in effect be short-circuited, and so the valve will be working at zero bias. It therefore follows that excessively high anode current will suggest a breakdown of this nature; the fact can be confirmed by imposing a momentary short-circuit across the bias resistor, a

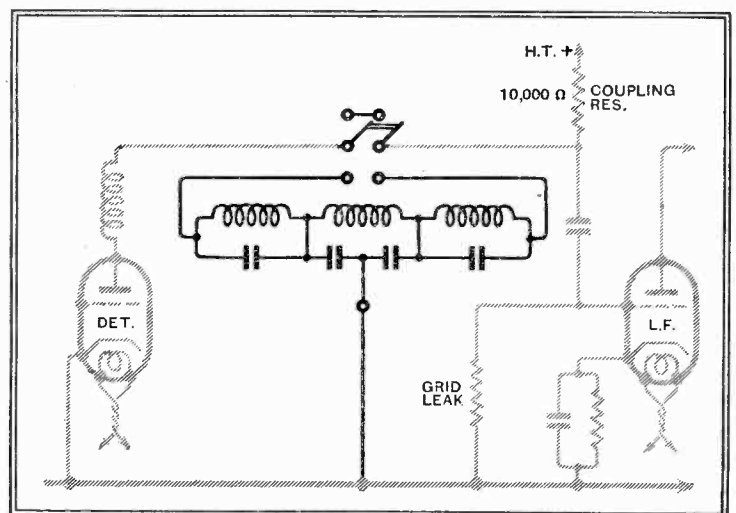


Fig. 2.—Adding a low-pass whistle filter to a receiver with resistance coupling.

milliammeter being at the same time inserted in series with the anode. If the short-circuit produces no change in anode current, it is fairly certain that the fault in question exists, at any rate, if the insulation of the usual parallel by-pass condenser can be depended upon.

# Universal Output Transformer

## Constructional Details of a Multi-ratio Component

By H. B. DENT

THE importance of correctly matching the output valve and the loud speaker has been emphasised so often in these pages that it would seem hardly necessary to comment further on it here. But it is well to bear in mind that strict adherence to this practice is just as important when trying out experimental circuits, for otherwise many promising schemes may be written down as unsatisfactory, their performance falling far short of expectations possibly because an unsuitable output transformer ratio was employed.

While it is not always possible to achieve the ideal condition, at least a very good compromise can be made with a universal type transformer, but to be of any value as an experimental component it should provide a large number and wide range of ratios. One that has proved very useful in this respect is illustrated here. Its windings are arranged as shown diagrammatically in Fig. 1; the secondary is in four sections interleaved with the primary, thereby obtaining a tight coupling and keeping the leakage inductance as low as possible.

### Push-pull Circuits

The design allows for anode currents of the order of 60 mA. to be handled, and the maximum A.C. output is about six watts. By making use of tappings on the primary winding twelve ratios can be obtained with but four secondary sections. The primary tappings are located equidistant from the centre, and as this is also brought out to a terminal, the transformer can be made to serve for push-pull circuits as well as for the more orthodox output system.

Of the twelve possible variations, two happen to give the same ratio, yet the eleven that result will meet most requirements, for they range from 75 to 1 to 12.5 to 1. With the whole of the primary in use the inductance is 52 henrys, and with 60 mA. of D.C. flowing it falls to about 39

even so this will be adequate for most occasions.

The construction of the transformer will require a little care, although on the whole it is not difficult. It is very necessary, however, to keep a check on the beginning and finish of the various sections, and a good plan is to thread different coloured insulated sleeving on the leads as the coils are completed.

The windings are carried on two bobbins, each  $3\frac{1}{4}$  in.  $\times$   $3\frac{1}{4}$  in.  $\times$   $1\frac{5}{16}$  in. wide overall with a centre hole measuring  $1\frac{1}{4}$  in. square. Both are wound exactly the same, but in the final assembly one is turned round so that the

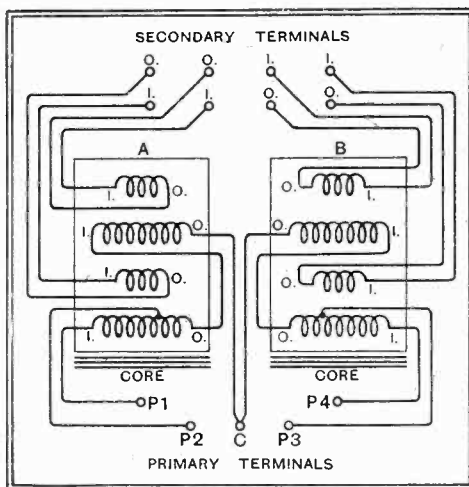
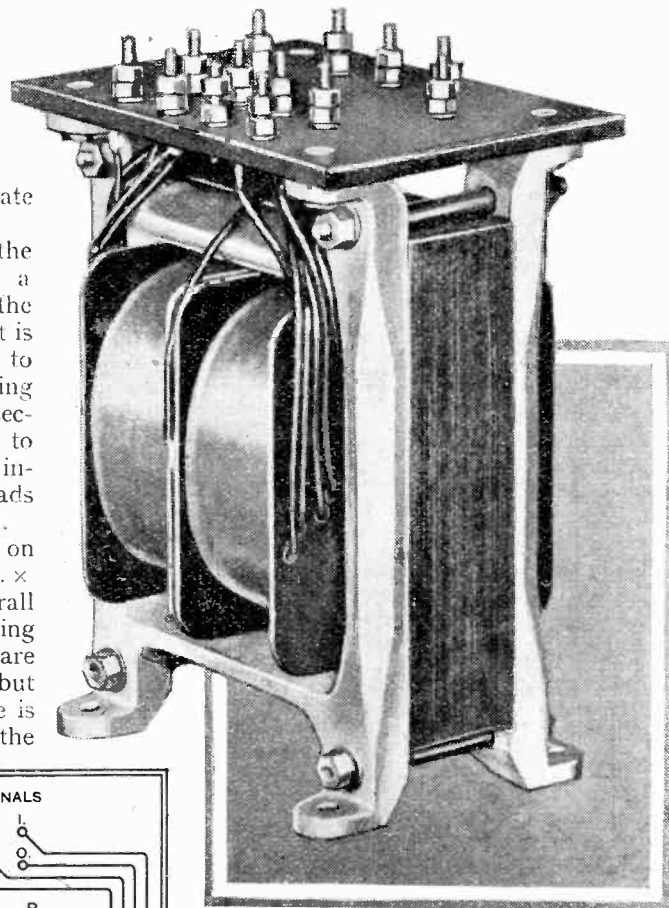


Fig. 2.—The relative position of the windings, inter-coil connections and wiring to terminal board is clearly shown by this schematic layout.

of Fig. 1, there will be no difficulty in comprehending the general layout of the transformer.

One point in particular requires special attention when assembling the bobbins, and this is to ensure that the external leads joining the two primary sections of bobbins A and B where their cheeks butt do not short circuit, a cheek of thin press-pahn, empire cloth, or any other good insulating material should be interposed between them as a safety measure.

The winding is carried out as follows: first 1,000 turns of No. 32 enamel wire is wound on evenly, a tapping is then brought out and this section completed by the addition of a further 500 turns. Two turns of empire cloth or waxed paper then follow, and the first secondary section, consisting of 80 turns of No. 20 enamel wire put on. Follows a further applica-

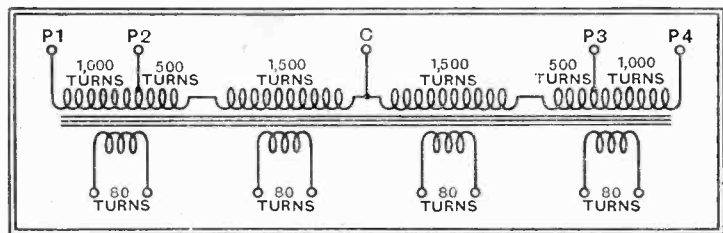
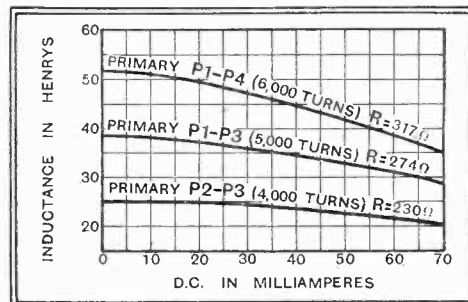


Fig. 1.—Theoretical arrangement of the transformer showing the symmetrical disposition of the windings.

henrys. The two inside tappings, P2 and P3, reduce the primary to 4,000 turns and its inductance then falls to 25 henrys;

direction of the winding is opposed to that of its companion. It is for this reason that all leads should be clearly marked during the winding process so as to avoid mistakes when it comes to joining them to their respective terminals. The actual arrangement of the windings is shown diagrammatically in Fig. 2; here they are displayed as in the final assembly, the inners and the outers of each being marked and the inter-section connections and the wiring to the terminals shown. If this diagram is studied in conjunction with that



That an adequate primary inductance is available under all conditions is seen from these curves.



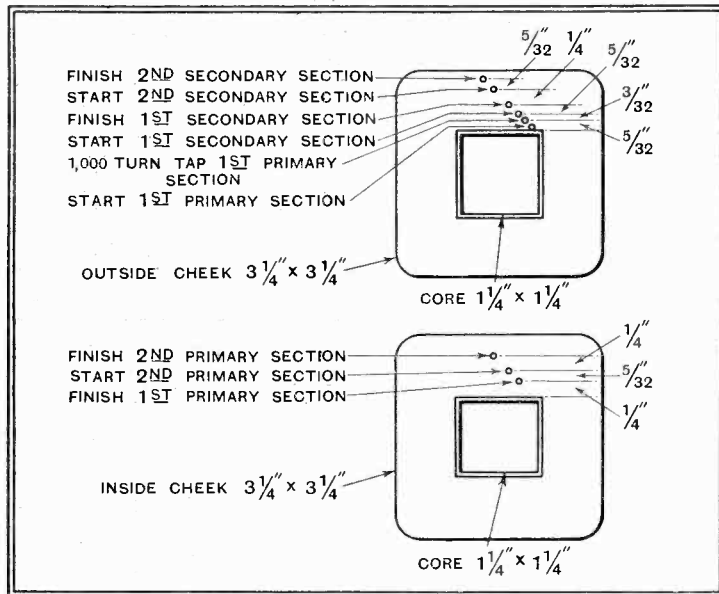
**Universal Output Transformer—**

tion of insulating material as before and the second primary section of 1,500 turns of the No. 32 enamel wire follows. To complete this bobbin two layers of insulation are required, and then the next secondary section of 80 turns can be wound. The finished bobbin may be covered to protect it by overwinding with a few layers of the insulating material or any other that may be handy. The second bobbin is wound in exactly the same way.

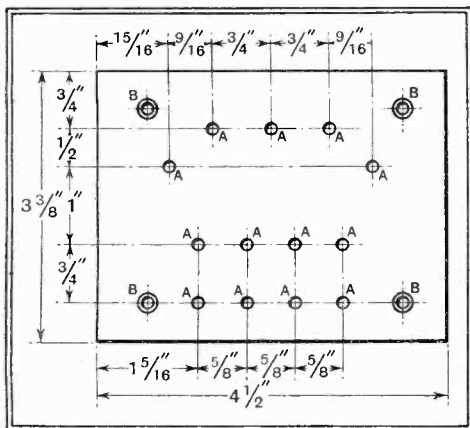
If bobbin A in Fig. 2 is taken as an example it will be seen that the beginning and finish of both secondary sections come out through the same cheek, and on this side is brought out as well the start of the first primary section and its tapping. The end of this section, also the beginning and the finish of section two of the primary, pass through the opposite cheek where they fall most convenient for joining together. To obviate any likelihood of the thin primary wires being broken or damaged, either during the winding process or during the final assembly, the leads that come out through the bobbins' cheeks should be of heavier gauge wire, or, better still, thin flex. Pieces about a foot long soldered to the wire before, and also

be passed through it. The "T" pieces must be packed as tightly as possible into the centre hole of the bobbin, and incidentally it is a wise plan to fit a few before winding so as to ensure that the hole is free from obstructions at all parts to pass the tongue-piece without binding. If not, clean out the inside with a file until an easy fit is obtained.

Little more remains now to be done than to insert, at the three points where the "T" and the "U" laminations abut, a distance piece 0.01in. thick. This is



In addition to giving the position of the holes in the bobbins this drawing serves as a winding identification chart.



Drilling details of terminal boards; sizes of holes are: A = 1/8 in. dia.; B = 3/16 in. dia. countersunk for 4BA screws.

after, winding, with one or two turns taken round the bobbin to take the strain, will serve this purpose. A word of warning may not be amiss here: use a non-corrosive flux!

Remains now but to assemble the core, for which about 90 pairs of Stalloy No. 33 stampings will be needed. They are arranged with all like-shape pieces on one side, for an air gap is required in the core as comparatively large D.C. currents may

equal to three thicknesses of the paper on which this is printed or twice the thickness of the cover of *The Wireless World*. Cast aluminium end plates should be obtained for clamping the core, after which a terminal board, laid out with 4BA screws and nuts to serve as terminals, is prepared and fixed in position.

Round-headed screws are used with soldering tags threaded on between the head and the panel. The ends of the various coils are then soldered to the tags in the order given in Fig. 2. An alternative method of anchoring the leads would be to loop the wires round the screws below the panel and secure by means of locknuts.

The position of the holes marked B on the drawing of the terminal board is purposely left vague, as these can only be determined accurately after the transformer is assembled.

From the table of ratios the connections for the primary and for the secondaries can be obtained, while in Fig. 3 a few examples have been taken and the terminal connections filled in. The first, marked (a),

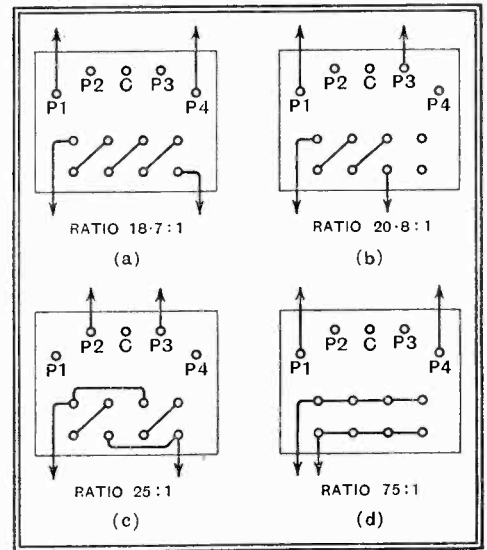


Fig. 3.—The output terminals joined as in (a) place all four sections in series; (b) gives three sections connected in series; (c) two in series and two in parallel, while (d) shows the four sections in parallel.

shows a series arrangement of the four secondaries; in (b) we have three secondaries joined in series, while in (c) two on each bobbin are joined in series and the two sets connected in parallel. Finally, diagram (d) shows the connections when all four sections are required to be joined in parallel.

**Material Required.**

- 90 Pairs of Stalloy No. 33 stampings Jas. Sankey & Sons, Sound Sales
- 2 Bobbins 3 1/2 in. x 3 1/2 in. x 1 3/4 in. with 1 1/2 in. x 1 1/2 in. hole. Sound Sales
- 1 Pair aluminium end-clamps Sound Sales
- 1 lb. No. 32 S.W.G. enamelled wire; quantity empire cloth; quantity insulated sleeving. Various colours.
- 13 4BA 1/2 in. brass screws, round head, with like number of soldering tags and washers.
- 4 4BA 1/2 in. countersunk screws; 30 4BA nuts.

Although the holes in the side cheeks of the bobbin can be drilled as the winding progresses if care is exercised, it would, on the whole, be better to prepare the bobbin beforehand. Drilling details of the bobbin are given, therefore, on this page. All holes should be about 1/8 in. diameter to allow for slight discrepancies in winding. This drawing will serve, also, as an identification chart, for against each hole is marked its respective lead.

**TABLE OF RATIOS AND CONNECTIONS**

| Ratio.    | Primary Connections.           | Secondary Connections.   | Secondary Resistance. |
|-----------|--------------------------------|--|-----------------------|
| *12.5 : 1 | P2 and P3                      | Four sections in series ..   | 1.76 ohms.            |
| 15.6 : 1  | P1 and P3                      | Four sections in series ..   | 1.76 ohms.            |
| *16.6 : 1 | P2 and P3                      | Three sections in series ..  | 1.32 ohms.            |
| *18.7 : 1 | P1 and P4                      | Four sections in series ..   | 1.76 ohms.            |
| 20.8 : 1  | P1 and P3                      | Three sections in series ..  | 1.32 ohms.            |
| *25 : 1   | (1) P1 and P4<br>(2) P2 and P3 | { (1) Three sections in series<br>(2) Two sections series<br>Two sections parallel } | 0.44 ohms.            |
| 31.2 : 1  | P1 and P3                      | { Two sections series ..<br>Two sections parallel<br>Two sections series .. }        | 0.44 ohms.            |
| *37.5 : 1 | P1 and P4                      | { Two sections series ..<br>Two sections parallel }                                  | 0.44 ohms.            |
| *50 : 1   | P2 and P3                      | Four sections in parallel ..   | 0.11 ohms.            |
| 62.5 : 1  | P1 and P3                      | Four sections in parallel ..   | 0.11 ohms.            |
| *75 : 1   | P1 and P4                      | Four sections in parallel ..   | 0.11 ohms.            |

\* These ratios can be used for push-pull.

# NEWS of the WEEK

## Current Events in Brief Review

### 100 Kilowatts from Hamburg

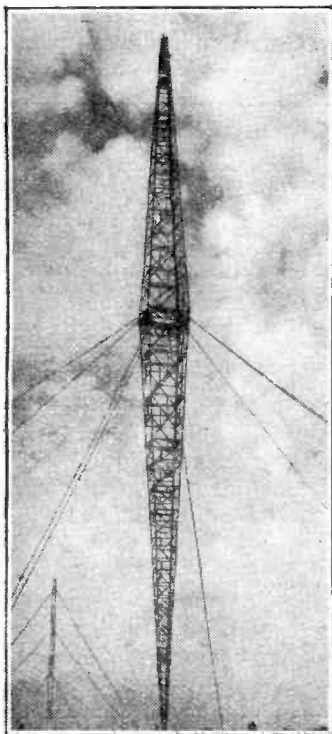
HAMBURG'S new 100-kW broadcasting station is to be inaugurated on January 15th, 1934, using its Lucerne wavelength of 331.9 metres.

### Russian Radio House

TWENTY-FOUR designs for a Radio House for Moscow are now being considered by the Soviet Broadcasting Authorities. It is stated that the building will be second only in size to Radio City, New York.

### The Wireless League

THE annual general meeting of members of the Wireless League, will be held on Friday, December 15th, at 3.15 p.m., at 12, Grosvenor Crescent, Hyde Park Corner, London. The chief business will be the annual report and accounts, and the election of committee for the ensuing year. In the chair will be Sir Arthur Stanley, Chairman of the League, and all members are cordially invited to attend.



### Japanese Honour

MARCHESE MARCONI, on the occasion of his visit to Japan, has been presented with the Grand Cordon of the Order of the Rising Sun by His Imperial Majesty the Emperor.

### Prison for German Pirates

THE number of wireless pirates in Germany is increasing. During the period from July 1st to September 30th last, it is officially stated, 245 persons have been fined for not paying their radio licence fees. The number during the corresponding period last year was only 165. In eight cases the offender has been sent to prison.

### A Pleasant Surprise

BELGIAN wireless pirates have received a pleasant surprise in having their confiscated sets returned to them by the Post Office authorities. Contrary to expectation, the receivers appear to have been treated with the utmost care, and, according to a correspondent, "have been found in the most perfect working order." It would almost seem that the Post Office engineers had considered it the courteous thing to repair any sets which were not functioning as they ought.

### Budapest To-morrow

TO-MORROW (Saturday) sees the opening of the new 120 kW. broadcasting station at Lakihegy, near Budapest, which owns the world's highest wireless aerial and, incidentally, the loftiest structure in Europe. This cigar-shaped mast is 314 metres high and thus exceeds the height of the Eiffel Tower by 14 metres. Actually, the mast itself is 284 metres high, but a steel rod projecting from the top can be extended to a maximum of 30 metres in order to tune the aerial to exactly the desired wavelength.

The station is built on the 100 per cent. spare system, i.e., everything is duplicated—even the crystal oscillator—in readiness for emergencies. In the last stage

four 120-kW. valves are used in push pull.

An interesting novelty is the provision of a switch which, in case of emergency, will cut out all current supply, closing down the station in a fraction of a second. Naturally, this "brake" must only be used in very special circumstances, as such a drastic cut-off is a great strain on the equipment.

The present 20-kW. transmitter at Budapest is continuing operations four hours a day with an alternative programme.

### THE ANNUAL PROBLEM.

Next week's issue of *The Wireless World* will be a special CHRISTMAS NUMBER incorporating seasonal ideas both for presents and entertainment.

ORDER YOUR COPY TO-DAY.

### Reports, Please!

TO mark the opening of the Budapest transmitter, Hungary is holding a radio week from to-morrow onwards with an official banquet in the evening and an exhibition sponsored by the Post Office, the Radio Industry, and Army Communications.

British listeners are cordially invited to send us reports comparing the relative merits of the old and new transmissions.

### Why They Switched Off

WHY do people give up listening? An interesting table published by the German Broadcasting Organisation announces the reasons why licence holders have omitted to renew their subscriptions. Apparently, only 1.5 per cent. during 1933 ceased to listen on account of discontent with the programmes. 1 per cent. became defaulters because reception was bad, 3.35 per cent. because of man-made interference, and 37.41 per cent. for "economic reasons." The remaining 56.74 per cent. switched off for the last time for "miscellaneous reasons."

### Background Noise

THE Spontaneous Background Noise in High-gain Receivers Due to Thermal Agitation and Schrott Effects" is the title of the paper to be given by Messrs. E. B. Moullin, M.A., and H. D. M. Ellis, B.Sc., at the meeting next Wednesday, December 6th, of the Wireless Section of the Institution of Electrical Engineers, Savoy Place, Victoria Embankment, London, W.C.2. The meeting opens at 6 p.m.

### Listen to Warsaw To-night

MR. THAD ORDON, whose English talk from Warsaw last month brought hundreds of enquiries for the free booklet on Polish history, will again broadcast this evening, Friday, from Warsaw, at 9.40 p.m. (G.M.T.), with a special message to the six hundred or more British listeners who wrote to him.

### Late Programmes from Germany

SPECIAL programmes for listeners who are unable to follow the programmes during normal hours are now provided by the Stuttgart, Frankfurt, and Trier group of German stations. These interesting late night concerts are sometimes continued till 12.30 a.m. The announcements are in German, Italian, Spanish, French, and English.

### "Music from the Air"

LT.-COL. ASHLEY SCARLETT, of the Golders Green and Hendon Radio Scientific Society, writes to express his regret that a number of *Wireless World* readers were unable to obtain admission at the Society's recent meeting for the

demonstration of electronic music. The meeting was announced in these columns, and, partly in consequence of this publicity, the hall, which holds only 280, was filled five minutes before the opening of the meeting.

The moral is that readers who wish to attend meetings announced in *The Wireless World* should arrive at least ten minutes before the stated hour of opening!

### Short Waves from Belgium

SHORT-WAVE relays of the Brussels transmissions are to begin very shortly, writes our Belgian correspondent. The transmissions will be made by one of the Ruysselede stations on a wavelength of 29.04 metres, starting each day at 6 p.m. (G.M.T.). The transmissions are intended primarily for the Belgian Congo.

### Radio-Paris: Official

A DECREE signed by the President of the French Republic and published in the *Journal Officiel* of November 22nd, announces that Radio-Paris becomes a State transmitter during this month.

The governing board will consist of thirty members.

Part of the programme time is to be devoted to "the radiation of French thought abroad."

### A Radio Medal

THE annual award for the clearest radio diction, awarded by the American Academy of Arts and Letters, goes this year to Jimmy Wallington, an announcer on the National Broadcasting Company's network and famous for his work on Eddie Cantor's programmes.

### An Illicit Transmitter

A NEW secret broadcasting station has broken in upon the ether at Enschede, Holland, its object apparently being to attack all political parties except the Independent Socialist group. The authorities have started a "round up," but have not yet run the fox to earth.



RADIO-BUDAPEST. Miss Lily Flotas, the announcer at the new high-power station at Budapest, which opens to-morrow with a power of 120 kilowatts. On the right is Mr. Eduard von Scherz, the world's first announcer, who was superintending Budapest's wired broadcasting programmes in 1893. (Above) The 314-metre mast.

# Broadcast Brevities

By Our Special Correspondent

## Confirming the News

The B.B.C.'s official list of its new wavelengths under the Lucerne Plan simply confirms the list first exclusively published in *The Wireless World* of June 23rd last, but I wonder whether readers realise that the arrangement is purely temporary.

There is to be a grand reshuffle of British wavelengths immediately the new regional transmitters are opened.

## Confidential Schedule

By agreement with the International Broadcasting Union the B.B.C. will re-allot its wavelengths according to a schedule already in the hands of the Union, and this schedule cannot be altered at less than six weeks' notice. In all probability, however, it will not be altered.

## Another Wavelength Shuffle

When the reshuffle takes place in 1935, the Midland Regional wavelength of 391.1 metres will go to Scottish Regional, the former then taking the 296.2 metre wavelength of North National. West Regional will take the Scottish Regional of 373.1 metres.

## North-Eastern

London Regional will remain on 342.1 metres, but the new Northern Ireland transmitter near Belfast will acquire West Regional's 307.1 metre wavelength, while the 285.7 metre wave, allotted to Scottish National under the Lucerne Plan, will be transferred to the new North-Eastern Regional near Newcastle.

## North Scottish

The mysterious North Scottish transmitter, whose probable whereabouts are still uncertain, will operate on 267.4 metres, which Belfast will be using until superseded by the high power station.

To complete the shuffle, Scottish National will take the 261.1 metre wavelength previously shared by the London and West Nationals.

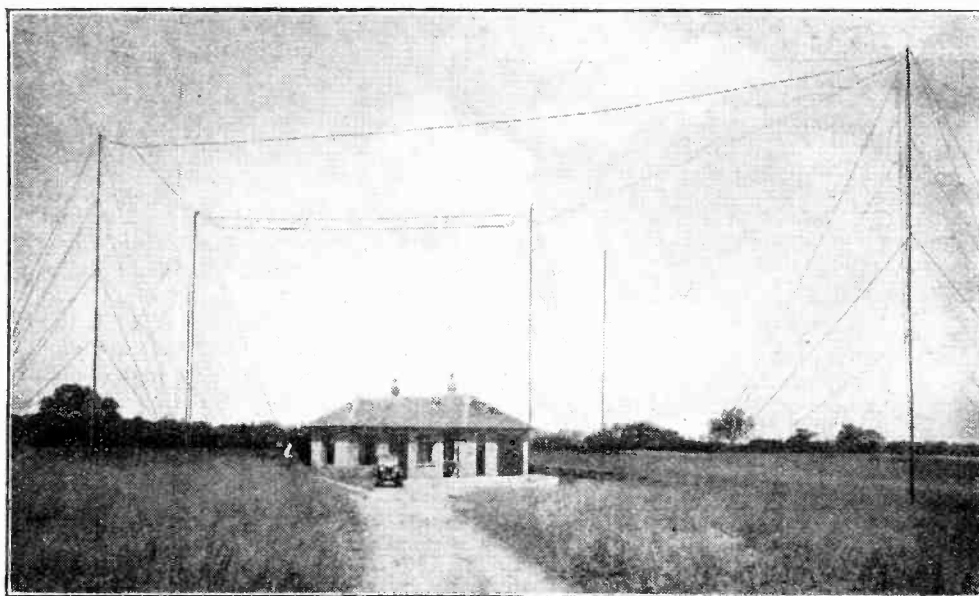
## The Happy Midlands

CAN anyone doubt that Midland Regional is among the brightest of the B.B.C. stations at the present time? Unlike so many "veterans," Percy Edgar, the station director, shows no sign of resting on his laurels. The Midland programmes abound in stunts and surprises.

## Bring Him to London

THE artistes are keen and original. Any one who heard Will Gardner, whose songs and patter were relayed from Walsall on November 18th, must agree that if this comedian looked half as funny as he sounded, the audience could have been forgiven for blasting the microphone with their laughs. As it was, they applauded him to the echo.

Will Gardner has the broadcasting voice and I hope we shall soon hear him in London.



CHECKING EUROPE'S WAVELENGTHS. A general view of the B.B.C.'s checking station at Tatsfield, Surrey, which will play a prominent part in the great wavelength change-over on January 14th and 15th.

## At Christmas

THE Christmas programme plans are still somewhat nebulous, but certain features are already decided upon. Pride of place must be given to the King's broadcast to his people throughout the Empire on Christmas Day. His Majesty is expected to speak from Sandringham at about 3 p.m. (G.M.T.), and will be heard, to use his own words in last year's message, by "men and women so cut off by the snows and the deserts that only voices out of the air can reach them."

## Recording the Bells of Bethlehem

To avoid offending religious susceptibilities the B.B.C. has decided not to broadcast any form of service from Bethlehem on Christmas Eve. What listeners will hear will be the sound of the bells from the 1,600-year-old Church of the Nativity, built over the traditional site of Christ's birth.

It is interesting to note that the chimes will be recorded by Blattnerphone for re-broadcasting to the Empire and also, possibly, for future programme occasions.

## Big Ben, and Then . . .

A strange and thrilling contrast should be afforded by the fact that the bells from Bethlehem will follow immediately after the chime of Big Ben at 8 p.m. on December 24th.

## Impossible Problems

Engineers and producers alike seem to have been beaten by certain problems arising out of "Sindbad," the pantomime to be broadcast to National listeners on Christmas Day and to the Regional supporters on Boxing Day. For example, it has not been found possible to depict the touching coconut scene in which Sindbad, chased round and round the stage by monkeys throwing coconuts, escapes, while numerous members of the cast are injured.

## A Brittle Topic

Likewise it has been found utterly impossible to broadcast the hatching of the egg in the roc's nest. However, listeners will find themselves, in imagination, on the back of a whale and, if they survive that, in an Arabian slave market and other exotic situations.

"Sindbad" is to be produced by Gordon

McConnell. The part of Sindbad will be taken by Arty Ash, and Hindbad, the principal boy, by Bertha Willmott. Wynn Ajello will be the Fairy Queen.

## A Real "Music Hall"

ST. GEORGE'S HALL has now lost much of the makeshift, impromptu appearance that it wore just after the B.B.C. took over. It is now a fully equipped broadcasting studio.

When I dropped in during the rehearsal for last Saturday's "Music Hall" I was surprised to find a newly erected silence cabinet in the wings, standing some 10 feet above stage level. From the windows of this little box on stilts Paul Askew, the Balance and Control Chief, has complete command of the performance, and nothing could be more fascinating than to sit at his side while he operates the mixing panel and controls the microphones in various parts of the hall.

## Balancing and Controlling

We can see Billy Merson at the "mike"; between him and the auditorium is the Theatre Orchestra; beyond in the semi-darkness is the audience. At the moment only the orchestra is heard, for the artistes' "mike" has been faded out. A touch of the gain control and in comes Billy's voice on the loud speaker. The orchestra fades out and is then brought back again until a perfect balance is obtained.

At the end of the turn the microphone in the auditorium is faded in and, if we like, we can have applause which is literally deafening.

## Five Microphones

What a fortune awaits the man who can invent a device which would make the same sort of control available at the listener's end. Actually, there are five microphones in circuit in St. George's Hall. These are placed in the commentator's box in the wings, in the footlight gully, up stage, in mid-air in front of the stage, and away back in the auditorium.

## B.B.C.'s Best Studio

Engineers and musicians alike agree that the hall is the finest ever used for broadcasting in this country, with the sole exception of the lounge of the Grand Hotel, Eastbourne.

## Letters to the Editor:—

# Disturbance or Interference

## Long-wave National : Tuning by Name : Cabinet Design

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

### Disturbance or Interference

WE noted with interest the fact that Mr. E. M. Lee, when speaking at a recent meeting, differentiated between the word "disturbance" and "interference," as applied in particular to apparatus intended for connection in mains leads to reduce the parasitic noises emanating from electrical apparatus.

We agree with the speaker that clear definition is desirable, but we do not agree that the word "disturbance" is necessarily the most suitable word to describe this type of parasitic trouble.

Consultation of leading dictionaries inclines us to the view that of the two words "interference" comes nearer to being the suitable description.

Language is, of course, a living matter, and the meanings of words are always changing. Whichever word is used, therefore, implies a new and slightly different meaning. "Interference," however, necessitates a lesser jump in meaning. The word has hitherto been universally used to cover the objectionable intervention of heterodyne whistles, atmospheric noises, and so forth.

Parasitic noises from electrical apparatus come, we feel, in a similar class of unwanted noises, and we feel, therefore, are also to be described as "interferences," possibly clarified by the word "mains" to indicate and differentiate from other types of interference.

We suggest the following descriptions and notes would clarify matters:—

#### *Aerial Interference Devices.*

To be applied to devices for connection in the aerial system for reducing parasitic noises emanating from electrical apparatus and collected by the aerial system.

#### *Mains Interference Devices.*

To be applied to devices for connection in the mains leads to reduce parasitic noises emanating from electrical apparatus and propagated along the mains wiring.

We appreciate that this leaves heterodyne whistles and atmospheric forms of interference still unclassified. There are, however, on the market many devices known and classified already as selectivity units and so forth, and it is already understood that these are connected in the aerial-earth system. We suggest that these descriptions are worthy of close consideration as serving to clarify to the public the uses and intentions of devices with which they are not fully familiar.

At present we feel that the word "interference" alone, although descriptive, is too broadly used, and the purposes of devices to which it is applied remain vague.

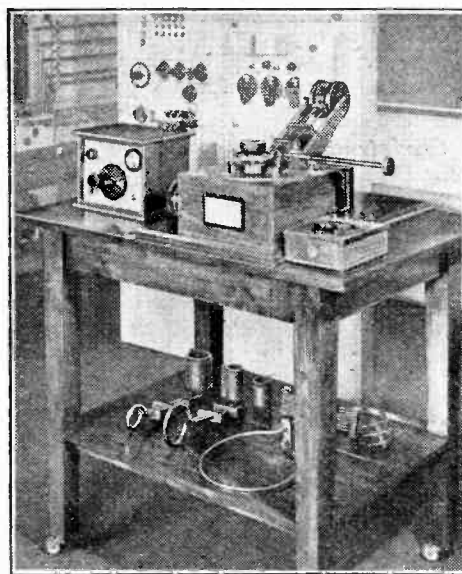
Barking, Essex. H. T. STOTT,  
Technical Department, A. Bulgin &  
Co., Ltd.

### Closing Down the National

I HEAR many comments on the proposal of the B.B.C. to close down the National transmitter when the new station at Droitwich opens.

There are many thousands of listeners who do not care about foreign programmes but who want their two local programmes free from interference.

During the past hot and dry summer it has been remarkable how little interference has been experienced from atmospheric in the local Regional and National programmes, whereas on the Daventry wavelength they have been bad.



WATCHING THE WAVELENGTHS. The B.B.C.'s checking station at Tatsfield includes the short-wave wavemeter covering a range of from 10 to 100 metres shown in this photograph.

The proposed discontinuance of the National low-wave transmitter means a backward step to the days of 1929, when the local programmes were the only ones of programme value. A transmission interspersed with a local "Brocks' benefit" has no programme value, and any transmitter situate more than fifty miles away from the receiver, whatever its power, suffers from this disability.

LOUIS J. WOOD.

Halifax.

### Alternatives to the Disc Record

THE present reproduction obtained from disc records is comparatively good considering the price paid, and cost is the first consideration with both the recording companies and the purchaser. Therefore, until such times as a better method just as cheap as the present can be found, let the companies concentrate on keeping records as cheap as at present. No doubt one of the companies would be glad to make special quality records for those who want them, providing they are willing to pay for them.

Sidcup, Kent. QUITE SATISFIED.

Correspondence, which should be as brief as possible, should be addressed to the Editor, "The Wireless World," Dorset House, Stamford Street, S.E.1, and must be accompanied by the writer's name and address

### Why Tune by Wavelength ?

MY view is that the scheme put forward by Mr. Hallows is just as unsound as kilocycles or wavelengths, for the reason that a number has to be memorised in each case.

The public refused to turn to kilocycles because they had got a few of the numbers in wavelengths in their heads, and they were not going to start learning all over again. They will reject channels for the same reason.

If there is to be no stability in the relative tuning positions of stations, then dials will have to be devised with interchangeable slips bearing the station names—not a difficult matter on horizontal and vertical scales—allowing the owner to rearrange his dial when and as changes occur. In fact, each of Mr. Hallows' channels would be a little slide into which the required name could be slipped.

The public demand is, rightly, for names, not wavelength, kilocycles or channels.

N. Ireland. J. N. BROWN.

### Cabinet Design

YOUR article on "The Receiver in Outward Form" gave food for thought, but a question which must be asked is, "Would the public favour a drastic change in cabinet design?" I venture to suggest that the answer is in the negative.

My opinion is that a design on the lines of the present-day horizontal cabinet, in a console form, with a sloping control panel, to enable operation to be carried out with ease in any position, would solve most of the problems.

With regard to fatigue, my experience—gained from hundreds of customers to whom I sell receivers weekly—is that a sloping control panel, at 45°, would definitely overcome the problem.

Your readers' views will be of interest.

Guildford. S. G. BUTTON.

### Tuning Scales

THE writer has read with the greatest interest and agreement the editorial in *The Wireless World*, dated November 3rd, in which you draw attention to the great importance of a larger and more clearly visible tuning scale.

It is interesting to note that this point was appreciated by the designers of Ekco receivers as far back as 1931, when the R.S.3 receiver was designed with a large tuning scale completely encircling the loud speaker fret. This is, surely, a case in which the area of the tuning device was the maximum which the dimensions of the cabinet permitted.

The same type of scale was continued in an improved form in 1932, whilst the present Ekco receivers have also a tuning scale of sensibly large and even more convenient design.

E. J. WYBORN, B.Sc., A.C.G.I.,  
Chief Engineer, E. K. COLE, LTD.  
Southend-on-Sea.

# Television Explained

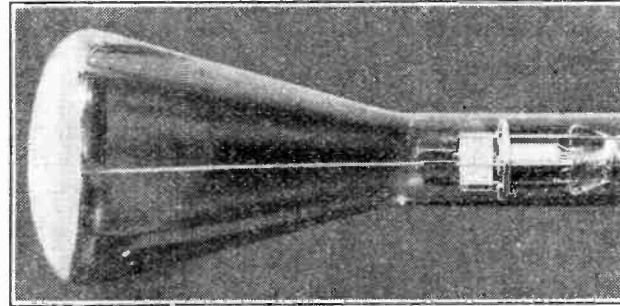
## VI.—The Cathode-ray Tube

**T**HERE are two general systems whereby the cathode-ray tube may be used for television reception; one involves a special type of transmission, but has the advantage of involving no synchronisation difficulties in the receiver; the other can be used for the reception of any mechanically scanned transmission, but necessitates careful attention to synchronisation if successful results are to be obtained. Taking the latter first, let us consider the requirements for successful operation.

The principles of the cathode-ray tube have recently been described in *The Wireless World*,<sup>1</sup> and it is unnecessary to go into it in any detail. It will suffice to say that a beam of electrons is emitted by the cathode, and, on striking a fluorescent screen mounted on the end of the tube, gives rise to a spot of light. The intensity of the spot of light is dependent upon the density of the electron beam, and means can be provided for controlling this. The position of the spot of light can be varied at will by deflecting the electron beam by applying suitable potentials to pairs of

to move vertically 375 times a second, and horizontally  $12\frac{1}{2}$  times a second.

One difficulty which will be obvious with this arrangement is that when the spot of light has moved to the bottom of the screen it must return to the top before the next scanning line can start. If it took as long to return to the top as to travel



A cathode-ray tube in which the beam of electrons can clearly be seen.

from the top to the bottom it is obvious that with normal methods of transmission no intelligible picture would be obtained, for alternate lines would be upside down. The waveform applied to the deflecting plates, therefore, is of a special type, so that during the scanning cycles the light spot moves steadily down the screen, but, having reached the bottom, it returns to the top for the next line much more rapidly. The time taken for the return upward movement of the spot is negligible in comparison with that required for the downward movement. In the horizontal movement for the separation of the scanning lines the same quick return is obtained.

### The Synchronising Voltages

The apparatus additional to the cathode-ray tube, therefore, must provide suitable deflecting voltages, and ensure that they are in synchronism with the synchronising impulses in the transmitter. A special form of oscillator is required, therefore, for the ordinary oscillator gives an output which, in the absence of harmonics, is a sine wave, as shown in Fig. 1a. Suppose we try using an oscillator of this nature, however. Considering the lowest portion of the negative half-cycles to represent the zero line, the voltage rises slowly at first from the point A, then rapidly, and again slows down as it approaches the point B. After passing this point, it commences to fall, slowly at first, then more rapidly, and then slowly again as it approaches the minimum C.

The light spot on the viewing screen will follow these variations. The scanning stroke is between A and B, and the speed of the light spot will obviously vary during the line; moreover, the return stroke is the interval BC, which is equal to the

*THE cathode-ray tube is of particular interest for television reception since it avoids the necessity for mechanically moving parts. The whole process of building up the picture is achieved through the aid of a beam of electrons. In this article the principles of operation are explained.*

scanning stroke. Obviously this will be unsatisfactory.

Let us consider, therefore, what is actually required. During the scanning stroke we need a voltage which rises steadily until the line has been completed, and which then falls instantaneously to zero to permit the light spot to return for the next line. The voltage required, therefore, takes the

form shown in Fig. 1b in which the interval AB represents the scanning stroke, and BC the return stroke. In practice, of course, it may prove impossible to obtain exactly this waveform, but it is by no means difficult to generate a voltage which closely approaches it, but which is actually of the form shown greatly exaggerated in Fig. 1c.

The methods of generating such a voltage are more complicated than those for

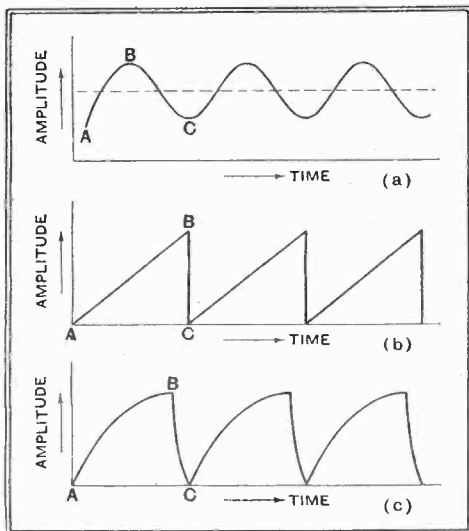
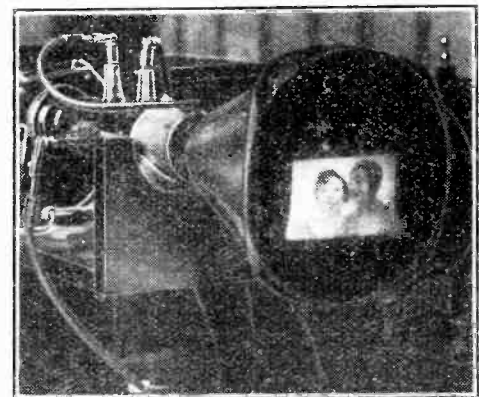


Fig. 1.—The various types of waveform which might be used for the voltages applied to the deflecting plates are illustrated here. A saw-tooth waveform as at (b) is desirable.

plates set at right angles at a suitable point in the tube.

By applying a suitable type of voltage variation to one pair of plates, the light spot can be made to move sideways and give the effect of a line of light. The application of another suitable voltage to the other pair of plates will cause the light spot to move vertically. By the choice of the correct frequencies, waveform, and amplitude for these voltages the light spot can be made to move over the screen in any desired manner. For the reception of vertically scanned transmissions, such as the present B.B.C., the light spot is made



The manner in which the picture appears on the end of the cathode-ray tube is well brought out in this illustration.

the usual sine wave, but there is nothing essentially difficult about them. In general, the rise in voltage along AB is obtained through the charging of a condenser through a constant current device such as a saturated diode or a screen-grid valve or pentode, while the sudden drop along BC is obtained by suddenly discharging the condenser with the aid of a neon tube, a thyatron, or an over-biased valve.

The frequency of oscillation is determined by the effective resistance and capacity of the circuits, and can be varied by changing either. It is, therefore, quite pos-

<sup>1</sup> The Cathode-ray Oscillograph. Nov. 3rd, 1933.

**Television Explained—**

sible to produce oscillators the frequencies of which can be readily controlled by variable condensers or resistances. The cathode-ray tube, therefore, offers the important advantage over mechanical systems that it is readily adaptable to the reception of signals with any scanning or picture frequencies, for the oscillator frequencies can be easily adjusted to suit the transmission, whereas with a mechanical system it is necessary to fit at least a new drum or disc. A change from horizontal to vertical scanning at the transmitter requires only a change-over in the frequencies of the two oscillators with the cathode-ray system, but it would necessitate the complete rebuilding of the receiver with a mechanical arrangement. As most foreign stations use horizontal scanning, and the present British transmissions are vertically scanned, this is not without importance.

Synchronisation is dependent upon the maintenance of the two oscillators at

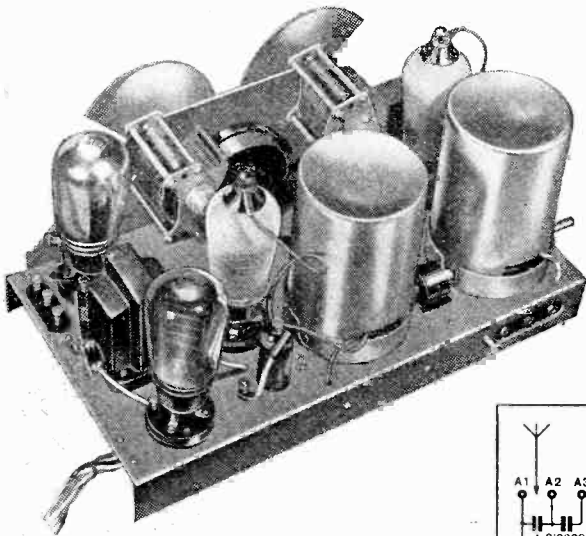
exactly their correct frequencies, and in practice this is usually obtained by feeding them with the synchronising impulses carried by the television signal. These impulses increase the oscillator potential momentarily when it is approaching the point B (Fig. 1), and ensure the breakdown of the discharging device at the correct instant.

There are, of course, certain difficulties in the way of good cathode-ray television reception among which synchronisation is one of the foremost. Another point which must not be forgotten is that the variations in intensity of the electron beam, which are required for the variations of light and shade in the picture, affect the focusing of the beam to some extent, and may possibly affect its position on the screen. All this means distortion and a reduction of detail, so that an alternative system which requires neither synchronisation nor modulation of the electron beam is of considerable interest, and will be dealt with in the next instalment.

## 12 TO 2,000 METRES

### The Lissen "Skyscraper 4" Tested

**S**O-CALLED "all-wave" sets, covering short, medium and long broadcasting wavelengths, are becoming more and more attractive. Great advances have of late been made in their design, and many



of the better examples, far from being Jacks-of-all-trades and masters of none, give a very satisfying performance on all wave-bands.

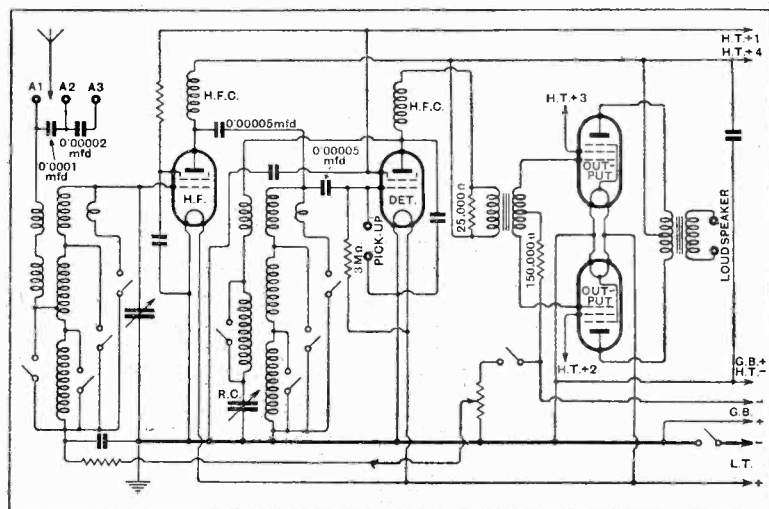
The fact that such a set can be put forward to the amateur constructor in the form of a kit of parts is indicative of the advances that have been made. The Lissen "Skyscraper 4," with which we are here concerned, is a battery-operated set covering four wave-ranges—nominally, 12-35 metres; 28-80 metres; 195-520 metres; and 800-1,970 metres—and is cleverly planned so that it may be built by the least experienced of home constructors with virtual assurance of success.

Basically, the circuit comprises a three-stage H.F.-det.-L.F. arrangement, with single-tuned input and intervalve circuits, and a Q.P.P. output stage. The various wave-ranges are covered by multiple coil

assemblies with built-in wave-range switches. In a set of this nature it is obvious that defective switch contacts might cause endless trouble, and so it is reassuring to note that during our tests the Lissen set gave no trouble whatever in this direction, and indeed, the switching system looks as if, bar accidents, it should go on functioning almost indefinitely.

There are several other interesting features, not the least of which is the combined volume-reaction control, which is effected by a single specially designed component. This consists of a

The Lissen "Skyscraper 4" chassis, and (below) the complete circuit diagram.



potentiometer through which the grid bias of the H.F. valve is varied from maximum negative to zero; further rotation of the control has the effect of increasing reaction feedback between plate and grid circuits of

the detector valve in the usual way, grid voltage being meanwhile held at zero.

With regard to the Q.P.P. output circuit, which is coupled to the detector valve by a high-ratio L.F. transformer, it should be noted that matching of the output valves is effected by adjustment of auxiliary grid voltage. To this end, individual pentode valves supplied with the kit of parts bear a label showing the appropriate voltage to be used, and so the constructor meets with no difficulty, and does not require any measuring instruments.

#### On the Short Waves.

In testing an "all-wave" set, one generally makes subconscious allowances for the fact that something extra is being provided as compared with the more conventional type of receiver. But, particularly on the 28-80 metres range, there is no need to be tolerant towards the Lissen set, which can well be judged on its merits. Hand-capacity effects were virtually non-existent; the unconventional reaction system worked very sweetly, and, in spite of the two tuning knobs, adjustments were not difficult. Tuning of the input circuit is quite flat, but that of the intervalve coupling requires much more critical adjustment. On the shortest wave-lengths (12-35 metre range), too, performance was also very satisfactory, although the usual slight falling off became evident below 20 metres, where very fine adjustment of the H.F. coupling circuit became necessary. A good "bag" of short-wave stations was obtained both before and after dark.

#### Medium and Long Wave-bands.

On the medium band, the set is comparable with others having two tuned circuits in regard to selectivity and sensitivity. In order to avoid interference, it is sometimes necessary to use the weakest of the three optional aerial couplings, with a consequent loss of signal strength. On the long waves, performance was well up to the standard for a receiver of this class.

The Q.P.P. output system works well, providing ample volume and good quality, with a commendably low average consumption of H.T. current. It is, indeed, something of an achievement to have designed such a satisfactory all-wave set in a form suitable for amateur construction.

The makers are Lissen, Ltd., Worple Road, Isleworth, Middlesex, and the kit of parts, complete with valves, costs £5 12s. 6d. The model we tested was fitted with a Lissen moving-coil loud speaker, but a moving-iron instrument may be used.

The Lissen "Skyscraper" may be housed in almost any manner, but many constructors will prefer to use the special table or "console" cabinets which are available in the form of sets of parts.

# NEW APPARATUS REVIEWED

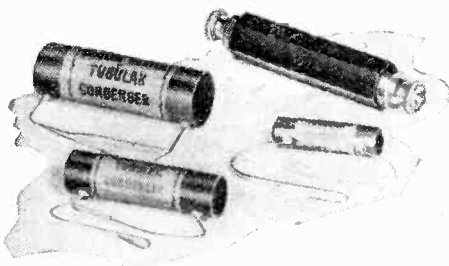
## Latest Products of the Manufacturers

### GRAHAM FARISH TUBULAR CONDENSERS AND 3-WATT OHMITES

THE new tubular condensers made by Graham Farish, Masons Hill, Bromley, Kent, are fitted with wire ends securely anchored to the bakelite container, a method of construction which gives adequate strength without imposing any strain whatsoever on the condenser insert. They are rated at 250 volts working, but tested at twice this potential, and a wide range of values from 0.0001 mfd. to 0.25 mfd. is available.

Some specimens taken at random show that the customary tolerance of plus or minus 10 per cent. is nowhere exceeded; for example, an 0.05 mfd. condenser measured 0.0502 mfd. or plus 4 per cent.; an 0.01 mfd. gave 0.00988 mfd. (minus 1.2 per cent.), whilst one of 0.0003 mfd. measured 0.000291 mfd. or minus 3 per cent. In a few cases only discrepancies of between eight and nine per cent. were found. Prices range from 1s. to 1s. 6d. according to size.

The heavy duty Ohmite resistances are equally as good in their agreement with the marked values, and a 10,000-ohm sample was only 3 per cent. low, whilst one of 25,000 ohms was 4.8 per cent. high. This style dissipates three watts without overheating, or with the temperature rising to an extent that precludes handling it with comfort, and under these conditions only a small change in resistance occurs. After a severe test all the specimens were found to be within a few ohms of their original values. They are, of



Selection of Graham Farish tubular condensers and heavy-duty Ohmite resistance.

course, synthetic resistors. Quite massive terminals are fitted and they are made in values ranging from 300 to 100,000 ohms, the price being 2s. 3d. each.

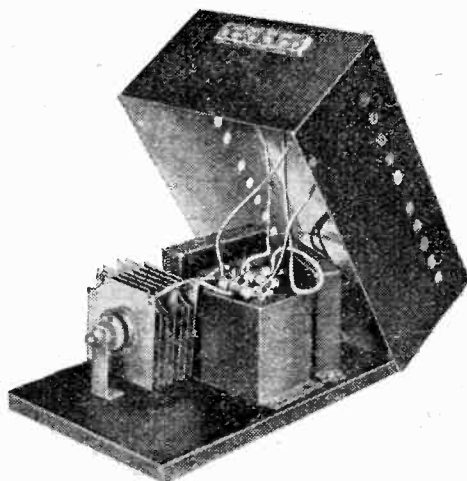
### FEL-ELECTRIC H.T. MAINS UNIT

THE battery eliminator sent in for test is one of a wide range made by Fel-Electric Radio, Garden Street, Sheffield, 1, which includes both A.C. and D.C. models, and some of the former embody a trickle charger. In addition, all the A.C. models can be supplied with a 4-volt 3-amps. L.T. winding at a small extra cost.

The model illustrated is the type C7/C.H., rated to give 120 volts at 12 mA., and it provides three separate output voltages. The detector valve supply comes from a resistance joined to the "power" tapping and is decoupled by a condenser. A potentiometer supplies the screen grid voltage for the H.F. valves, and under normal working conditions these tapings give 90 volts at 1.5 mA. and 70 volts at about 0.5 mA. respectively, and with the other valves in

the set taking 10 mA. in all at 140 volts. These voltages were obtained with the unit connected to a 230-volt 50c/s supply main.

The primary winding of the mains transformer is not tapped, but is stated to be suitable for all A.C. mains of from 200 to 250 volts; the output will, however, be subject to slight change on supply mains of different voltage.



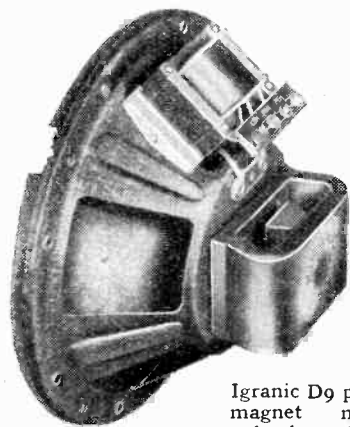
Fel-Electric battery eliminator, model C7/C.H., with cover removed.

This unit is quite suitable for use with practically any type of battery set taking not more than 12 mA., and very little more background will be present than with batteries. For when tested with a sensitive four-valve set mains hum could be heard only by listening close to the loud speaker.

The components are neatly arranged on a metal base-plate, and the workmanship is very good. The price is £2 2s.

### IGRANIC D9 LOUD SPEAKER

THIS unit is very well made and finished and has a magnet system which is designed to reduce amplitude distortion to a minimum. That this aim is accomplished is proved by the fact that frequency doubling cannot be detected by ear when the diaphragm is developing full amplitudes at low frequencies.



Igranic D9 permanent-magnet moving-coil loud speaker unit.

The efficiency is good and in a small room not more than 250 watts is required to give an adequate volume level. The balance of tone at this level is good, and the bass is

provided by a complex group of resonances between 80 and 120 cycles. In the upper register, also, there is a commendable absence of isolated and prominent resonances, but the general level of output is higher over the band of frequencies from 2,500 to 4,500 cycles.

The unit is supplied in three types, the "Standard" model for single output valves at 32s. 6d., and the "Q.P.P." and Class "B" models at 35s. each. The makers are the Igranic Electric Co., Ltd., 149, Queen Victoria Street, London, E.C.4.

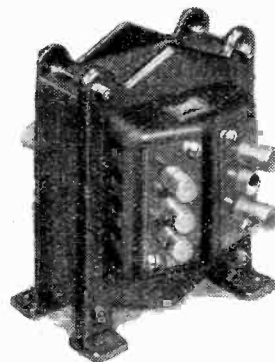
### HEYBERD MAINS TRANSFORMER MODEL W.41

A RECENT addition to the Heyberd range, this model is designed for use with the new Westinghouse H.T.12 rectifier and provides two alternative output voltages for the unit, in addition to one L.T. supply of four volts at four amps. for the A.C. valves. The transformer was tested in conjunction with a voltage doubler circuit, using 4-mfd. condensers of 500-volt test rating and a smoothing choke of 300 ohms resistance.

The smoothed D.C. at various current loads is given in the table below, using in the one case the 110-volt output and in the other the 140-volt supply.

| 110-volt Output. |        | 140-volt Output. |        |
|------------------|--------|------------------|--------|
| Current in mA.   | Volts. | Current in mA.   | Volts. |
| 5                | 257    | 5                | 335    |
| 10               | 236    | 10               | 315    |
| 15               | 216    | 15               | 295    |
| 20               | 196    | 20               | 276    |
|                  |        | 25               | 256    |
| 25               | 176    | 30               | 245    |

With the full load of four amps. the L.T. winding gave 4.25 volts with 20 mA. flowing in the H.T. circuit when measured at the transformer. As there will be a small voltage drop along the L.T. leads this ensures that the



Heyberd model W.41 mains transformer for use with Westinghouse H.T.12 rectifier.

valves are operated at their correct voltage. The transformer runs cool, there is no trace of hum due to looseness in the assembly, and, in common with all Heyberd products, it is a very well-made component. Insulated plugs and sockets are fitted in place of terminals, and the price is 22s. 6d.

The makers are F. C. Heyberd and Co., 10, Finsbury Street, London, E.C.2.

### CHANGE OF ADDRESS

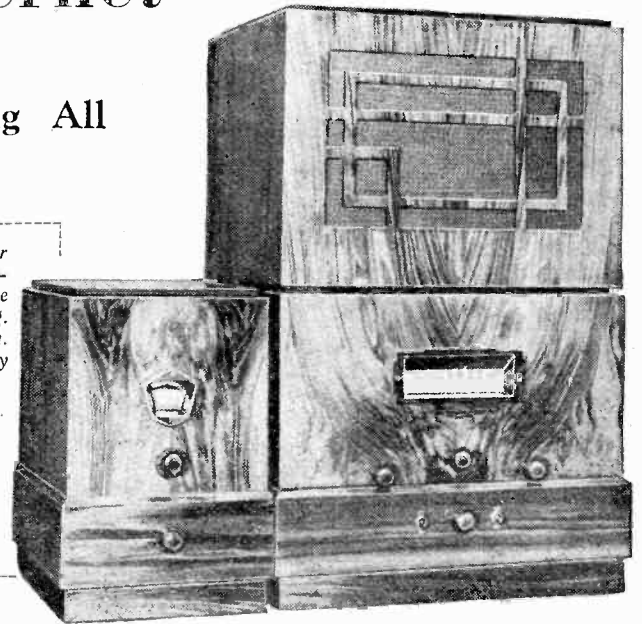
The head office of the Edison Swan Electric Co., Ltd., from Queen Victoria Street to 155, Charing Cross Road, London, W.C.2. Tel.: Gerrard 8660.

# C.A.C. "Pentagrid" Superhet

## AND SHORT-WAVE ADAPTOR

### A Sensitive Receiver Equipment Covering All Broadcast Wavelengths

**"Pentagrid" Receiver. FEATURES. Type.**—Table model superheterodyne for A.C. mains. **Separate loud speaker unit. Provision for Gramophone pick-up. Circuit.**—Band-pass input to heptode frequency-changer—variable-mu I.F. stage—duo-diode-pentode second detector—pentode output valve. **Full-wave Rectifier. Controls.**—(1) Tuning. (2) Waverange Switch. (3) Volume control. (4) Pre-set sensitivity control and switch. (5) Radio-grano. switch. **Price.**—14 gns. (including L.S. unit.) **Makers.**—City Accumulator Co. Ltd., 18-20, Norman Buildings, Central Street, London, E.C.1.



**T**HE enthusiast for long-distance reception will find in this group of receiver units the ideal medium for the pursuit of his hobby, for there can be

broadcast receiver before turning to a consideration of the Short-wave Adaptor.

The four-valve superhetero-

little doubt that the range available is the maximum which can be gained from the number of valves used.

From this point of view the C.A.C. set is able to offer something a little better than the ordinary run of four-valve superhets., and it is for this reason that it should appeal to the man who takes an interest in foreign-station listening and a pride in the number of stations in his log book. That is not to say that the receiver is a job for the specialist, for the tuning is simple and the quality of reproduction will more than satisfy those who prefer to settle down to the local station programme.

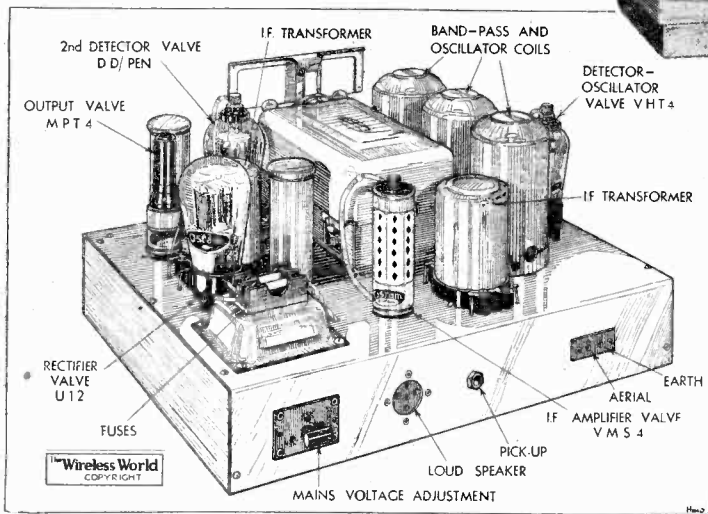
The basic unit is the "Pentagrid" superhet. receiver, which is designed to cover the medium- and long-wave bands, and we propose to discuss its merits as an ordinary

dyne circuit is of thoroughly up-to-date design and includes automatic volume control. An inductively coupled band-pass filter precedes the frequency-changer valve, which is the latest Ferranti "Heptode." A special advantage of this valve is that it

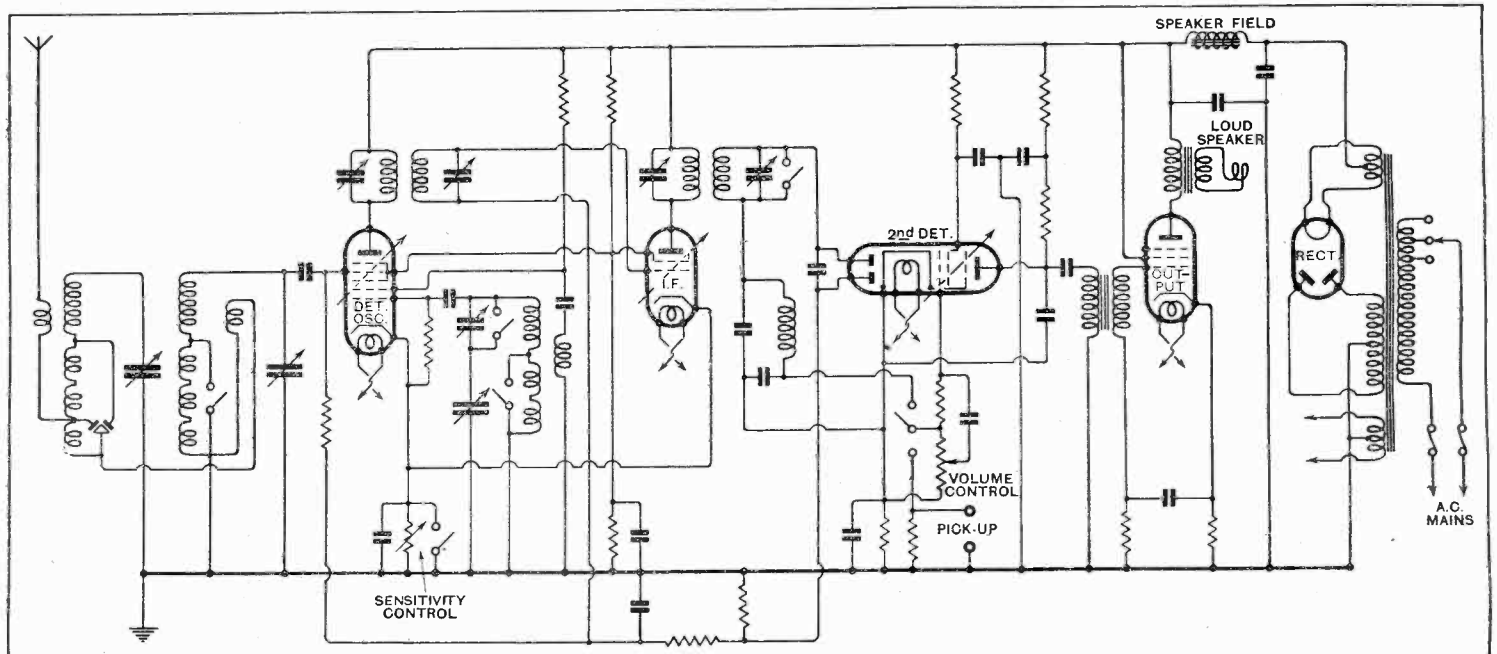
minimises mutual interference between the various tuned circuits associated with the first stage. A sensitivity control is connected in this stage and consists of a variable cathode bias resistance which is common to both the frequency changer and the I.F. valve, and which can be adjusted to a pre-determined level. It is brought into operation by opening the switch in parallel with it.

The I.F. stage is straightforward and includes a variable-mu valve with four tuned circuits. It is followed by a duo-diode-pentode which combines the function of detection with the provision of the automatic control bias and a degree of L.F. magnification. It is interesting to note that transformer coupling has been included between this valve and the output stage, and it is probable that this contributes materially to the unusually good performance of the set from the point of view of sensitivity.

The set is built in two units, the loud speaker occupying the top section and being connected to the receiver through the medium of a five-pin plug. This is a particularly convenient arrangement and the loud speaker can be used in another room without



A logical layout of components contributes to the efficiency of the "Pentagrid" receiver chassis.



Circuit diagram of the "Pentagrid" receiver. Modern high-efficiency valves are used in all stages.



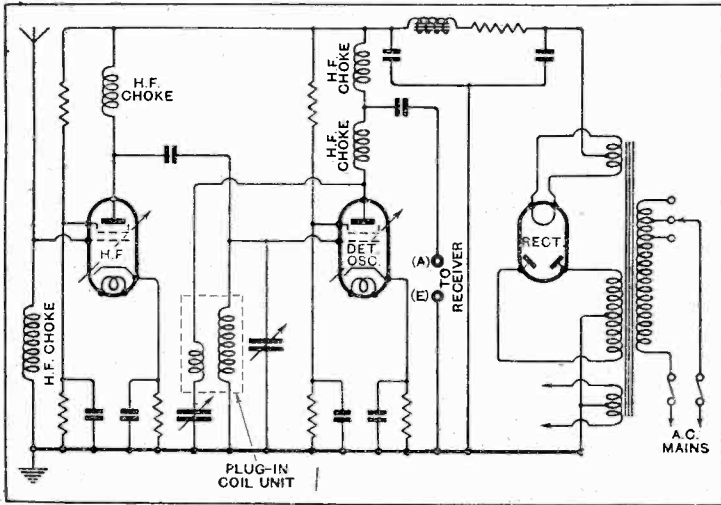
C.A.C. "Pentagrid" Superhet—

detracting from the appearance of the set. A horizontal type of tuning scale has been adopted, and in the model tested was calibrated only in degrees. We understand, however, that all future models will be marked both in wavelengths and degrees. This will enable the non-technical listener to tune-in the station he requires without any difficulty, and, at the same time, will not deprive the enthusiast of the means of preparing his own accurate tuning charts or calibration curves.

The first thing to attract attention in testing the receiver is its extraordinary liveliness and high overall magnification. Continental stations on the medium waveband, which are difficult to receive in daylight, came in with a volume which normally one would expect only after sunset. The selectivity on medium waves was excellent and barely one channel is lost in Central London on either side of the local B.B.C. transmitters. On long waves, however, there was some difficulty in receiving Zeesen with Radio Paris in operation, but this may have been due to slight misalignment on the long waveband.

With regard to second channel whistles, those due to the London Regional and National transmitters were well defined on the medium waveband, and there was one

The auxiliary short-wave unit is designed to couple-up with the aerial and earth terminals of the main receiver and is provided with its own power supply. The broadcast receiver is tuned to about 1,875 metres and the output from the short-wave unit then receives not only with the full over-all magnification of the set, but is also provided with the advantage of automatic volume control, which is a very real advantage on short waves which are subject to fading.



Circuit diagram of C.A.C. Short-wave Adaptor which is provided with its own power supply.

The autodyne frequency-changer in the short-wave unit is preceded by an aperiodic H.F. stage with choke coupling. The degree of reaction in the frequency-changer stage is under control, and this was found to be a very real advantage when adjusting the set for the maximum sensitivity, as the efficiency of this stage is appreciably affected by the relative strengths of the incoming and locally generated oscillations. This adjustment, however, may be regarded as a refinement, for it is not necessary to touch the reaction control when searching in the normal way.

A specially designed short-wave condenser mounted on an insulating base of ceramic material is used and is fitted with a two-speed slow-motion dial which is admirably suited to short-wave tuning conditions. Another sensible feature is the employment of Catkin valves, which completely overcome the microphonic troubles frequently experienced in sensitive short-wave receivers. The short-wave ranges are changed by means of plug-in coil units, and in the receiver tested the bands covered were as follows: 15.5 to 27.5 metres, 26.5 to 51.5 metres, and 46 to 95 metres.

During the periods of the test the lowest waveband gave best results, at any rate, as far as long-distance reception is concerned. Three American stations, Pittsburgh, W8XK, Schenectady, W2XAD, and Bound Brook, W3XAL, were received at good strength with only slight fading during the afternoon. On the two higher wavebands all the European amateurs and short-wave broadcasting stations were always available, and as a medium for the exploration of this interesting field the C.A.C. short-wave unit could hardly be bettered.

The predominant impression left after handling this equipment is that, by comparison with the ordinary run of mass-produced receivers, it possesses just that extra degree of efficiency that is sought after by the enthusiast for long-distance reception.

The Short-Wave World

DURING the past fortnight short-wave listeners who have been able to listen during the afternoons and early evenings have had much to interest them. The broadcasting of special programmes commemorating the opening of "Radio City," New York, has fortunately coincided with a spell of quite exceptional conditions on the shorter waves.

Probably the best and most reliable station of all has been W3XAL, Bound Brook, on 16.87 metres, which has been received at good strength almost continuously from 2 p.m. until "fade-out." The time of the latter has varied between 5 p.m. and 6.30 p.m. in the course of a week, and will, of course, occur earlier almost day by day until the shortest day.

Many owners of short-wave receivers seem to miss W3XAL on this wave, either because of their inability to tune down below the 19-metre band or simply because they do not realise the excellence of W3XAL's transmissions. Just at present it is certainly better in every way than the 19-metre stations. W9XAA, Chicago, on 16.57 metres, has also been heard on several occasions.

Amateur transmitters throughout the country have been finding the 20-metre band very unsatisfactory for the past two or three weeks—a rather surprising fact in view of the excellence of the 16- and 19-metre broadcasting. It is generally safe to assume that if the amateur 20-metre band is "lifeless," the general conditions below 30 metres are bad. The characteristics of the 20-metre band at present seem to be the somewhat unreliable reception of Australia and New Zealand between 7 and 10 a.m., and the reception of the East Coast of U.S.A. from noon onwards, the strength of signals varying tremendously from day to day.

From the Antipodes

The 40-metre band, on the other hand, has been productive of very interesting results. Signals from the Antipodes have been well and reliably received in the early mornings for the past two months or more.

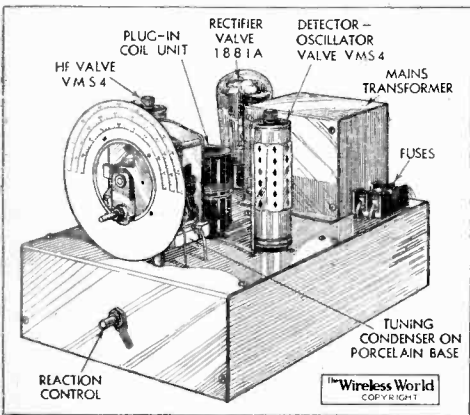
In the evenings the South African stations may often be heard—from 7 p.m. onwards—while the Australians, presumably received "the other way round," are generally almost as good as in the early mornings. As has always been the case, there seems to be a preponderance of New Zealand in the mornings and Australia in the evenings.

This would appear to confirm the fact that signals are received across the Pacific and South America in the morning, and across Asia in the evening. For this reason it is difficult to explain the presence of South American stations most evenings and their absence in the mornings!

The one remaining continent—Asia—has recently been represented by Japanese stations on 40 metres at about 8 p.m., but they could certainly not be described as reliable. Readers who remember the extraordinary influx of these "J" stations on the 20-metre band two years ago will be disappointed by the weakness of their 40-metre signals at present.

The amateur bands have been dealt with at some length, because they serve as a fairly reliable guide to the general level of short-wave conditions. High-power broadcasting stations may be received consistently on the worst of days, owing to "freakish" conditions of some kind; low-power amateur transmissions seldom survive.

MEGACYCLE.



Non-microphonic all-metal valves are a feature of the Short-wave Adaptor chassis.

fairly prominent whistle on the long waveband which was, no doubt, due to a harmonic of the oscillator. In relation to the high magnification of the set, however, these whistles cannot be regarded as being more serious than those in any four-valve superheterodyne of average performance.

The Short-Wave Adaptor

FEATURES.

**Type.**—Two-valve autodyne unit for attachment to broadcast receiver. **Circuit.**—Aperiodic H.F.—autodyne detector-oscillator. Full-wave rectifier. **Controls.**—(1) Tuning. (2) Reaction. **Price.**—£10. **Makers.**—City Accumulator Co. Ltd., 18-20, Norman Buildings, Central Street, London, E.C.1.

# Readers' Problems

## Bias Polarity

IT is possible, when making alterations to a receiver with automatic bias, to bring about an accidental reversal of voltage and thus to operate one or more of the valves with positive instead of negative bias. A reader has apparently fallen into this trap through attempting to adapt methods that now tend to become obsolete to a modernised set.

When bias is developed across a resistor in the common H.T. negative lead to the receiver, this resistor may be treated as a potentiometer, across which negative bias voltages up to the maximum value provided may be obtained for any number of valves in a set. Referring to Fig. 1 (a), we will assume that a pressure of 10 volts is developed across the bias resistance; point A will therefore be 10 volts negative with respect to the earth line and the cathode of the valve, and any lesser intermediate voltage down to zero is obtainable by making contact with intermediate points on the resistor towards point B.

With a true "self-biased" circuit, such as that shown in Fig. 1 (b), it is no longer possible to obtain negative bias voltages for any other valves from, say, the cathode resistor associated with the output valve.

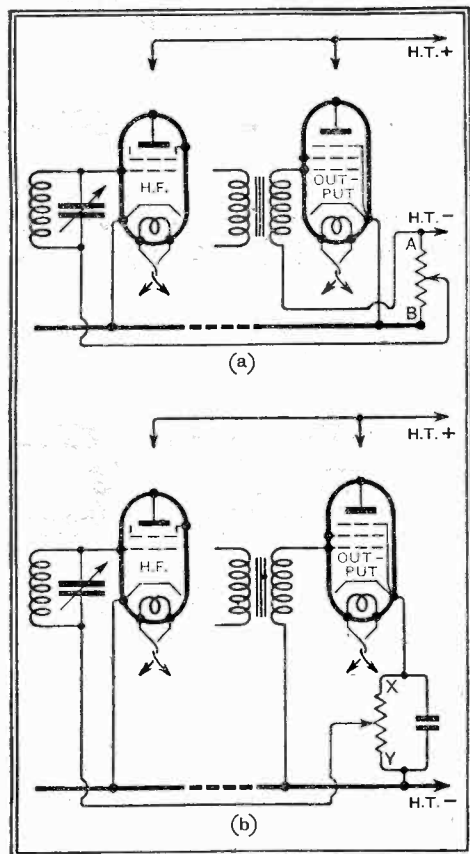


Fig. 1.—Diagram (a) represents a workable method of obtaining negative bias for two valves from a single resistor. The second circuit gives positive bias for the H.F. valve, and is incorrect.

Referring to diagram (b), it should be realised that point X on the bias resistor will be positive with respect to the earth line. At whatever position on this bias resistor we may make contact, it is impossible to obtain a negative voltage for application to earlier valves; even with the slider at Y, the H.F. valve will be operating

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.

with a zero grid, and not with negative bias as is required. The second diagram represents the incorrect arrangement (so far as the H.F. valve is concerned) used by the reader whose letter prompts this paragraph.

## Inter-connected L.T. Windings

A CORRESPONDENT asks whether it would be advisable to connect in parallel two of the 4-volt low-tension secondaries of his power transformer. It is desired to feed the heater elements of five indirectly heated valves, taking one amp. each; the secondaries were designed to give 3 amps. each.

It is hardly safe to recommend this course. The usual transformer bears no indication of the "sense" of the windings, and if two of the L.T. secondaries were interconnected in the manner proposed by our correspondent, but in the wrong sense, it is possible that the transformer would be burnt out, or at least seriously damaged.

In any case, we can see little advantage in running any risk of trouble. Surely, there is no objection to feeding three of the valves from one secondary, and the remaining two from the other?

## Q.P.P. with Triodes

QUIESCENT push-pull amplification with three-electrode output valves (as discussed at length in *The Wireless World* of February 24th) is perhaps not so popular as it deserves to be. A correspondent who has been using the system for many months says that results were excellent until a slight but appreciable deterioration of quality set in a few weeks ago. Subsequent tests with

## The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

a milliammeter show that the individual anode currents of the output valves now differ considerably, although when the set was new they were sensibly the same. Our correspondent goes on to ask whether there is not some method of equalising the characteristics of the valves; it does not seem possible to match them by applying different values of bias, and, of course, the expedient of matching anode currents by adjustment of auxiliary grid voltage (as applied to pentodes) is impossible.

The circuit diagram submitted by our querist shows that he is using an ordinary push-pull transformer; with a special transformer having a "split" secondary with two windings, it would be possible to adjust the bias of each valve independently.

As it is, we can only suggest the use of

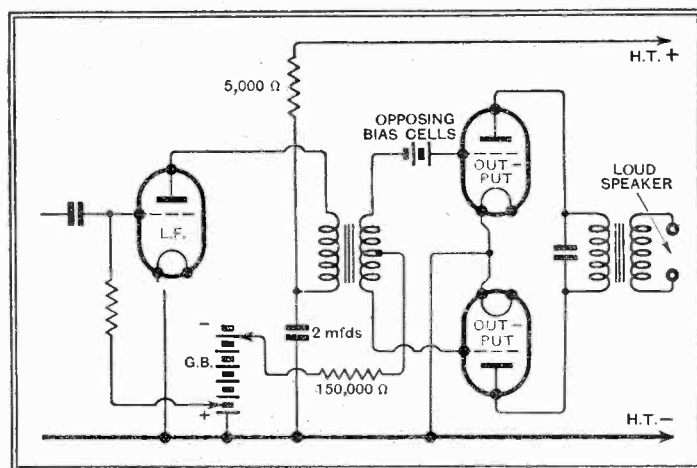


Fig. 2.—Applicable to all push-pull systems: an arrangement whereby the bias of each valve may be adjusted separately.

one or two extra bias cells connected directly to the grid of one of the valves. Although it is unusual to insert the bias battery at the high-potential end of the circuit, there is actually no objection to doing this if very small cells, carefully insulated and preferably suspended in the wiring, are employed. It is often convenient to connect the extra "balancing" cell or cells so that the voltage applied to the grid is in opposition to that of the main source of bias; this method of connection, shown in Fig. 2, would, of course, be applied to the valve which is found to consume the lower value of anode current when both are working with the same bias.

## Aerial Circuit Trimming

A READER who proposes to use a commercial receiver with an exceptionally large aerial asks whether it is probable that this course will necessitate a retrimming of the aerial circuit. He goes on to enquire whether this operation could be satisfactorily carried out by means of an external semi-variable condenser connected in series with the aerial.

This is quite a practical course of procedure, but it will be effective only if, with the particular aerial in use, the input tuned circuit of the receiver suffers from an excess of capacity. In the circumstances described, this condition is likely to obtain, and so the series trimmer should be quite effective, and there will be no need to have access to the built-in trimmer, which is presumably hard to get at.

# The Wireless World

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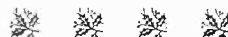
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*As many of the circuits and apparatus described in these  
pages are covered by patents, readers are advised, before  
making use of them, to satisfy themselves that they would  
not be infringing patents.*

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## A Wireless Christmas

*Help to Bring Broadcasting into Every Home*

**F**IRST let us take this opportunity to convey to our readers in all parts of the world our sincere wishes for Christmas and the New Year. To readers in this country it may seem early to talk of Christmas, but it must be remembered that many of our readers in distant parts of the world have to wait some weeks for their copies; some, in fact, will not even receive our greetings until the New Year.

Another reason why we should talk of Christmas in advance is that we like to remind our readers that wireless provides the ideal Christmas gift; not only does broadcasting to-day still remain unquestionably the cheapest possible form of entertainment, but if we give a friend a wireless set or accessory, we do so with the satisfaction of knowing that it is a gift which can be counted upon to give long service and be a constant source of pleasure. A wireless gift carries with it the assurance that it will provide entertainment far into the future, and since almost everyone in this country is interested in wireless in some direction, it would be hard to find a gift of more universal appeal.

### *An Unlimited Choice*

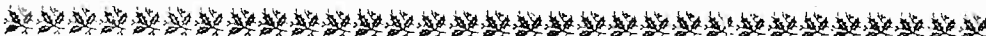
In the matter of gifts there is an enormous variety of wireless articles, from sets down to replacement valves or other accessories, so that the choice is wide enough to come within the pockets of everyone. In the case, too, of a present to a family, wireless

provides the ideal gift because it can be enjoyed by all members of the family and a more ambitious gift can be indulged in instead of dividing the sum to be expended amongst a number of individual smaller presents.

As each Christmas time comes round broadcasting is used more and more to bring the atmosphere of Christmas into the home. The B.B.C. is already planning special broadcasts on more ambitious lines than ever, whilst all over the Continent Christmas will be celebrated by means of broadcasting, so that those of us who listen-in will have the opportunity to tune in to local atmosphere more than at any other time.

### *Empire Broadcasting*

Empire Broadcasting will, we hope, this year serve more than ever its purpose of linking together those who are celebrating Christmas at home with those in the Dominions and the Colonies. It will be remembered that the Empire Broadcasting station was inaugurated about this time last year, and we feel that we have a special interest ourselves in the progress of this service. It is now many years since we first put forward the proposal that an Empire Broadcasting service should be established, and we look forward to important developments in the future, although, of necessity, progress up till now has been slow. It is, however, on occasions such as Christmas that the true value of a station which links all parts of the Empire is brought home to us all most forcibly.

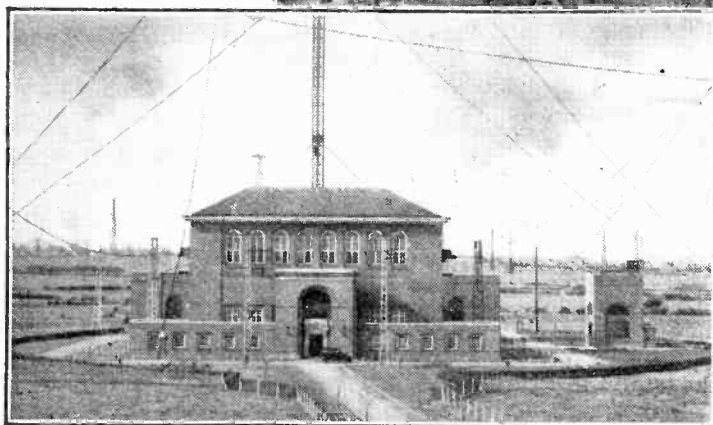
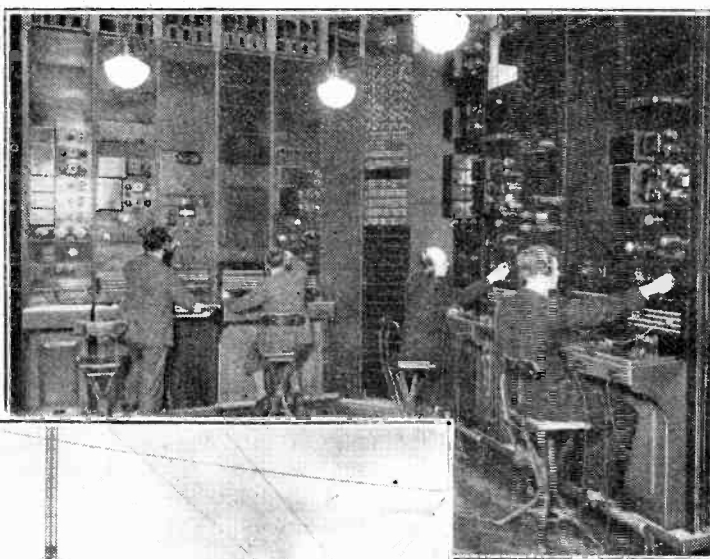


# The Christmas Spirit Embraces The World

## How the Earth will be Girdled

**A** FEW years ago the home without wireless was not the anomaly that it will be next Christmas Day, when the whole of the Empire will be linked up by an invisible network of wires and wireless. No one need miss the opportunity of joining in; indeed, to be deaf to such a world-stirring event—and the adjective is justified—will constitute something of a reproach. The event will take on an even greater significance this year because practically all English-speaking peoples will be included, the broadcasting organisations of the United States having decided to join in. Nor will the festival be confined to Christmas Day, for the broadcasting of the bells from the Church of the Nativity, Bethlehem, on December 24th, is also an event in world history, and must be

The control room at Faraday Building, London, which will form the hub of the world broadcast. The wireless signals are handled at the desk on the left.



A general view of the Post Office beam transmission station at Rugby, which will convey the greetings to Montreal, New York, Sydney, Cape Town, and Bombay.

Sandringham House, from which His Majesty the King will speak to his Empire on Christmas Day.



the interval, however, thanks to the active co-operation of the Colonial Office and the High Commissioner for Palestine, arrangements have been made for the relay from the Holy Land at 8 p.m. (G.M.T.) on Christmas Eve. Fortunately, it will not be in the nature of a technical experiment, for the recent relay of the opening of the

the chimes will be relayed by overhead line via the repeater station at Ismailia to Cairo, which is connected by a short line to the Post Office beam station at Abu Zabal, there to be transmitted and picked up by the Post Office beam receiving station at Baldock. This station is connected direct to the Faraday Building, Queen Victoria Street, London. This point will, indeed, be the "nerve centre" for nearly all the exchanges of wireless messages at Christmas. It will pass the signals to the beam transmitters at Rugby and also by special line to the control room at Broadcasting House, whence the messages will be distributed to all the B.B.C. stations and also to the Empire broadcasting station at Daventry for retransmission by short waves all over the world. It will be possible for a man in Bethlehem to have the uncanny experience of hearing the actual bells while at the same time picking up the sounds from Daventry.

### The Three Phases

The great Christmas Day programme really falls into three divisions. First, Britain will speak to the Empire, then the Empire will reply, and, finally, as a fitting climax, the Empire, and, indeed, the world, will hear the personal message of His Majesty the King, delivered from his home at Sandringham.

At 2 p.m. (G.M.T.), when Christmas Day has already become but a memory to Australia, there will begin a series of sound pictures broadcast by the B.B.C. These will go out to the world *via* the short-wave station at Daventry on 25.28 metres (G.S.E.) and 16.86 metres (G.S.G.), and also over the Post Office telephone routes to the Dominions and Colonies, giving the world an idea of how Christmas is being spent in the towns and villages of the United Kingdom. Street noises, the clock chimes, and even, perhaps, the outdoor hush which is always noticeable on

included in any radio record of Christmas, 1933.

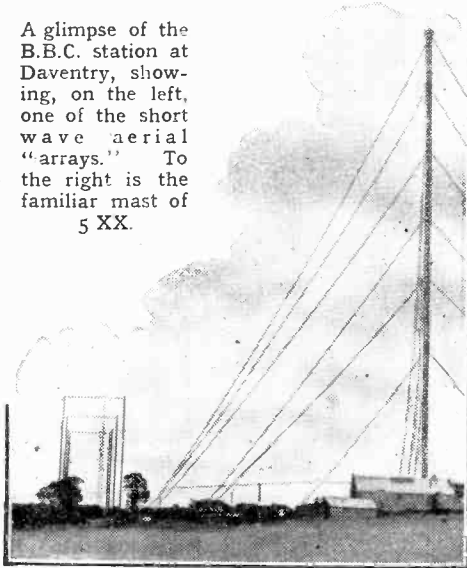
The suggestion for such a broadcast came from the National Broadcasting Company of America last year, but, owing to various difficulties, it was not then possible to put the idea into practice. In

new harbour at Haifa proved that the land-line arrangements between Palestine and the Post Office beam transmitter at Cairo are more than adequate. The sound of the bells will be picked up by a microphone installed at the traditional site of the birthplace of Christ, and from thence

**The Christmas Spirit Embraces the World—**  
 Christmas Day during the consumption of turkey and plum pudding indoors, will form a vivid tableau of almost poignant interest, one imagines, to Colonials and other exiles who are spending their Yuletide sweltering under palm trees or driving away mosquitoes in African swamps.

At 2.45 p.m. the Empire will exchange Yuletide greetings. Not only will the messages come to Britain; they will be distributed by beam and short-wave wireless

A glimpse of the B.B.C. station at Daventry, showing, on the left, one of the short wave aerial "arrays." To the right is the familiar mast of 5 XX.



from one Dominion to another, so that South Africa will hear Canada's greeting just as clearly as we shall hear it in London or Edinburgh. First will come a message from the Irish Free State, relayed from Dublin to Belfast and thence by the special

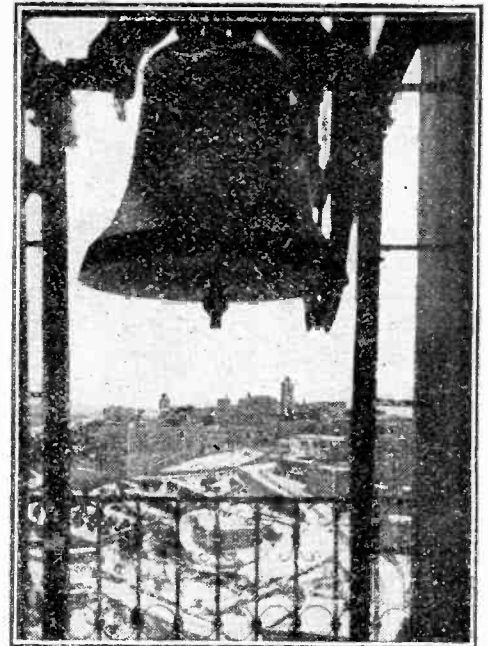
B.B.C. line to Manchester. Then the Bermuda Isles will greet the world *via* New York, and the transatlantic beam system. Canada's message will come from Ottawa and through the beam station at Montreal, while New Zealand and Australia will transmit their greetings *via* the beam station at Sydney. India's message will be transmitted from Bombay. South Africa will speak from the transmitter at Cape Town.

After 3 o'clock the Empire will wait expectantly for the message of His Majesty the King, who, speaking from his study desk, will have the largest audience ever within the call of one voice.

**The Task of the Post Office**

Included in the great circle of listeners will be millions of citizens of the United States. The King's message, picked up by the transatlantic telephony station at Houlton (Maine), will pass thence, after amplification, to the New York radio terminal switchboard, there to be relayed to the control rooms of the American National Broadcasting Company and the Columbia Broadcasting System. The two great networks controlled by these organisations include at least several hundred stations ranging in power from a humble 500 watts to 50 kW.

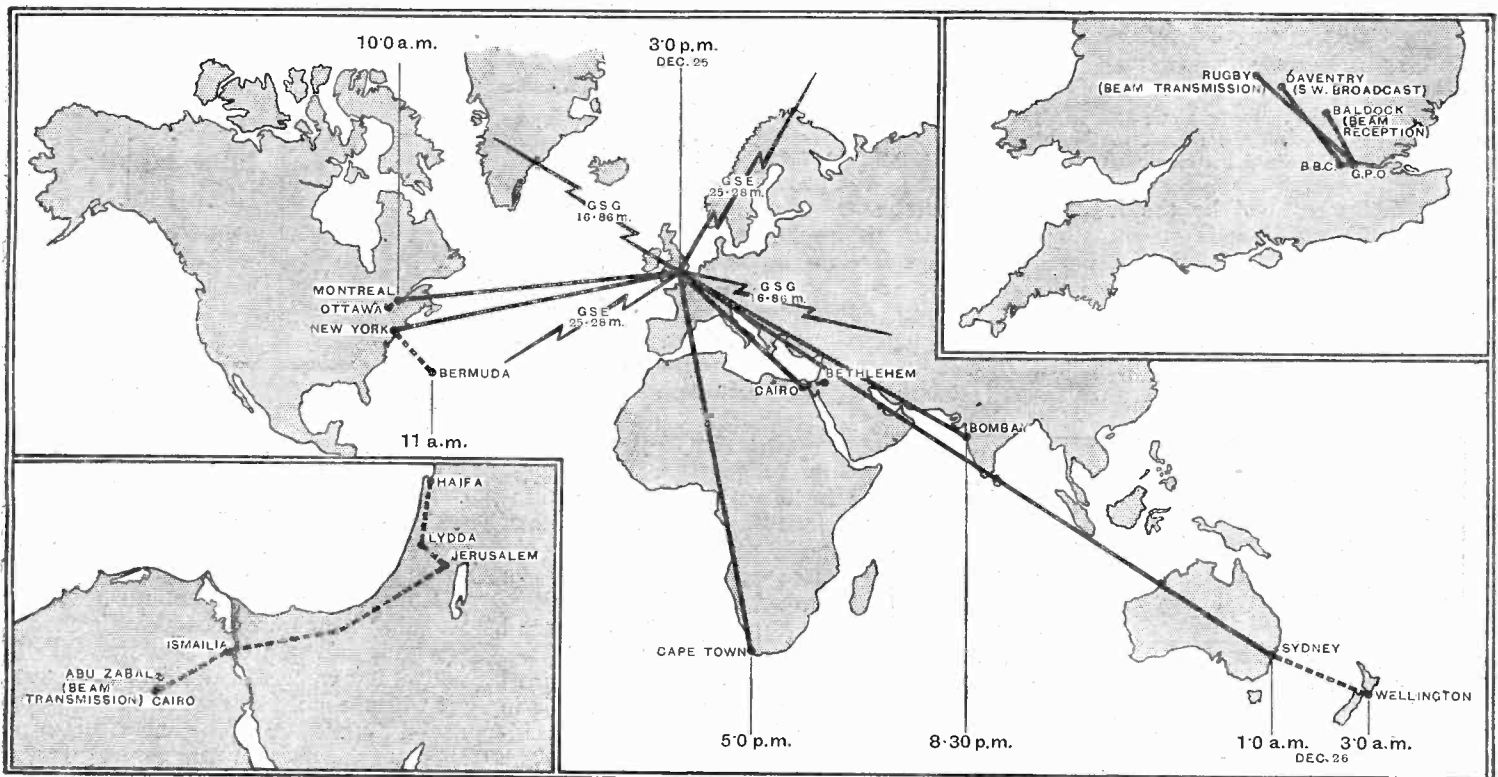
His Majesty's speech will also be recorded by the Blattnerphone system, so that listeners in the farthest-flung portions of the Empire will be able to participate even after the actual event has passed into history. The retransmission will be made from the other wavelengths at Daventry at the appropriate zone times.



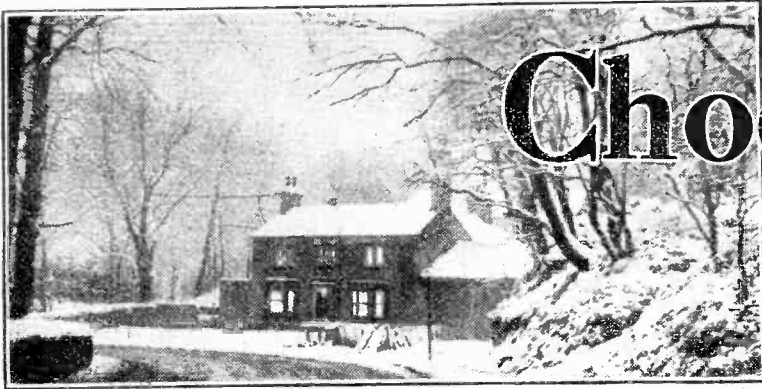
A picturesque view of Bethlehem, seen from the belfry of the Church of the Nativity.

A very great burden of responsibility for the broadcast falls on the shoulders of the Post Office. For an hour and a quarter on Christmas Day, when the majority of listeners are at their ease in their own homes, the control-room officials at Faraday Building will be engaged in a task which admits of no mistakes, no flurry and no haphazard working. To them, to the B.B.C. engineers, and to the host of operators contributing towards the success of this great effort in all parts of the world, we extend the time-honoured greeting: "A Merry Christmas!"

**THE WORLD BROADCAST AT A GLANCE**



This map gives some idea of the magnitude of the world-programme on Christmas Day. The Post Office telephone services will bear a large share of the messages, though the "nooks and crannies" of the Empire will be brought in by means of the B.B.C.'s short-wave transmissions from Daventry. Left inset: The land-line route to Palestine. Above: The main lines in Great Britain.

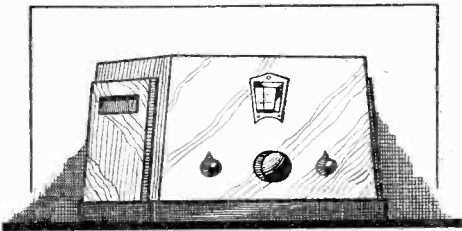


# Choosing a New Set

## Types Suitable for Every Purse and Purpose

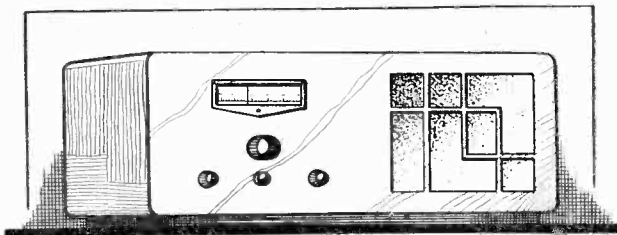
**M**OST of us can recall the time when, having had to suffer in silence the enfeebled noises emanating from the antiquated receiving set of some deserving though less fortunate friend or relative, we have experienced the impulse to make them a present of a set which will do real justice to the quality of the B.B.C. transmissions. No season of the year is more propitious than the present for giving effect to such a resolve, and the range of choice is now so wide that there should be no difficulty in finding a suitable instrument at the price one is prepared to pay.

In the majority of cases a simple two- or three-valve set capable of receiving the local and national programmes is all that is required, and in the interest of future maintenance costs it goes without saying



The two- or three-valve detector-L.F. set is an inexpensive medium for the reception of the local broadcast services.

that a mains set will be the inevitable choice if the recipient is on the supply mains. On the other hand, if a battery set is indicated there should be no hesitation in paying the little extra that will buy a set with one of the modern economical output stages, such as Class "B," for by so doing the gift will carry with it a



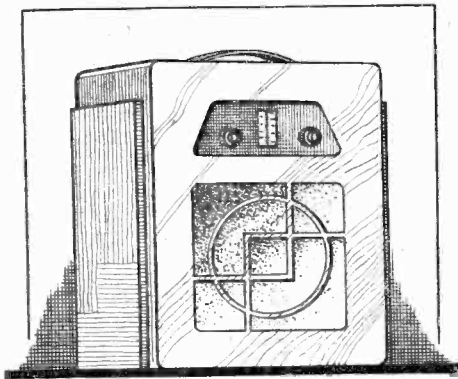
For good "all-round" performance under modern reception conditions the four-valve superheterodyne is unquestionably the most popular type.

saving which may well amount to £1 per annum in perpetuity.

For use in urban areas a detector-L.F.

set will almost always suffice, but if there is a possibility that an adequate aerial may not be available, or if the set is for use in a remote country district, a three-valve set with an H.F. stage will provide the extra range required.

Though sets of the last-mentioned type



Where little is known of the circumstances in which a set is to be used, the modern battery superheterodyne portable can be relied upon to give a good account of itself.

will suffice and can be bought very cheaply in these days, there is some justification for the view that, as we are not likely to be giving a wireless set away every day, it might as well be a good one with a performance somewhat in advance of the owner's present requirements. In any case, if there is any question of serious foreign station listening it would be as well to go straight to the four-valve superheterodyne class. There can be no doubt that under modern receiving conditions

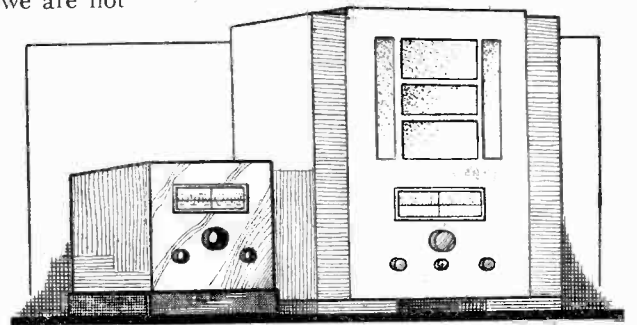
a set of this calibre is necessary in order to attain the requisite degree of selectivity. In this category we would include "straight H.F." sets of modern design, which are often capable of giving an equivalent performance without the drawback of second channel interference.

Where little is known of the circumstances under which a set is to be used, one cannot go far wrong in deciding on a modern battery portable. The set will, of course, be independent of aerials and supply mains, and as there are now superheterodyne models with auto-

*M*ANY Christmas gifts are of transitory interest and value, but a wireless receiving set will be remembered and appreciated for many years to come. For this reason it should be chosen with due regard for the requirements—both present and future—of the recipient.

matic volume control there is no reason why the results obtained should be inferior to those given by sets working on an outside aerial. Of course, if it is known that facilities exist for the erection of an aerial and there is some doubt as to the nature of the mains supply, or if there is a possibility that the current may be changed shortly from D.C. to A.C., the obvious choice will be a set incorporating universal indirectly heated valves.

If we are feeling in a particularly expansive mood a radio-gramophone might be considered, and in this connection the latest battery models should not be overlooked. These instruments, which can be bought for a little over £20, now give a



A short-wave adaptor opens up a fascinating field for those already in possession of a broadcast receiver.

sound output comparable with their mains-driven cousins and, thanks to the new output valves, are surprisingly economical in H.T. consumption.

It may well happen that our friends are already fortunate in possessing a modern receiving set. In this case the gift of a midget receiver as an auxiliary to the main set will probably be acceptable. Another useful adjunct would be one of the many short-wave adaptors now on the market. These are really superheterodyne receivers in miniature; for they change the incoming signal to a frequency which can be

**Choosing a New Set—**

amplified by any ordinary broadcast receiver.

In these days most sets are equipped with terminals for the addition of a gramophone pick-up, and a record playing desk or gramophone adaptor will contribute to the entertainment value of the installation. If for any reason the set is unsuitable for gramophone reproduction a separate high-quality amplifier will remedy matters.

Where it is known that the recipient is of a mechanical turn of mind, a kit of parts for the construction of a modern receiver will give additional interest and pride in the final result.

For friends overseas there can be no doubt that one of the many excellent all-

wave receivers now available is the ideal gift. With such a set the listener is less dependent on seasonal changes in reception conditions, and there is generally at least one waveband which will provide news and entertainment from the home country. Great strides have been made in the technical design of these sets, and with stable, calibrated tuning and automatic volume control the results now to be obtained on short waves are far superior to those of a year or two ago.

Incidentally, a new receiving set is not a bad present to give oneself. Like a new hat its tonic effect is not to be underrated, and many recreative hours will pass in learning to use the controls and exploring its capabilities.

## DISTANT RECEPTION NOTES

### Hearing America on the Medium Waves

**A** CORRESPONDENT insists that the station causing interference with Huizen is of Russian and not of Roumanian origin. All I can say is that the Station Director of Huizen himself was quite definite in a letter that the interfering station was a Roumanian. Myself, I think that there are often two interfering stations. Probably one of them is Russian and the other Roumanian.

From WLW I have just heard that the first tests of the new 500-kilowatt transmitter are to begin within the next week or two. Permission to make tests with full power between the hours of 1 a.m. and 6 a.m. Eastern Standard Time has been granted by the Federal Radio Board. The corresponding hours over here are 6 a.m. and 11 a.m. As American stations are coming in very well at about seven o'clock in the morning, this station will be well worth trying for.

The high-frequency units of the plant have already been installed. There are three of them, each with a power rating of 180,000 watts. Every unit contains four giant valves, and by an ingenious arrangement two of these can always be kept in action should trouble necessitate switching off part of the apparatus.

### Good U.S. Stations

Speaking of American reception, stations from across the Atlantic are splendidly heard now on any night when atmospheric conditions are not troublesome. On several recent evenings I have had to be at work rather late, and before going to bed I have made a search over the medium waveband. The stations best received have been WKAQ (St. John, Porto Rico, 241.8 metres), WHAM (Rochester, 260.7 metres), WPG (Atlantic City, 272.6 metres), WTAM (Cleveland, 280.2 metres), WTIC (Hartford, 282.8 metres), WBZ (Springfield, 302.8 metres), KDKA (Pittsburgh, 305.9 metres), WABC (New York, 348.6 metres), WGY (Schenectady, 379.5 metres), WBBM (Chicago, 389.4 metres), WJZ (New York City, 394.5 metres), WSB (Atlanta, 405.2 metres), and WLW (Cincinnati, 428.3 metres).

The optimum wavelength for transatlantic reception seems definitely to have moved a considerable distance upwards. The greatest signal strength is now obtain-

able from stations with wavelengths between 300 and 400 metres. WGY was coming in the other night with all the strength that we used to associate with this station six or seven years ago.

Test transmissions of the 120-kilowatt Budapest transmitter have probably been picked up by a good many readers. By the time that these notes appear in print the official opening will have taken place, and Budapest will probably be one of the easiest of Continental stations to tune in. The new transmitter was working at two o'clock on a recent afternoon, and the pro-

Toulouse, Strasbourg, Milan, the Poste Parisien, Breslau, Hilversum, Heilsberg, Turin, Trieste, Nürnberg and Fécamp are outstanding, whilst Vienna, Florence, Prague, Lyons Doua, Stockholm, Katowice, Hamburg, Göteborg, Bordeaux Lafayette and Frankfurt all give a good account of themselves.

There are many others that can be logged by careful tuning on good nights. Amongst these I would particularly like to mention Grenoble, which often comes in very strongly, Brno, Genoa, Bratislava, Toulouse PTT, Hörby, Gleiwitz, Moravská-Ostrava and Rennes.  
D. EXER.

## CLUB NEWS

### 5-Metre Film Stars

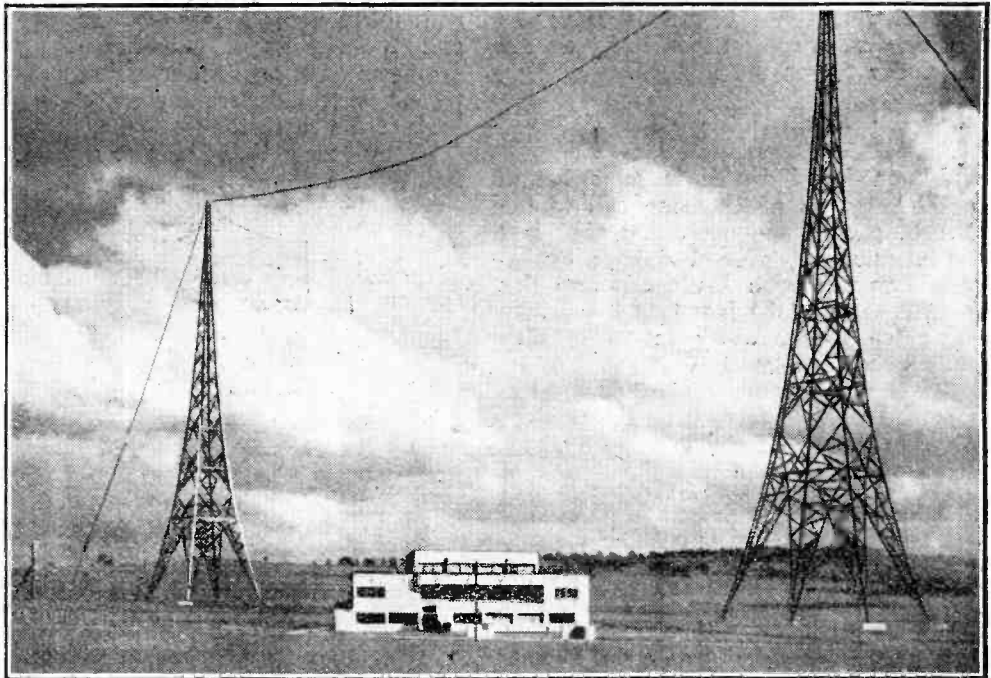
A film showing members of the Kentish Town and District Radio Society on a field day last summer, with 5-metre apparatus, has caused various members to wonder if they ought to give up radio and go to Elstree! Meetings are held at Holmes Road School every Tuesday, and prospective members are welcomed. Hon. Secretary: Mr. E. A. C. Jones (2BOC), 46, Lady Margaret Road, Kentish Town, N.W.5.

### The Osram Catkin

All about the new Osram Catkin valves was told by Mr. F. Inchley, of the General Electric Co., at a recent meeting of the Smethwick Wireless Society. Prospective members should write to the Hon. Secretary, Mr. E. Fisher, M.A., 33, Freeth Street, Oldbury, near Birmingham.

### The Lady Visitor

The first lady visitor was welcomed by the Catford Radio and Television Society at a recent meeting, at which Mr. Humphreys, of



**ON A SWISS PLATEAU.** Although the Berne station, seen above, is only a low-powered relay, it rivals in imposing appearance many of its high-powered cousins. Its situation on high open ground accounts for the considerable signal strength.

gramme came through as strongly as those of Langenberg or Brussels No. 1.

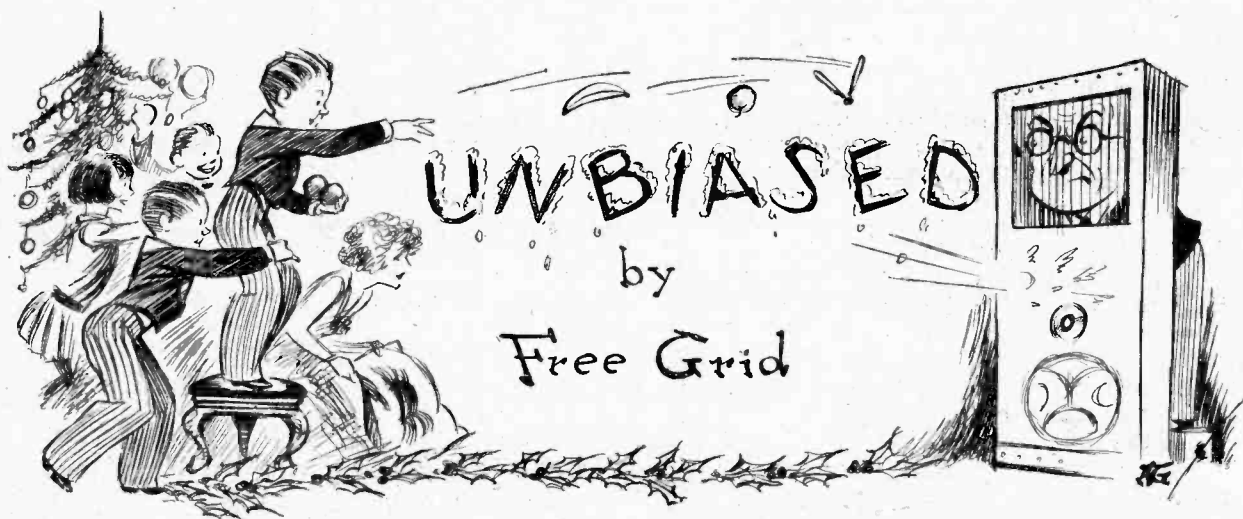
There is some improvement on the long waveband. Huizen has been less frequently interfered with, and good reception can be obtained from Radio-Paris, Zeesen, Warsaw, Luxembourg, Kalundborg and Oslo.

Of medium-wave stations Brussels No. 1, Langenberg, Beromünster, Rome, Leipzig,

the Edison Swan Electric Co., lectured on cathode ray tubes. The lecturer displayed lantern slides and gave a very effective demonstration. Hon. Secretary: Mr. H. W. Floyd, 38, Como Road, Forest Hill, S.E.23.

### Radio at Oxford

The Oxford University Radio Society has recently been formed, the Hon. Secretary being Mr. G. C. Wood, New College.



## Our Distinguished Contributor in a Well-meant Effort

**T**HE melancholy voices of the waits remind me that I spent last Christmas Day lying in bed, minus two teeth and with a badly contused countenance as the direct result of the black ingratitude of a miserable and bespavined set of children, whom, in a moment of generosity and feeble-mindedness, I had undertaken to entertain with a television demonstration.

The idea was actually suggested to me by a rumour that the B.B.C. were to give a surprise entertainment of this nature on Christmas Eve. The reason why Christmas Eve and not Christmas Day was chosen was, of course, that, last year, the latter day fell on the sabbath.

### My Yuletide Dilemma

I soon found myself in somewhat of a dilemma, as a telephone call to the B.B.C. elicited the news that they had no intention whatever of giving a Christmas Eve television broadcast—and this notwithstanding the fact that I carefully explained the difficulty in which they thus placed me.

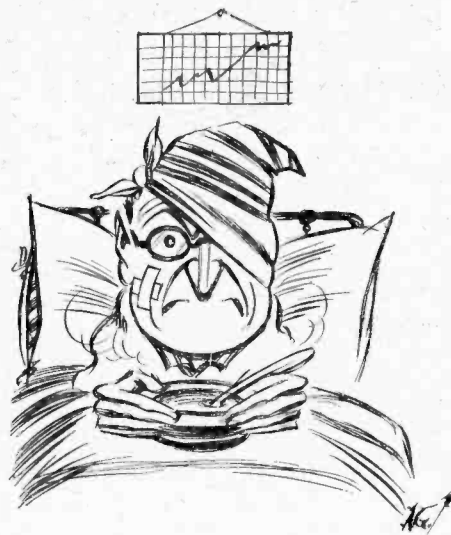
Excitement concerning the demonstration had risen to fever heat amongst the juvenile fauna of the village, so that, instead of telling them that the show was off, as I ought to have done, I allowed myself, in a weak moment, to be led astray by an article written by a fool of a woman in a well-known periodical on the serious risks of dangerous complexes being set up in the *alter ego* of children who were subjected to severe and sudden disappointment.

I resolved, therefore, to keep them in ignorance concerning the breaking of faith on the part of the B.B.C. and give the show myself. Needless to say, I had no intention of giving an actual television show, either by wire or by wireless, as, to begin with, I had no transmitting gear. I determined to solve the problem in a far more simple and satisfactory manner by constructing a large cabinet capable of housing myself, a good receiver, a turntable, pick-up, and a microphone.

My first task was, of course, to find out a satisfactory way of explaining my absence from the juvenile audience, and I hit upon the idea of stating that I had been invited to Broadcasting House to organise the show.

My next task was to construct the cabinet, and after a certain amount of experimental work behind the locked doors of my laboratory I decided to employ a coffin-shaped crate, stood on end, with the television screen at the top and the loud-speaker grille at the bottom. The screen was constructed of ground glass with thirty vertical lines scratched on it, and I fixed up a patent epidiascope arrangement of my own invention for projecting on to the glass any objects at the back of the cabinet.

In my young days I was no mean performer as a Punch and Judy showman,



No fruit, by request.

and, indeed, was much in demand in the mess of my old regiment on guest night. This stood me in good stead, for not only was I able to disguise my voice to represent various artistes, but also to manipulate a pair of old gardening gloves behind the ground glass in order to give visual representation of the artistes.

At length the great day arrived, and I soon got into my stride and held my audience spellbound. I fancy, however, that in my zeal I rather overdid matters, for I noticed that after an hour or two the children began to get restive, and one rude little girl sitting in front flicked an orange pip on to the screen, and unfortunately this sport was quickly taken up by the others.

### The Unhappy Ending

Even then all might have ended happily, but in my enthusiasm I determined that for my grand finale I would put on a real C. B. Cochran turn in the form of the divine Tetrassini singing "Old Man River." As ill-luck would have it, however, my voice side-slipped badly in attempting to hold a high E.

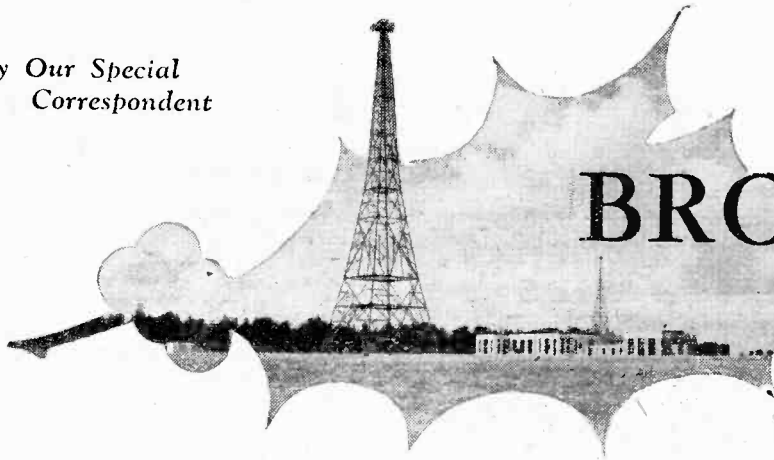
This seemed to be the signal for causing the under-current of revolt which had been seething among my audience to burst into open conflagration, and with one accord a terrific yell of execration burst forth from them, and a volley of nutcrackers crashed through the glass panel just as I had pushed my face close to it. Naturally, I took a hasty backward step, with the unfortunate result that the whole bag of tricks toppled over, leaving me in a very undignified position, from which I was unceremoniously pulled by my would-be lynchers. So far from being sobered by the sight of blood, they burst into thunderous applause, due, as I learnt afterwards, to the fact that some of the younger ones thought that it was all part of the entertainment.

It is necessary at this stage to draw a merciful veil over the remainder of the day's proceedings, and I can only excuse the drastically sudden lapse on my part from the duties of a host by the fact that, apart from the loss of dignity to which I had been subjected, I was in considerable physical pain.

In the meanwhile I have an excellent but slightly damaged Television cabinet for sale, suitable for use as a coffin or for any other purpose.



By Our Special  
Correspondent



# BROADCAST

# BREVITIES

## Don't be "Cut Off" at Christmas

IN "Ye Old Yuletide" days our sympathies were usually directed towards the poor and needy gathering winter *phew-ell*, as the carol singers put it, but nowadays, on looking through the B.B.C. programmes for Christmas, I feel that our real heart-pangs should be reserved for the unhappy creatures without wireless sets.

## A Great Day

Scintillating on my study table is a mass of bright programme details which make it embarrassingly difficult to pick and choose.

One thing is obvious. The spirit of Christmas will permeate the whole of the programmes on Christmas Day from the opening at 10 o'clock with a Christmas morning service relayed from Christ Church, Oxford, to the closing strains of the B.B.C. Dance Orchestra, directed by Henry Hall, at midnight.

## First Real Broadcast Panto

The pantomime on Christmas Day and Boxing Day—and here is a bit of news—is to be performed for the first time in the real theatre atmosphere of St. George's Hall.

"Sindbad," to which I referred last week, is in the real pantomime tradition, having been originally produced by Arthur Collins at Drury Lane Theatre in 1906.

## Audience of Little Londoners?

There is only one snag in the arrangements at the moment; who will form the audience? It has been suggested that the B.B.C. might fill those 450 empty plush seats with the Little Londoners who are attending the annual banquet on December 22nd organised by the trustees of the Treloar Crippled Children's Christmas Hamper Fund.

That they would make a noise, no one could doubt, but having stood with Paul Askew in his control box last week I can boldly asseverate that practically all auditorium noises can be excluded from the mike.

## Gilbert and Sullivan

On another page are details of the great exchange of Christmas greetings between British citizens and friends of the Empire, so I will not duplicate what has already been said.

Following the pantomime on Christmas Day, Act II of "The Mikado," by Gilbert and Sullivan, will be given by the principals and chorus of the D'Oyly Carte Opera Company, who will go to a studio at Broadcasting House for the performance.

The B.B.C. Orchestra (Section E) will be conducted by Isadore Godfrey.

## Mr. Lloyd George in the Studio

It has now become an established institution that the British Wireless for the Blind Fund should be the grounds for a microphone appeal on Christmas night. This year the appeal will be made by Mr. Lloyd George.

## A Christmas Mystery

In a divertissement programme, produced by Martyn C. Webster, and relayed from Midland Regional to the National transmitters, Mr. J. C. Cannell will tell, under



THE MICROPHONE MANNER. A "still" from the new British Lion film, "On the Air," showing Davy Burnaby (right) and Reginald Purdell in a duologue at the microphone.

the title of "The Mystery of the Christmas Bells," the true story of how the famous Houdini baffled the Mayor and magistrates of a Midland town one Christmas Day.

## Organ Recitals: A Grumble

TO readers who have asked me whether organ recitals at Broadcasting House are rehearsed by both the organist and the balance and control department, I must answer yes and no.

It seems that the balance and control official is present while the organist is practising, *if opportunity permits*, but I fear that, more often than not, the man at control comes to the broadcast with a very uncertain knowledge of what the organist intends to do. Otherwise we should not be

aware of those frantic rotations of the gain control knob just when the player follows a soft passage with a double forte on the diapasons. I have often wondered whether, for organ broadcasts, at least, some form of automatic volume control could be devised, giving a proportionate increase or decrease to cope with the volume range of the microphone.

Inventors, forward!

## When the Pedals Boom

By the way, I notice that practice on the organ at "B.H." is nearly always done during the luncheon hour when the staff are out. Nor am I surprised. The reverberation set up by the pedal notes is noticeable in many of the offices. Paste pots, ink-wells, and scissors rattle helter-skelter across the desks—so I am told. B flat on the pedals rings the telephones—so I am also told.

## Good News of Radio Drama

I DID suspect—and why conceal the fact?—that all these revivals of past radio plays was a sign that invention was running thin. It is all the more refreshing, therefore, to learn that we are about to hear a number of entirely new radio plays, beginning on December 30th with "Meet Mrs. Beeton," in which L. du Garde Peach will deal with the lady of cookery-book fame.

In March a new play about Napoleon and St. Helena—"Quarrel Island"—by Norman Edwardes, will be broadcast, followed by a new actuality play called "The Egypt's Gold," by Terence Horsley—a story of salvage.

## Specially Commissioned Plays

In the second quarter of 1934 we are to be feasted with a series of twelve absolutely new and specially commissioned microphone plays which will be in the nature of a counterpoise to the twelve revivals ending with "The Three Musketeers."

## Great Names on the Air

BERNARD SHAW, H. G. Wells, Winston Churchill and Lloyd George are among the names of those taking part in a new series of broadcast talks from January to March, entitled "Whither Britain?" Altogether, I hear, there will be twelve speakers, who will outline their individual solutions for the problems of to-day and to-morrow.

## Youth Represented

Other names in the list are Ernest Bevin, Israel Sieff, Lady Rhondda and Quintin Hogg. I am glad to see the last name as representing the younger generation, who, after all, are most affected by the question.

# Practical HINTS and TIPS

**ALTHOUGH** the original A.C. Monodial has been superseded by a later version, even now it represents a highly advanced technique, and is still used by a large number of enthusiastic amateurs in its original form. Tone correction is embodied in the design, and the frequency characteristics of the receiver are such that any modification is seldom desirable.

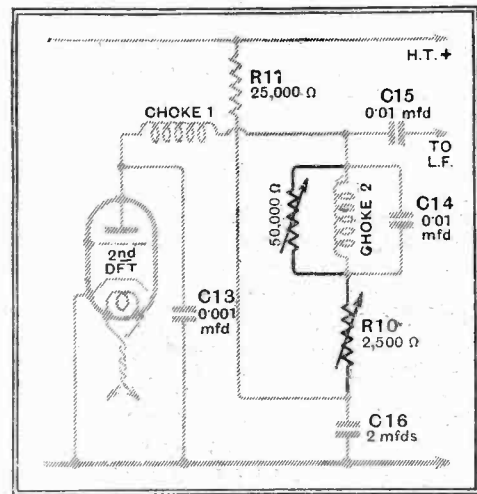


Fig. 1.—Applying variable tone control to the original "Monodial."

But, in order to satisfy the needs and tests of certain listeners, and to accommodate the characteristics of different loud speakers, it would sometimes be an advantage to make provision for manual control of tone. In the Monodial it is particularly easy to do this by replacing the fixed 1,000-ohm detector anode resistor (R10) by a variable resistance of about 2,500 ohms. Increasing the value of this resistance will tend to increase the proportional amplification of the lower register, and vice versa. As with almost all other systems of control, volume will be affected at the same time, and so compensating adjustments of sensitivity will usually be required when drastic tone correction is applied.

Another, and from some points of view even a better, tone control is obtained by shunting the tuned L.F. corrector circuit with a variable resistance of about 50,000 ohms. This method provides for attenuating high notes, and consequently for reducing heterodyne interference, but does not provide for tone control in the reverse direction. Both methods, shown in Fig. 1, may be used in combination.

## SIMPLIFIED AIDS TO BETTER RECEPTION

**UNDER** ideal conditions, the audio-frequency output of a pair of push-pull valves is restricted to the transformer primary or output choke; a negligible proportion of this energy will flow through the H.T. supply circuits, and in consequence there should be little, if any, tendency towards undesirable interaction with earlier amplifying stages.

**A Self-decoupling Circuit**  
One of the great advantages of a push-pull set is that, for this reason, it is not prone to motor-boating, and, if this effect should ever become evident, we have a fairly clear indication that the circuit is in some way out of balance. The most probable cause for this will be that one of the output valves is defective.

**IT** was recently shown that the ordinary insulation test, as applied to a fixed condenser, does not give positive proof that everything is in order; for instance, a complete internal disconnection between foils and external terminals would not be revealed by such a test.

**Neon Lamp Condenser Tests**  
It is worth while pointing out that the neon test lamp—a useful device that seems to be rather neglected by wireless people—is particularly

handy for making rough-and-ready tests of fixed condensers. The procedure is to charge the condenser by connecting it across a source of high D.C. voltage, and then join it across the lamp. If everything is in order, a momentary flicker, of an intensity depending on the capacity of the condenser, its insulation resistance, and the voltage of the charging source, will be produced in the lamp. High-tension voltage for charging purposes is usually obtainable from the receiver anode supply system, and, with a voltage of 250 or so, a condenser of as small a capacity as about 0.002 mfd. may be tested. Still smaller condensers may be dealt with when higher voltages are obtainable.

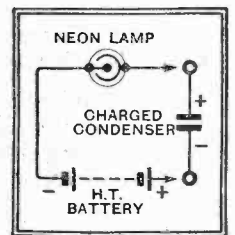
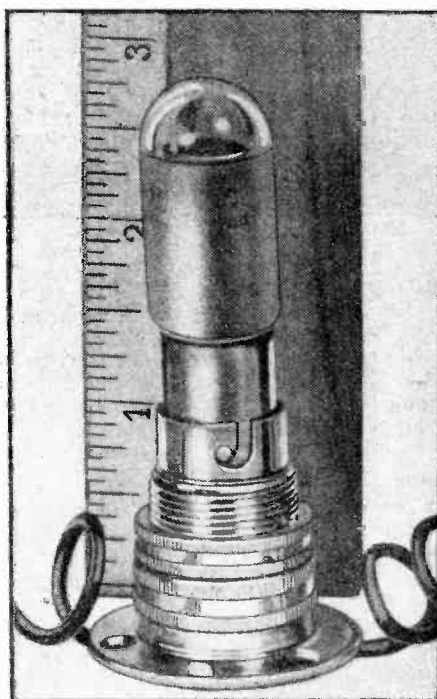


Fig. 2.—Testing low-capacity condensers with a neon lamp.

Even when a relatively low H.T. testing voltage is available, the neon lamp still has its uses. By charging the condenser, reversing it for correct polarity, and then connecting it in series with the source of voltage and the lamp, as shown in Fig. 2, a quick test may be made of the smallest fixed condensers in ordinary use. The principle is that the voltage of the supply must be insufficient to cause the lamp to glow until the additional voltage accumulated in the condenser is added in series. A condenser that is defective either in insulation or with regard to internal connections cannot accumulate a charge, or at any rate cannot hold it.



Suitable for testing purposes: a small neon lamp (Philips) which "strikes" at slightly over 100 volts.

**AS** an alternative to the insertion of a milliammeter in series with the detector anode circuit, it may be remembered that similar results can often be obtained by shunting a voltmeter across the bias resistor of an indirectly heated detector valve. Naturally, this bias resistor will only be included in the cathode circuit when provision is made for using the valve as a gramophone amplifier.

**Signal Strength Indicator**  
The advantage of this plan is that it may be put into execution without the need for breaking any existing connections. The voltmeter must be sufficiently sensitive to show clearly changes of a volt or two, and its addition in the manner suggested will not prejudice the operation of the set as a radio receiver.



# Wireless at Christmas Time

## What To Do and What To Give

**T**HE present year has seen the introduction of many important developments which, apart altogether from their technical merits, have the advantage, from our present point of view, that most of them are readily applicable to existing sets.

None of these innovations has exerted a greater influence on receiver design than the so-called battery economy circuits, which, although they differ in method, all have the same object—to prevent wastage of anode current by controlling its flow in sympathy with the modulation of the transmitter.

Class "B" amplification is now the most popular system and is easily added to any battery set. Almost invariably the present output valve will be converted into the driver, and the additional components required will be a Class "B" valve and holder, a driver transformer, and a special output transformer. In addition, it will often be desirable to have a new loud speaker—preferably of the permanent-magnet moving-coil type—as well, although a good moving-iron speaker works reasonably satisfactorily.

As to how the actual alterations involved in fitting Class "B" are carried out is largely a matter of taste. The old hand will probably prefer to obtain the components separately and to mount them in the most convenient position. But there are at least two alternatives to this plan; one may obtain a complete unit comprising the necessary components in some form of container suitable for ex-

ternal mounting, or the components may be fitted to a loud speaker, making a complete conversion unit.

Although Class "B" is now so popular, it would be incorrect to say that it is the only battery economy system to be considered. Quiescent push-pull amplification, for which special input and output transformers are generally needed, shows

*CHRISTMAS is not only the customary season for giving presents; it also marks a period of intense activity among radio amateurs. This year most of us may look forward to a four-day holiday, and how could we spend it better than in improving our sets?*

*This article, then, in addition to suggesting gifts for wirelessly minded friends, is intended to serve as a guide to readers in planning their own activities over the holiday season.*

signs of staging a "come-back," and there is also the system in which a metal rectifier controls output valve bias.

Much as we may dislike the idea, it sometimes becomes necessary to reduce the high-note response of our sets in order that heterodyne interference may be avoided. Hitherto this has too often been done in the crudest and most brutal way by the use of by-pass condensers, but now scientifically designed filters, which are more effective and introduce much

less dullness into reproduction, are available. They are easily fitted, and the results are more than gratifying.

Until one hears a broadcast receiver operated in ideal local conditions one hardly realises how annoying and distracting is the continual background of interference to which most sets installed in urban areas are subjected. Devices with which the listener himself can mitigate the interference are now available, and so it is hardly worth waiting in the hope that interference will eventually be suppressed at the source.

It may seem inopportune to suggest alterations to the aerial in the depth of winter, but, on second thoughts, outdoor exercise may prove a wholesome corrective to over-indulgence at the Christmas festivities! Be this as it may, it is an undoubted fact that the installation of a screened aerial, if properly carried out, does effect a noticeable improvement in the noise-to-signal ratio in the majority of cases. Briefly, two competing systems are available; one may either use a special low-capacity cable, which does not involve any alteration to the set or any extra appliances; alternatively, the screened down-lead may be ordinary rubber-insulated braided wire, in which case the severe losses which would normally occur must be neutralised by the fitting of proper impedance matching transformers at each end. Each system has its points, but the latter is undoubtedly preferable when a very long screened lead becomes necessary.

**Wireless at Christmas Time—**

No one who suffers from man-made electrical interference should fail to try the effect of connecting suitable filters to his mains supply. Two positions for these filters are available—either at the point where the mains enter the house, or in the feed lead to the set. Of these the first is undoubtedly the most effective.

Filters connected to the point of entry of the mains may be sub-divided into two types—those with chokes and those which consist merely of a pair of condensers. The design of the necessary chokes is somewhat involved, as their D.C. resistance must be sufficiently low to prevent any appreciable loss of voltage, because all the household supply current will pass through them. The simple capacity filter with which we are



Although we say it who shouldn't . . . !  
(The implication is obvious.)

here mainly concerned is, more often than not, quite effective, and may be installed without any risk or trouble, as suitable self-contained units, complete with fuses, are now obtainable commercially.

The second type of filter is directly connected to the set, and is often almost unbelievably effective, in spite of the fact that it can do nothing to prevent re-radiation of interfering high-frequency energy from the household wiring to the aerial. This filter, for which low-resistance chokes (small tuning coils will often serve) must be used, is shown diagrammatically in the accompanying composite sketch, which also illustrates the various other anti-interference devices that have been discussed.

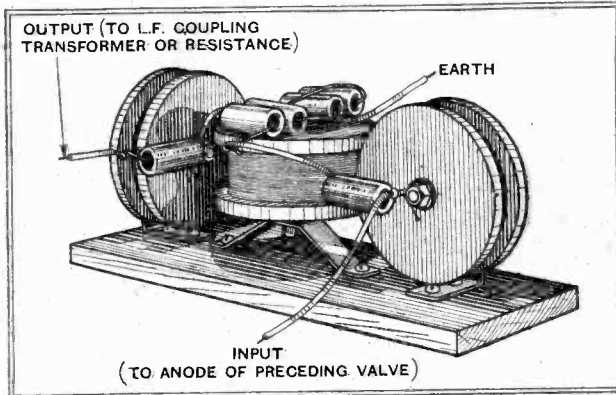
But interference—and especially that of a type which should never occur in well-regulated society—is not a pleasant subject to discuss at Christmas time. Let us turn to something more cheerful and point out the possibilities of improving our sets with the latest iron-cored tuning coils, which, when fitted with care and a little commonsense, add enormously both to sensitivity and selectivity. There is little reason to anticipate that this change will introduce instability, for the reason that

the new coils are generally so arranged that they will be rather more loosely coupled than those which they replace.

If, through inaccessibility or any other cause, it is not desired to replace all the coils in a receiver, it is worth while re-

dynes, in which type of receiver they operate at intermediate frequency. But, nevertheless, the units are extremely valuable, even in a simple H.F.-det.-L.F. set, when it is used in conjunction with a superheterodyne converter or adaptor for the reception of short-wave signals.

A good loud speaker is just such an obviously desirable thing that there is little need to stress its suitability as a present—either for oneself or anybody else. The most important recent advances have been in the direction of combining two moving-coil loud speakers of dissimilar characteristics, or, alternatively, of combining moving-coil and electrostatic instruments. Apart from the question of acoustic characteristics, one

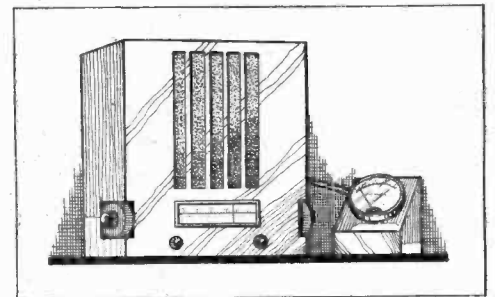


A home-made whistle filter, showing the simplicity of external connections. Ready-made filters of various types are obtainable.

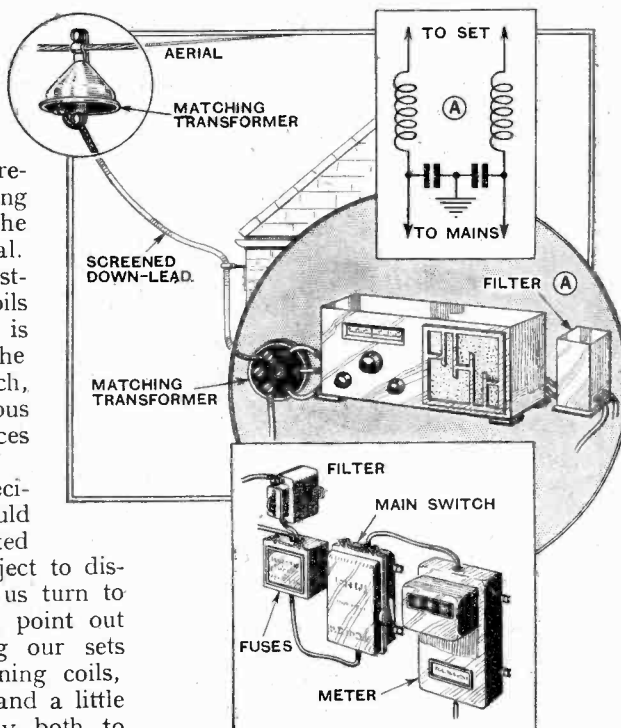
must consider, when choosing a new instrument, the question of energising current for the field winding, and incidentally the resistance of this winding. For battery-driven sets, of course, this question does not arise, so far as moving-

members that certain iron-cored coils include provision for adjusting their inductance, and so they may be mixed with other types without impairing the alignment of a ganged tuning system. Automatic volume control units of compact dimensions and completely self-contained are now available and offer the advantage that they may be fitted to existing sets without any trouble. Applied to short-range receivers, A.V.C. is of questionable advantage, but there can be no doubt that its inclusion in a highly sensitive set doubles the pleasures of distant listening. After giving it a trial, indeed, one wonders how we have ever got along without it. These units work at their best on long wavelengths, and so it follows that they are, strictly speaking, applicable mainly to superhetero-

coil instruments are concerned, for the reason that the self-energised permanent-magnet type is always used. In cases of doubt, the same type is a safe choice for mains sets as well.



A tuning indicator meter may be mounted outside the receiver cabinet.



Points at which anti-interference devices may be installed. A circuit diagram of the receiver filter A is inset.

**Extension Loud Speakers**

Many wireless users, who would appreciate a second loud speaker installed at a point more or less remote from the receiver, have hitherto been deterred from making this addition by reason of the difficulty in obtaining correct matching. But there is no longer any need to hesitate on this score, as the manufacturers have stepped into the breach and have shown much ingenuity in devising means whereby these extension speakers may be connected in a satisfactory way—electrically speaking—to existing sets.

A few hints on connecting extension speakers will be opportune, although, as a matter of fact, many instruments are now supplied with definite instructions. Originally, when a self-contained set was fitted with terminals for a second speaker, they were usually wired in shunt with the primary of the output transformer. Lately there has been a tendency to put the terminals across the secondary, which

**Wireless at Christmas Time—**

means that the speech coil of the remote instrument will be in parallel with that of the built-in speaker, and so a second output transformer will not be needed.

In either case, similar considerations arise with regard to matching. Usually the principle is accepted that the reproduction of the built-in instrument must be affected as little as possible and that a somewhat reduced volume will be tolerated at the remote point. Consequently, this latter speaker generally has rather a

will serve well enough. Except where cost is of vital consideration a moving-coil instrument should be chosen; the resistances of the better-class instruments vary between 200 and 1,000 ohms per volt. Users of mains sets need a milliammeter more than any other instrument, as measurements of anode and screening grid current will give as much information as it is necessary to have about the condition of the valves. An instrument reading 50 milliamps at full scale will be quite suitable for the majority of sets, although an additional lower range is useful.

The more advanced wireless man will appreciate the advantages of one of the modern multi-range measuring devices, which combine in one instrument scales for volts, amperes, milliamperes, and

sometimes ohms as well. Although the so-called "ohm-meter" is rather sneered at by the highbrow technician, it is an extremely useful aid to quick testing, and often provides a clue to the location of a fault which would not be revealed by ordinary continuity indicators.

Some of the best multi-range instruments read A.C. as well as D.C.; provision for checking alternating voltages,

(say, 0-10 milliamps) for connection in the anode circuit of the controlled valve or valves. Space may not always be available on the front panel for mounting this meter, in which case it must be fitted in a small box placed either on top or at the side of the receiver.

Short-wave broadcasting is of ever-increasing importance, and to those who have previously concerned themselves only with the normal wavebands offers a new field of interest. One may either make a complete set, or, what is perhaps more usual nowadays, an adaptor to work with the normal receiver.

Turning to more general topics, is it not a fact that one never seems to have enough fixed condensers and resistances? However well we happen to be supplied with these components, it always seems that any experimental work or the testing of a new circuit is held up by the lack of a condenser or resistor of the desired value. Condensers of between 0.0001 mfd. and 8 mfd., and resistors between 50 ohms and 2 megohms, will never be wasted.

Battery users should see that their source of current supply is capable of meeting the Christmas demands, and now is the time to buy replacements or spares. The same applies to valves.

Mains apparatus in general, including indirectly heated valves, should be highly acceptable to all who are still operating battery sets in spite of the fact that an electrical supply is available. Where a complete conversion is undesirable, an eliminator will save the ever-recurring cost of H.T. battery replacements.

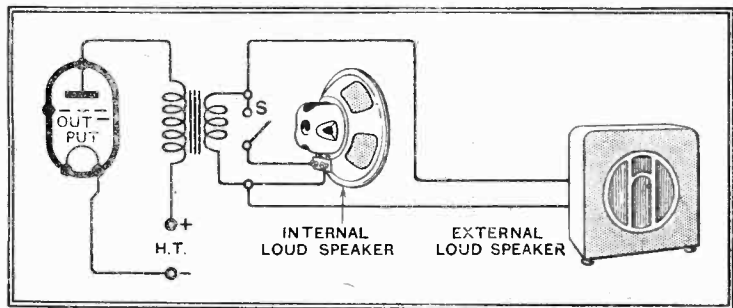
The conversion of existing sets for gramophone reproduction has lately been dealt with at length, and now is the time to put any ideas one has on the subject into practice. The essential gear—motor and turntable, pick-up and volume control potentiometer—may be disposed in numberless ways to suit the users' convenience.

**THE RADIO INDUSTRY**

**A** REASSURING statement in connection with the forthcoming wavelength change-over has just been issued by Ekco. When the Lucerne plan comes into operation, users of existing sets will be supplied with an amended tuning scale at a purely nominal price. Further, owners of Ekco sets in the Bournemouth and Plymouth areas will be glad to know that these receivers will all tune to an even lower wavelength than 203.5 metres.

The latest development of the W.B. Micro-lode loud speaker is in the form of an instrument designed specifically for use as an extension speaker with existing sets, and known as the "Equilode." It includes a special universal matching device suitable for any set; both cabinet and chassis models are available.

Constructional details and wiring plans of the Westinghouse battery superheterodyne receiver have just been published (price one shilling). The new set is similar to the A.C. model, and, of course, employs a Westector as a second detector and source of A.V.C. voltage. Another Westector acts as a battery economy device by automatically regulating the bias of the output valve in sympathy with modulation changes.



Method of connecting an extension low-impedance speaker to the secondary of a built-in output transformer.

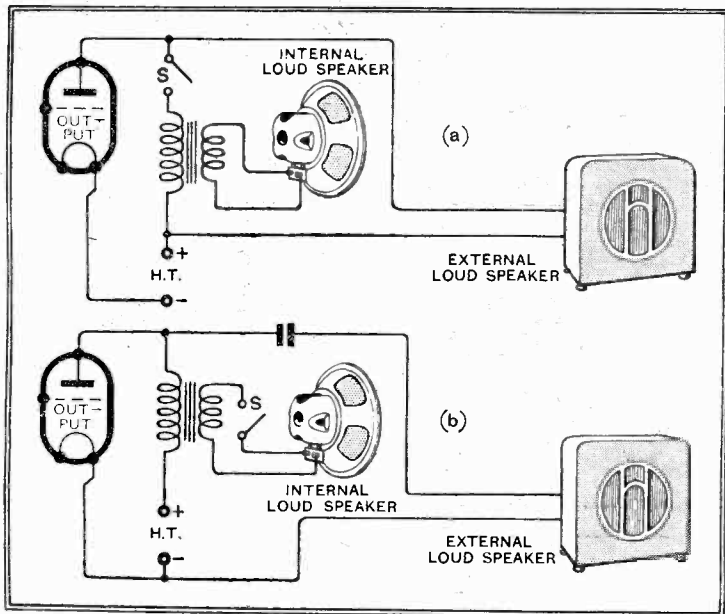
higher impedance and so will take less than its full share of the available energy. Provision for adjustment, within certain limits at any rate, is usually made nowadays, and it is a simple matter to determine by trial and error the best operating conditions for one's own particular circumstances.

It is a source of amazement to some of us that so many wireless users—even those who take an intelligent interest in their sets—manage to get along, apparently quite comfortably, without any measuring instruments whatsoever. To work on a set without the means of finding out whether the appropriate currents and/or voltages exist at vital points is like working blindfold, and, unless one happens to be particularly fortunate, it seems impossible that any wireless amateur, without some form of quantitative indicating device, can ever hope to obtain anything like the performance of which his set should be capable. But already it would appear that a great number of people have learned their lesson, as meters are unquestionably being used in greater numbers. Now is the time for those who are meterless to make good the deficiency.

For battery-operated sets, a reasonably accurate three-range meter combining H.T. and L.T. voltage scales with a milli-ampere scale of from 0-15 or 0-30 mA.

both of the mains and of heater circuits, will be appreciated by the more advanced amateur, who would also find use for one of the modern test sets and for testing gear generally.

Everyone who has fitted, or intends to fit, A.V.C. should provide himself with some form of tuning indicator. Although other devices are available, it is doubtful whether the amateur can do better than obtain a milliammeter of suitable range

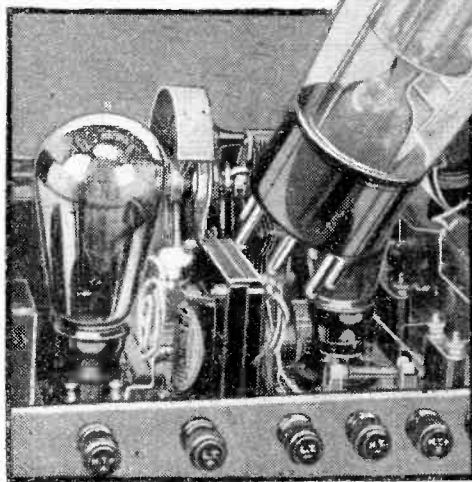


High-impedance extension speakers. In diagram (a) the wiring is "live," but this disadvantage may be avoided by interposing a large condenser as in (b)

# New Valves in Old Sets

Where Substitutions  
are Desirable, Merely  
Permissible, or  
Slightly Risky

**A**LTHOUGH the replacement of an old valve by a new one of improved characteristics will generally be beneficial, instability may sometimes result from the change. This article shows how such troubles may be avoided, and how to ensure that the new valve may be made to operate under best conditions.



**R**EPLACEMENT of valves may be rendered inescapable by sheer decrepitude of the old ones, or may proceed from a desire to obtain some of the benefits of the recent extensive progress in valve design. In any case, it will probably be found that the original types are obsolete and not readily obtainable. So, in all likelihood, the said benefits will be thrust upon one, willy-nilly.

Some considerable time ago it was pointed out that the putting of new wine into old wineskins is liable to be an uneconomical proceeding, in that the wine will be spilled and the skins marred. The same tendency is present when new valves are plugged into old sets. Both valves and set may suffer, or at least give less than their best, because they were not designed to work in harness. A modern high-slope detector valve, for instance, substituted for an old type, might take an altogether excessive current; and, besides being in an unsuitable adjustment for best performance, would give both itself and the battery (if any) a short life.

New valves, then, must be used with circumspection. Many of them—such as heptodes and double-diode combinations—are ruled out altogether, because they are not applicable to old receivers. Here we are to consider valves that can be plugged straight in, with (at the most) only minor

alterations, such as valve holders or operating voltages.

In what ways, then, do the new valves differ from old ones of the same general types? "Catkins," for example, look sensationally different from the glass valves that were previously universal. Actually, they are precisely equivalent to the glass valves bearing the same designations, so far as electrical characteristics are concerned. Their appeal is on the grounds of robustness, consistency, and non-microphony; and these should be given due consideration when the replacement

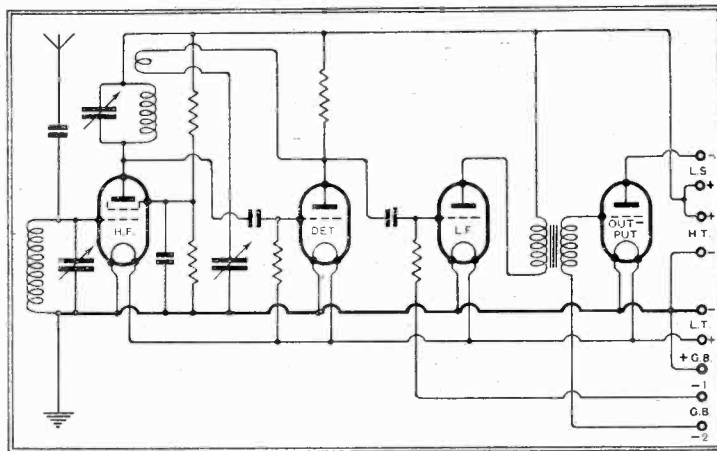


Fig. 1.—Typical circuit arrangement of a receiver designed a few years ago. The effect of substituting new valves is discussed.

of old-type valves becomes necessary.

Whether the external construction is of metal or glass is of less importance than the electrical characteristics. The trend of progress in this respect has been mainly in the direction of increased slope, alias mutual conductance, or  $G$  for short. That means either that the internal resistance (impedance),  $R_a$ , has been reduced, or that the magnification factor,  $\mu$ , has been

increased; or perhaps a bit of both. In any case the general tendency is to give more amplification. Just how much more depends on whether the other components happen to be such as to take advantage of the improved valve efficiency.

But let us get down to something rather more definite. Fig. 1 shows the skeleton circuit of a receiver which, disregarding details such as decoupling, is typical of the practice of a year or two ago. A screen-grid H.F. stage is followed by detector, L.F. stage, and output. Your receiver may not happen to have all these stages, but it certainly has some of them.

Take the H.F. valve first. A typical battery S.G. valve of the period had a  $\mu$  of 200 and a  $R_a$  of 200,000;  $G$  is  $\frac{\mu \times 1,000}{R_a}$ , or 1 milliamp. per volt in this case. A likely figure for the "dynamic" resistance of the tuned circuit is 50,000 ohms. This means that the valve's amplification of 200 is divided between itself and the tuned circuit in the ratio of 200,000 to 50,000. The tuned circuit, therefore, gets only  $\frac{50}{200 + 50}$ , or one-fifth of the whole. The amplification that is actually available for passing on to the detector is thus 40.

## How Amplification is Increased

This little calculation, of course, is just an example of the way all valve amplifiers work. The coupling is there to extract, as it were, as much as possible of the amplification,  $\mu$ , which would otherwise simply be wasted in the resistance of the valve itself.

Now, suppose the new valve has a slope of 2 milliamps per volt. If  $R_a$  is as before, but  $\mu$  doubled, then the stage gain is doubled. If, however,  $\mu$  is as before and  $R_a$  halved—still giving the same slope—the original  $\mu$  is divided in the ratio of 100 to 50, and the amplification actually yielded is  $\frac{200 \times 50}{150}$ , or about 67—a less pronounced increase.

The response to a transmission which is off tune is increased practically 100 per cent. in either case, which means that the response to the wanted station, relative to interference, is unchanged if  $\mu$  is doubled, but actually deteriorates if  $R_a$  is halved. From the point of view both of selectivity

**New Valves in Old Sets —**

and gain it is better to go for a high  $\mu$ , other things being equal.

As a matter of fact, the figures given in the valve catalogues can be varied considerably by altering the operating voltages. Reducing the screen voltage increases  $\mu$  when the negative grid bias is small, and therefore tends to improve selectivity (Fig. 2). Unfortunately, it increases  $R_a$  still more rapidly, so there is a net loss in amplification. Still, it is a good thing to realise that the catalogue characteristics are not governed by the

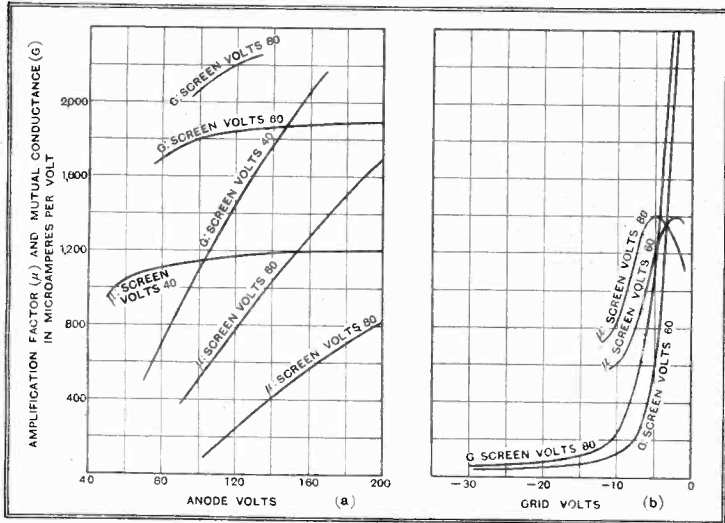


Fig. 2.—Characteristics "to order"; amplification factor and slope are determined by operating conditions.

immutable laws of the Medes and Persians.

You may perhaps find that the increased amplification with the new valve is too much for stability, and the receiver goes off into self-oscillation. The correct thing is to trace the stray coupling that is the cause of the trouble—try turning the tuning coils round or moving them farther away from one another; but if that is too much bother you can at least make use of the more efficient valve to improve the selectivity by reducing screen voltage until stability is achieved all over the tuning scale.

**Rules of Thumb for Bias**

The details of correct biasing are fully supplied with the valve; so there is no need to go into it here, except to remark that failure to alter the bias tapping or cathode resistor *may* cause an excessive current to be drawn. Increased  $\mu$  generally necessitates reduced grid bias; and decreased  $R_a$  increased bias. Sometimes, too, a new valve is found to give much poorer results, particularly if little or no bias is used. This is because grid current starts at a more negative grid voltage and damps the tuned circuit. Obviously, the cure is to increase the negative bias slightly.

It is possible to plug-in a variable-mu valve where a fixed-bias type previously dwelt, for the characteristics with a small fixed bias are much the same. But this is not particularly recommended, because it gives a lower slope for a given consump-

tion of anode current. You may, however, like to consider the conversion of your receiver to variable-mu volume control, which can be done by modifying the voltage-dropping resistors according to the makers' instructions. As a compromise, particularly in battery-driven sets, there is a type between the old fixed-bias valve and the "long-base" variable-mu; the Mullard PM.12M is an example. Instead of needing 20-40 volts maximum grid bias, 5-10 is enough for volume control. Of course, the control is not so perfect, but it is quite good if something is done to prevent the excessive signal of a local station from being applied.

Fig. 3 shows one way of staging a variable-mu control. A volume-control potentiometer is connected across the full grid-bias as supplied to the last valve. This takes current where formerly none was drawn, so a switch S is included to prevent the bias battery from wasting away with probably serious results on the power valve and H.T. battery. The resistance of the volume control is not

important within close limits; about 1,000 ohms for each volt of grid-bias is a satisfactory figure. Neither is the capacity marked 0.1 mfd. important—anything from 0.01 to 1.0 may be used.

Incidentally, although  $\mu$  is pronounced "mu," a variable-mu valve is really a variable-mutual-conductance valve, though it is true the  $\mu$  is somewhat affected at the same time.

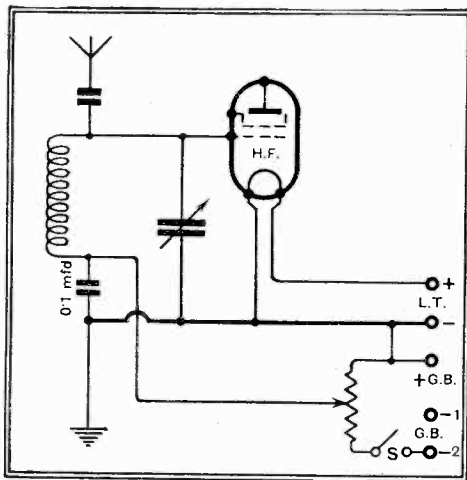


Fig. 3.—Providing adjustable bias for a variable-mu valve.

To be really up to date you might short-circuit the more recent S.G. developments by going straight on to an H.F. pentode. But remember that, while some have the usual five pins, others are fitted with seven.

(To be concluded.)

**NEW BOOKS**

**ELEMENTS OF ENGINEERING ACOUSTICS**, by Dr. L. E. C. Hughes, pp. 159. (Ernest Benn, Ltd., 154, Fleet St., E.C.4. 1933. Price 8s. 6d.)

THE author of this book, who is lecturer in electrical communication at the City and Guilds Engineering College, London, has taken as a basis a series of articles published recently in the *Electrician* under the title "Engineering Acoustics." The book is primarily concerned with the system comprising microphone, amplifier, and reproducer, which is fundamental to telephony, broadcasting, gramophones, and talking pictures: the underlying principles involved in this system are adequately investigated and a clear account is given of methods of measuring gains and losses at each stage. Considerable attention is given to the causes of defective performance in microphones and loud speakers and the economic limitations to good production are made evident.

The factors which determine good performance are extended to include the acoustic properties of the studio and the auditorium. Thus the reverberant properties of rooms affect the ratio of direct to reverberant intensity. This quantity, called the acoustic ratio, is of æsthetic importance, and its calculation also involves the directional response of the microphone and loud speaker.

The inefficiency of the commercial telephone is remarkable: its transmission is limited to the band 500-2,000 c.p.s., its amplitude distortion is large, and a count of words spoken into the instrument shows that the intelligibility at the receiving end is only 50 per cent.

This is a text-book of fundamental principles and is recommended to the serious student who wishes to get down to the basis of engineering acoustics. R. T. B.

**The Projectionist's Handbook, a Complete Guide to Cinema Operating**, by R. Pitchford and F. Coombs.—After two introductory chapters on Elementary Electricity, Magnetism and Applied Electricity, the authors give practical advice and instruction on the many details with which the Cinema Projectionist should be acquainted, including film handling and making-up, projectors of various types, their care and adjustments, accumulators, valves, rectifiers, sound reproducers and amplifiers, British Acoustic Films, Western Electric, and British Talking Pictures equipment, the arc, and much useful advice on the management and practical running of cinemas.

We believe this to be the first book published which deals with this subject in such a manner, and it should undoubtedly prove useful to radio amateurs interested in the details of "talkies." The authors maintain that the cinematograph industry secures a large percentage of its recruits from the ranks of the technically minded radio enthusiasts, and that the call for trained men of a standard of intelligence above the ordinary is becoming more and more insistent.

Pp. 352, with numerous illustrations and diagrams. Published by the Watkins-Pitchford Technical Publications, 34-35, High Holborn, London, W.C.1. Price 18s. 6d.

**Igranic D9 Loud Speaker**

In connection with the review of the Igranic D9 loud speaker in our December 1st issue, we are asked by the makers to state that the current prices for this model are as follows: "Standard" 29s. 6d., Class "B" and "Q.P.P." 31s. 6d.

# “One Moment, Please..!”

## EUROPE’S INTERVAL SIGNALS

*M*ANY listeners to foreign stations must have wondered just how the various interval signals are produced. Here is an interesting first-hand description of some of the ingenious devices by means of which stations are able to proclaim their individuality and assist listeners in identifying them.



(I) The Milan announcer, Signora Rizzi and her husband, with the station musical box.

**W**HOM should we admire most: the man who first conceived the idea of filling up programme gaps with interval signals or the heroes who have put his idea into practice? It is difficult to say. Even in the case of the least beautiful of these symbolic sounds, when objectors have come to examine the actual mechanism producing the sounds, then it can be said, with Goldsmith, that “fools who came to scoff remained to pray.”

The interval signals of the European stations fall into two distinct types. In the first, the sound is produced mechanically and picked up by a microphone or by a special magnet and passed through a valve amplifier to the normal speech input equipment. The second type is the product of any bright station engineer who has set himself the task of producing the sound entirely by electrical means. An example is the oscillator system at Ljubljana used to produce the famous “cuckoo” signal.

In the majority of stations, however, it is the semi-electric method which has found favour, and the contrivances seem to cover the whole field of human ingenuity; indeed, in the small space at my disposal, it is impossible for me to describe more than a few of the most typical.

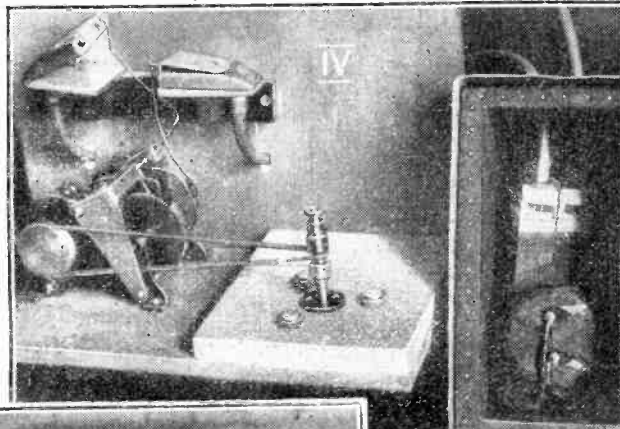
Up to a year ago the most honest and straightforward call was that of Katowice, which purported to be the sound of a hammer struck on an anvil, and actually was! One of the hall porters would come

into the studio during each interval and deliver a series of steady strokes on a real anvil, the underlying idea being to symbolise the steel and iron industry for which Upper-Silesia is famous. Unhappily, the porter eventually lost interest in his rather tedious task and asked for more pay. So Katowice resorted to the present signal, which consists of two tiny hammers striking two tuned steel bars in turn, the sound being picked up by a small micro-

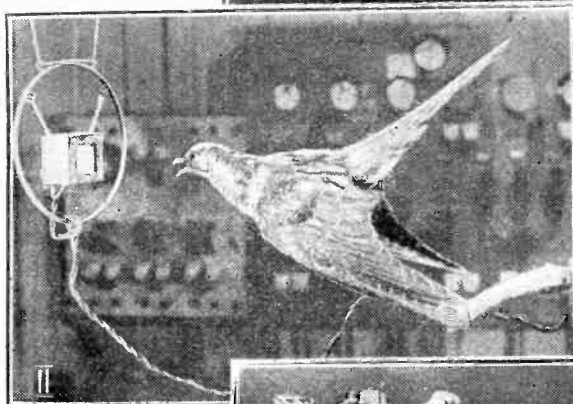
The note is picked up electromagnetically by placing a magnet immediately under the tongues. The same principle is now used at the Deutschlandsender and a number of other German stations. At Budapest, as can be seen from the illustration on next page, the first amplifier is contained in the same box as the signal mechanism. By the way, the Oslo station recently asked Budapest to supply two interval signals, which were duly sent.

At Radio-Berne and at Lille use is still made of the simple musical box, which is played in front of the microphone.

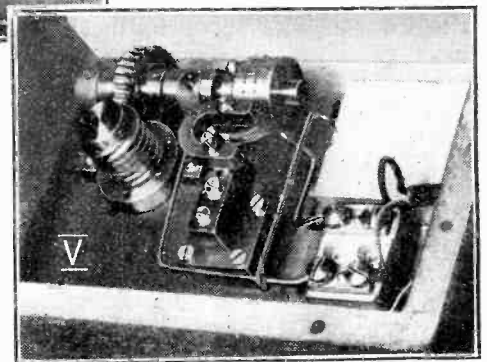
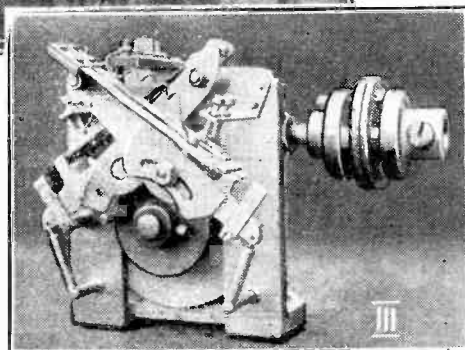
One of the most amusing interval signals to examine is the “cuckoo” call at Wilno, produced by two small bellows, each blowing a tiny organ pipe. One pipe does the “cucking,” and the other the “ooing.” In the illustration on this page the mode of operation can be very clearly seen. The



(IV) The cuckoo call at Wilno. On the right (V) is the electro-magnetic device at the Deutschlandsender.



(II and III) Above is the “dummy” cuckoo at Ljubljana and (below) the switching mechanism for operating the valve oscillators which actually produce the call.



microphone is situated immediately below the organ pipes. The bellows are driven by a small motor.

At Turin, Milan, and the other North Italian stations the same principle is used, though a clockwork, instead of an electric, motor is employed, and it is necessary for the announcer to wind up the device. This method, although simple, has the great disadvantage that perfect silence must be observed in the announcer’s studio during the interval.

phone on the top of the appliance.

So far as I am aware, Radio-Budapest was the first European station to adopt the musical-box principle. A number of steel tongues, tuned to different notes, are struck by small pins set in a revolving cylinder.

No doubt many readers will realise that gramophone records are occasionally used to produce an interval signal, the original sound being recorded a number of times and then played just as long as the interval lasts. The disadvantage is that



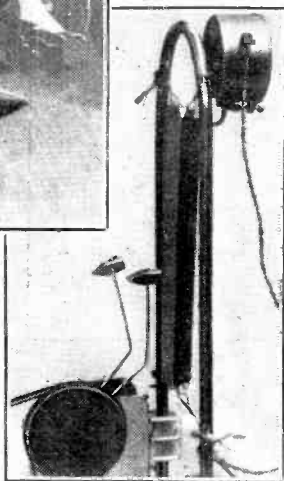
**One Moment Please—**

records soon wear down under this continuous treatment.

An interesting example of an entirely electric interval signal is the "cuckoo" call at Ljubljana, which has been devised by Professor Osana, the chief engineer at the station, and is operated by oscillating valves producing two notes of audio frequency. A human touch is the provision of a stuffed cuckoo in a glass box in front

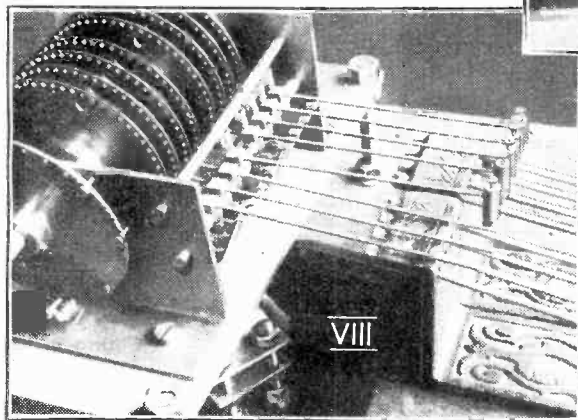


(VI) Here is a typical scene before the porter went on strike at Katowice. On the right (VII) is his mechanical successor.



of a dummy microphone "so as not to disappoint visitors to the studio!"

The original purpose of the interval signal was to provide listeners with a means of knowing whether their sets were still operating satisfactorily during the periods between one broadcast programme and another. With the steady improvement in receivers this function has become almost unnecessary; on the other hand, there was never a time when identification signals were more



(IX) The Budapest interval signal, with its revolving drum and valve amplifier. On the left (VIII) is the simple gong mechanism at Geneva.

the insistent call of Nature's most unsporting bird. And if the cuckoo call holds the palm in this respect, the constant repetition of even Chopin's "Polonaise in C Sharp Minor," as used at Warsaw, can become irritating

in the extreme.

At the time when the B.B.C. chose a clock tick as the symbol of its waiting moments, there were many complaints on

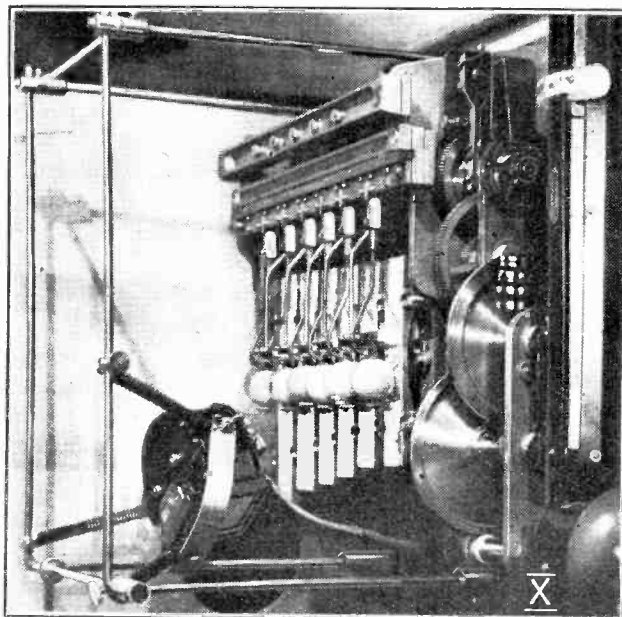
station in Europe. It is this "signature tune" which can give every station an individuality of its own and also, which is more important, can enable the ever-growing army of distant listeners to recognise each transmitter and record it in his tuning chart.

We do not ask for elaborate calls—the simpler they are the better for their purpose—but whether it be a musical-box, a gramophone record or the tintinnabulation of bells, every station director who decides from this Christmas onwards to give his transmissions this extra touch of personality will be taking one more step towards international goodwill.

Opinions differ on the question of what is the ideal form of interval signal. A serious trouble has always been the difficulty of knowing whether a signal which gives intense

pleasure when played two or three times is likely to give the same satisfaction when repeated perhaps for ten minutes without intermission. It is to be feared that very few interval signals can pass this acid test. With all due respect to Ljubljana and Katowice, it must be admitted that few sounds in this noisy world are more maddening than

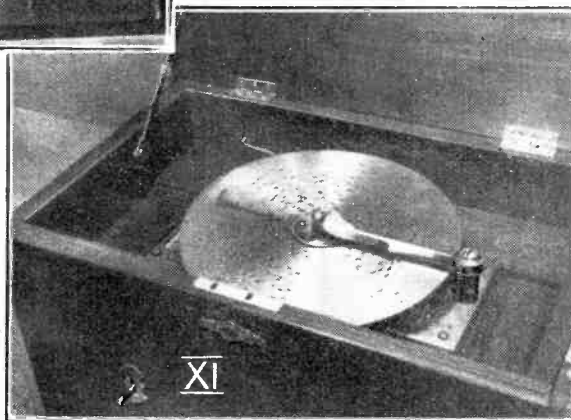
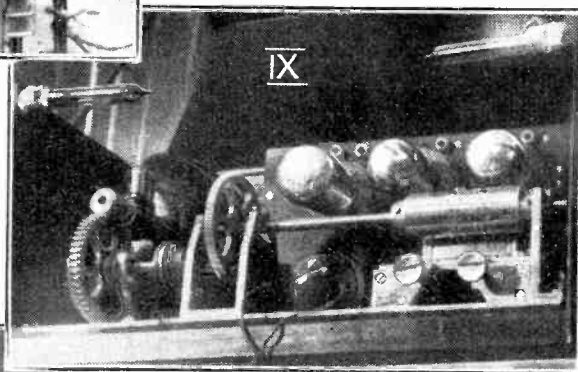
the score of monotony, but there is no doubt that the clock tick belongs to that class of monotonous sounds which are soothing rather than exacerbating. Will



(X) The gongs and their associated microphone at Kalundborg.

the ideal interval signal be a compromise between the soothing and the stimulating type of call?

In America the very expression "interval signal" is beyond the comprehension of the ordinary listener, who is never asked to wait more than a few seconds between one item and the next. The American broadcaster has the greatest difficulty in retaining the interest of his audience during the programme, and he simply dare not trust the fickle fancies of his listeners during a silent period for a longer time than it takes to get from the armchair to the tuning knob. However, we in Europe seem to be in less of a hurry, and prefer quiet moments for reflection. Like the guests who attended Society dinners in London in the Regency days in company with a certain celebrated but rather too loquacious "talker," we are some-



(XI) The homely musical box at Berne.

needed than they are to-day. And it is this consideration that prompts me to put in a plea for the universal adoption of some such means of identification by every

times glad of these occasional "eloquent bursts of silence."

WANDERING WAVE.

# NEWS of the WEEK

## Current Events in Brief Review

### Listeners' Greetings Broadcast

DANISH listeners having relatives or close acquaintances in Greenland are being permitted to visit broadcasting studios to utter a few Christmas greetings to their friends in the far north.

### A Regular Programme Item?

THE idea of broadcasting Christmas greetings of listeners may be extended as a permanent arrangement. According to our Copenhagen correspondent, it is suggested that private individuals should be given the opportunity at intervals to broadcast to Danes abroad, the object being to strengthen the ties of kinship between Danes all over the world.

### A New Christmas Game

THE keen wireless listener should have an unusually discriminating ear, and this should give him an advantage in some of the Christmas games which are being suggested for gramophone enthusiasts. Promising material for excitement should be found in "Every-day noises as heard through the microphone," a new H.M.V. disc, C2609, giving familiar sounds recorded with varying strength. Listeners are asked to guess the identity of each sound.

### 150kW. from Sweden

WE learn that the Motala station, which relays the Stockholm programmes on 1,348 metres, is to double its present power output to 150 kW. in January next.

### New Menace to Lucerne Plan

THE secret is out with regard to plans of the Swiss broadcasting authorities to increase the power of the three principal stations if the working of the Lucerne Plan is not successful. It is believed that various other European broadcasting organisations have similar plans.

If this is really the case it is difficult to believe that the Lucerne Plan will long be able to cope with the inevitable interference following a general all-round increase in power.

### The New Paris Programmes

ALTHOUGH the Radio-Paris transmissions are now under State direction, M. Henry de Jouvenel is to remain Programme Director. This will be good news to the many English listeners who have enjoyed the programmes of Radio-Paris under the old régime. Incidentally, the programmes under State direction are to be considerably improved.

### New Fish Story for Christmas

MARSEILLES is noted for its tall stories, but this one is the tallest ever. It appears that during the recent fêtes the sea front was bedecked with sixty loud speakers which provided a continuous concert. Moved by curiosity, or perhaps maddened by the noise, shoals of fish came shorewards and the local fishermen have secured record catches.

### More High Power from France

THE first stone of another French high power Regional station was laid a few days ago at Marseilles by M. Stora, a member of the French Cabinet. The station is expected to be ready by July next year.

### CHRISTMAS AND THE HOSPITALS

*When thinking of your own arrangements for Christmas remember that there are still a good many hospitals where wireless is not yet available, and there are others with equipment so out of date or neglected that it is almost unserviceable.*

*If you are yourself in a position to help, either with technical service or in some other way, or can influence others to do so, remember that Christmas time is the ideal occasion to make the effort.*

### Danish King's First Broadcast

THE King of Denmark gave his first broadcast on Sunday last, December 3rd, from the Copenhagen transmitter. His Majesty's speech was transmitted to America and relayed over the Columbia network. The royal microphone was installed at the Castle of Sorgenfri.

### English Talks from Warsaw

IN his interesting talk in English from Warsaw on Friday last, Mr. Thad Ordon addressed more than six hundred correspondents who had written to him from this country. More than three hundred copies of the promised booklet on Polish history have been despatched, and a new supply specially ordered in view of the unexpected demand, will enable all who applied for the booklet to receive their copies within the next few days.

Full particulars of further broadcasts in English from Warsaw will appear in future issues of *The Wireless World*.

### Television: A Free Lecture

A LECTURE on "The Progress of Television" is to be given by Mr. R. W. Corkling, F.P.S., at the Central Hall, Westminster, London, at 9 p.m., on Friday next, December 15th, under the auspices of the Institute of Patentees. The Rt. Hon. the Lord Askwith, K.C.B. will occupy the chair. Admission is by free ticket, obtainable on application to the General Secretary of the Institute, Mr. G. Drury Coleman, 39, Victoria Street, Westminster, London, S.W.1.

### And Another

"ELECTRO-OPTICS in Television" is the title of a lecture to be delivered before the Television Society on Wednesday next, December 13th, at 7 p.m., at University College, Gower Street, London, W.C.1. The lecturer is Mr. L. M. Myers, B.Sc. Cards of invitation may be had on written application to Mr. J. J. Denton, 25, Lisburne Road, Hampstead, London, N.W.3.

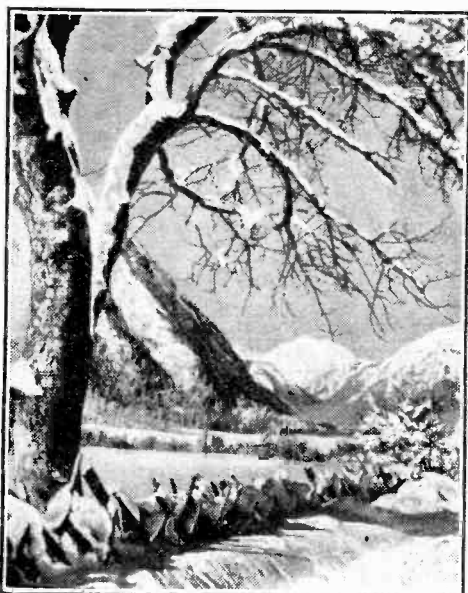
### Where Listeners Choose

LISTENERS all over Europe will cast envious glances at Denmark where broadcasting subscribers are entitled to elect the programme directors. The Danish Radio Board consists of representatives of various groups of the community. One member is appointed by the Education Office, four are members of Parliament, and the publishers' and journalists' associations may appoint one member each. No fewer than six members are elected by listeners.

The next election of the whole of the new Radio Board takes place early in 1934. The candidates were chosen at an exciting meeting on November 22nd when the discussion was broadcast and listeners all over Denmark were able to follow the fortunes of their favourite candidates.



THE WORLD'S BIGGEST ORCHESTRA BROADCAST? A scene at Radio City, New York, during the inaugural ceremonies, showing what is described as "the world's biggest orchestra in the world's biggest studio." There was a large audience of celebrities.



## Letters to the Editor:—

# Super-regenerative Receiver

## Loud Speaker Response Curves

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

### Super-regenerative Receiver

WITH reference to articles on super-regenerative receivers which appeared in your issues of May 18th and June 8th, 1932, followed by articles on May 26th and June 16th, 1933, the enclosed account of my experiments may be of interest.

These relate to the use of a separate quenching valve, which is assumed to vary the detector grid potential by means of a L.F. oscillating current. No mention is made of H.F. current in the quenching circuit, although a small H.F. choke or small resistance in the centre tap lead from this valve's grid circuit will stop super-regeneration, i.e., the quenching action is partly effected by H.F. currents in the quenching circuits. This view is apparently verified when the quenching valves L.F. grid coil and condenser are earthed through a tuned H.F. circuit which is capacity or L.F. filter coupled to the reacting detector grid circuit, as in the Figure. Using a small variable coupling condenser  $C_3$  super-regeneration can be obtained with all but minimum values. Also, this effect can be controlled by tuning the H.F. circuits, and excellent reception, with absence of noise and broad tuning, is possible when adjusted to work on the border line between regeneration and super-regeneration.

A low amplitude gives best results, and also a low anode resistance and low H.T. voltage are better than high values of both. This leads to the view that grid current is important, and the connection of another diode across quencher grid-filament substantiates this view. The quencher H.F. circuit can oscillate with unsuitable

anode-grid coupling, without reaction being used in the detector circuit, thus stopping super-regeneration. This effect may be controlled and grid damping reduced by connecting the quencher valve's L.F. and H.F. circuits by a H.F. choke shunted by a small

variable condenser ( $L_2-C_2$ ). This condenser sharpens tuning and controls super-regeneration, and this circuit can be adjusted to separate W8XK and DJB or other similarly related frequencies.

Valve noise need be no greater than with any other type of receiver using an oscillating valve. With thorough shielding the detector valve can be coupled by a screened grid valve to an aerial to minimise re-radiation.

The relationship between capacity and inductance in the L.F. oscillating circuits can be altered to suit the requirements of the H.F. circuits. Perhaps our mathematical friends will state that super-regeneration of this type is simply band-pass coupling or superheterodyne first detection boosted by L.F. oscillations, in which case the L.F. oscillations ought to be of a beat frequency which is equal to the difference between H.F.'s in quencher and detector grid circuits. The higher the frequency of the L.F. oscillations, the greater is the value of the H.F. coupling condenser required to produce super-regeneration.

I trust that these observations may be of use to short-wave enthusiasts, and, as a recent dweller in the Southern Hemisphere, I think an efficient three-valve set of this type with small battery requirements is ideal for "vast open spaces."

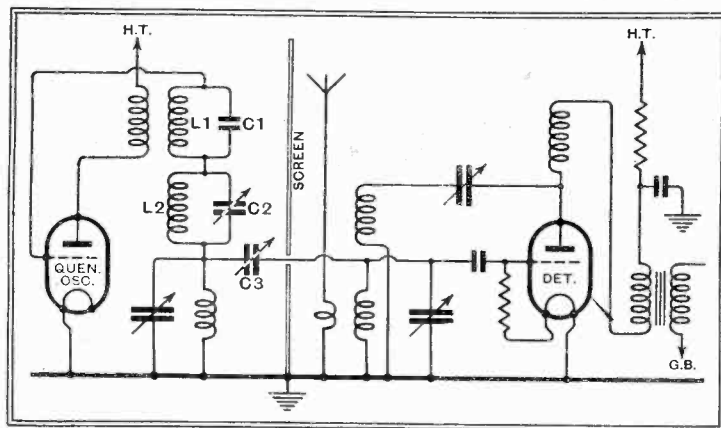
Swindon, Wilts.

R. T. DALE.

### Loud Speaker Response Curves

I SHOULD like to add to the remarks of Mr. Tyers on the interesting subject of speaker calibrations.

Taking a speaker curve by plotting points



$C_1 = .01$  mfd.  $C_2, L_1$ , circuit  $n = 10,000$ .  $L_2 =$  long-wave choke.  $C_3 = 0$  to  $16$  m.mfd.

is liable to give very misleading results unless a very great number of points are plotted. The time taken to do this is very considerable and makes this method unsuitable for quick tests which are desirable in development work. Fortunately, recording

milliamp. meters are available, and with their aid it is possible to devise apparatus which will draw out the characteristic as a continuous curve on paper. Such apparatus will reveal every peak and trough, and shows at a glance the nature of the response in the direction of the mike.

Electric lamps do not, as a rule, radiate green light downwards and red light sideways, but the equivalent of this happens with most loud speakers. This raises the question of whether the curve giving the total forward radiation, or the curve taken with the mike on the axis, should be considered as the correct curve of a loud speaker.

Since the majority of loud speakers concentrate a beam of high frequencies forward along the axis, it generally happens that loud speakers show a considerable rise in the high frequencies on the axis and a serious loss of high frequencies everywhere else. The curve taken with the mike on the axis, therefore, only tells what the response will be like to the listener on the axis near the speaker, while the curve of total forward response gives the average of all points in the room. (In the case of very reverberant rooms the echo serves to even out the distribution.) In the case of ordinary living rooms, however, and particularly in very dead rooms, this average with ordinary speakers may not be obtainable in any one spot; the response as heard tending to be independent of the total forward radiation and approximating to the characteristic as measured for the direction of the listener.

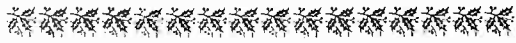
With either type of curve, therefore, information as to the variation of characteristic with direction is required in order that the performance of the speaker under normal listening conditions can be judged.

In an ideal speaker the response should be the same in all directions to which the sound is intended to be distributed, and in such a case the axial curve would be identical with the curve of total forward radiation. This state of affairs, however, has not yet been achieved with ordinary moving coil speakers. Since listening generally takes place from a point more or less in front of the speaker, the axial curve, together with a curve taken  $30^\circ$  of the axis, will, in general, give satisfactory information of the oral effect of the speaker under examination. The practice of showing both has the further advantage of avoiding the very considerable labour which is involved in calculating from several curves what the R.M.S. total forward radiation is at each frequency, and plotting the resultant curve.

P. G. A. H. VOIGT.

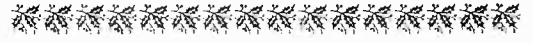
Correspondence, which should be as brief as possible, should be addressed to the Editor, "The Wireless World," Dorset House, Stamford Street, S.E.1, and must be accompanied by the writer's name and address

# 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.



## Manual Control for A.V.C. Sets

BECAUSE it was convenient, and in spite of published advice to the contrary, a reader, who has constructed a set with A.V.C., has included a manual volume control of the type which operates by increasing the grid bias of the variable- $\mu$  H.F. valves in his set. The arrangement seems to work satisfactorily enough, but the A.V.C. system seems less capable than was anticipated of dealing with severe fading.

But surely this is what one would expect? If a receiver is to be capable of dealing with a fading signal, the A.V.C. system should be able to restore full sensitivity when it is needed. It cannot do this if negative bias on the controlled valves has been set manually at a higher value than optimum.

## Isolated Aerial Circuit

IT has been noticed by a correspondent that the performance of his D.C. mains receiver, so far as silence of background is concerned, can be greatly improved by removing the earth lead from its terminal. But although hum is reduced by this procedure, there is a slight falling-off in sensitivity; we are asked to suggest means whereby this very acceptable freedom from hum may be retained, and the original sensitivity restored.

Our reader's experience is by no means an uncommon one. Of course, after removing the earth lead, the receiver is more or less effectively earthed through the mains, and so it is not surprising that its sensitivity suffers but slightly.

Most D.C. receivers are connected to earth in the manner shown in Fig. 1 (a), with a large condenser (C) interposed in the earth lead. Sometimes a reduction in the value of this condenser to some 0.002 mfd. will reduce hum without noticeably affecting sen-

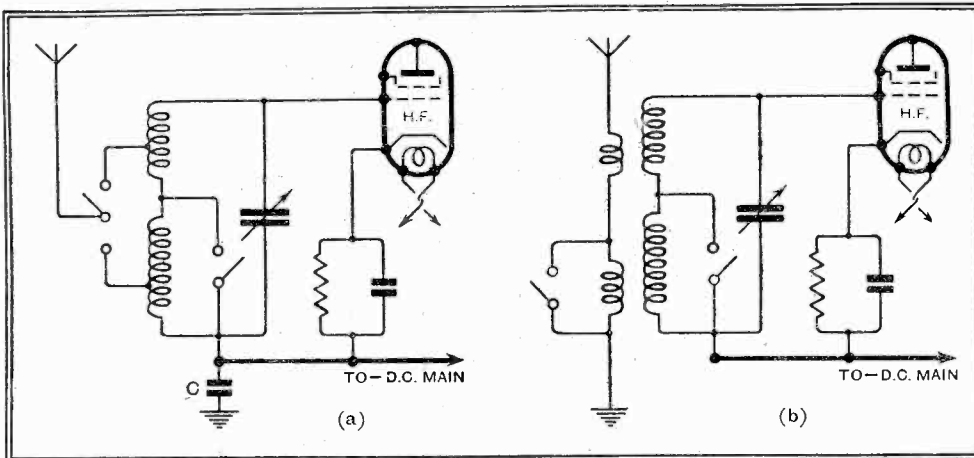


Fig. 1.—The conventional input circuit of a D.C. mains set, and an alternative arrangement which provides isolation between mains and earth.

sitivity, and we suggest that this alteration should first be tried. There is no need to disturb the wiring of the set, as the desired effect is obtained by connecting the condenser externally between the earth terminal and earth—two condensers in series.

A still better plan to adopt in the circumstances would be that shown diagrammatically in Fig. 1 (b). Here the aerial circuit is completely isolated metallically from the

closed tuned circuit, a double-wound aerial-grid transformer being employed. Unfortunately this may involve the replacement of the existing input coil.

Occasionally mains interference which manifests itself in this way may be reduced by inserting an H.F. filter in the power leads which feed the set. Alternatively, something may often be done by changing the position of one of the smoothing chokes.

## Coil Positions

A PROSPECTIVE constructor of the A.V.C. Three asks in what order the tuning coils should be mounted.

In this receiver the aerial input end is at the back, and consequently the coils should be mounted in the following order, starting at the back of the set and working towards the panel: BP.1, BP.2, TC.1.

## Interaction Between Components

IT is worth while emphasising the fact that when following a published receiver design, the substitution of certain components (particularly L.F. transformers, smoothing chokes and power transformers) of makes other than those used in the original design may be responsible for the introduction of hum. This is accounted for by the fact that the stray fields of different components are apt to vary considerably.

From a description of the effects noticed by a querist, we are inclined to think that

## Community Charging

IT is asked whether it would be an economical plan to charge about twenty-five L.T. accumulators direct from 220-volts D.C. mains—with, of course, the necessary resistance interposed. The reader who propounds this question tells us that he and a number of his neighbours propose to join forces in this matter, he asks us to publish a circuit diagram of a suitable scheme, and goes on to enquire whether the cost of a rotary converter to "step down" the mains voltage would be justified.

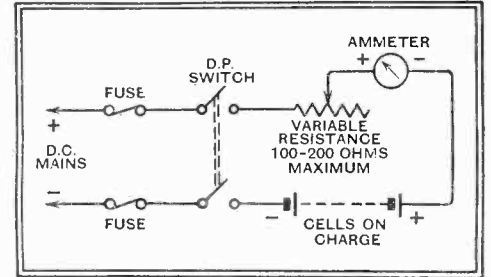


Fig. 2.—Charging series-connected L.T. accumulators directly from the mains.

We assume that all the accumulators to be charged will be dealt with at the same time, and that they are of the single-cell two-volt type. On this assumption, rather more than three-quarters of the total wattage taken from the mains will be wasted if direct charging be employed. That sounds terribly wasteful, but actually it is not so bad as it seems. A rotary converter would, of course, be much better, judged from the aspect of pure efficiency, but it would represent a considerable capital outlay which would hardly be justified unless the communal charging scheme were to be permanent.

A diagram illustrating the appropriate charging arrangements is given in Fig. 2. A definite value for the limiting resistance cannot be given, as the charging rate will be the rate of the smallest cell to be charged.

## "Building a Whistle Filter"

REFERRING to the description of a low-pass whistle filter described in our issue of November 10th, information is requested as to the amount of wire needed for winding the three high-inductance coils.

Roughly six ounces of No. 40 D.S.C. wire will be needed for these coils.

## The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

the excessively noisy background of which he complains must be due to this cause. Fortunately, the cure is simple, and an experimental re-orientation of those components mentioned above should put matters right. Indeed, it is doubtful whether it will be necessary to touch anything but the L.F. transformer, which should be wired temporarily with flexible leads in order that its position may be altered while testing.



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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

### Do Transmitters Tire? *A Matter for Serious Investigation*

**I**N the correspondence columns of this issue we publish a letter in which the suggestion is put forward that wireless transmitting stations fall short of their initial efficiency after a time and never entirely regain the range enjoyed in the early days of their life, even though the standard of efficiency of the station in general may be well maintained.

Our correspondent is himself convinced that this phenomenon exists, and states that he and others have observed it over a period of some twenty years. He puts forward as a possible explanation that the effect may be the result of a change in the nature of the soil, resulting from the operation of the transmitting station, this change producing the effect of a gradual deterioration in the properties of the soil as a satisfactory earth.

We imagine that there is already sufficient information available in records at transmitting stations to go a long way towards proving or disproving this theory, and it only requires that those who have charge of these records should come forward with the necessary evidence.

If it should be found that this theory is correct, then it is a matter of the utmost importance and might well be regarded as likely to have far-reaching effects on the efficiency of transmitting stations in the future. It would have to be conceded that if the operation of a transmitting station can so affect the conductivity of the soil as to produce such changes, then inversely it should be possible to treat the surrounding soil in such a way as to enhance the general efficiency of the station.

It will be interesting to see whether any observers having experience of these effects will come forward with evidence to confirm or refute this alleged phenomenon.

### Mains Voltages *A Handicap to the Electrical Industry*

**W**E were gratified to see in last week's number of *The Electrical Review* an Editorial comment on the chaos which at present reigns in the matter of the variety of voltages at which electricity is still supplied in various parts of this country. It is stated that fewer than three-quarters of the 644 undertakings holding distribution powers declare the standard power of 230 volts, and of these well over 100 supply on the D.C. system. There are some 270 undertakings supplying at three or more voltages between 100 and 480, and in forty-three instances five or more voltage systems are employed.

*The Electrical Review* points out that the prospective purchaser of electrical equipment is hampered by the consideration of these complications. Those who may from time to time have to move from one location to another are discouraged from purchasing domestic electrical apparatus, whilst at such times as Christmas the question of a friend's voltage supply always crops up as a factor to discourage the giving of electrical equipment as a present and to invite attention to some other gift as an alternative. The longer this chaotic state in the matter of voltages persists, the more expensive it must become to adopt standardisation, supply authorities being themselves responsible to the consumer to make good the effect of a voltage change.

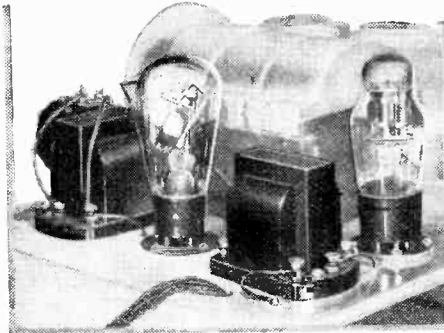
# High Quality Class "B" Amplification

## How to Get the Best Out of the B.21 Valve

**T**HE immediate effect of the introduction of Class "B" amplification into broadcast receivers has been the opening up of hitherto unrealised possibilities in the design and construction of economical battery sets. The term "economical" is used here to denote the type of set worked from the smaller types of dry batteries and consuming no more than 10 milliamps. Where cost of running is not an important consideration, good quality and volume can be obtained with Class "A" amplification by the provision of a large enough H.T. battery, but where this is not possible the need for limiting the average H.T. current consumption to about 10 milliamps. rules out the possibility of obtaining sufficient output for any except the smallest rooms, as long as Class "A" amplification is retained for the output stage.

When the advantages of Class "B" amplification are available this drawback in economical battery operation largely disappears, for with the same average consumption of H.T. current the maximum power output is increased from about 0.2 watt to 1 watt. This is due,

**C**lass "B" amplification, while affording a marked saving in H.T. battery current, is not without its special problems. In this article the effect of leakage inductance in the driver and output transformers is discussed and it is shown that by careful design reproduction of a very high quality is obtainable with this system.



A few figures will serve to illustrate this point. In the case considered, where the "peak" output is about 1 watt, a B.21 valve working from a 120-volt battery will take an average H.T. current of 6 or 7 milliamps., but a Class "A" triode working at the same anode voltage will require over 30 milliamps. in order to be able to provide 1 watt of a.c. power for the loud passages. The striking economy — 75% — resulting from the use of the B.21 is responsible for the enthusiasm which designers of battery sets have felt towards this system of amplification.

Unfortunately, however, like most technical advances, Class "B" amplification is not without its difficulties, and the users of certain combinations of valves and transformers have in the past often been keenly disappointed in the tone-quality given by the new system. The harshness often noticeable in soft notes reproduced by this method was found to be all the more distressing by reason of the fact that the ear is accustomed to hearing such notes free from distortion; this effect has been called "Class 'B' jangle," and by many experienced workers was believed to be inseparable from Class "B" amplification.

During the development of the B.21 valve, investigation revealed the fact that the harshness already referred to was due to free electrical oscillations in the transformer windings, and further that this tendency to oscillation could be reduced to an extent when it no longer spoils the tone quality by careful attention to three points:

- (i) The design of the output valve.
- (ii) The design of the transformers.
- (iii) The filter circuit.

The first point has already been cleared up in the design of the B.21 valve, but in order to obtain really pleasing reproduction and the attendant economy in battery current with this valve, some little extra care and initial outlay in the matter of circuit components are needed.

By K. A. MACFADYEN

With regard to the valve design, it was found that the high magnification factor of a zero-bias valve was particularly conducive to electrical oscillation. Accordingly, the magnification factor was reduced to a value such that, given reasonably good auxiliary components, the tendency to oscillate was sufficiently small. This accounts for the negative bias of 4½ volts which the B.21 requires. Incidentally there is another advantage in this, namely, that the valve can be biased to operate correctly over a much larger range of H.T. battery voltage than is possible with a zero-bias valve.

It is a familiar fact to radio amateurs that in a simple valve oscillator the tendency to oscillate is greater when the capacity is small, or the inductance large rather than vice versa. In many practical cases it has been found that the leakage inductance of the output transformer

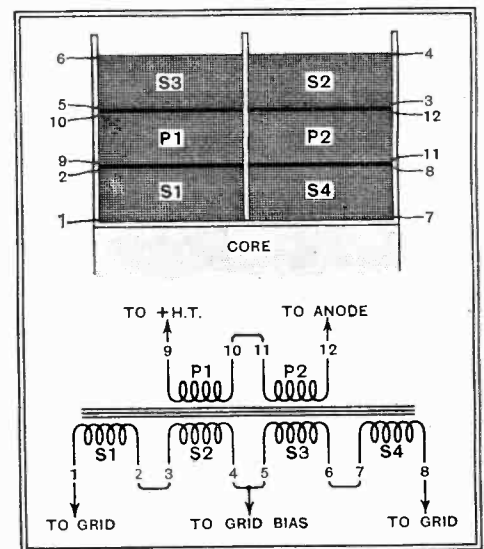


Fig 2.—Theoretical arrangement of the winding on the driver transformer and the method of interleaving the sections on the bobbin.

primary and its self-capacity constitute an oscillatory circuit. If the leakage inductance is kept as low as possible the tendency to oscillate will be much reduced. (It should be noted also that the same precaution ought to be observed in the design of the intervalve transformer.) It might be supposed that the same result could be achieved by increasing the capacity in the oscillatory circuit by joining a condenser across the transformer winding. It is true that some improvement can be secured in this way, but unfortunately it is found that by this means the frequency of the unwanted oscillation is reduced to a value at which the ear is very sensitive, and in consequence the result is not so pleasing as one might suppose.

We shall now consider the design of the

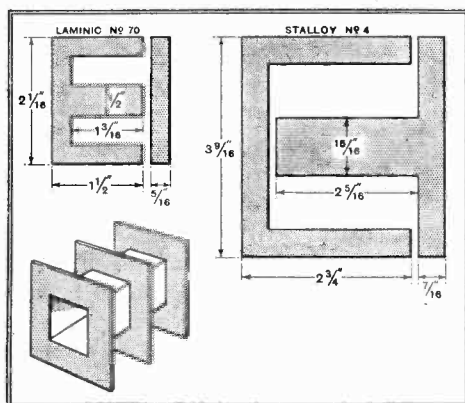


Fig. 1.—Dimensions of core stampings of "Stalloy" No. 4 and "Laminic" No. 70 from which the size of the bobbin for each style can be determined.

of course, to the fact that the Class "B" output valve consumes only enough current to reproduce the sound which is momentarily being amplified, while a Class "A" valve continuously absorbs enough current to handle the loudest undistorted output, even during quiet passages in the programme.

**High Quality Class "B" Amplification—** transformers in more detail. It is not intended that the following details should be regarded as hard-and-fast, but they can be relied on to give satisfactory results and enable the user to derive the full benefits of Class "B" amplification. Slight modifications of these designs have been used with success, although any attempt to secure extreme cheapness in construction is likely to lead to a reappearance of the harsh reproduction.

If the "Stalloy" No. 4 stampings are found to be too bulky, equally good results may be obtained by the use of a smaller core of "Laminic," a high-permeability alloy obtainable from Messrs. Magnetic and Electrical Alloys, Ltd., Lancelot Road, Wembley. A very satisfactory core can be built from No. 70 "Laminic" stampings (0.015 in. thickness, enamelled on one side preferably). The correct bobbin-size may be readily deduced from Fig. 1.

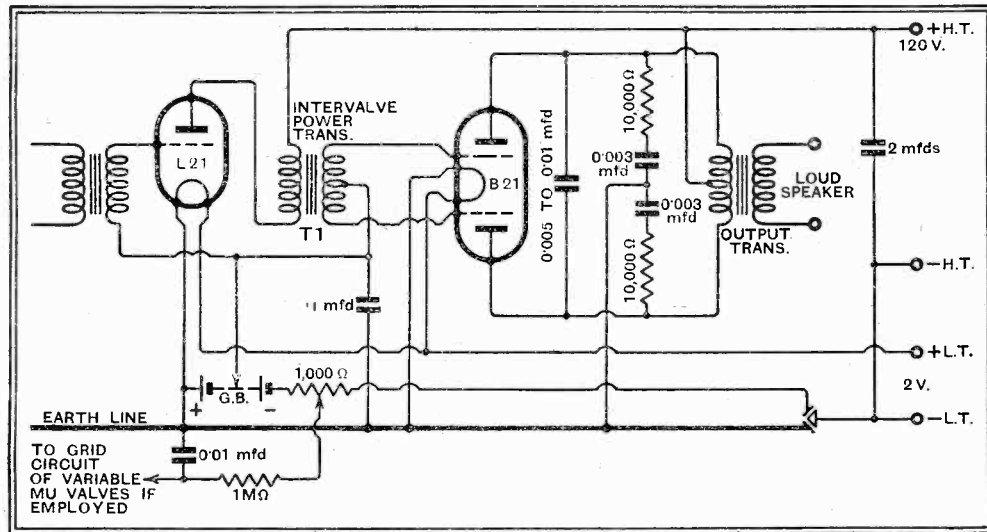


Fig. 3.—The complete Class "B" stage, including all the refinements necessary for good quality reproduction.

If a "Stalloy" core is used it should be of generous cross-section. The use of Sankeys' No. 4 "Stalloy" for both intervalve and output transformers enables reproduction of the highest quality to be obtained. The core should be built up so that the centre member is of square cross-section. This will necessitate the building of a bobbin out of thin fibre or other insulating material like that shown in Fig. 1. The correct dimensions can be deduced from the diagram of the stampings in the same figure. In winding the intervalve transformer, which has a centre-tapped secondary winding, the whole secondary is divided into four sections and the primary into two. The interleaving of these six coils confers freedom from flux-leakage and also electrical symmetry. The method of interleaving is shown in Fig. 2. This is brought about by first winding one section of the secondary (i.e., one-quarter of the total number of turns) on each side of the double bobbin shown in Fig. 1, following this by half the primary on each side, finishing up with the remaining half of the secondary divided between the two parts of the bobbin as before. All these coils should be wound in the same sense.

It is assumed that the ends of the six sections have been brought through the bobbin cheeks. Reference to Fig. 2 will show the correct method of connecting these together.

The above description need not be repeated for the construction of the output transformer. It is only necessary to interchange the words "primary" and "secondary."

The correct wire sizes and number of turns are given in the table below.

If the speaker impedance is different from 4 ohms, the transformer ratio is readily calculated from the approximate formula

$$\frac{\text{Total primary turns}}{\text{Secondary turns}} = \sqrt{\frac{12,000}{\text{speaker impedance}}}$$

In the above specifications, silk-covered wire can be used instead of enamelled, if a smaller wire-size is chosen, but, of course, a very slight drop in efficiency results.

**Filter Circuit**

This has an important bearing on the quality of reproduction, but Fig. 3, which includes the filter-circuit, is self-explanatory. The use of moving-coil speakers is strongly recommended for this type of output stage. The large reactance of the coils of moving-iron speakers is as much a disadvantage in this system as it is with "Q.P.P."

**Distant Reception Notes**

**B**UDAPEST's new 120-kilowatt station was officially opened on December 2nd, and since then it has been going great guns. This is one of the easiest of European stations to receive after dusk now, and good reception is often possible in broad daylight. Budapest should become very popular with listeners in this country, for a variety of reasons. Interference is rare in the neighbourhood of its wavelength, fading is almost unknown, and, most important of all, excellent programmes are transmitted.

The regional organisation of the German stations is now an accomplished fact. There are three regional areas—the Northern, Western, and South-Eastern. The main stations in the Northern area are Berlin Funkstunde and Hamburg. In the Western area Mühlacker and Frankfurt are the key stations, and in the South-Eastern Breslau, Leipzig, and Munich. The National programme is transmitted by Zeesen, or, if you so prefer it, the Deutschlandsender Reichsender; but, since these jaw-breaking words mean simply German National transmitter, I cannot see why we should not either translate them into English or stick to the shorter and more familiar place name.

It will be interesting to see within the next few weeks whether the vertical aerial will be found in practice to have the anti-fading properties prophesied for it. Those already in use include Budapest's, Vienna's, Langenberg's, and Breslau's, and very shortly Mühlacker, Hamburg, and the new Berlin station will be using similar devices. On the far side of the Atlantic WLW will be equipped in the same way when the new station comes into operation, as it may do before these notes appear in print.

**Best Reception for Years.**

Reception conditions at present are better than they have been for many years. Fading is almost entirely absent, few important stations suffer from serious heterodynes except on odd days, and the field strength of foreign stations is such that with a modern set considerable use of the volume-control knob has to be made.

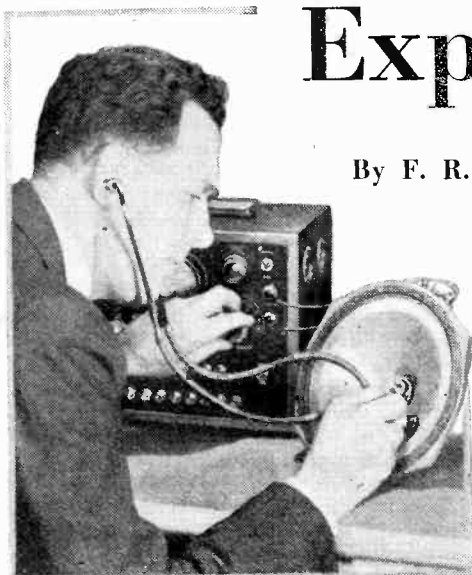
On the long-wave band matters are much improved. Huizen is clear on two or three days during the week, whilst Radio-Paris, Zeesen, Warsaw, Motala, Kalundborg, and Oslo all furnish excellent reception. Luxembourg appears to have developed a permanent and most distressing heterodyne.

The choice on the medium waveband is now so large that it is difficult to pick the twelve best stations. Budapest, Vienna, Brussels No. 1, Prague, Langenberg, Lyons Doua, Rome, Leipzig, Strasbourg, Breslau, Hilversum, and Heilsberg have virtually local-station reliability, but it would be easy to pick another dozen almost, if not quite, as good. D. EXER.

| INTERVALVE TRANSFORMER.   | OUTPUT TRANSFORMER.   |
|---|---|
| No. 4 "STALLOY" CORE.   |   |
| Primary:—6,400 turns (total) of 42 S.W.G. enam. and S.S.C. (2 sections of 3,200 turns).   | (4 ohm speaker).<br>Primary:—3,200 turns of 30 S.W.G. enam. and S.S.C. (4 sections of 800 turns). |
| Secondary:—6,400 turns (total) of 38 S.W.G. enam. and S.S.C. (4 sections of 1,600 turns). | Secondary:—52 turns of 20 S.W.G. D.S.C. (2 sections of 26 turns).                                 |
| No. 70 "LAMINIC" CORE.  |   |
| Primary:—6,000 turns of 42 S.W.G. enam. (2 sections of 3,000 turns).                      | Primary:—4,000 turns of 38 S.W.G. enam. (4 sections of 1,000 turns).                              |
| Secondary:—6,000 turns of 40 S.W.G. enam. (4 sections of 1,500 turns).                    | Secondary:—82 turns of No. 22 S.W.G. enam. and S.S.C. (2 sections of 41 turns).                   |

# Exploring Diaphragm Resonances

By F. R. W. STRAFFORD



**T**HE complex behaviour of a loud speaker diaphragm while rendering the daily efforts of the B.B.C. is a subject for reflection and an opportunity for research, and as such has engaged, and still engages, the careful attention of physicists and sound engineers.

The physics of loud-speaker design indicate that, if the square of the diaphragm velocity multiplied by its radiation resistance was independent of frequency and was merely proportional to the electrical power supplied to the speech-coil windings, then the *ne plus ultra* of design would have been reached years ago. This would have resulted in an increase in the unemployment figures for scientists; so, in a way, Nature is beneficent to those who are rude enough to delve into her secrets!

It is well known (or should be) to readers that one of the main contributions to the success of the moving-coil type of loud speaker is the fact that the cone does not move as a rigid element at the higher frequencies. Were it to do so, a simple mathematical analysis would prove that the high-note response would be so severely attenuated that, apart from the introduction of an extremely steep filter system involving the use of an additional stage of audio amplification, this type of speaker would have fallen into obscurity. The high-note response is obtained, quite accidentally, by virtue of the "breaking up" of the diaphragm. While this term, though somewhat slangy, is popularly used, it is meant to infer that separate elements of the diaphragm are behaving in different manners at the same instant. While one element is moving forward to a certain maximum displacement, its neighbour may be busily engaged in doing nothing in particular, or moving in the opposite direction, or even in the same direction, with less maximum displacement.

## Modes of Vibration

If the diaphragm could be successfully examined, by means of a stroboscope, at any single note of medium or high frequency, one might observe something akin to those picturesque telescopic photo-

## The Surgical Stethoscope and its Application to Loud-speaker Design

*THE cone diaphragm moving-coil loud speaker is dependent on resonances for its high electro-acoustic efficiency and in developing a design for commercial production it is essential to control the distribution of resonances for best results. At high-frequencies the use of a stroboscope is impracticable, but reliable observations may be made with the aid of a modified surgical stethoscope.*

graphs of the moon. The irregular contours, in this case, would be due to nodal and anti-nodal regions of vibration. These may be of circular, circumferential, or radial composition; the former two types possibly arranged symmetrically about the centre of the diaphragm at medium frequencies, but more inclined to asymmetry as the frequency is increased.

The shape and disposition of these nodal and anti-nodal regions definitely confer upon the diaphragm certain characteristics, which affect both the sensitivity and frequency response of the loud speaker in normal operation.

The type of nodal vibration which does attenuate the output of a loud speaker is of radial distribution, and occurs at the lower frequencies, extending into the bass regions. Like any other nodal vibration,

tribution varies with frequency to a considerable extent.

How far they are related to the attenuation or augmentation of the output is an uncertain factor, and it is here that further research appears to be necessary.

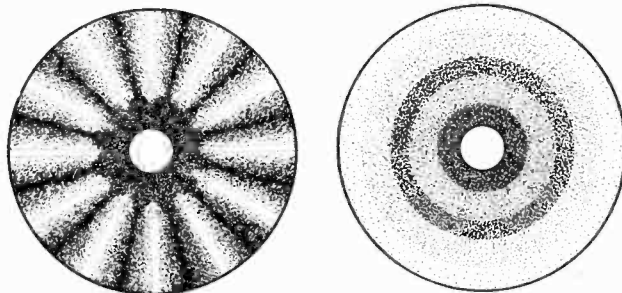
## Method of Operation

Modern loud-speaker development incurs the use of sound measurement devices which give a plotation of the frequency response from the whole area of the diaphragm. While characteristics thus obtained are of great service as a basis for experimental comparison tests, they do not reveal any relationship between the variations in frequency response with the type and distribution of the nodal points. Some other instrument is required whereby the explorations may be achieved and thus related to the frequency characteristic, and in this connection the surgical stethoscope, of conventional type, shows distinct promise.

The type fitted with a removable, bell-shaped mouth-piece is the instrument required, and in operation is worn in the conventional manner. The loud speaker is driven by a pure note oscillator, variable over the range of frequencies to be explored.

Fixing upon a suitable frequency, e.g., 500 cycles per second, the output is adjusted so that a reasonable acoustic output is obtained. Although there is a considerable background of sound when the stethoscope is worn, as soon as the mouth-piece is placed at approximately one-quarter of an inch from the surface of the diaphragm it is quite easy to receive sufficient energy *via* this source to produce negligible masking from the direct output. The sensation must be realised by actual experiment rather than by a stretch of the imagination.

As the surface of the diaphragm is explored, the presence of nodal vibrations will be indicated by changes in the strength of sound received. A node will be indi-



Sketches showing typical distributions of nodes at medium and high frequencies. (Left) Symmetrical radial nodes due to an auxiliary vibration of lower frequency than the fundamental. (Right) Approximate sound distribution at 1,000 cycles. (The sound intensity is proportional to depth of shading.)

it is caused by asymmetry in the transmission properties down the section of the diaphragm, or incorrect terminating conditions at its periphery. Since it occurs at the lower frequencies where the diaphragm displacement is at a maximum, it may be examined stroboscopically and shows that the diaphragm has resolved into a number of radial sectors vibrating in phase opposition. The effect naturally tends to neutralise the air-particle velocity over the surface of the diaphragm, producing an acoustic short-circuit, as it were, and thereby restricting the sound output.

The circular and circumferential nodes occur from the medium frequencies upwards, and their number, shape, and dis-

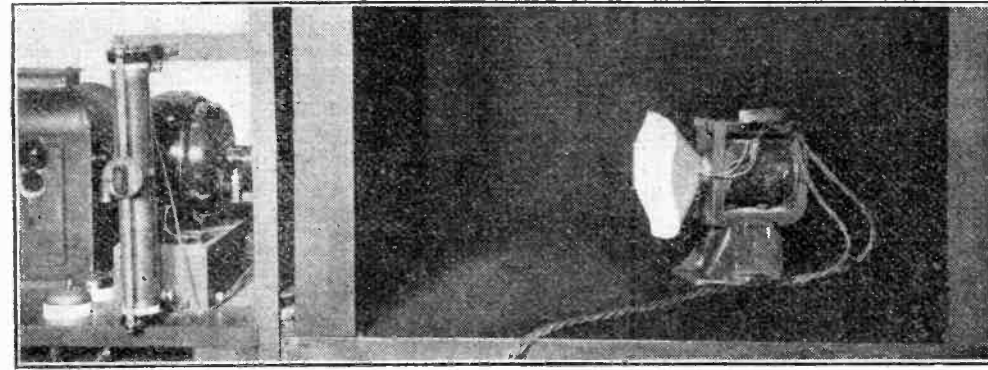


**Exploring Diaphragm Resonances—**

cated where a region of comparative silence is observed, and an anti-node by the reverse effect. After a little practice it is possible to sketch the relative positions of the nodal vibrations, so that a series of sketches for different excitation frequencies may be evolved.

In a recent contribution by the writer,\* the stethoscope was used to discover that certain auxiliary vibrations were accompanied by a series of perfectly symmetri-

cal radial nodes, the number of which was directly proportional to the causation frequency; and in this case it therefore proved to be the indispensable tool of research.



At low frequencies the formation of nodes in a cone diaphragm may be observed visually by means of a stroboscope.

Likewise, the comparison of various loud speakers (1) by taking the frequency response characteristics by modern methods, and (2) by observing the nodal distribution by the method outlined,

\* *The Wireless Engineer*, March, 1933, p. 141.

should materially assist the designer in understanding the complex action of the loud-speaker diaphragm at the higher frequencies. At the time of making these notes the writer was, unfortunately, concluding his activities in loud-speaker research, so that the absence of the necessary equipment by which a complete investigation might have been made and published hereunder is a pity. Nevertheless, the stethoscope opens up a wide field of research of which advan-

tage should be taken if this has not already been done, since these notes were compiled during the early spring of 1932.

As a point of interest, the stethoscope has many other useful applications to the designer and service engineer, in that it serves, admirably, in the location of various rattles and buzzes which are sometimes added, gratis, to a programme by virtue of some mechanical fault associated with the moving system.

taking the minimum current, and the extra 2 mA. was accounted for in the output stage.

Thus in a receiver of this type maximum performance is returned for every milliamp. of current expended, whether it be used in reaching out for distant stations or providing additional sound output from the loud speaker.

**CLUB NEWS****For New Cross Enthusiasts**

A new radio society has been formed at Goldsmiths' College, New Cross, S.E.5, where meetings are held every Monday at 7.30 p.m. All interested are invited to apply for further particulars to Mr. Albert L. Beedle, 15a, Fontenay Road, Balham, S.W.12.

**Cathode Ray Television**

A lecture and demonstration of television, using the cathode ray tube, was recently given to the Bristol Radio and Television Society by Messrs. Price and Parr, of the Edison Swan Electric Co., Ltd. Hon. Secretary: Mr. G. E. Benskin, 24, Stadium Road, Kellaway Avenue, Bristol, 6.

**Q.P.P. Described**

Quiescent push-pull will be the subject of a lecture by Mr. G. N. Fordyce at a meeting on Thursday next, December 21st, of the Edinburgh and District Radio Society. Non-members interested are asked to communicate with the Hon. Secretary, Mr. W. B. Winkler, 13, Lockharton Crescent, Edinburgh.

**Loud Speakers of To-day**

"Modern Loud Speaker Design" is the title of a lecture to be given by Mr. H. A. Hartley at the meeting on Monday next, December 18th, of the Newcastle-upon-Tyne Radio Society at 7.30 p.m. in the Church Hall, Holy Trinity War Memorial Church, Armstrong Bridge, Jesmond. Hon. Secretary: Mr. W. W. Pope, 9, Kimberley Gardens, Jesmond, Newcastle-upon-Tyne.

**A Short-wave Evening**

Mr. C. L. Wood (5WY) will lecture on "Points in the Design of Short-wave Receivers" at the meeting at 8 p.m. on Monday next, December 18th, of the Exeter and District Wireless Society. All communications should be addressed to the Programme Secretary, Mr. E. H. Wate, "The Beeches," Woodbury, nr. Exeter.

**A Three-foot "Catkin"**

A huge model, standing 3ft. high, of a Catkin valve was shown by Mr. Nixon, of the G.E.C., at a recent meeting of the Radio Section of the New Eltham Ratepayers' Association. The model was used to demonstrate the construction stage by stage. Hon. Secretary: Mr. A. E. Gillborn, 87, Montbelle Road, New Eltham, S.E.9.

## Battery Economy with A.V.C.

### Some Interesting Experiments with the Marconiphone "269" Portable Superhet

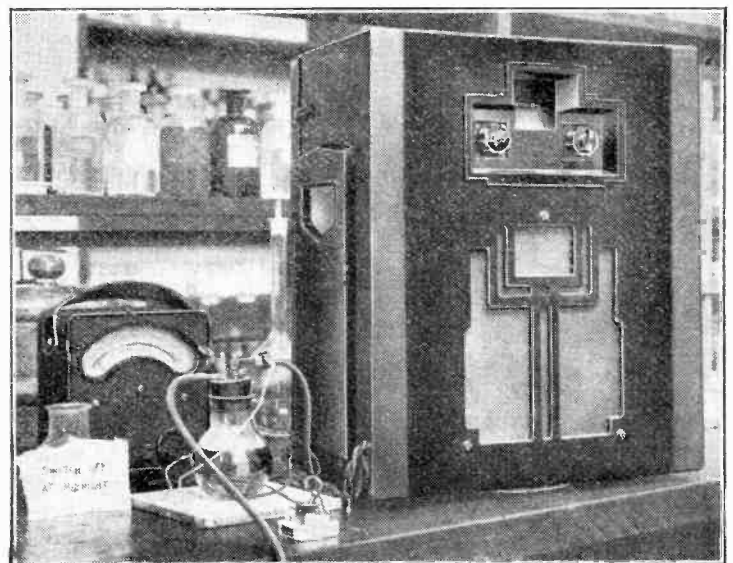
THE behaviour of a battery-operated circuit incorporating both automatic volume control and a quiescent push-pull output stage presents an interesting study from the point of view of H.T. current consumption in relation to signal strength. In both cases the current consumed is in proportion to the work which that particular section of the circuit is called upon to do, but the two factors are working in opposite directions. Thus for a weak signal the output stage is drawing very little current, but the H.F. stages are working at full magnification with a small bias, and are consequently taking the maximum H.T. current.

In a superheterodyne receiver in which a considerable fraction of the total current consumption is accounted for by the H.F. and I.F. stage, we may have the apparent anomaly of a set with an economical output stage taking less current as the signal strength is increased. An example of this is to be found in the Marconiphone "269" portable receiver, and in order to clarify the position some interesting experiments were undertaken by the makers with the aid of the copper voltammeter. This is a device for measuring the average value of a fluctuating unidirectional current, and for the purpose of the tests the voltammeter cell was

connected in the negative H.T. feed lead. With no signal the standing H.T. current was between 12 and 13 mA. Tests were then made over periods of four or five hours on London Regional, Fécamp and Huizen, the average currents being 7.5, 7.2 and 7.4 mA. respectively. Next, a test was made on Daventry long wave at maximum volume with occasional overloading on loud passages to ascertain the maximum average current consumption. The result worked out at 9 mA.

In the latter case the H.F. stages were

The copper voltammeter connected to a Marconiphone portable for investigating the combined effect of A.V.C. and quiescent output stage on the average H.T. consumption.



# UNBIASED

By  
FREE GRID



A reader's remarkable effort towards solving the "tripe and onions" mystery.

## A Comfortable Receiver

I WAS interested in the remarks made by the Editor of this journal the other day concerning the unsuitability of the present tuning dial arrangement, and of the general lack of originality which most designs show.

It is my opinion that the whole design of our sets is radically wrong, as they should be fully controllable from the fireside chair. It is no good arguing that systems of remote control have been devised to prevent the necessity of rising in order to change the programme, as this only means a lot of complicated wiring to the set. What is needed is a pair of velvet-covered knee clamps to which the receiver could be clipped quite tightly in a few seconds.

As for the loud speaker, what more natural position for it than in the arm-chair on the other side of the fireplace where, so far as my own experience goes, it usually sits in the flesh?

## Tripe and Onions

I CANNOT too warmly thank all the many sleuths, both amateur and professional, who have sent me in suggested solutions of what has now become known as the great "tripe and onions" mystery. (New readers should refer to *The Wireless World* for November 17th.) One reader was, however, very near the mark, as his sketch, which I gratefully reproduce above, bears silent witness. Fortunately, however, by an amazing piece of luck, I have been able to clear up the mystery myself, as I will now relate.

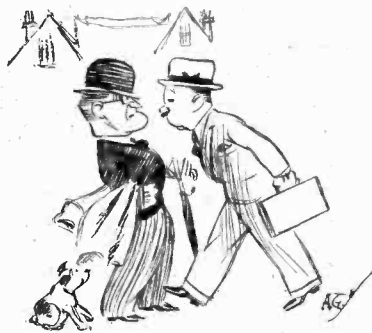
I happened to be somewhat late in journeying down one evening, and as I left the station of the unwholesome suburb in which my cousin lived, I suddenly heard the familiar Morse signals emanating from the loud speakers in the houses which I was passing. I was halting to hear whether the message pertained to kippers or sardines this time, when a little man in front of me, who had done likewise, quickly hurried back in the direction of the town. Needless to say, I was

speedily on his trail, and pulling back the lapel of my coat to show an official badge, as I am told that American detectives do in the talkies, I immediately challenged him and soon had a full confession.

It appeared that the Morse messages were requests for him to do certain shopping overlooked earlier in the day by his wife. They were despatched over a period of half an hour at about the time that she knew he would be leaving the station and be able to pick them up from the loud speakers in the neighbouring houses. As for the transmitter itself, this consisted of nothing more than one of those pestilential violet-ray machines which I know to my cost have a considerable transmitting range even when an aerial is *not* attached to one side of the "make and break."

Possibly the most interesting part of the apparatus was the actual Morse sender. It consisted of one of the old war-time omnigraph machines with which any Morse message could be speedily set up and churned out again and again merely by turning a handle or in the more expensive models by merely starting a small electric motor.

Feeling thoroughly satisfied, I am inclined towards leniency, and have, therefore, contented myself with merely reporting the matter to the proper quarter, knowing full well that this will mean that nothing will be done, though the delinquents may not be so foolhardy as to start their malpractices again.



Quickly hurried back.

## Ingenious Fraud

MY attention was arrested a week or two back by the superb artistry of a London pavement violinist.

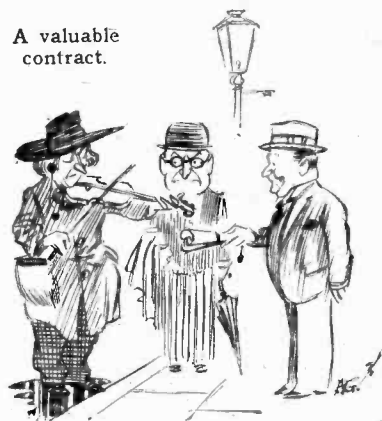
Delightedly I hurried away to find an impresario friend, who not only occupies an eminent position in the musical world but, in addition, really knows something about music. He fully shared my enthusiasm, and for hour after hour we stood enraptured in front of our newly discovered Paganini.

Now and again he would pause for a rest, but never for long, and my friend was on the point of handing him a valuable contract for "the halls," complete with dotted line and fountain-pen, when

I stretched out a restraining hand; for my keen powers of observation, dulled momentarily by the soppy and soporific effect of Isaacstein's "Melody in H," were jerked rudely into activity once more when I noticed that at the conclusion of each piece he furtively consulted the foreign programmes section of a singularly greasy and dog-eared copy of *The Wireless World*.

There was also a certain suspicious bulginess about his clothes, and yet another point that struck me was that he did not, when resting, remove the violin from his chin.

A valuable contract.



What finally decided me to take action, however, was the fact that he stood in a puddle of water. Accordingly I prodded him in the abdomen with my umbrella, thus compelling him to take a backward step out of the puddle in order to preserve his balance. Instantly the melodious notes from the violin gave place to a piercing high-pitched whistle.

As I had rightly suspected, he was working too near the oscillation point, and the sudden removal of his low-resistance earth connection had caused the concealed battery midget to fly off into oscillation.

One could not but admire his ingenuity. The aerial consisted of several wires sewn into the lining of his overcoat, the earth wire running down his leg and then through a hole in the sole of his boot to the hobnails.

It was only necessary for him, after glancing at his *Wireless World* foreign programme section, to put his hands inside his overcoat to tune in the station and start going through the motions of playing his violin while the midget moving coil in the body of the fiddle did the rest. Naturally, he had to keep his violin *in situ*, partly to conceal the loud speaker connection, which came out of the top of his collar, and partly to let him have both hands free for tuning.

As for the risk of the public hearing the preliminary announcement, this was nil, since he could switch the loud speaker in or out of circuit by a tiny switch in the neck of the violin, his own listening being done by a tiny deaf-aid earpiece.

# New Valves in Old Sets

## II.—How Amplification, Stability and Quality are Affected

**A**N H.F. pentode with a 5-pin base may be plugged into any set designed for the corresponding S.G. valve (variable-mu or otherwise). The other type, which is not readily interchangeable, has a 7-pin base, in order that the suppressor grid and metal coating may be brought out to separate pins. This is necessary in many modern circuits, but we are not discussing them just at the moment. The Mullard VP4 and Cossor MVS/PEN. can be obtained "ready for use" with 5-pin bases.

Generally speaking, the pentodes have slopes about equal to those of the most recent S.G. types. But the  $\mu$  is enormous. Unless the dynamic resistance of the tuned circuit is exceptionally high (as with a high-efficiency iron-core coil) the increase in amplification is inappreciable. The other advantage of the H.F. pentode—ability to handle a very large signal amplitude—hardly concerns us, because only very recent designs require enormous



*IN last week's issue the question of substituting new valves in general, and H.F. amplifiers in particular, was discussed. The special uses of H.F. pentodes and new detectors, L.F. amplifiers and output valves are now considered.*

the same  $\mu$  but a higher G is chosen, there is a likelihood that it will take an excessive current if it is allowed to. A resistance coupling (which, of course, includes the parallel-fed transformer) does not allow it, because the voltage actually on the valve anode drops correspondingly. But a directly fed transformer may be badly saturated. To avoid this difficulty the high slope may be taken in the form of increased  $\mu$ . The result is then a proportional rise in amplification, which may not be an unmixed blessing. It increases the tendency to hum, motor-boating, microphony, overloaded output or underloaded detector. Apart from that, the high-slope triode, with a  $\mu$  in the neighbourhood of 100, is likely to do more harm than good even to the amplification, by throwing a greater damping on the preceding tuned circuit. Altogether it is a bad move.

### Drastic L.F. Changes

It may, however, be practicable to make use of the efficiency of modern valves to cut out a L.F. stage entirely. This disposes of a possibly embarrassing excess of amplification; but, of course, the survivors must work double-shift. A good way of getting the necessary extra magnification to enable a whole valve to be saved is to use as the detector a S.G. valve; or, better still, an H.F. pentode, such as the Mullard SP4. The latter type of valve is less tricky to get right; S.G. valves are apt to be disappointing unless all the working conditions are just so. But the great merit common to both (in addition to the large amplification) is the absence of damping on the input tuned circuit. Improved selectivity and sensitivity are secured at one stroke.

(Concluded from page 447 of last week's issue)

Fig. 5 gives the circuit in the case of the Osram MSP4. Whether pentode is used or triode, the increased slope is likely to make oscillation much easier—perhaps too easy. If so, it may be a sound plan to remove a few turns from the reaction coil. A good principle is to use as few reaction turns as will serve the purpose.

In view of the foregoing suggestions, the L.F. stage shown in Fig. 1 may have ceased to exist by the time we arrive there. It is quite superfluous with modern valves. But, supposing it to be too much trouble to uproot the stage, the same general principles are observed as heretofore, except that the existence of grid bias makes it possible to exercise more control on the anode current. Study of this point is particularly worth while in battery sets. It is seldom necessary or desirable to take more than about 2 milliamps.

### Estimating Overall Magnification

The results given by resistance-coupled stages are calculated in just the same way as for H.F. stages, with this advantage, that the actual anode coupling resistance is much more likely to be known. On the other hand, the valve resistance is not quite such a simple matter, because the voltage on it is more or less considerably reduced. The valve resistance is consequently greater—sometimes quite a lot greater—than that specified in the valve list. In most cases one isn't far wrong in taking a figure 50 per cent. higher.

Now we come to the last stage. Some very high slopes have been attained by recent valves. There is the Micromesh PA1 triode, with 12 ma. per volt, and the Mazda AC2/PEN. with 9 ma. per volt.

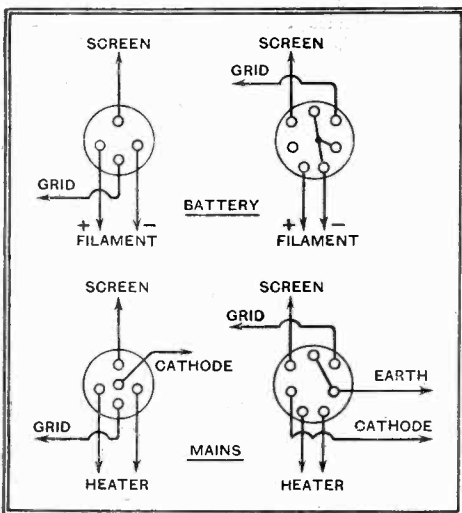


Fig. 4.—Changing over to H.F. pentodes: appropriate alterations to wiring when 7-pin valve-holders are employed.

signal voltages to be handled in the H.F. stages. If the old valve was a high-slope S.G. type, there is no reason to expect noticeable improvement on substituting a pentode with the same slope. The Mazda AC/S2/PEN., however, is rather exceptional with its slope of 6 milliamps per volt; and if one cares to go to the trouble of fitting a 7-pin valve-holder it is capable of giving a useful increase of gain. Fig. 4 shows how little alteration in wiring is involved in changing over to a 7-pin pentode.

To pass on to the detector in Fig. 1; assuming the usual grid-leak type, there is no bias (until a station is tuned in). When a new valve with approximately

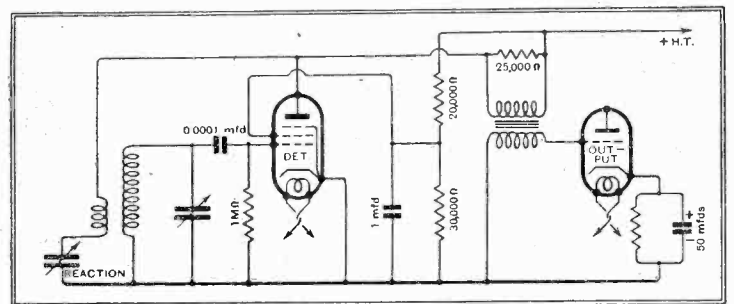


Fig. 5.—An H.F. pentode, used in this way as a detector, has several important advantages.

Such valves as these plugged into receivers several years old are not likely to be satisfactory. The AC2/PEN. has a 7-pin base, and thus cannot be immediately substituted.

The receiver must be designed to make proper use of these exceptional valves. But a mild degree of stimulation can be quite safely imparted to a rather tired

**New Valves in Old Sets—**

set by careful choice of replacements. As a general rule, assuming that the original valve suited the loud speaker, the best all-round results are given by a new valve in which the higher slope is about equally due to lower  $R_a$  (impedance) and greater  $\mu$ . If anything, the tendency should be in favour of increasing  $\mu$  rather than decreasing  $R_a$ . It is difficult to make a universally applicable recommendation, for there are so many things to take into account; but provided that one does not abandon oneself recklessly to an orgy of "slope," things cannot go very far wrong. Adopting the above rule, it is often possible to use the same grid bias as before—a definite advantage when auto-bias is employed. But the question of bias must be carefully gone into with the aid of the makers' slip. Fig. 6 compares curves for typical old and new small power valves, and the effect on the biasing question can be grasped from it. O is the curve for an old valve with a slope of about 1 ma. per volt. It is biased to the point marked—about  $7\frac{1}{2}$  volts. The other three valves are all recent types with slopes of 3 ma. per volt; but A has the same  $\mu$  and lower  $R_a$ , and obviously requires more bias. By the same token it requires more amplification preceding it to drive it fully. The maximum power output is also greater; but, as the impedance is only one-third that of valve O, the loud speaker is no longer properly matched, and the full benefit would not be obtainable without altering the loud speaker impedance to suit it.

Curve C relates to a valve having the same  $R_a$ , but three times the  $\mu$ . Considerably less bias is required, and less grid swing to produce full output. The output is somewhat less, but not in the proportion of the bias, so the sensitivity (milliwatts output for a given grid swing) is higher. And the original loud speaker is correctly matched.

Curve B indicates more  $\mu$  and less  $R_a$ : the same bias voltage is quite correct. The same amount of amplification is required of the preceding stages in the receiver, and the output is rather greater. The valve impedance is on the low side for the original loud speaker, but that is a very good fault.

The output pentode, being a relatively modern type of valve, has not changed much. New types have been brought out, but the original types have not shown much tendency to increase their slopes. Unless, therefore, the intention is definitely to alter the design of the receiver, there is not much to be said under this heading.

**Pentode Valve Bases**

There is one point that should not be forgotten when ordering a replacement. Originally, all output pentodes had the auxiliary grids connected to side terminals, the other electrodes being brought to 4- or 5-pin caps for battery and mains valves respectively. Now the side terminal is abolished and 5- and 7-pin caps substituted. So, unless you are prepared

to fit new valve-holders, you must take care to order side-terminal valves.

A quite appreciable all-round increase in working voltages of an A.C. set, and consequently in undistorted output, can be gained by the simple expedient of substituting a rectifier of low internal resistance, such as the Micromesh R series, for an old type. As these, and a number of other makes, have slow-heating cathodes,

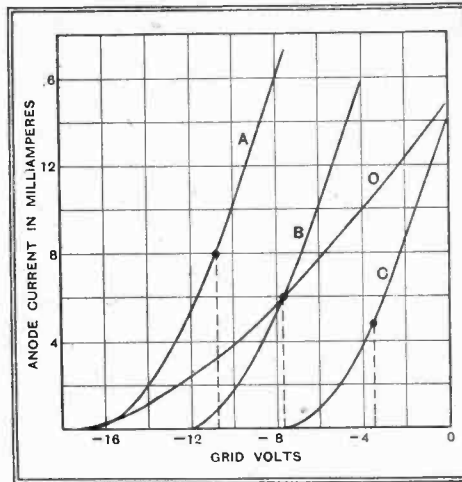
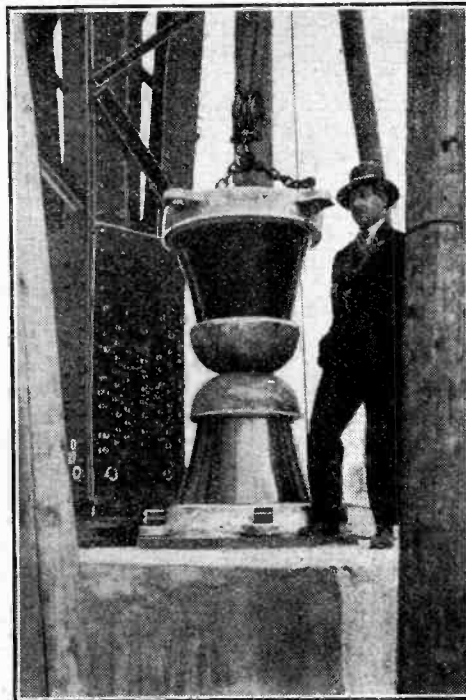


Fig. 6.—How the question of grid bias may be affected when fitting a new output valve.

there is no danger of the greater voltage jeopardising the smoothing condensers, because it is not applied until the load of the other valves has come on.

If, before embarking on valve replacements, the decoupling arrangements were no more than just good enough, the probability is that they will not be good enough when more lively valves are in operation. It is not always very easy to tell when this is so. Long before actual motor-boating or other obvious signs of distress



AT BUDAPEST. The base of the 1,020-ft. cigar-shaped mast of Hungary's new 120 kW. transmitter. The porcelain base supports a weight of 480 tons.

set in, there is distortion or loss of amplification, or both. So, in cases of doubt the decoupling should be augmented, or introduced if none exists. Decoupling can be made more effective by increasing either the resistance or capacity comprising it; but, in order to avoid dropping too many H.T. volts, the latter alternative is usually to be preferred.

D.C. working is in a class by itself, and a most unhappy one. Valve designers seem to have been unable to make up their minds what to do about D.C., because every new batch has a different heater current. This wouldn't much matter with anything else, but on D.C. it matters vitally. All the current goes through all the heaters in series, so substituting a valve rated at a different heater current or voltage throws the whole set into confusion. It is a nasty business.

In any case, indirectly heated D.C. valves are quite recent, and so hardly come within the scope of this article. And the earlier D.C. sets were most unpleasant pieces of work, using all sorts of make-shifts, such as ordinary battery valves run in series. It is a case for set replacement rather than valve replacement.

**THE RADIO INDUSTRY**

**T**HE ALTON BATTERY CO., LTD., of Alton, Hants, have obtained contracts for replating batteries at the telephone exchanges at West Hartlepool and Dudley. A number of large batteries are being exported to South Africa.

Purley Radio, Ltd., recently arranged a successful and well-attended recital of electronic music executed on the *Electronde* by Martin Taubmann. The *Electronde*, which was illustrated in *The Wireless World* of July 21st, is now actually on the market at the price of eight guineas complete: it includes two oscillator valves and a controlling valve, of which the function is to determine the suddenness with which a note is started or stopped, and thus the nature of the music may be controlled by the executant. The *Electronde* works with any broadcast set, and includes several ingenious and practical features, including what would be referred to in wireless circles as a "band-spreading" device, whereby the length of the invisible keyboard may be adjusted to suit the player. Four-electrode valves, which take their anode voltage from the L.T. battery, are used throughout. The makers are the Electronic Music Development Co., Ltd., 16a, Whyteleafe Road, Purley, Surrey.

We have received from Microfuses, Ltd., 36, Clerkenwell Road, London, E.C.1, a list giving full particulars of current-carrying capacity and resistance for all the standard fuses now available. These range from 3 to 750 mA., and may be supplied in three types suitable for 260-, 750- and 1,500-volt circuits.

A series of blue-print curves has also been prepared to show the time lag in milliseconds between the application of overload currents of different values and the actual breaking of the circuit.

Copies of the data sheet and of the "speed of fusion" curves relating to the particular fuse required will be sent to readers on application.

In a recent reference to a receiver by Messrs. Berry and Wilson, Ltd., of Mansion Works, Gt. Horton, Bradford, we referred to the instrument under the name "Distavox," this name having inadvertently been given to it by the manufacturers, who were unaware at the time that the name "Distavox" was the property of Distavox, Ltd., of 119, Bunhill Row, E.C.1.

# Television Explained

## VII.—Variable Speed Scanning

**T**HE usual cathode ray television receiver can be used for the reception of all ordinary kinds of transmissions, whether they are effected by cathode ray tubes, Nipkow discs, or mirror drums. The receiving tube, in fact, merely performs in a different manner the functions carried out by a modulated light source and a mechanical scanning system. An alternative arrangement, however, is possible, and it is one which is not based in any way upon mechanical methods and which involves the use of cathode ray tubes at both transmitter and receiver. The tubes, moreover, can be of simpler construction than those normally used for television purposes, since a means of controlling the density of the electron beam is unnecessary. In the construction of the tube, therefore, the electrodes for modulating the electron beam can be omitted.

The system is due to Von Ardenne and is usually known as variable speed scanning; instead of the light spot traversing the screen at a steady rate to build up the scanning lines, its speed depends upon the light and shade in the picture. At first sight, the system appears complicated, and there are undoubtedly practical difficulties in the way of obtaining satisfactory results at the transmitting end. The basic theory, however, is delightfully simple, as is also the receiving equipment.

### Brilliance *v.* Speed

Suppose we set up a cathode ray tube and apply a saw-tooth waveform to one set of deflecting plates only. A single line of light will appear on the viewing screen, and we may enquire what governs the brilliancy of this line. Apart from factors such as the screen material, the construction of the tube, and its operating voltages, which for our present purposes we may take as constants, the important point is the speed at which the spot of light traverses the screen to produce the visible effect of a line through the retentivity of the eye. Provided that the speed of repetition is not so slow that the building up of the line becomes visible, the slower the speed of traverse, the more brilliant will the line appear. This carries with it also the assumption that the number of repetitions remains constant, which means that under certain circumstances the operating voltage on the plates of the cathode ray tube may not assume a true saw-tooth waveform.

It is of great importance fully to appreciate this point, so that it will be well to consider it in somewhat greater detail. Suppose that the spot of light is moving down the viewing screen 15 times a

second. The deflecting plates of the tube have applied to them a true saw-tooth waveform in which the potential rises steadily to its maximum value and then drops instantly to zero, so that the spot of light moves steadily across the screen, and having completed one line immediately drops back to its starting point ready for the next line. This condition is then the same as for ordinary cathode ray television scanning, save that in practice, another voltage is applied to the other set of deflecting plates to spread the lines out to form a picture and the frequencies are higher than we are here assuming.

Suppose now that we arrange matters so that the spot of light traverses the line more rapidly, and having completed a line, let it drop back ready for the next line as before. Instead of letting it commence the next line immediately, however, let us so arrange matters that an interval elapses equal to the difference of

*THE possibilities of the cathode ray tube are not confined to methods which are basically similar to those of mechanical systems, and television can be arranged by purely electrical means. In this article, a new and attractive method is described, the particular advantage of which is the extreme simplicity of the receiving equipment.*

obvious, therefore, that in an uncontrolled system of this nature the number of pictures a second becomes a very variable quantity. Should the picture predominate in light patches, the cathode ray beam moves more slowly than if it be largely dark, and a longer time is required for the complete traverse of the whole picture. Thus, there will be fewer pictures a second with a light object than with a dark.

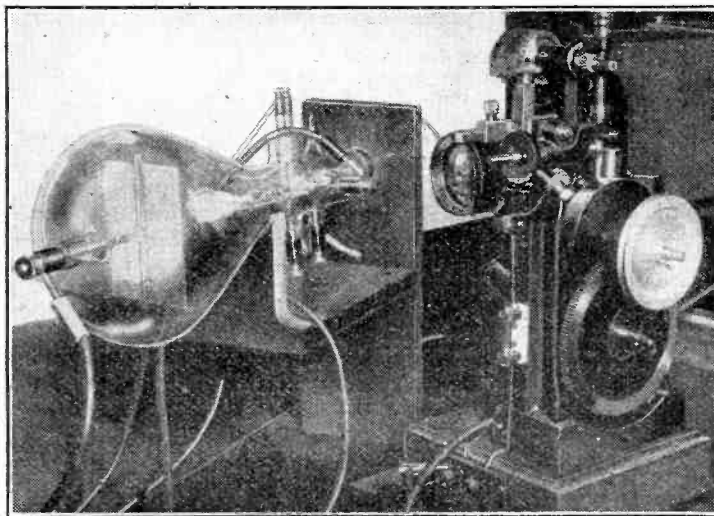
In order to avoid this, it is usual to arrange matters so that the normal time

for a single scanning line is that for a white object. The usual line is darker than this, so that means are included to stop the beam at the end of the line and make it wait until the correct time has elapsed before starting the next line. In other words, a definite time interval is assigned to each line, and if the picture be such that the beam has scanned a line in a shorter interval, it must wait before it starts on the next line. In this way the number of scanning lines and pic-

tures a second is maintained constant as with ordinary cathode ray television methods.

One arrangement for achieving this form of television is illustrated diagrammatically in Fig. 1. The beam from the transmitting tube is focused on to a photo-cell or its equivalent, passing through a cinema film on its way. The oscillators provide voltages to the deflecting plates which cause it to describe a series of lines, just as in the case of an ordinary transmitter. If we now took the photo-cell current and applied it to the modulating electrode of a television type cathode ray tube, to the deflecting electrodes of which the synchronising voltages were applied, we should have an ordinary cathode ray television system.

Instead of doing this, however, the out-



This photograph shows some of the experimental gear employed for television by the variable-speed scanning system.

time of the two speeds of traverse. Whatever the actual speed of traverse, therefore, there will be exactly the same number of lines a second, but the higher the speed, the smaller will be the time during which the spot of light is actually traversing the picture. Obviously, therefore, the higher the speed, the less visible will be the line.

### The Scanning System

This is the principle adopted in variable speed scanning. The light and shade in the picture is reproduced, not by variations in the intensity of the electron beam, but by variations in its speed of traverse. Over a dark portion of the picture the beam moves rapidly, but over the light parts much more slowly. It will be

**Television Explained—**

put of the photo-cell is applied to the oscillators controlling the deflection of the cathode ray beam. After suitable amplification, matters can be so arranged that a reduction in photo-cell current causes an increased voltage to be applied to the deflecting plates, so that when a dark portion of the picture passes in front of the beam, the speed of the latter is accelerated.

If we parallel the deflecting plates of the transmitting tube with those of an ordinary cathode ray tube fitted with a fluorescent screen, therefore, the beam in

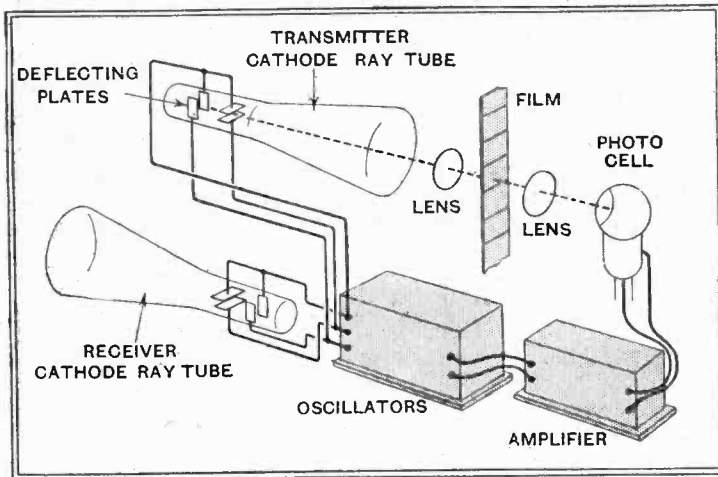


Fig. 1.—The details of the variable-speed scanning system are illustrated here. The receiving tube is shown as connected by wires to the transmitting apparatus; actually, of course, a radio link can be interposed.

the latter will vary in exact accordance with that of the transmitter, and the picture will appear on the screen. It will be observed that two sets of deflecting voltages are required, but as they are of widely differing frequencies, they can be carried by a single pair of wires, and separated at the receiving end by suitable filters. Alternatively, they can be used to modulate the carrier of a wireless station.

The extraordinary simplicity of this arrangement from the receiving point of view will now be apparent, for in addition to the receiver, nothing is required beyond the cathode ray tube, mains equipment for its operation, and suitable filters to separate the deflecting voltages. No oscillators or synchronising circuits are necessary. The cathode ray tube is thus analogous to a moving-coil loud speaker of the energised type, the mains equipment for its operation being not unlike that for providing the field current of the speaker.

Although this seems a striking advance, the transmitter is actually more complicated than that with ordinary methods, and the major difficulty of television, the wide sideband spread, is in no way alleviated. This may well explain the reason why experimenters in the transmitting field usually stick to the older systems. Nevertheless, it is to be hoped that more attention will be paid to this system in the future, for it possesses the supreme merits of lower cost and simpler operation on the part of the receiving equipment, and would thus appear more suitable for general use in broadcasting.

# Lissen Car Radio Equipment

## Six-valve "Straight" Receiver with Class "B" Output

READERS are doubtlessly familiar with the outward appearance of the Lissen motor car wireless equipment from the several illustrations that have already appeared in this journal, yet so far very little technical information has been available, but a recent demonstration afforded the opportunity for a more detailed examination, during which some interesting facts were revealed.

The receiver is intended mainly for battery operation, and consists of a six-valve "straight" receiver having three H.F. amplifiers, a diode, serving for detector and A.V.C. control, a driver stage, and finally a Class "B" output valve. This arrangement ensures a very high order of sensitivity coupled with a large power output—about two watts maximum—yet economical so far as battery consumption is concerned. There are three tuned circuits, for only the H.F. intervalve couplings are tuned, the aerial circuit being aperiodic. A.V.C.

operates on all the H.F. valves and gives very good control indeed. There is a manual volume control, however, embodied in the L.F. amplifier. Lissen iron-cored coils are used, and the receiver unit is housed in a stout iron container measuring less than a foot cube and designed for sinking below the floor-boards in the car.

On the remote control unit, which is fixed to the steering column, are three controls, namely, tuning, volume and wave-band

modated in the front cockpit just under the dash. A further unit contains the H.T. battery, which may be located in any convenient part of the car. Alternatively, an H.T. converter driven by the car battery could be employed, and there is a model available with it incorporated in the receiver.

We understand that with the battery model about 2½ amps. only are taken from the car battery.

Over a dozen stations were tuned in with ease and at good volume during daylight, and in the heart of London. The A.V.C. holds signals at a constant level once this is adjusted by the manual control despite rapid change in direction, screening by buildings or when passing under iron bridges.

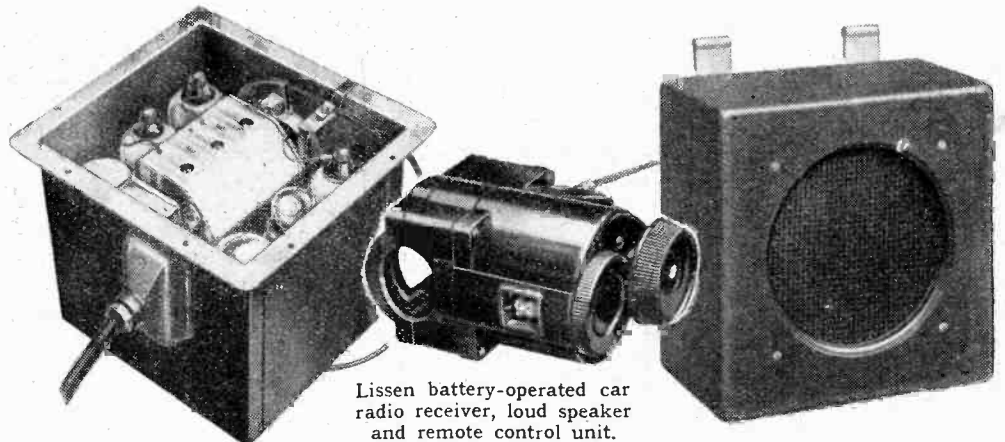
The controls are most conveniently placed and fall readily to hand, since they are grouped on the extreme right of the unit. The switching lever is a little inaccessible, especially when wearing thick gloves, as it is partially obstructed by the tuning knob; however, this is minor detail.

Tuning is not critical, yet the selectivity would appear adequate for the needs of motor car wireless, while the quality of reproduction is very good and well up to the best standard attainable with Class "B."

The battery model costs £25 and the converter style £30. The makers are Lissen, Ltd., Lissenium Works, Worpole Road, Isleworth, Middlesex.

### BOOKS RECEIVED

**Worked Examples for Wiremen and Students**, by H. Rees. A concise guide to D.C. circuit calculations. Each section begins with a brief summary of the principles involved, followed by worked examples and questions. The sections include:—Ohm's Law, Series and Parallel Circuits, Power and Energy, Resistance of Wires and Cables, Simple D.C. Measurements, Dynamo and Motor Calculations, Starting Resistances for D.C. Motors, and selected examination questions from City and Guilds and A.M.I.E.E. Examinations. Pp. 114+vii, with 23 diagrams. Published by Sir Isaac Pitman and



Lissen battery-operated car radio receiver, loud speaker and remote control unit.

switching. A Bowden cable transmits the drive to the gang condenser, but the wave-band switching and the volume control are electrically operated. A small relay is used for the former, and with it is combined the on-off switch and the loud speaker field switch. The tuning dial is wavelength-calibrated with the medium- and long-wave scales illuminated in different colours for easy identification.

The moving-coil loud speaker is a separate unit having its field energised from the car starter battery, and will usually be accom-

Sons, Ltd., Parker Street, Kingsway, London, W.C.2. Price 3s. 6d.

**Wireless for Beginners**, by C. L. Boltz, B.Sc., explaining in non-technical language the general principles of wireless reception and the various types of receivers, loud speakers and radio-gramophones, with explanations and definitions of the terms used, and the functions of the various components. Pp. 227, with 114 diagrams and illustrations, and 5 plates. Published by G. G. Harrap and Co., 39, Parker Street, Kingsway, London, W.C.2. Price 3s. 6d.

# BROADCAST BREVITIES

By Our Special Correspondent

## Is the Public So Bad?

IT is feared in the B.B.C. Engineers' Department that brickbats will be flying in January next when the Lucerne Plan comes into operation, for the simple reason that the British wavelength changes are so slight. The engineers, who must have been studying psychology in their spare time, feel that many people will not bother to alter their tuning, but will simply boost up the apparent decline in signal strength by means of the H.F. or L.F. volume control. Result: Poorer quality. Further result: Brickbats.

However, I believe this is a case where the B.B.C. underestimates the intelligence of the British public.

## B.B.C.'s Recording Section

A NEW department figures on the B.B.C. pay-roll. This is the Recording Section, with an engineer in charge, who, with the aid of a growing staff, will superintend every type of recording carried out by the B.B.C.

### Systems Used

In addition to the well-known Blattner-phone system, two other methods are now used. There is the system employing a soft wax disc which goes through the ordinary pressing and baking processes of a gramophone record, and can be available for re-playing in not less than six hours. Secondly, there is the platinum blank, which can be played back immediately, and costs only two shillings.

The B.B.C. rather favours this last method, although recognising that the quality is not quite so good as that obtainable from the other methods. It is, however, extraordinarily useful at rehearsals.

## Quick Progress at Droitwich

THE two 700ft. masts at Droitwich are now nearly completed, and in a week or two the first of the heavy apparatus will be delivered, including the Diesel generator sets, transmitters, rectifiers, and motor generators. These are now undergoing official tests at the works.

The first test signals from Droitwich may go out by April next.

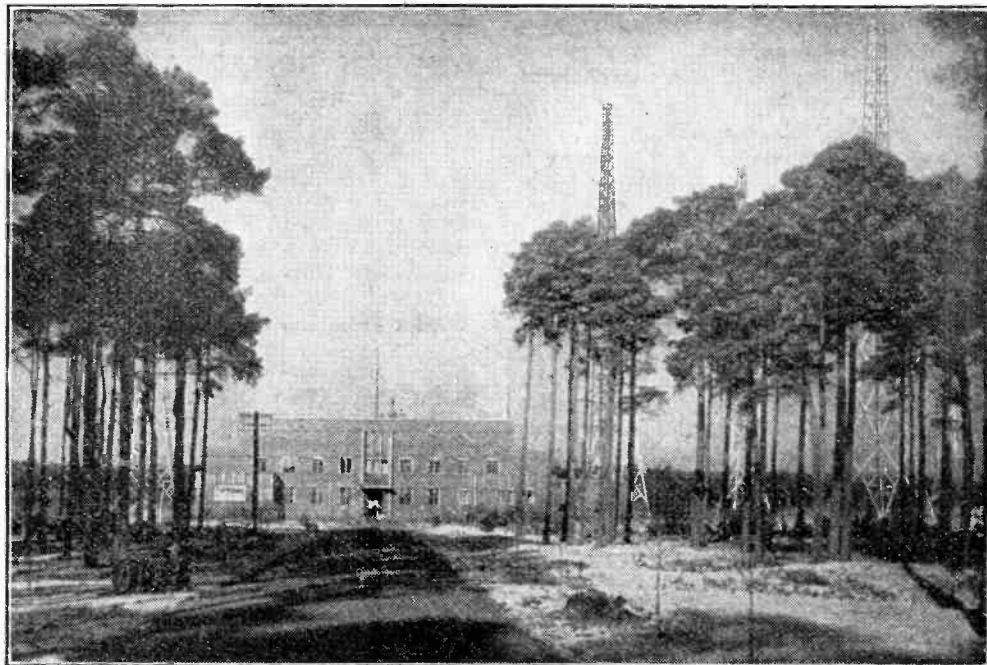
## An Innovation

"B.B.C. Prayer Book in Moon," ran the title of a roneoed note which reached me the other day. I imagined that the B.B.C. was taking another step towards including the whole solar system in its service area.

Actually, the note came from the National Institute for the Blind, and told how the B.B.C.'s book of prayers for the morning services is now issued in the system of embossed lettering known as "Moon" type. This was invented by the late Dr. William Moon, of Brighton, for the special benefit of the aged blind and others having difficulty in mastering the Braille alphabet.

## News from Maida Vale

IN *The Wireless World* of September 1st last I was able to offer you the first exclusive photograph of the discarded skating



GERMANY'S "DAVENTRY." A fine scenic setting has been found for the new short-wave broadcasting centre at Zeesen, which will shortly open directional services to South Africa, South America and the Far East. Omni-directional aerials will also be used.

rink in Maida Vale which the B.B.C. has now leased from the Ecclesiastical Commissioners for use as an auxiliary broadcasting studio.

The skating rink will fulfil exactly the same functions as the old No. 10 studio at Waterloo Bridge.

## No "Proms" in the Skating Rink

There is no truth in the stories that the Promenade Concerts will be transported to this suburban retreat, or that the May Festival series will not be given in the Queen's Hall; nor is it likely that the "Music Hall" programmes will be broadcast from Maida Vale. There is every likelihood that the St. George's Hall will be retained permanently for B.B.C. use.

## Broadcast Concerts from the National Gallery

HOWEVER ugly the National Gallery, Trafalgar Square, may appear from the outside, no one can fail to admire the impressive interior, particularly under the cupola.

Strolling in there the other day, it occurred to me that here was a first-class broadcasting studio. Some years ago, if I remember rightly, lunchtime recitals were given in the Gallery with a small string orchestra; what more appropriate than a revival of this pleasant custom in a building which from all appearances should prove acoustically excellent for broadcasting? The novelty would also draw more visitors to the Gallery, which, to my mind, badly needs a "boost."

## The New Fashion

NOT to be beaten by the films and the theatres, the B.B.C. is "going historical." I hear that the idea is to dwell on the great days of Queen Elizabeth, and one of the first efforts will be by Herbert Farjeon, who is working on a masque dealing with Good Queen Bess. It will form part of the "It Might Have Been" series.

## History of a Later Day

I had a chat the other day with Leslie Baily, author of that other very successful historical piece, "Scrap Book," broadcast

on Monday last. I understand that this may be the forerunner of a series. Actually, the idea was carried out in the North some years ago, and, like many another good scheme, has proved old enough to be new again.

## Around Scotland

SCOTTISH Regional listeners on Christmas Eve will hear a programme taken from the three broadcasting stations in Scotland, entitled "Round the Country." Janette Sclanders, in Glasgow, will sing songs by Handel, Roger Quilter, and other famous composers; Richard Garioch playing in the Aberdeen studio, will give some familiar violin music, and Frank Philip will have two groups of songs to sing from Edinburgh.

## Archbishop of Canterbury to Broadcast

The Sunday evening service at 8 o'clock on New Year's Eve will be relayed from Canterbury Cathedral. The Archbishop of Canterbury will give the address.

## On New Year's Eve

Scotland will play its customary share in the New Year celebrations. The Watch Night service on New Year's Eve is to be relayed from St. Giles' Cathedral, Edinburgh, and included in the National programme. The broadcast will start at 11.45 p.m., and end at five minutes to midnight.

## A Record Appeal

ON behalf of the London Hospital, Sir William Goschen, chairman, will broadcast an appeal on December 17th. It was on a Sunday in February, 1928, that Lord Knutsford, "Prince of Beggars," made his seventh and final quinquennial appeal during his long chairmanship of "The London," the largest institution of its kind in England. On that occasion he said, "I am specially anxious for the success of this year's effort, as I am seventy-three years of age, and it will be therefore in all human probability my last."

His words proved prophetic, for a short time afterwards he died; but that last appeal bore fruit. A sum of £20,000 resulted from

his few minutes' talk. Sir William Goschen aims in his broadcast on December 17th at least to equal the record of his predecessor.

**Sims Reeves' Successor**

FRANK TITTERTON'S heroic efforts to revive the songs of his brilliant predecessor in vocal art, Sims Reeves, continue unabated, and on December 30th he is to give another of these Sims Reeves recitals in the National programme. Titterton started singing professionally after the war, during which he served in the Tank Corps, "and," he says, "I required a tank almost to myself, even at that time." His girth has since increased still more, and now, paradoxically, he uses one of the smallest cars on the market.

I believe his presence in a broadcast studio has a quite definite effect on the acoustics.

**Some Toon!**

AFTER following several of the plays in the Radio Drama Festival series I have discovered that each is preceded by a signature tune in which the saxophone predominates. I have now identified this tune, and am still wondering why it was chosen to set its stamp on this great series by the British Broadcasting Corporation. It is Louis Alter's "Manhattan Serenade." Oh boy!

FOREIGN BROADCAST GUIDE

**RADIO ALGER**

(Algiers, North Africa).

Geographical position : 36° 45' N. ; 3° 11' E.  
 Approximate airline from London : 1,045 miles.  
 Wavelength : 363.3 m. Frequency : 825.5 kc/s.  
 Power : 13 kW.  
 Standard Time : Greenwich Mean Time.

**Standard Daily Transmissions.**

11.30 G.M.T. : (Sun.), 12.30, concert ; news ; 18.00, Oriental music ; talks ; weather ; news ; 20.00, main evening entertainment ; 21.55, news.

Announcers : Man and Woman.

Opening Signal : Fanfare of the Sidi Brahim Trumpets (gramophone record).

Call : *Allo ! Allo ! Ici le Poste de Radiodiffusion du Gouvernement Général des P.T.T. d'Alger.* Often abbreviated between items to : *Ici P.T.T. Alger.*

Interval Signal : One stroke on gong.

Closes down with usual French formula, followed by *La Marseillaise.*

According to Lucerne Plan, this station will alter its wavelength to 318.8 m. (941 kc/s) on January 15, 1934.

valve is rated to deliver over 3 watts output to the moving-coil loud speaker, so that the volume obtainable is ample for domestic purposes. Separate cabinets are employed for housing the speaker and the receiver ; the former, therefore, may be used in another room if desired.

The tuning controls are few in number and the manual volume control is operative on both radio and gramophone. Hum is completely absent, and the sensitivity and selectivity are both sufficiently high for the reception of all worth-while Continental stations under average conditions, while background hiss is negligible. The A.V.C. system largely counteracts fading and keeps all the stronger stations at substantially the same volume level. A noise suppressor is fitted, with the aid of which the background so often found while tuning an A.V.C. set can be removed.

**LIST OF PARTS**

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- 1 R.F. Supe: Radiopak, 110 kc/s British Radiophone
- 1 Bulb, 6 volts, 0.15 amp. Bulgin 615
- 2 I.F. Transformers, 110 kc/s Varley "Nicore" BP.42 (Colvern.)
- 1 Screened H.F. choke Bulgin H.F.10 (R.I., Wearite.)
- 2 Fixed condensers, 2 mfd., 200v., D.C. working T.C.C. 50
- 3 Fixed condensers, 0.1 mfd., tubular T.C.C. 250
- 1 Fixed condenser, 0.005 mfd. T.C.C. Type "M"
- 1 Fixed condenser, 0.01 mfd. T.C.C. Type "M"
- 2 Fixed condensers, 0.0002 mfd. T.C.C. Type "M"
- 4 Fixed condensers, 0.0001 mfd. T.C.C. Type "M" (Dubilier, Peak, Telsen.)
- 1 Electrolytic condenser, 50 mfd. T.C.C. 521
- 2 Electrolytic condensers, 4 mfd. T.C.C. 802
- 3 Electrolytic condensers, 8 mfd. T.C.C. 802 (Dubilier, Peak, Telsen.)
- 2 Metallised resistances, 150 ohms 1 watt Dubilier
- 1 Metallised resistance, 400 ohms 1 watt Dubilier
- 1 Metallised resistance, 500 ohms 1 watt Dubilier
- 1 Metallised resistance, 800 ohms 2 watts Dubilier
- 1 Metallised resistance, 4,000 ohms 3 watts Dubilier
- 1 Metallised resistance, 5,000 ohms 3 watts Dubilier
- 2 Metallised resistances, 10,000 ohms 1 watt Dubilier
- 1 Metallised resistance, 20,000 ohms 1 watt Dubilier
- 2 Metallised resistances, 250,000 ohms 1 watt Dubilier
- 2 Metallised resistances, 1 megohm 1 watt Dubilier
- 2 Metallised resistances, 2 megohms 1 watt Dubilier (Erie, Graham-Farish, Claude Lyons, Seradex, Watmel.)
- 1 Tapered volume control, 250,000 ohms Rothermel Type 1-010-004 (Magnum.)
- 1 Plain brown knob British Radiophone
- 1 Potentiometer, 5,000 ohms Watmel T.2 (Haynes Radio, Claude Lyons.)
- 1 Smoothing choke, 10 henrys Sound Sales (Bulgin, Ferranti, Heayberd, Rich & Bundy.)
- 1 Mains Transformer, Primary, 200 to 250 volts, 50 cycles; secondaries, 300-0-300 volts, 75 mA.; 4 volts, 2.5 amps., centre-tapped; 4 volts, 4/5 amp. centre-tapped. Rich & Bundy Type No. 233 (Challis, Heayberd; Savage, Vortexion.)
- 5 Valve holders, 5-pin W.B. Reversed Terminal Type
- 1 Valve holder, 7-pin W.B. Reversed Terminal Type (Bulgin, Clix.)
- 1 Westector Westinghouse W.26
- 1 On-off Toggle switch Bulgin S.80 (Claude Lyons.)
- 1 Double-pole double-throw switch Bulgin S.98
- 1 5-pin plug British Radio Gramophone Co. (Bulgin.)
- 4 Ebonite shrouded terminals, A., E., pick-up (2) Belling-Lee "B"
- 1 Length of Screened Slewing Harbros
- 1 Loud speaker with pentode output trans-former and 2,500 ohms field- Rola F.6/P.2,500
- Cabinets for set and speaker Peto-Scott (C.A.C.)
- 1 Plymax baseboard, 10 1/2 in. x 16 in. x 3/4 in Peto-Scott
- 2oz. No. 20 tinned copper wire, aluminium, 12 lengths Systollex, wood, etc.
- Screws:—  
 4 1/2 in. No. 4 R/hd. 4 1/2 in. No. 4 R/hd.  
 6 1/2 in. No. 4 R/hd. 12 1/2 in. No. 4 R/hd.  
 All with nuts and washers.  
 12 1/2 in. No. 4BA R/hd with metal thread and nuts and washers.
- Valves:—2 Ferranti VPT4, 1 Ferranti VET4, 1 Osram or Marconi MPT4 (Catkin), 1 Osram or Marconi MU12.

**In Next Week's Issue**

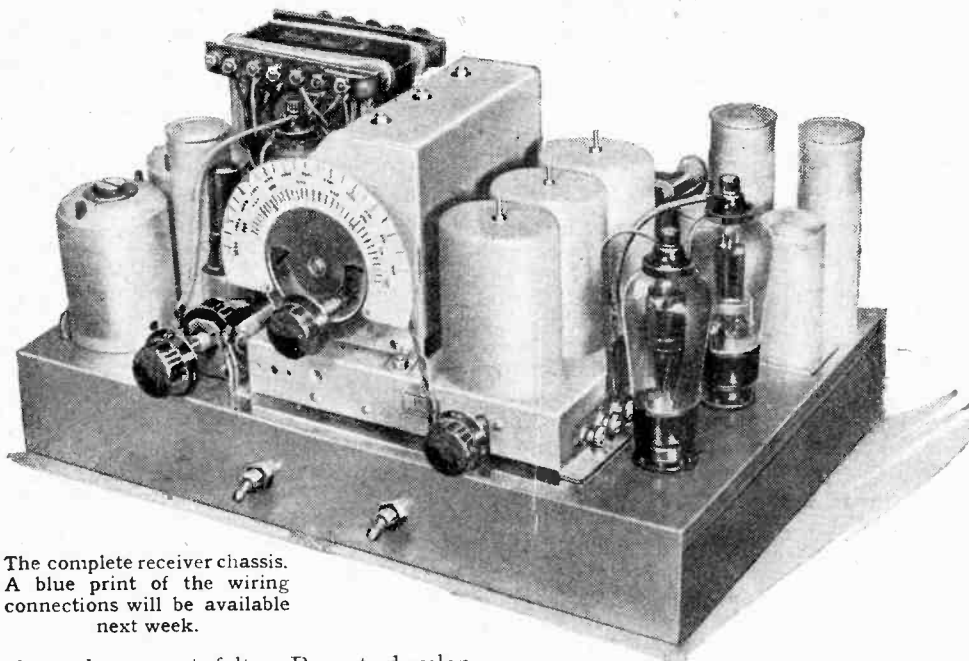
The Wireless World

**Everyman A.C. Super**

A Four-valve Receiver Employing the Most Recent Superheterodyne Improvements

THE standard of performance expected from a receiver is continually increasing, and this is particularly the case with the smaller class of set, for it is here that improvements in valve and circuit design make

The Everyman A.C. Super has only four receiving valves but includes a signal frequency H.F. stage, an I.F. stage with four efficient tuned circuits, and delayed automatic volume control operative on three variable-mu valves. H.F. pentodes



The complete receiver chassis. A blue print of the wiring connections will be available next week.

themselves most felt. Recent developments have led to a striking increase in the efficiency of the four-valve type of superheterodyne, which is now capable of a very satisfying performance.

are used for the H.F. and I.F. stages, and the Heptode provides a single-valve frequency changer which is both efficient and trouble-free. The pentode output



# NEWS of the WEEK

## Current Events in Brief Review

### The Eternal Topic

THE Bavarian broadcasting stations are now issuing weather bulletins five times a day.

### English Talks from Warsaw

MR. THAD ORDON, whose talks in English from the Warsaw Station have proved so popular, will give another address from the Warsaw studio on Monday next, December 18th, at 9 p.m. (G.M.T.). He will give further replies to his numerous correspondents in Great Britain.

### Anti-Propaganda Move

AN International Convention to prohibit the broadcasting of radio propaganda has been discussed at the Paris Institute of Intellectual Co-operation, where jurists have met representatives of the Norwegian and Czechoslovakian broadcasting authorities.

It is proposed to ask Governments to undertake the discontinuance of all broadcast appeals to the inhabitants of other countries likely to affect the peace or security of Europe.

### New P.O. Research "Lab."

THE Engineer-in-Chief's department of the Post Office, which is responsible for the maintenance of all telegraph and telephone communications, as well as the Rugby wireless station, at present occupies seven different buildings within a stone's throw of St. Martin's-le-Grand. The Postmaster-General is about to promote a Bill in Parliament for a new building immediately behind the Central Telegraph Office, which will house the whole department of the Engineer-in-Chief, as well as Administrative Offices. The building will contain the Engineering Workshops and Research Laboratories.

### U.S. Criticism of B.B.C.

AN attack on the British broadcasting system has been launched by the newest member of the American Federal Radio Commission, Mr. James H. Handley.

"The British system," he declares, "is unworkable in this country because of its restrictions on free discourse, particularly political. Moreover, the American people would not stand for a set tax like the one of two dollars fifty per year levied in Great Britain.

"While the British system escapes commercialism, it has the weakness of monopolistic 'czarism' which gives the people what those in charge think they ought to have rather than what they want."

Mr. Handley concludes: "Moreover, to set up a Government-operated radio system in this country might cost the Federal Treasury anywhere from 50 to 100 million dollars to install."

It is difficult not to believe that the last consideration largely governs the attitude of Mr. James H. Handley.

### Radio for Unemployed

LECTURES on wireless for the unemployed of Nottingham are being given on Monday afternoons at 3 o'clock at the Norton Street Centre.

### Three New 100 kW. Stations on Wednesday

THREE high-power German broadcasting stations will come into action on Wednesday next, December 20th. The new Berlin 100 kW. station will begin regular transmissions on 360.5 metres, Munich on 100 kW. on the existing Witzleben wave, and Mühlacker on 100 kW. on Munich's present wavelength of 533 metres.

### The King's Greeting

AN appeal for co-operation by a wireless set owners to enable as many of the public as possible to hear the King's broadcast on Christmas Day has been made by Sir Arthur Stanley, Chairman of the Wireless League. Sir Arthur writes: "The message of His Majesty to his people is of supreme interest and importance and should be heard by every person throughout the whole Empire. Everyone does not possess a wireless set, but it would be a graceful gesture, as well as a patriotic action, if those who do would enable their less fortunate neighbours to hear the King's own voice on the afternoon of Christmas Day."

### Running Commentary on Snail Race

RADIO LL, Paris, does not go beyond the confines of its own studios for lively sporting commentaries. On November 26th an announcer broadcast the closing stages of a race in the miniature "Escargodrome" which had been erected in the studio. Twenty-four hours before the start listeners had been invited to send in their preferences. Each racer was a thoroughbred Bourgoine carrying a number. Numbers 7 and 10 arrived at the winning post (a salad) neck to neck, or, rather, horn to horn. They had crossed the studio in 68 mins. Holders of the winning tickets divided 800 francs in prizes.

### The Radio Hat

AN annual fête has just been held in Paris for the benefit of Mademoiselles who have not hit the matrimonial target by the age of twenty-five. It is the custom on this occasion for the participants to don the *Coiffe St. Catherine*, a distinctive headpiece, the design of which is left to the ingenuity of its wearer. One of the most successful hats was in the shape of a radio transmitting station with centre building, high aerial masts, and golden wire connections. Our Paris correspondent states that the transmissions, though waveless, were picked up by a number of receptive bachelors.

### Interference Made Illegal

FRANCE has taken the lead. The *Journal Officiel* publishes the anti-interference decree which makes it illegal as from April 1st, 1934, to operate electrical apparatus capable of interfering with wireless reception. The decree consists of eleven clauses. No one, from manufacturers, retailers, and users, can escape responsibility. The manufacturers and purveyors of electrical apparatus must equip it with the necessary devices for preventing radiation, while purchasers must see that the law has been complied with.

Provision, however, is made for softening the application of the law in cases where the disturbance is not very grave or where the existing technique is not yet equal to the complete suppression of the trouble. It is, therefore, considered that certain domestic ap-

### Germany's "Daventry"

WITHIN the next two or three weeks Germany will supplement the present short-wave transmissions to America with a regular schedule of programmes to South America, Japan, and South Africa. This will be possible by means of the new plant at Zeesen. There are now ten masts, each 70 metres high. Like the B.B.C. short-wave station at Daventry, Zeesen makes use of omni-directional waves in addition to those transmitted from the beam aeriels. The American transmissions are made on 19.5, 25.5, and 49.8 metres. There are two beam aeriels for South Africa, one for the 49.8-metre wavelength, the other for use both with the 25.5-metre and the 31.38-metre wavelength.

Japan and the Far East are also catered for by two beam aeriels. One is used exclusively for these



IN TEGEL FOREST, near Berlin, the new 100-kW. station has been built to replace the 1.5-kW. transmitter at Witzleben. The station will begin regular transmissions on Wednesday next (December 20th) on 360.5 metres, the present wavelength of Mühlacker.

pliances, such as irons, vacuum cleaners, etc., will probably remain outside the operation of the law, and it is likely that the decree will not require the attachment of apparatus, the cost of which would be out of proportion to the importance and value of the installation.

The law will be enforced by the Post Office officials, assisted by the police. The penalties for a first offence range from 16 to 50 francs.

### Another Power Increase

THE Deutschlandsender is to be raised in power to 150 kW. during 1934.

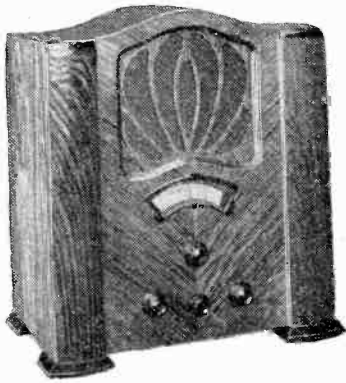
### "The Whole Town's Talking"

THE Lewcos Staff Dramatic Society recently made their second public appearance in "The Whole Town's Talking." The performance proved an even greater success than that of "The Sport of Kings" given last year. The play was under the able direction of Mr. Frank Lockett, who must accept our tribute of praise on behalf of his very able cast.

Eastern transmissions on 19.7 metres; the other, working on a 31.38-metre wavelength, can transmit either to the Far East or to South America by means of converting the aerial into a reflector and vice versa as at Daventry. The last of the beam aeriels is permanently directed to South America for use on a wavelength of 16.89 metres. There are two short-wave transmitters. The station is connected to the studios of the Deutschlandsender a few miles away.

### Candidates for Free Reception

SINCE the introduction of the radio tax, the French Government has been deluged with requests for special clemency in regard to certain sections of the community. The latest is an appeal from the Communist group asking that licence fees may be waived in the case of people suffering from consumption, the aged and infirm, and all those incapable of earning their living. It is stated that the authorities are afraid that the last category would admit of a dangerously wide interpretation.



# FOX Superheterodyne

TYPE 401A

**FEATURES.** *Type.*—Table model superheterodyne receiver for A.C. mains. Moving-coil loud speaker. Provision for pick-up and external L.S. **Circuit.**—Band-pass input to frequency changer valve—I.F. band-pass filter—anode bend second detector—output valve. Full-wave rectifier. **Controls.**—(1) Tuning with illuminated dial calibrated in stations and wavelengths. (2) Volume control and on-off switch. (3) Waverange switch. (4) Tone control. **Price.**—13 guineas. **Makers.**—Fox Industrial Ltd., 15-17, King Street, London, S.W.1.

could be tuned in clear of Daventry, but could not be entirely freed from the background of Radio-Paris.

## Quality and Reproduction

Second-channel whistles are fairly widely distributed over both waveranges, but with the exception of those due to the local transmitters and one on long waves due to the second harmonic of the oscillator, they are not of sufficient strength to interfere with any worth-while stations.

The makers are to be congratulated on the loud speaker reproduction, which has an unusually spacious quality, particularly in the bass. Individual instruments in the orchestra stand out clearly, and the general effect is not unlike that associated with dual unit loud speakers. The tone control gives

## Good Range with Excellent Quality on the Local Station

**T**HE design of this receiver shows several departures from conventional practice, and a highly creditable performance has been attained in relation to the comparative simplicity of the circuit design. There are only four valves, including the rectifier, and the three active stages incorporate pentode valves in each case.

The first stage performs the function of frequency changer and is coupled to the second detector through a band-pass I.F. transformer, there being no amplification at the intermediate frequency other than that provided by the efficiency of the I.F. coils.

Resistance coupling is used between the second detector and the power pentode output valve, and as the loud speaker field is used for smoothing, the number of components incorporated in the chassis itself is reduced to a minimum. On the underside of the chassis there are the various decoupling resistances and condensers and the waverange switch, while on the top there is the mains transformer, smoothing condensers, H.F. and I.F. coils, and the main tuning condenser.

## Range and Selectivity

A capacity-coupled band-pass filter is used in the input circuit, and it has been arranged that the aerial may be connected directly to the secondary circuit in circumstances where an increase of signal strength is desirable at the expense of selectivity. The oscillator coupling coils are included in the cathode circuit of the frequency changer valve.

Volume is controlled in the second detector stage by varying the auxiliary grid potential. This valve functions as an

anode bend detector and is arranged to limit automatically the input to the last stage, so that unpleasant noises due to overloading on loud signals are avoided.

A tone control, consisting of a condenser and variable resistance, is associated with the output stage and provision is made for the addition of an extension loud speaker.

On test we found the set unusually free from background noise picked up on the mains. This is accounted for by the use of an electrostatic screen on the mains transformer, a feature which we should like to see more widely adopted.

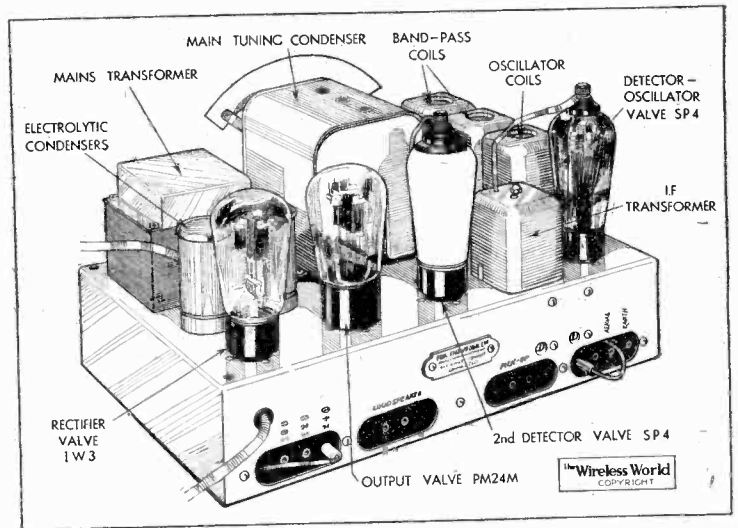
The range of the set leaves nothing to be desired and appeared to be little different from that of the average four-stage receiver with I.F. amplification. Selectivity, on the other hand, was not quite up to the standard of the conventional four-valve circuit, but is, nevertheless, adequate for most people's needs. As an indication of the degree of selectivity which may be expected, we found it possible to receive Brussels No. II clear of London Regional on a full-sized outdoor aerial in Central London, but a slight background of North National was audible when accurately tuned to Langenberg. On long waves Zeesen

just the right range of variation, and even with the maximum high note cut-off, there is no suggestion of wooliness in the general response. The cabinet is well finished and is imposing in appearance, as it should be in a set giving so high a standard of volume and quality.

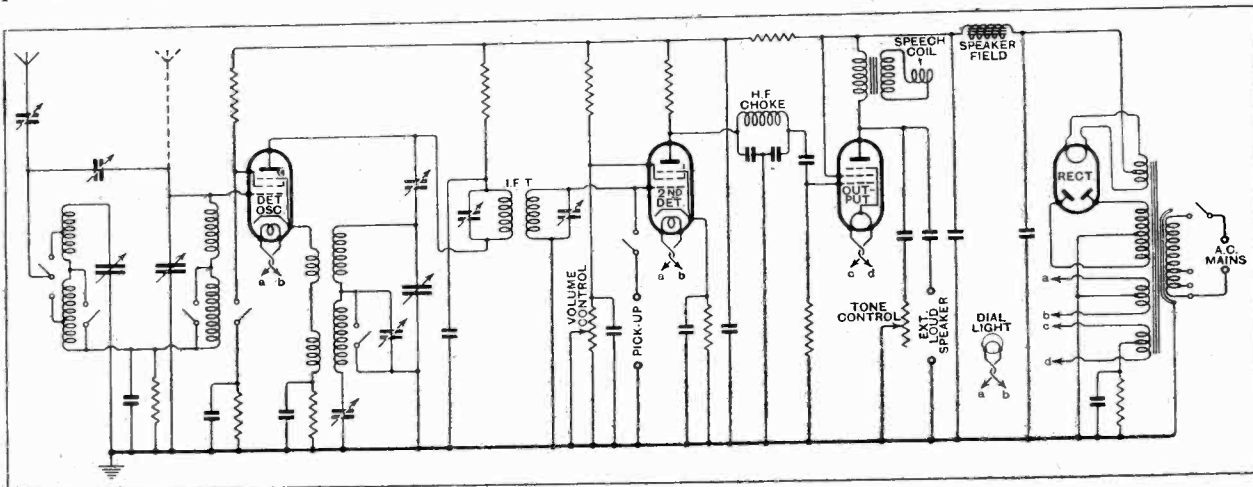
The overall dimensions are 20in. x 18½in. x 11in., and the back is left open, so that cabinet resonance is entirely absent.

Incidentally, the upper half of the front panel of the cabinet is reinforced by a thick baffle board, and the Rola loud speaker is held rigidly in position by three bolts and clamps.

There is an ample reserve of magnification for gramophone reproduction, and the radio volume control is also effective when playing records.



General view of the chassis. The mains voltage adjustment is accessibly placed at the back of the set.



Pentode types of valve are used in both H.F. and L.F. stages of the circuit.

## Letters to the Editor:—

# Stations that Lose Power

## Sound-on-Film Records : Background Mystery : Long-wave National

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

### Do Transmitting Stations Get Tired?

IN the October 27th issue of *The Wireless World* "D. Exer" refers to the mystery of stations that lose power; within a few weeks or months of their opening signals fade slowly away until they can no longer be heard or heard only with difficulty.

This is a phenomenon with which I have been familiar for twenty years. It affects all types of radio stations—spark, C.W., telegraph, or broadcasting on any wavelength. The initial range of the station when first opened slowly decreases after a few months, and is never regained at any subsequent date unless major changes are made in equipment.

In the July 14th, 1926, issue of *The Wireless World*, under the heading, "Do Transmitting Stations Suffer from Fatigue?" I described my observations in detail. I quote from that letter:—

"There are only two possible variables in a transmitting station which cannot be closely checked up. One is the surface condition of the aerial wire, and the other is the earth connection and the condition of the surrounding soil. . . .

"As regards the earth connection, ordinary soil is not accustomed to having umpteen kilowatts of current pumped steadily into it. After a few weeks of such treatment what sort of electrolytic actions take place, and in what way does that soil become decomposed or altered in character in the immediate vicinity of the earth plates? Has anybody ever investigated that point?"

I don't think the surface condition of the aerial makes any material difference, but I am still curious about the earth connection—the only part of a transmitter which has not, to my knowledge, been closely investigated. It is perhaps significant that, during the course of many years of close association with ship transmitters as a sea-going operator, I have never yet known a ship transmitter whose range fell off after the first few weeks or months of operation. Provided that no major changes are made in the installation, and provided also that the installation is efficiently maintained, its range remains constant year after year. It is very difficult, of course, for an observer ashore to check the range of a constantly moving ship; that can only be done accurately by the ship's operators.

The important point is that a ship's earth connection is constantly being renewed.

Several other correspondents agreed with my observations in 1926, but still, nearly eight years later, the mystery apparently remains unsolved. May I commend this problem to the serious attention of adequately equipped research organisations?

New York. A. DINSDALE.

### Alternatives to the Disc Record

I WAS extremely glad to read Mr. King's letter on the question of alternatives to disc records, and astonished at the answer given by the Gramophone Co., Ltd.

The five reasons advanced for not producing sound-on-film records seem to be on

the grounds of expense as to the first three reasons, the fourth merely baulks the whole question, and the fifth is hardly relevant.

As regards the first three reasons offered, I should be astonished to hear that the cost of the material used forms such a large percentage of the total price of the record as to make any appreciable difference in the cost of the finished article. The question of the difficulty of printing copies of the sound-on-film record is also a question of expense and will surely not be greatly in excess of the present method (which is not at all simple and which is far more susceptible to mechanical inaccuracies) once a plant is established.

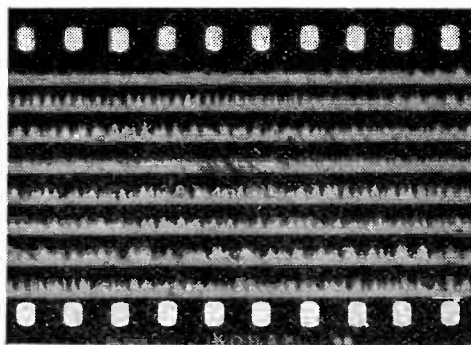
As regards the cost of the acoustic reproducer, this, surely, is of secondary importance when there must be a great number of people who would be prepared to pay 25 gns. for a really satisfactory instrument that would be incapable of wearing out good records.

Once a market is established, the cost of these instruments would undoubtedly fall as in the case of present day models.

London, E.C.2. B. MOWBRAY.

I WAS interested to read the various letters under the above heading, which have appeared in *The Wireless World*, and thought it might interest your readers to know that I constructed a sound-on-film recording and reproducing machine about two years ago, which gave very satisfactory results.

Unfortunately, I have not been able to commercialise the idea.



It will be noticed from the sample of film illustrated that there are eight separate sound tracks. The standard speed for sound-on-film recording and reproduction is eleven minutes per thousand feet of film. Consequently, the eight sound tracks will give us an eighty-eight minutes programme per thousand feet of film.

The advantages of this will be apparent in many directions—complete speeches or lectures can be recorded, as also a complete opera or concert.

It will of course be obvious that in operation the first sound track is traversed for 1,000 feet, when the mechanism is reversed, and the second sound track is traversed, and so on.

Shoreham-by-Sea. H. GREEN.

DESPITE Mr. J. L. Carden's assertions in your issue of November 24th, regarding the photo-electric record, the indisputable facts, as far as we are concerned, are:—

(1) Film records of the normal celluloid type would cost the customer at least twice the price of disc records, and probably four times as much.

(2) The cost of a "paper" film record mechanically printed would be more in material and process costs than a disc of similar playing time. Most of the cost of a record of any character lies in the recording, payments to artists, royalties, etc.

(3) No one has yet demonstrated "paper" films mechanically printed in continuous lengths. Short pieces stuck together every two to three feet have been made, but are utterly impracticable.

Your correspondents may rest assured that this company has always been alive to every opportunity of progress, for, besides providing a consumer with the latest developments of science, new inventions often create more business. If a different base for recording was introduced this would naturally mean that a very large market for new type reproducers would be opened.

An excellent example to illustrate this point was the introduction of electrical recording in 1925, when automatically thousands of matrices of standard recordings became worthless, but new business resulted in the sales of electrically made records.

RICHARD ARBIB,

Hayes. The Gramophone Co., Ltd.

### Control

IN order to avoid the very real and serious trouble of control-room manipulation of musical broadcasts, would it not be possible for the B.B.C. to make use of some form of automatic control?

It is stated in the B.B.C. Year Book that in broadcasting, variations in amplitude of the order of 1,000 to 1 have to be reduced for the purpose of modulation to about 35 to 1. What would be the objection to the employment of a *proportionale* reducer, making use, perhaps, of variable-mu amplifying valves biased back by potentials derived from rectified L.F. currents from the same or a separate amplifier, somewhat on the lines of an inefficient A.V.C. circuit?

Ilford.

D. H. PEGRUM.

### Background Mystery

I AM gratified to find in my *Wireless World* of December 1st that you have taken up this matter of mutual interference between twin transmitters.

I was much interested in the articles and letters on "Diode Rectification," which appeared in your esteemed journal during February-March, 1932, and I tried out one of the circuits for local station work. The diode was coupled to the aerial without H.F. magnification. The results were very satisfactory, and provided ample volume to work a moving-coil speaker. The high selectivity was a special and surprising feature, the signal disappearing in about five degrees

# AN INTERESTING REVIVAL

## Kit of Parts for a Modernised Everyman Four

each side of resonance, but only to reappear as background when the other transmitter was tuned to resonance.

Both Scottish Regional and National had a very pronounced background of the other's programme.

I was assured by the B.B.C. that the trouble was due to cross-modulation. I had to abandon the circuit and resort to anode-bend rectification, when the trouble practically disappeared.

I am far from satisfied that, at a distance of twenty-five miles, the aerial signals were sufficient to cause cross-modulation on the diode. I tried several types of valves, and all picked up the undesirable background.

Motherwell. A. McPHAIL.

**Y**OU will, of course, remember some time ago the B.B.C. attempted to synchronise the North Regional and Newcastle transmitters on 479.2 metres, but abandoned the experiment after a few weeks' trial. During this trial period it was possible in the North to hear the National programme in the background when tuned to the Regional transmitter, the signal being quite strong enough to follow clearly during intervals in the Regional programme.

At the time not many Northern listeners heard the interference, but, as far as I can remember now, the trouble disappeared after about two weeks. One of your contemporary journals published an explanation of the cause of the interference from information given to them by the B.B.C.

The trouble, it said, was traced to induction between the lines carrying the National programme and the tuning-fork "oven" used by the Regional transmitter (tuning-fork drive being used by both North Regional and Newcastle at that period) in the control room at Moorside Edge.

Since the London and West National transmitters are now synchronised by this method, I should say that this is, without doubt, the real explanation of the interference in question. H. SCATCHERD. Sheffield.

### Long-wave National and Interference

**I**N your "Editorial Comment" columns and "Letters to the Editor" page of your issue of December 1st, mention is made of the proposal to replace the local National transmitters by the long-wave National from Droitwich, mainly with reference to interference from various causes on long-wave reception. It is fairly well known that trolley-bus interference has been alleviated by fitting choke coil suppressors to the buses, which operate only on the local medium-wave stations' wavelengths. With the closing down of the "local Nationals," this will mean that all listeners on trolley-bus routes—and we are told that there is shortly to be a change-over from tramways to trolley-buses for a further ninety miles in the London area—will be confined to "one-station" reception. There is a long, interesting article on this interference in the 1933 Year Book of the B.B.C., which holds out hopes of a further improvement by modification of the trolley-bus equipment. In this district no change has been apparent during this year, and no mention is made of the matter in the 1934 edition.

With the proposed change-over of the National wavelength and extension of the trolley-bus system, surely the B.B.C. should enlighten listeners on the present and proposed new trolley-bus routes as to what they may expect. E. WINDSOR. Twickenham.

**I**T is perhaps unbecoming for us to complain that the *Wireless World* Everyman Four receiver, described as long ago as 1926, is "an unconscionable time a-dying." Three or four years after its appearance, and shortly after a specimen had been accorded an honoured place in the Science Museum, we urged that it was high time for the famous old set to fade into decent obscurity. All to no purpose; the best receiver of its day in the whole world seems to be "not of an age, but for all time."

And now the veteran has supplied inspira-

transmissions), and the natural concomitant of reaction. Ganged tuning and provision for long-wave reception are other additions.

As we expected, the specimen receiver submitted for test by Ready Radio was found to be definitely more selective and sensitive than the general run of comparable sets. The "goodness" of the coils has not been impaired by "potting." They are unshielded, but complete stability has been achieved by careful positioning of H.F. components, helped by a minimum of metallic screening. Accurate ganging of two high-efficiency circuits has been attained in the most practicable way by fitting an external concentric trimmer; this is a feature that will appeal to the amateur user, as the circuits may be aligned with extreme precision; indeed, there is enough general flexibility to allow the exercise of a certain amount of skill.

Anode consumption is to some extent dependent on the position of the volume control potentiometer, and when receiving a strong signal is unlikely to exceed 11 or 12 milliamps. Quality of reproduction is satisfying, and the set is worthy of a good loud speaker.

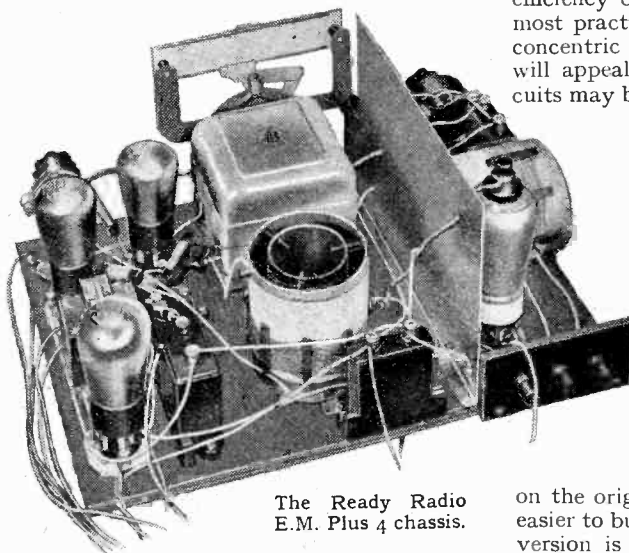
Constructionally, the E.M.

Plus 4 is planned very much on the original lines, but is probably rather easier to build. We understand that an A.C. version is shortly to appear, and also that the redesigned dual-range "Everyman" coils are available separately.

We feel sure that the E.M. Plus 4 will be welcomed by those who are still using the Everyman Four (and it seems probable that thousands are doing so). Ready Radio are to be congratulated on producing a satisfactory, up-to-date version which embodies so many of the attractions of the original set.

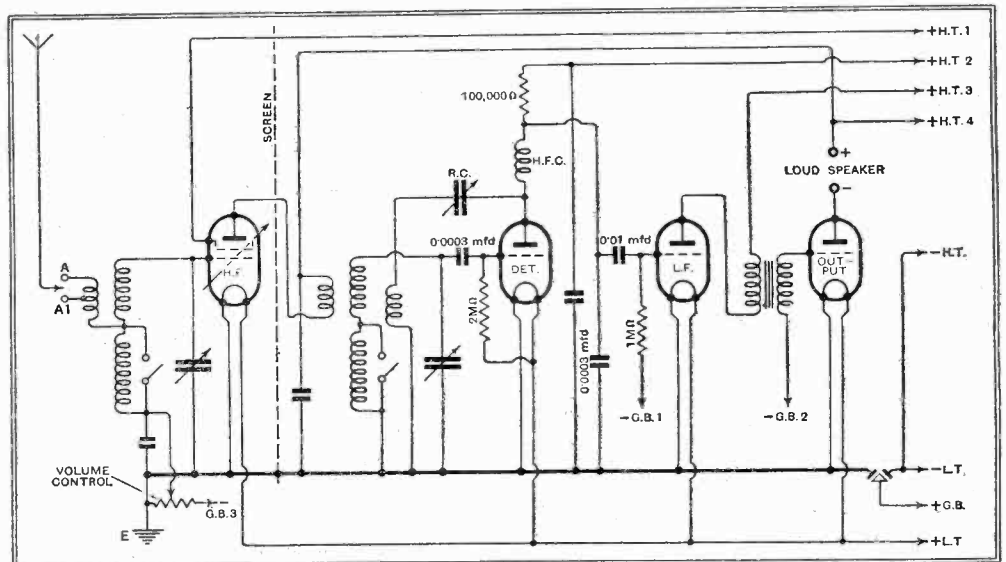
At £4 17s. 6d., less valves and speaker, the kit of parts represents very good value.

A well-designed "Consolette" cabinet of good proportions has been produced for the receiver; complete with a P.M. moving-coil loud speaker it costs £2 in oak, or £2 10s. in walnut.



The Ready Radio E.M. Plus 4 chassis.

tion for a modernised version, in the form of a kit of parts designed by Ready Radio, Ltd., of Eastnor House, Blackheath, London, S.E.3, and called the E.M. Plus 4. It is not only an Everyman Four in name; most of the basic features, which older readers will remember, have been retained. The circuit is still an H.F.-det.-2 L.F. arrangement, with two tuned circuits employing high-efficiency Litz coils, and with resistance and transformer coupling on the L.F. side. The modern features include a variable-mu H.F. valve in place of a neutralised triode; a grid detector (better capable of dealing with deeply modulated



Many of the original "Everyman" features are retained in the modernised version.

# Readers' Problems

## Eliminator Voltage

IT may be taken as an axiom that the voltage delivered by any H.T. battery eliminator or power supply unit is largely dependent on load; in other words, the voltage will rise to a maximum when no current is taken from the apparatus, and will fall progressively with increasing consumption of anode current.

This is a truism that is well known to the majority of readers, but apparently there are still a number who do not see why an eliminator marked "150 volts" should not be regarded in the same way as an H.T. battery.

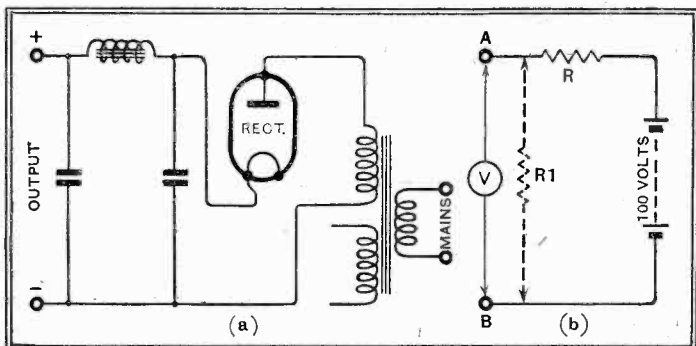


Fig. 1.—The simplest type of H.T. supply unit and an equivalent circuit to illustrate inter-dependence of voltage and load.

Although a complete explanation of the inter-dependence of voltage and load is rather beyond the scope of this section, we shall not go far wrong if we regard it merely as a matter of resistances, ignoring the complications introduced by rectifier action and alternating current, etc.

Fig. 1 (a) represents the simplest possible type of eliminator for use on A.C. supplies with a half-wave rectifier; this rectifier and the associated smoothing choke and power transformer secondary all have appreciable resistance. For the purpose of illustration, diagram (b) can be taken as representing the equivalent circuit, with a battery as a source of voltage, although the values are quite arbitrary.

Still referring to diagram (b), we will imagine that a perfect voltmeter, giving accurate readings under all conditions, is connected across the output terminals A, B, with the artificial load resistance (shown in dotted lines) removed. This voltmeter will still read the full voltage of the battery, even if resistance R be as high as 1 megohm, so long as no current is taken. Now impose an artificial load by connecting a 1-megohm resistance R1 to the output terminals, and the meter reading will at once drop from 100 to 50 volts. The lost 50 volts have been absorbed in the series resistance R; this represents, in exaggerated form, what happens in an eliminator.

## Taking Heed for the Morrow

FOR high quality reproduction of signals from a near-by station, there is nothing wrong with a simple detector-L.F. circuit; always provided that the incoming signals are strong enough, such an arrangement is perfectly satisfactory for its purpose. But a reader who asks us to criticise his circuit diagram of a proposed short-distance set on these lines should, we think, be warned that

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.

changes are imminent which will seriously restrict the usefulness of the set.

In the near future, transmission of the "National" programme will be carried out solely by the new Droitwich station, which,

though it will be of high power, cannot, we think, be expected to provide a sufficiently strong signal to operate satisfactorily the detector valve, unaided as it is by H.F. amplification, of the set that it is proposed to build. Our correspondent lives too far away. At a pinch, it might be possible to obtain sufficient input by pressing reaction, but too much reliance on this aid to sensitivity is to be deprecated.

This is why we strongly advise the fitting of an H.F. stage, which is better than redesigning the set to work with a small detector input.

## Series and Series-Parallel

EXCEPT in D.C. mains receivers, valve filaments are almost invariably connected in parallel across the source of L.T. supply. But there are occasions when the series connection is much more economical; a case in point is brought up by a reader who proposes to build a three-valve H.F.-det.-L.F. set which is to take its L.T. current from a large 6-volt accumulator, the same battery supplying H.T. to the anode circuits through a rotary converter. We are asked to suggest a suitable arrangement of the filaments, it being insisted that the circuit shall be as "safe" as possible; our querist does not wish to run the risk of having any valves burnt out should one of the filaments fail. In addition, it is stipulated that a pentode valve with a 2-volt 0.2-amp. filament is to be used in the output position.

### The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

We doubt if a better arrangement can be devised than that shown diagrammatically in Fig. 2 (a), in which the filament characteristics of the valves are indicated. A screen grid valve rated at 2 volts 0.2 amp. is readily obtainable, and so may be connected in series with the chain without special precautions, while the detector valve, taking half the current, must be shunted with a bypass resistance as shown. By connecting the output valve at the negative end of the chain, and joining H.T. negative to L.T. negative, it may be ensured that the anode current of the pentode valve (which will be relatively heavy) does not pass through the filaments of any of the other valves.

In stipulating that the arrangement shall be "safe," we imagine that our correspondent has in mind the dangers of a circuit such as that of Fig. 2 (b). As 2-volt H.F. valves consuming only 0.1 amp. are now available, it would be a practicable scheme to connect the H.F. amplifier and detector in parallel with each other and in series with the output valve and a limiting resistance R in the manner shown. But the disadvantage of this

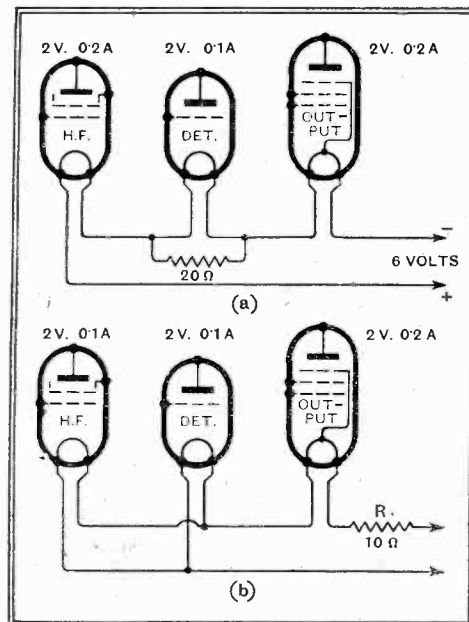


Fig. 2.—Series and series-parallel connection of valve filaments.

scheme is that, if the filament of either of the parallel-connected valves were to fail, or even if the valve were withdrawn from its socket, an excessive current would pass through the filament of the other 0.1-amp. valve.

## Present Practice Criticised

ADMITTEDLY, it seems rather wasteful that, in a conventional six-valve A.C. superheterodyne, four of the valves should be consuming L.T. and H.T. current but doing no useful work whatever during the time that the set is being used for the reproduction of gramophone records through a pick-up. Present-day practice in this matter is criticised somewhat caustically by a correspondent, who enquires whether there is any basic objection to switching off the unwanted valves while gramophone reproduction is in progress.

Although it would not be impossible to devise a satisfactory arrangement for avoid-

ing wastage of current, we are not at all sure that modern practice is wrong. For instance, a switch designed to interrupt the heater circuit of four indirectly heated valves would have to carry 4 amps, and it is most important that it should have a negligible contact resistance. Even if the switching difficulty were satisfactorily overcome, there would be a general rise in A.C. voltage across the secondaries of the power transformer.

There is also the question of eliminator voltage; if the heaters of four valves were switched off, they would no longer consume anode current, and so a more or less serious rise in H.T. voltage would take place, with consequent risk of damage to smoothing and by-pass condensers, etc. Admittedly, this possibility could be overcome by devising the radio-gramophone switching system in such a way that an artificial H.T. load was applied in the "gramophone" position, but further complications would thus be introduced.

All this applies to mains sets; in dealing with battery receivers, a good case can be made out for switching off the unwanted valves.

**Class "B" on the Mains**

ALTHOUGH it has been stated that Class "B" amplification is not the best system to employ when mains are available, it should perhaps be made clear that these strictures do not apply to cases where the household supply is derived from a large accumulator battery. In these circumstances, smoothing should be quite unnecessary, and so the source of current for the output anode circuits should be no more subject to fluctuations under varying loads than if it were derived from an ordinary H.T. battery.

Household lighting supplies of about 100 volts may be supplemented by a small H.T. battery.

**An Inconclusive Test**

IN describing some tests that he has carried out, a reader states that his valves have been substituted for those in another set (known to be in good working order) and have proved to be perfectly satisfactory. From this test he concludes that the valves are in perfect condition.

This is not an entirely conclusive test. In some receivers there is a greater difference of working potential between the heaters and cathodes of the valves than in others. If insulation between these electrodes were deficient, it might conceivably fail in one case and yet remain perfectly satisfactory in the other.

We draw our correspondent's attention to this point because the symptoms he describes would certainly indicate a breakdown in heater-cathode insulation.

**Signs of L.F. Reaction**

THE user of a Class "B" receiver tells us that quality of reproduction is greatly improved by replacing his existing H.T. battery by a new one; this in spite of the fact that the voltage of the old battery, as measured with a good voltmeter when under load, is not appreciably less than that of the new one.

Here we have a certain proof that undesirable interaction is taking place between the various anode circuits of the receiver, and we are sure that it would be worth while fitting extra decoupling in either the anode circuits of the detector or driver valves, or possibly in both. Undoubtedly, the older battery has a high resistance.

**HIGH-VOLTAGE MAINS VALVES**

**For A.C., D.C. or Universal Receivers**

AS most readers know, Ostar-Ganz valves differ from others in that their heating elements are designed for direct connection across the mains without the intermediary of step-down transformers or voltage-absorbing resistances. For use on, say, 200-volt mains, one orders a 200-volt valve—just like an electric lamp.

Since these high-voltage indirectly heated valves were first introduced, the number of types available has been increased considerably; screen grid, variable-mu, high-power triode, multiple grid and multiple diode types have made their appearances, and indeed almost all the requirements of a modern set designer have been anticipated. Detail improvements have been effected in several directions, notably by rearranging the base connections and by designing a special screened holder; thus the "live" electrodes are isolated from the heaters, and difficulties associated with hum have virtually disappeared.

Although Ostar-Ganz valves are usable interchangeably on alternating or direct current supplies of anything up to 250 volts, they are perhaps most attractive for D.C. or "universal" sets. For D.C. work simplicity and economy are the attractions, while the versatility of the valves allows



The completed receiver.

the English agent, of 28-29, Southampton Street, Strand, London, W.C.2. This set, which is available either in completed form or as a kit of parts, employs the circuit arrangement shown in the accompanying diagram; high-quality components, including Varley iron-cored tuning coils, Dubilier dry electrolytic condensers, and a Ferranti transformer, are employed.

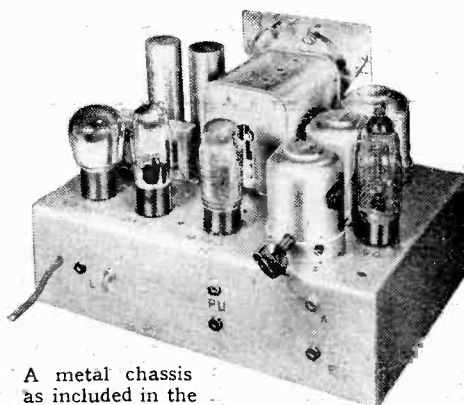
**Simpler Circuits Made Possible**

So far as the input and intervalve circuits are concerned there is nothing particularly unconventional; there is a band-pass input, with a tuned-grid intervalve coupling, while the detector is linked to the output pentode by a transformer.

The arrangement of the anode supply system should be studied; it will be seen that the rectifier valve operates on the half-wave principle, and that the loud speaker field is shunted across the output side of the smoothing circuit. As already inferred, all the valve heaters are connected directly across the mains.

One of these receivers, tested by *The Wireless World*, was found to give the performance one expects nowadays from a modern set with high-efficiency tuning coils. There was a commendable absence of hum; indeed, on either A.C. or D.C.; the performance did not in any way suggest a compromise. Although double smoothing chokes are no longer necessary, a well-designed component should be used for this purpose.

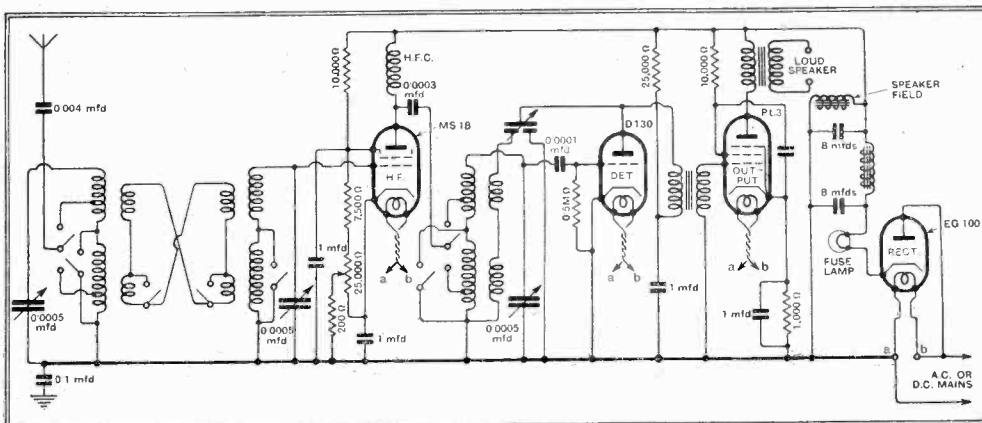
The complete kit of parts, with valves but without accessories, costs £8 15s., while the price of the completed set is £12 12s. Two superheterodynes are also produced, one with five valves and the other, embodying the Stenode principle, with seven.



A metal chassis as included in the kit of parts.

them to be used satisfactorily in sets intended to work interchangeably on A.C. or D.C.

To help those who wish to gain an insight into the use of these valves, we cannot do better than describe a straightforward H.F.-det.-L.F. three-valve receiver which has been produced by Mr. Eugen Forbat,



Illustrating the use of high-voltage valves: the Ostar-Ganz A.C.-D.C. 3-valve circuit.

# The Wireless World

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## EDITORIAL COMMENT

### The Everyman A.C. Super

*Confidently Recommended to Our Readers*

**E**VERYONE nowadays wants a superhet. Yet, some years ago the superheterodyne principle had been relegated to the archives of history and was generally regarded as a type of receiver of academic interest but of very little practical use for broadcast reception, chiefly because of difficulties in the way of attaining good quality. It was *The Wireless World* which revived the superheterodyne in this country. Both by theoretical articles and practical interpretations, *The Wireless World* proved conclusively that the disadvantages hitherto regarded as inherent in the principle could all be overcome, or even turned to special advantage, by careful design and by making use of more recent developments.

At the time that we championed the return of the superhet it was regarded as a bold step to take, so strong was the prejudice against receivers of this type; but one need not look far to-day to realise that the superheterodyne has not only returned to favour, but is rapidly taking the place of other types of receivers because of the present day need for extreme selectivity with sensitivity.

#### Experience Tells

*The Wireless World* has now had a long experience in designing superheterodynes of a variety of types, and each one has achieved outstanding popularity and has set a standard for a receiver of its kind. We have felt for some time that there was a growing need for a popular design which would

be comparatively inexpensive and yet, by making use of all the latest contributions in the way of improved valves and other components, would be outstanding in performance; a design which has, in fact, been achieved in the Everyman A.C. Super, which is described in this issue.

We make it our business to keep in touch with what is being produced in the way of designs for home construction generally, and this knowledge only serves to enhance our own opinion as to the outstanding merits of this receiver, which we can therefore recommend to our readers with the utmost confidence. Every care has been taken in design to make the construction simple and straightforward, whilst the illustrations bear testimony to the attractive appearance of the finished product.

### Cabinet Design

*Response to Our Invitation*

**I**N a recent issue we invited readers to send us their personal suggestions or preferences for accommodating the wireless receiver, and we take this opportunity of saying that a very interesting collection of material has been received in our offices which it is our intention to make the subject of an illustrated article in an early issue. The material is at present being prepared for publication, and whilst it will not be possible to deal with every suggestion put forward, we are choosing those which seem to us to show the greatest originality or merit. We are arranging to include with the descriptions sketches to illustrate the ideas. When this article has appeared it will be interesting to receive further comments from readers in criticism of the suggestions put forward.

## The Wireless World

# Everyman A.C. Super

## A Four-valve Superheterodyne with A.V.C.

By W. T. COCKING

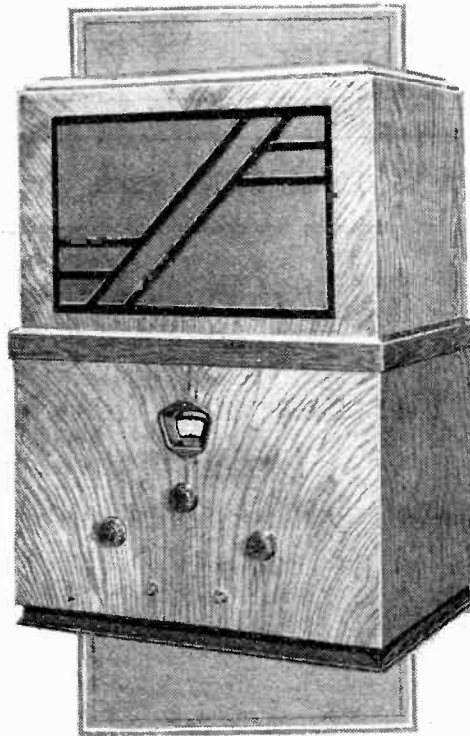
**T**HE idea is somewhat prevalent that the superheterodyne principle is fully applicable only to a large and ambitious receiver, and that if it be applied to a small set of four valves or so it loses much of its value. While this may have been true of early designs, it is no longer so, for valve and detector development has been such as to permit a reduction in the number of valves and yet to retain the performance hitherto associated with five or six valve receivers.

The most notable advance in superheterodyne technique during recent months has been the appearance of the Heptode or Pentagrid valve, for this performs the functions of the first detector and oscillator with the saving of a valve and an actual increase in efficiency and stability. Both from the technical and the economical standpoints, therefore, it is an advantage.

A four-valve superheterodyne of a year ago would almost inevitably have had its valves arranged as detector-oscillator, I.F. stage, 2nd detector, and output. The detector-oscillator would have been a bi-grid, self-neutralised pentode, or screen-grid valve and would inevitably have given a performance below that of a two-valve arrangement. The 2nd detector would probably have been of the grid type, working with quite a small input, and hence giving a certain amount of distortion on deep modulation.

### Modern Technique

In a modern design a diode type detector operated at a large input can be used to feed the output valve directly, and since a metal rectifier can be employed a valve becomes unnecessary. The output valve and the I.F. stage, of course, are retained and account for two out of the total of four valves. The frequency changer is of the Heptode type, so that the use of a single valve at this point is advantageous rather than otherwise. On account of the fact that a diode type second detector gives no amplification, while the grid detector may give a gain of over thirty times, an additional stage is necessary in order to maintain the sensitivity at a high figure. Since a valve has been saved in the detector stage, this is quite possible without exceeding a total of four, and it is naturally employed as an H.F. amplifier where it is beneficial in



helping to avoid background hiss. A modern four-valve superheterodyne, therefore, has its valves arranged as an H.F. stage, frequency-changer, I.F. stage, and power output.

The complete circuit diagram is shown in Fig. 1, and it will be noted that delayed automatic volume control is obtained—a further advance which would have been almost impossible in the older type of receiver. The H.F. valve is preceded by a

***M**ODERN superheterodyne development shows two distinct tendencies. On the one hand there is the trend towards the large receiver in which every possible refinement is included, with cost and the number of valves receiving little consideration, and on the other there is the development of the small set of only four valves, which is relatively inexpensive, but which combines a degree of selectivity and sensitivity sufficient for all but the most exacting with a high standard of quality of reproduction. When it is said that effective A.V.C., and an output of over 3 watts are included in addition, it will be realised that in spite of its small size there is nothing small about its performance.*

single tuned circuit and coupled to the tetrode portion of the frequency-changer by an H.F. transformer, so that two tuned circuits precede the frequency-changer and render second channel inter-

ference negligible under most circumstances. The grid connection to the H.F. valve, which is of the H.F. pentode type, is completed through the 0.0001 mfd. condenser C<sub>1</sub> and the bias is applied through the 2 megohms grid leak R<sub>1</sub>. A similar arrangement is adopted for the frequency-changer, the bias of which is fed through the 2 megohms resistance R<sub>2</sub>, the grid being isolated by the 0.0001 mfd. condenser C<sub>2</sub>.

In the oscillator section a normal arrangement is employed with a grid circuit tuned by a section of the gang condenser having specially shaped plates. Here, again, the grid condenser C<sub>3</sub> has a value of 0.0001 mfd., while the grid leak, the flow of grid current along which produces the bias, is given a value of 0.25 megohm. On the long waveband the padding condenser C<sub>4</sub> is automatically introduced by the switching.

### The A.V.C. System

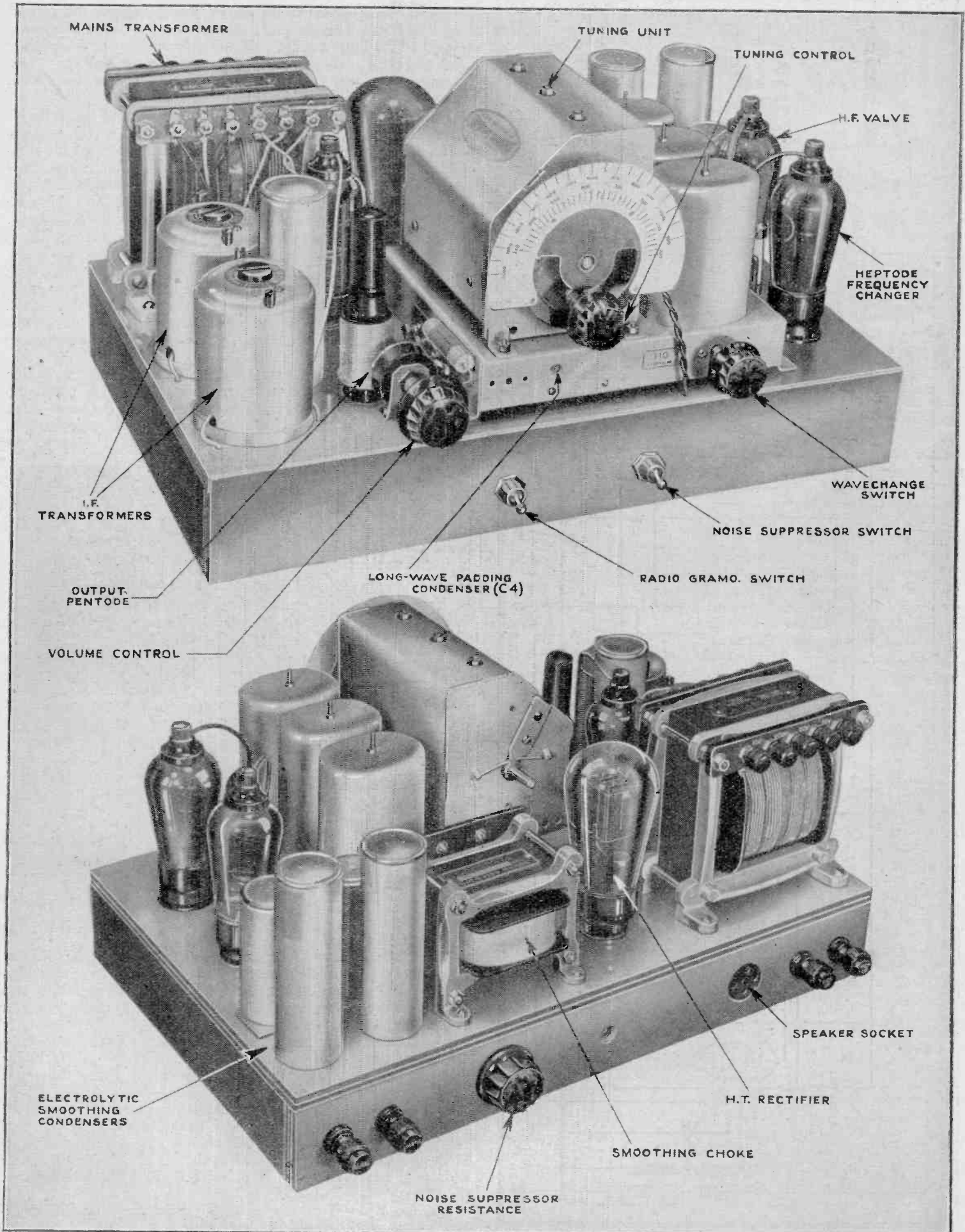
The coupling between the frequency-changer and the I.F. valve is by means of an iron-core transformer having a tapped secondary in order to maintain stability. The transformer is of the band-pass type, and provision is made for adjusting the coupling. A similar transformer, also with a tapped secondary, is used for the coupling between the I.F. valve and the second detector.

Two Westectors are used at this stage, one as the second detector, and the other for providing delayed A.V.C. Since their positive terminals are joined together, a single push-pull type component is actually used, but it functions exactly as two separate detectors. The first Westector acts to provide the L.F. output which appears across R<sub>12</sub>, and is applied through the I.F. filter comprising Ch<sub>1</sub>, C<sub>10</sub>, and C<sub>11</sub> to the output valve. The I.F. potentials across the last I.F. transformer secondary are also applied through the 0.0002-mfd. condenser C<sub>12</sub> to the second Westector. Now, this rectifier is biased negatively by the amount of the output valve grid bias, so that rectification does not occur until the signal voltage exceeds this figure. When it does, a potential, the value of which depends upon the excess of the signal over the delay voltages, appears across the 1-megohm load resistance R<sub>14</sub>. This potential is applied as A.V.C. bias through the filter R<sub>13</sub> and C<sub>9</sub> to the grids of the H.F. frequency-changer, and I.F. valves. By virtue of the large input at which the detector is normally worked, some 10 to 20 volts, and the high delay voltage which can consequently be used, the action of automatic volume control is exceptionally good.

The input to the output valve at first



A SET EMBODYING THE MOST RECENT SUPERHET IMPROVEMENTS



The inclusion of a noise suppressor circuit in conjunction with A.V.C. enables the background disturbances to be diminished while the set is being tuned.

THE CIRCUIT DIAGRAM

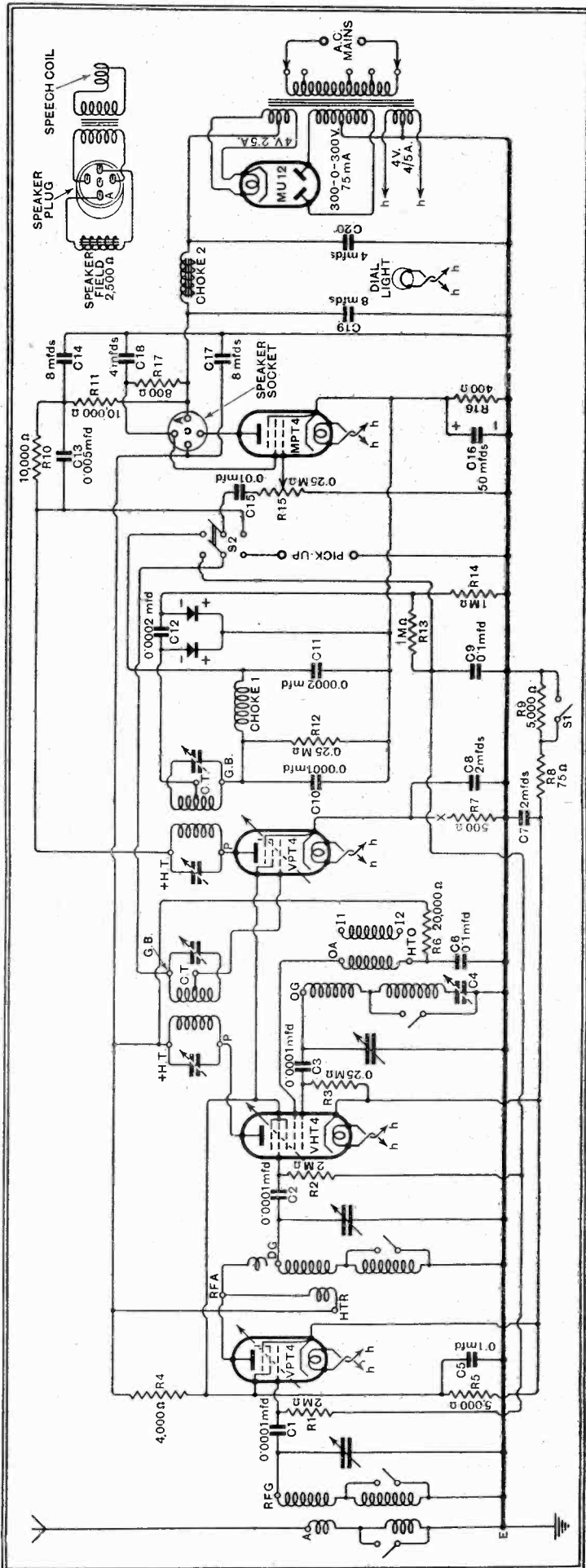


Fig. 1.—The complete circuit diagram of the Everyman A.C. Super showing the essentially straightforward arrangement of apparatus which represents sound practice

appears a little complicated, but this is due solely to the switching necessary to permit the use of a gramophone pick-up. On radio the switch S2 is closed in the upper position on the diagram of Fig. 1, and it will be seen that the L.F. output of the detector is applied to the output valve grid through the 0.01-mfd. coupling condenser C15 and the manual volume control R15. This potentiometer has a value of 0.25 megohm, and is of the tapered type to permit an even variation of volume.

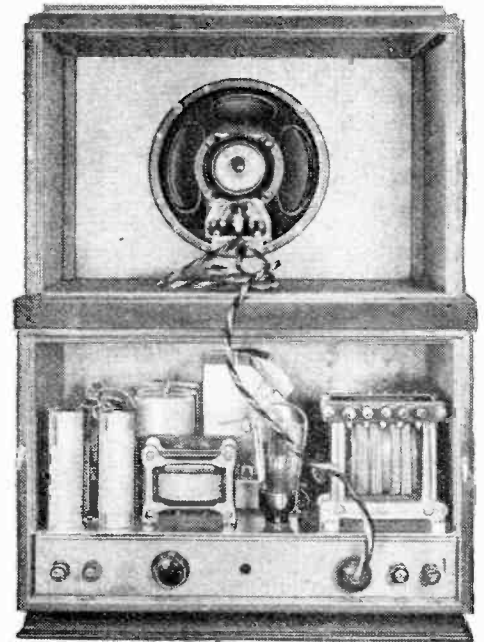
Since the output valve requires an input of over ten volts for full volume, and no L.F. amplification is used, a pick-up cannot be employed directly. The only simple way out of the difficulty is to arrange the circuit so that the I.F. valve is converted into an L.F. stage for gramophone only. The anode circuit of this valve, therefore, contains an L.F. coupling, and this consists of the 10,000 ohms resistance R10 shunted by the 0.005-mfd. condenser C13. In order to avoid motor-boating, decoupling is necessary, and the components must have values effective at low frequencies. A 10,000 ohms resistance R11 is used, therefore, with an 8-mfd. condenser C14. The radio-gramophone switch S2 changes over the output valve grid connection from the second detector output to the I.F. valve anode circuit, and inserts the pick-up in the control grid circuit, at the same time disconnecting the A.V.C. bias from this stage.

The mains equipment consists of the mains transformer which feeds the indirectly heated rectifier, giving an output of about 300 volts at 75mA. The reservoir condenser C20 has the usual value of 4 mfd., and is of the electrolytic type. Initial smoothing is provided by the 10 henry choke Ch2 in conjunction with the 8-mfd. condenser C19. The voltage available at this point is rather higher than the 263 volts required by the output valve for anode and bias supplies, so that the difference is dropped by the 800 ohms resistance R17, after which a further 4-mfd. condenser is connected. The current for the early stages is fed through the 2,500 ohms speaker field, which provides further smoothing with the 8-mfd. condenser C17. The potential of the main H.T. line is thus about 200 volts, and the anodes of the H.F. and frequency changer valves are fed directly from this and the oscillator anode through the 20,000 ohms resistance R6. A potentiometer built from the resistances R4 and R5 is connected between the H.T. line and the common cathodes of the first two valves, and the screen supply of 100 volts is tapped off from their junction. The two first valves are initially biased by the drop along the 75 ohms resistance R8 (actually two parallel connected 150 ohms resistances) when the noise suppressor switch S1 is closed.

Owing to the necessity for including resistances in the I.F. valve anode circuit it cannot be fed from the 200 volts line, and the full output of the mains equipment is consequently fed to it. Since the normal anode current of the VPT4 is 5 mA, there is a drop of 100 volts along R10 and R11, and the actual anode potential of the valve is 200 volts.

The assembly of the components, wiring up, and the operation of the receiver, will be dealt with in next week's issue.

A complete list of the component parts required to build this receiver will be found on page 484.



Back view of the receiver housed in the complete cabinet assembly

# The Electronic Organ at "Poste Parisien"

## Triode Oscillations and Filtered Harmonics

By R. RAVEN-HART

**M**ANY readers of *The Wireless World* who have heard recitals on the peculiar organ at "Poste Parisien" must have wondered how the very remarkable tonal effects are obtained. The organ has three manuals, each of four and a half octaves, together with two and a half octaves of pedals, making a total of two hundred notes. For each of these notes a triode is provided, with its associated oscillatory circuit, this comprising a fixed condenser and an iron-cored inductance. Tuning is effected within narrow limits by a screw adjustment of the iron core. This method would appear to be much simpler than tuning an ordinary organ, but it would be interesting to know to what extent variations in supply voltage, valve ageing, and the like affect the tuning.

Another 200 triodes are fitted in the amplifiers, which feed thirteen loud speakers. There are seventy-six registers, of which sixty-six are electronic and the other ten (mostly "effects") pneumatic. Altogether, including couplers, there are ninety-five stops, and it has been said that there is a close similarity between the resources of this organ and the very large and famous instrument at Notre Dame, although the latter, presumably, does not include drums, rattles, triangles, castanets, an auto-horn or a steam whistle!

Tone quality, it is officially explained, is produced by reason of the fact that the wave forms of the oscillatory circuits are very rich in harmonics, and that the "stops" actuate groups of filters which remove various harmonics to introduce changes in tone-colour. The question of "attack" seems to have received no attention, the depression of a note of the keyboard merely starting the valve oscillating, so that, whatever register is in use, the sound commences in exactly the same manner. This appears to be a serious disadvantage, for it is well known that a considerable part of the tone-colour effect depends on the attack or beginning of the note; if, for example, a trumpet register has the same smooth attack as that of a flute stop, no amount of filtration will restore the full difference of tone-colour.

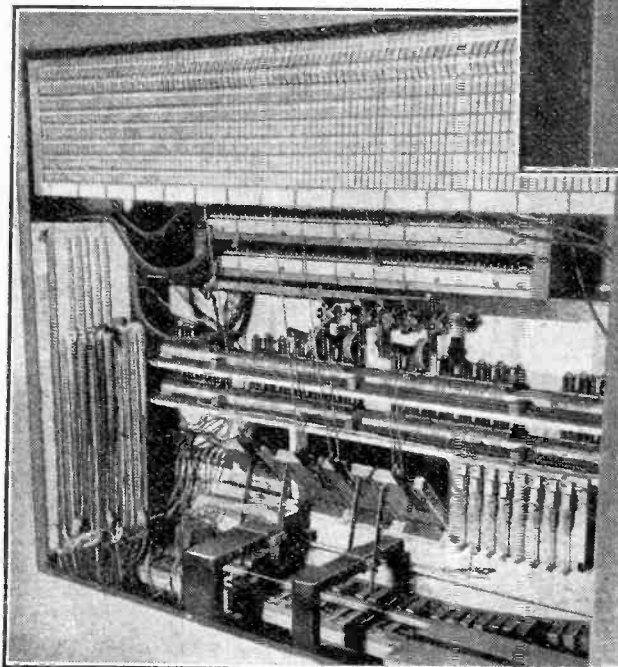
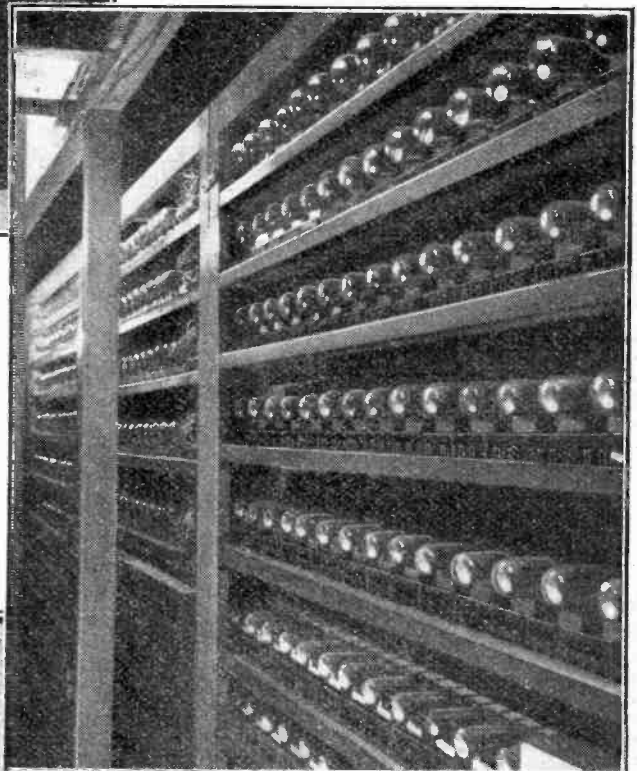
Points in favour of the new instrument include the "swell" action, with pedal-operated rheostat, applied to the whole of the organ, and not only to one or, more



M. Couplex, constructor of the organ, at the keyboard. With him is M. Givelet, the inventor and designer.

(Right) The bank of 400 valves, 200 of which are amplifiers. Variation in tone-colour is obtained by means of harmonic filters.

(Below) The interior of the playing console. Note the pedal-operated rheostat for obtaining a "swell" effect.



rarely, two manuals, as in the case of the normal organ. This is a really important improvement, provided that it does not tend to sentimental playing of the cinema-organ type. Again, the response of the oscillatory circuit to the depression of the key being practically in-

stantaneous, a note can be repeated rapidly in a manner not possible with pipes, especially in the lower registers. Consequently, more music should become available for the organ without transcription, and composers can write passages of a nature that up till now would have been unplayable. Whether this is any great advantage, leading as it does chiefly towards an increase of floridity, may perhaps be questioned.

A point of especial interest in the case of the Poste Parisien organ is that trans-

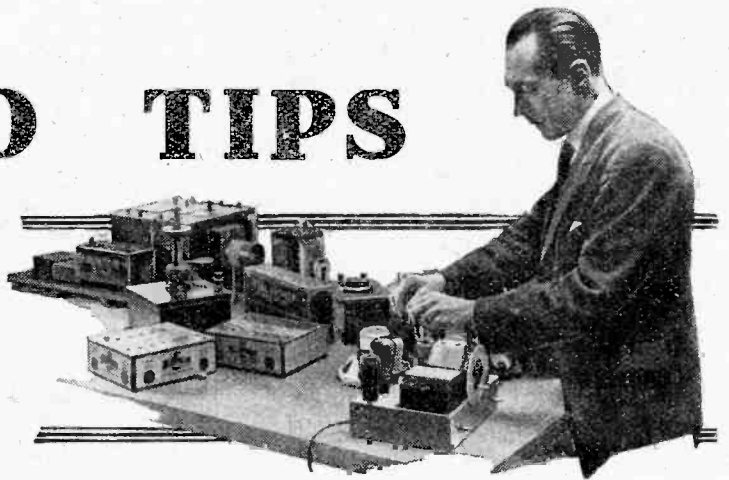
mission by wireless comes direct, it being obviously unnecessary to convert electrical into acoustical energy by means of the loud speakers when performing "on the air."

A very attractive advantage is the ease with which auxiliary "organs" can be fitted. If the normal organ is at the west end of a church and a similar organ is needed for accompanying the choir, or, if echo effects are desired, all that would be necessary in the case of an electronic instrument would be the installation of an extra group of loud speakers suitably situated.

Probably, however, the outstanding advantage of the new instrument is its extreme compactness. The console is of normal size, the loud speakers can be installed quite unobtrusively, while the 400 valves with all their associated coils, condensers, etc., take up a total space of only about 6 x 8 x 1ft.—about an eighth of the space occupied by the new organ at Broadcasting House!

# Practical HINTS AND TIPS

## AIDS TO BETTER RECEPTION



IT is probably due to the increasing use of metal for receiver chassis that accidental contacts between anode-circuit wiring and earth seem to be becoming rather more common. It is not the purpose of this note to decry the use of metal,

### Tracing Short-circuits.

which has obvious attractions, but to draw attention, in passing, to the need for proper insulation where wires pass through or in close proximity to the metal work, and also to describe the best method of locating a short-circuit if need should arise.

As a rule, the quickest way of finding the "short" will be to disconnect entirely the source of H.T. supply, and then to connect a fairly sensitive continuity indicator—such as a volt-meter and a small battery—between the H.T. positive and H.T. negative lines of the set. If there is a potentiometer for regulating screening grid voltage it should be disconnected as well. Having done this, it can be definitely assumed that any deflection of the test indicator shows a "short" somewhere in the anode circuits. The question is, where?

The quickest way to find out is to disconnect in turn the H.T. supply leads for each individual valve, watching the indicator at the same time. When a lack of continuity is shown we know that the short-circuit is associated with the particular valve of which the feed lead has just been disconnected.

Assuming, for the sake of illustration, that the detector valve is found to be at fault, we may proceed on the lines indicated in Fig. 1.

Fig. 1.—Having located the valve in which an anode short-circuit has arisen, the exact position of the fault is best found by making point-to-point tests.

still leaving the indicator in position, and after having reconnected the detector anode supply lead:—

(1) Remove the valve itself; in the unlikely event of a collapse of the internal electrode assembly, the test indicator will no longer show continuity, and we need look no farther for the fault. But if the "short" still exists, we must proceed to:—

(2) Interrupt the circuit at point A; lack of continuity now shows a fault in the valve-holder or in the condenser C<sub>1</sub>.

(3) Break the connection at point B; if continuity is now interrupted, we know that the H.F. choke or its wiring is "shorting" to earth.

Similar tests may be carried out by interrupting the circuits at points C and D, when we shall know that, dependent on the indications given by the continuity tester, the fault may be due either to the L.F. transformer, to the decoupling resistance R, or to the condenser C<sub>2</sub>.

A test carried out logically in this manner takes much less time to execute than to describe, and will probably prove quicker in the long run than a haphazard examination of the wiring.

MOST superheterodyne short-wave converters embody a combined detector-oscillator valve, functioning on the autodyne principle, which must be in a state of self-oscillation when signals are being received. It is consequently quite a usual practice to provide fixed reaction between anode and grid circuits of this valve in order that the necessary oscillation may be produced at all tuning settings. In this way the need for

### Short-wave Converters

an external adjustment of reaction is avoided.

But it may be pointed out that this arrangement is in the nature of a compromise, as the valve can hardly be operating under the best conditions at all wave-

lengths. Maximum sensitivity is usually attained when the valve is only just oscillating; accordingly, those who do not object to an extra adjustment will almost always bring about some improvement by substituting a variable reaction control (generally a variable condenser) in place of the fixed coupling.

EXPERIENCE shows that the anode lead of a pentagrid or heptode frequency changer is distinctly "hot"—to use the popular slang expression. In other words, this lead carries amplified signal-frequency currents, and so particular care must be taken to dispose of it safely, especially if it happens to be long. It must not be allowed

### A Lead to Watch

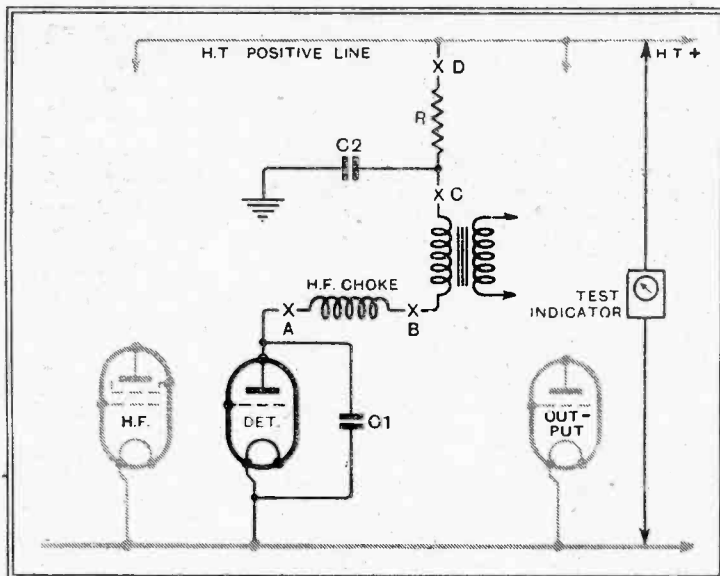
to "couple up" with the tuned circuits of a preceding H.F. stage.

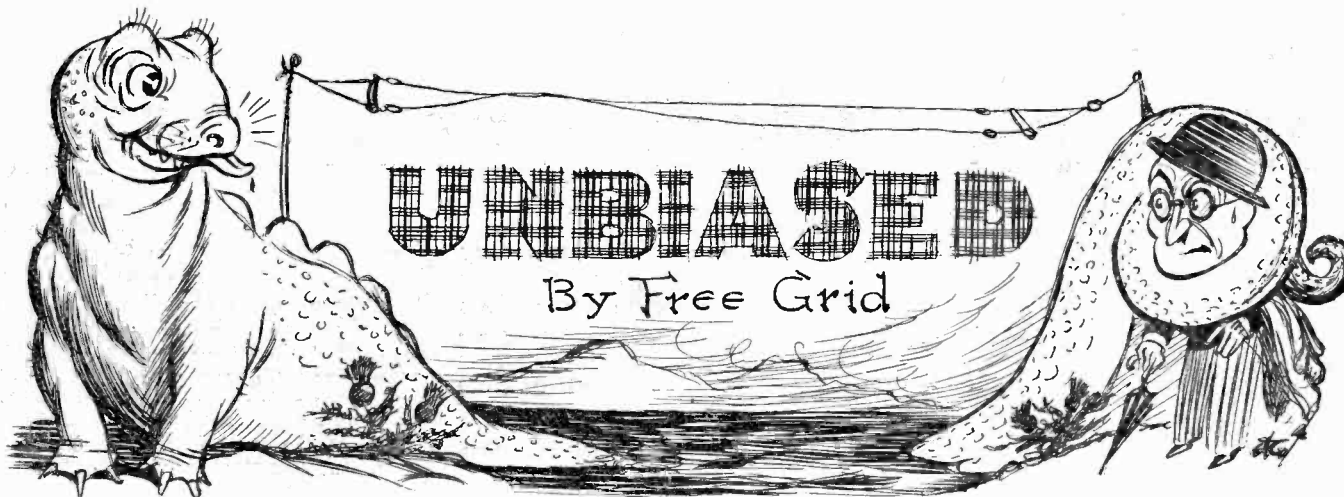
When everything else fails, the anode lead may be screened, but it should be remembered that any capacity added as a result of doing this will be thrown across the primary circuit of the first I.F. transformer, and so may upset the tuning of the I.F. amplifier. In consequence, any screened connection used should be of the lowest possible self-capacity, and, further, it is worth while considering the question of screening only a portion of the lead.

IT has often been pointed out that most detector valves are habitually operated under conditions closely bordering on overloading; at any rate, in most modern sets there is seldom any great margin of safety so far as output is concerned.

### Risk of Detector Overloading

This fact has an important bearing on the behaviour of a set to which a continuously variable tone-control device (operating in the L.F. amplifier) is added. The effect of all such devices is to reduce overall amplification, and so, to obtain full output, it will usually be necessary to increase the radio-frequency input to the detector. It is, therefore, not hard to see that, failing a margin of safety, this valve may easily be overloaded when the tone control is put into operation, and if possible its capacity should be increased by applying more anode voltage.





## Researches into the Telearchical Diplodocus Theory

WHILE carrying out some very special wireless work in my laboratory during the past fortnight I have been pestered by parties of juvenile waits whose rudeness is only equalled by their appalling ignorance.

Thus, upon opening my front door to the last party in order to question them concerning the good King Wenceslas of whom they sang, I found that not one of them had the vaguest idea who he was. One pop-eyed little girl ventured the opinion that the Saint was related to Old King Cole who, she alleged, was hanged, drawn and quartered for burning cakes while hiding in an oakapple tree on Christmas eve, after which he never smiled again. Talking of Good King Wenceslas, Father Christmas and such like things, brings me to yet another thing

"Talking of Good King Wenceslas..."



of like-nature which is very dear to my heart. I refer, of course, to the alleged monster of Loch Ness, which has baffled our so-called men of science to such an extent that they are imagining it to be a survival of some such prehistoric creature as the homely diplodocus.

### The Whistling Test

On the other hand the scoffers and the sceptics hint vaguely of tree trunks and over-indulgence in the national beverage.

So far I have not had time to track this alleged monster to its lair, but I trust that in the New Year I shall be in a position to commence certain experimental work ending in a final dramatic denoue-

ment in which I shall literally whistle the creature out of the vasty deep. It will simply be a case of "Oh whistle and I'll come to you my lad," in an entirely new setting.

The experiments will closely resemble those I carried out with a somewhat similar monster several years ago on Highgate Ponds. True my creation was considerably smaller, but so far as I recollect, it did everything that the Loch Ness creature has been reputed to do. It rested or moved along at the top of the water and even dived and went through the same evolutions under the water at my behest. Not being out for publicity or notoriety I did not deck out my contraption in any semblance of dragon or fierce-some monster of the deep.

Having no influence behind me to keep the pot boiling, and craving only to be able to pursue my researches quietly in the interests of science, I worked during the night hours, operating the key of my special short-wave transmitter in a nearby house.

### Ordinary Radio Principles

My submarine contained its own reversible electric driving motors and steering and driving gear, all of which were set in motion by suitable relays operated by the transmitter.

I did not then, nor do I now, pretend that the machine derived its driving power from electric fluids in my body nor do I claim that at any time its proper functioning depended upon the state of my health or the concentration of my mind, a stunt which old readers will remember I have already exposed (new readers see page 296, "W.W.," 3/9/32.)

The whole thing was a plain and straightforward application of ordinary radio principles, more commonly known under the name of Telearchics.

Neither did I make any claim for originality in my ideas; indeed, the *Wireless World* itself had already given full construction details several weeks prior to my experiments, in which it showed the precise method of constructing a model ship which could be controlled from the shore of a pond or lake by a low-powered 90-metre trans-

mitter. The arrangement is described in a series of articles\* published in "W.W." under the general title of Telearchics, and I shamelessly admit that I took my ideas from them.

However, in self defence I must add that I greatly improved upon the ship, converting it into a submarine using the famous Rogers underground and underwater antenna.

### The Real Truth

*It is quite evident that some jocund Scot has improved upon the idea still further by housing the mechanism in an outer casing made to resemble some frightening creature of the pre-historic swamps, while doubtless he sits in his humble butt and ben feverishly controlling its movements with his transmitter.*

The result is, of course, that the whole countryside is in a furore of excitement, so-called scientists have lost what little balance they ever had and policemen have been drawn from their lawful occasions.

If the P.M.G. would only send one of his detector vans up there and make a spectacular haul it would, I feel sure, have an immense effect in restoring the public's fast waning faith in the van's efficacy to detect unlawful receivers. The van would



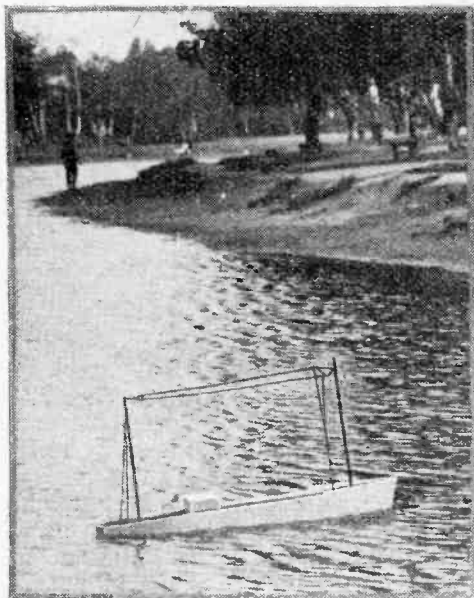
Controlling its movements.

not have to hang about until the transmitter started working; if it did, it might just as well stay at home, as the practical joker in charge of the transmitter is

\* This time he is right. The articles appeared in 1926.—Ed.

**Unbiased—**

obviously no fool and would lie low while the van was in the neighbourhood. Owing, however, to the P.M.G.'s remarkable ability in detecting receivers he would soon locate the monster at the bottom of the loch.



The Radio Ship Telerech I on a London pond in 1926.

As, however, the P.M.G. seems unlikely to tackle the problem I am compelled to do so myself, but I claim the right to handle the thing in a spectacular manner in the interests of the journal which is

backing me. And when, after working with direction finders I locate the transmitter I shall not blow the gaff to the police or to anyone else. Instead I shall take careful observation of its wavelength and other details which will enable me to build a more powerful replica of the transmitting plant.

Needless to say, it will take me many months of patient observation with my instruments to find out all the various combinations of impulses necessary to work the many relays, but I feel sure that I shall succeed in the end, and the final denouement will, of course, be arranged when the whole of the world and his wife are in Scotland.

Then at a time appointed I shall simply whistle the monster out of the vasty deep in the sight of all men, not forgetting the B.B.C. and the Talkie News reel people. Subsequently I shall present my catch to the Science Museum.

In the meantime I shall be carrying out certain preliminary experiments with my old submarine on Highgate Ponds between 3 and 4 a.m. commencing the first week in January. Should any of you care to come along to assist me you will be given a hearty welcome. In particular I wish to get hold of an intelligent small boy—if such a thing exists—to take up his position in the submarine in order to carry out certain under-water observations while I am manoeuvring the vessel from the shore.

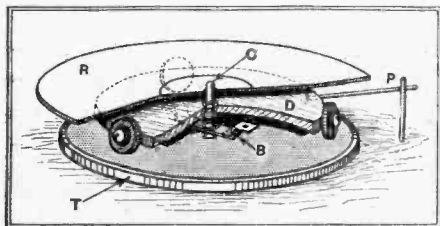
Mark your envelopes: "Supper for two; breakfast for one."

## Playing Records Backwards

### Outdoing the Modern Composers!

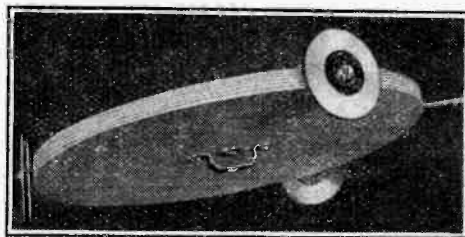
MANY cinema patrons have been mystified by hearing music resembling a cross between a concertina and a violin. The mystification is further increased when it is known that this peculiar music results from running a pianoforte sound-film backwards! When a reel is run in the correct direction, each isolated note is heard as a sharp "ping," followed by the note slowly decreasing in volume. When the film is run backwards the notes are heard as tones slowly increasing in volume and finishing with alarming suddenness. Ordinary speech sounds like a weird oriental language!

The effect is most interesting, and everybody hearing it usually wishes that they could run their gramophone records backwards to achieve the same effect. It may easily be done with simple apparatus.



Details of construction. R, Record; C, centring pin; D, wooden disc; B, metal bracket or saddle screwed to the disc. P, stop pin; T, turntable.

The main requirements are a circular or triangular piece of wood and three small wheels. Rubber umbrella rings fitted on to grooved Meccano wheels can be used, or circular erasers with metal centres, or



A simple form of reversing turntable.

even tap washers. A diameter of about 1½ in. is generally satisfactory.

The centre disc should be about eight inches in diameter, and it should be fitted with a centre pin on top to guide the record while it is being rotated by the rubber wheels. The disc is kept central on the turntable by a strip of metal with a hole in it to fit over the pin on the turntable. The natural tendency for the disc to rotate with the main turntable is prevented by a light rod projecting beyond the edge of the record and lodging against a stop pin on the motor board.

The pick-up must, of course, be temporarily raised and repositioned.

## The Short-wave World

### Winter Conditions on the Amateur Bands

SHORTLY after the previous set of notes under this heading was published, conditions below 30 metres underwent a considerable change for the better. That infallible "indicator," the 20-metre amateur band, has seen some very reliable long-distance work since the end of November, and conditions on the short-wave broadcast bands have, on the whole, been very good.

The short-wave broadcast stations are very well distributed about the spectrum. When conditions below 30 metres are very poor, one can generally find quite a lot of interest on the 49-metre broadcast band. If there were only a regular band allotted for broadcasting in the region of 90 metres, we could fairly claim that we were no longer dependent upon cycles of "conditions" at all.

### The Best Times to Listen

While short waves have become more subject to variation in the past few years, there is little doubt that the medium-wave broadcast band has been improving steadily, and this applies, in a lesser degree, to wavelengths between 100 and 50 metres.

It seems safe to assume that the 80-metre band is fairly reliable at times when the 20-metre band is almost useless.

The novice at short-wave work should therefore make a point of learning, at the outset, how to make the best use of his receiver by listening on certain wave-bands at the most appropriate times and seasons.

As a very rough guide, it is suggested that during this winter the 49-metre broadcast band will generally be interesting between the hours of 10 p.m. and 4 a.m.; and the African stations, Johannesburg and Nairobi, will generally be heard as early as 7 p.m. with a fair degree of reliability.

There is no point whatever in spending much time below 25 metres after 6 p.m. from now until late February or March. The 20-metre amateur band is already "fading-out" by 5.30 p.m. or even earlier. When conditions maintain a steady level, it is often possible to time the fade-out within a few minutes.

### A Christmas Time-table

The time of sunset varies only by a few minutes between December 15th and December 31st, and the fade-out is generally about an hour and a half later.

The 31-metre band, as might be expected, lasts much longer than the 19 or 16-metres broadcast bands, but usually fades out at this time of the year before 11 p.m.

A suggestion for a listening-schedule on Christmas Day would be on the following lines: Morning—anything that sounds interesting, on all bands; 2 p.m. onwards, 16 and 19-metre bands; 4 p.m., 19 and 25-metre bands; 6 p.m., 31-metres band, and possibly a hope of finding Nairobi on 49 metres; late evening, 31 and 49 metres only.

The amateur bands have not been included, because all three of them, 20, 40 and 80 metres, are usually interesting right through the day until sunset, after which the two upper bands will have the monopoly.

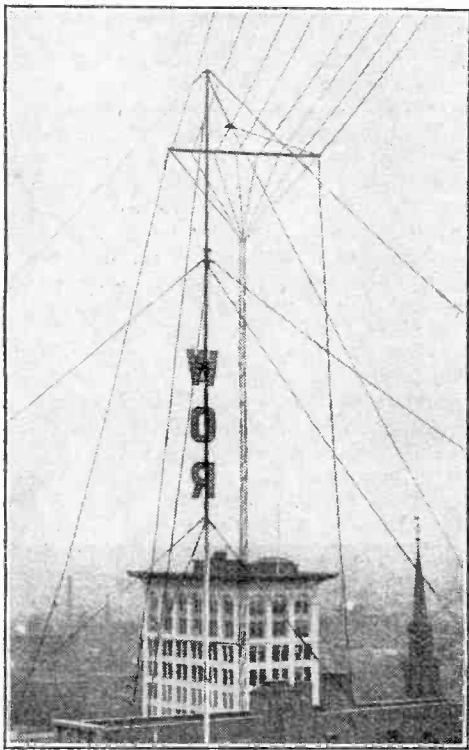
MEGACYCLE.

# Ten Years Ago

## How Broadcasting Stations and the Amateurs Made History

SO many radio developments have occurred in the last decade that we are tempted to forget the early achievements which made them possible. The year 1923 was remarkable as the beginning of a radio renaissance, both amateur and professional, as this article shows.

THE year 1923 belongs, not to the dark ages, but to the medieval period in wireless history, when nights were bold and days were, in consequence, dreamy. Those were the times when amateurs would gladly rise from a warm bed to hear the nasal renderings of a Long Island announcer or the querulous squeak of a Chicago cabaret band accompanied by a torrent of atmospherics.



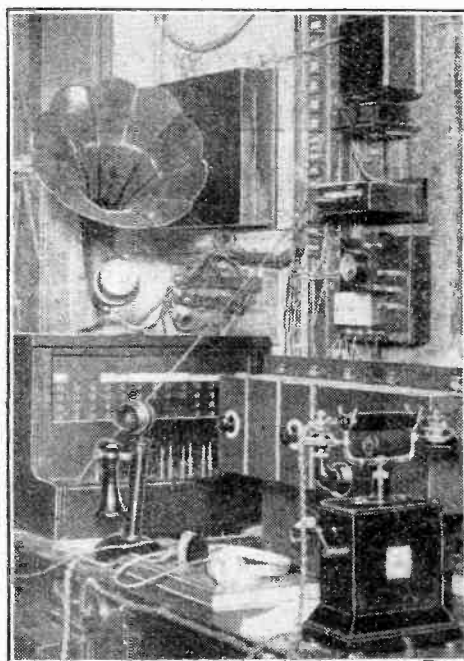
Heard in Runcorn and Halifax! WOR, Newark, N.J., which was logged by a handful of British amateurs in 1923.

It was this enthusiasm that made it possible for *The Wireless World* in December 1923—ten long years ago—to organise a transatlantic test which not only kept the American people out of bed until after midnight for a whole week, but induced the B.B.C. to operate its eight main stations until 4 and 5 in the morning! More than that: Senatore (now Marchese) Marconi and M. Georges Carpentier, the boxer, also took part, giving talks to America in the middle of the night. Much of the success of the venture was due to the enthusiasm of the engineers of the British Broadcasting Company, the chief engineer of which was Captain P. P. Eckersley.

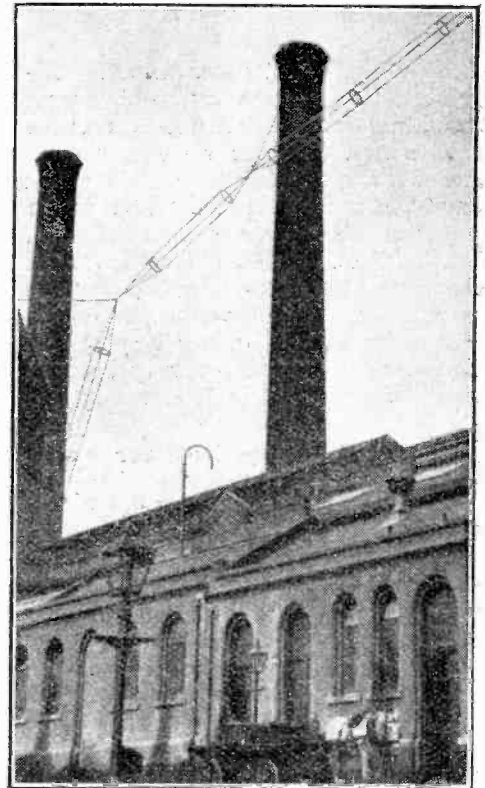
What appealed to U.S. listeners was the

fact that the Tests gave them an opportunity for the first time of hearing British stations during their more or less normal listening period between 10.45 p.m. and 12.15 a.m. (Eastern Standard Time). The ordinary British transmissions were, of course, given never later than 7 p.m. (American time), when the B.B.C. stations were usually giving their midnight closing signal. In the tests, however, which were organised by this journal in conjunction with *Radio Broadcast*, New York, the B.B.C. transmitters operated at varying periods from 3.45 a.m. to 5.15 a.m. (G.M.T.), giving the Americans every possible chance to hear them between 10.45 p.m. and 12.15 a.m. (E.S.T.). Meanwhile, America reciprocated with specially powerful transmissions between 3 and 4 a.m. (G.M.T.) on two nights, in which the novel features were microphone talks by Mr. Henry Ford and the President of the Radio Corporation of America.

The tests actually occupied five days. On November 26th the British stations transmitted. On the 27th America replied and later in the day we cabled reception reports to America. On November 28th this country again provided the transmissions and a day later America replied, the programme including the special address by the President of the Radio Corporation of America from WGY,



No, not a 10-watt amateur transmitter but the control room of the B.B.C. station at Newcastle ten years ago.



"I hear you calling me" wrote American listeners who picked up signals from 5SC, the Glasgow station of the B.B.C., seen above.

Schenectady. An attempt at two-way communication was made on December 2nd.

Enthusiasm ran high in both countries. In American listening circles—and judging from the letters there were as many women listeners as men—the excitement verged on hysteria. Granted that America had a more favourable listening time, i.e., before midnight, whereas British listeners had to stay out of bed several hours to hear from across the Atlantic, it was still obvious that the experience was more marvellous to America than to us, who were accustomed even then to the reception of multi-lingual programmes from the Continent and also to sometimes intelligible signals from across the Atlantic.

### Unfortunate Coincidence

It was a pity that a shrill station in Western Canada chose the very first night of the test to carry out a special high power test on London's wavelength, for as a result, *The Wireless World* offices were deluged with letters from the Middle West gleefully reporting perfect reception of "Roses of Picardy." After a feverish and fruitless hunt among the records of everything transmitted from London, Bournemouth, Cardiff, Glasgow, Birmingham, Newcastle, Manchester and Aberdeen on the night in question, we had tactfully and tearfully to tell our American friends the truth. Nevertheless, the

## Ten Years Ago—

B.B.C.'s little  $1\frac{1}{2}$  kW. transmitters got across, none more successfully than those of London and Newcastle.

As regards reception of American stations in this country, WGY, the G.E.C. station at Schenectady, was easily first, being received in many cases on a single valve set. WHAZ, Troy, N.Y., came second. Altogether some 500 American stations were transmitting during the tests but, from the reception reports which we were able to publish, it was too painfully obvious that many had been wasting their fragrance on the desert air. KDKA at Pittsburgh, WAOB, WJZ, WNAV, WOR—most of these with a large sprinkling of query signs—were the only others to figure in the lists, with the exception of a few isolated and little-known call signs probably born of imagination and the will to win.

## The Reacting Detector

Those were the good old days of the o-v-I set with a furiously reacting detector, and it tells something of the howls which must have filled the ether o' nights that this set appears to have been the most popular and the most successful in "pulling in" the Americans.

It would be better to draw a veil over the two-way communication test on December 2nd, 1923. England spoke from 3.0 to 3.5 a.m. (G.M.T.), America from 3.5 to 3.10 a.m., England again from 3.10 to 3.15 a.m., and so on for alternate five minutes. On December 19th we wrote: "Although the last experiment cannot, by any stretch of the imagination, be considered a success (atmospheric conditions were most unfavourable), the universal opinion of British listeners points to the immense interest which the experiment aroused, and no words have been spared by our correspondents in praise of the heroic efforts of the B.B.C. engineers to 'get through,' and also to hear the American signals."

No record of the closing weeks of 1923 would be complete without a mention of amateur triumphs in transatlantic communication during the tests organised at that time by *The Wireless World* and the American Radio Relay League.

The honour of being the first European amateur to establish two-way communication with America fell to the Frenchman, M. Leon Deloy, of Nice, who exchanged signals with 1 MO, Mr. Kenneth Warner, working the station of the A.R.R.L. at Hartford, Connecticut.

A few days later, in the small hours of December 8th, dots and dashes were exchanged between 1 MO and 2 KF, the station at Merton, London, S.W., of Mr. J. A. Partridge, who, incidentally, is now in charge of the B.B.C.'s wavelength checking station at Tatsfield.

This was a fitting climax to the great amateur efforts to span the Atlantic on short waves during 1921 and 1922. It was in the latter year that the American

amateur, Paul Godley, sent to this country by the A.R.R.L., set up his receiver on the West Coast of Scotland, and, in common with a number of British amateurs, picked up the first short-wave signals across the Atlantic and thus vindicated the despised short waves in the eyes of the world at large.

Those were the pioneering days, but we shall probably be saying the same of 1933 ten years hence! E. C. T.

## DISTANT RECEPTION NOTES

A DANISH reader is kind enough to write and tell me that up to the present Kalundborg has been using only 30 kilowatts (unmodulated) in the aerial. The full 60 kilowatts for which this station is designed may be used after January 15th, but it is possible that the station will continue at 30 kilowatts for a week or two on its new wavelength.

Munich will shortly be using its high-power station with a makeshift aerial. On some recent evenings there has been a noticeable increase in Munich's strength, which again suggests that tests from the new station were in progress.

Recently in an unguarded moment I wrote in these notes, without simultaneously touching wood, that fading was so rare as to be almost unknown on Budapest's wavelength. On the very next evening I found

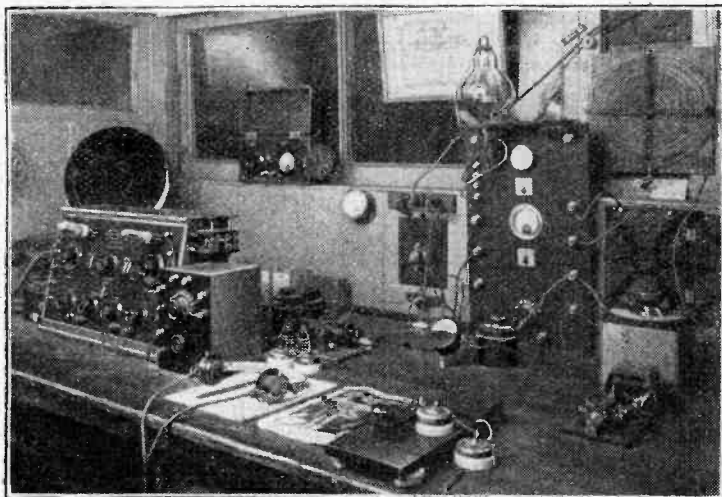
I believe, though, that the true explanation was that in my case the manual volume control was almost at the maximum position, so that there was not sufficient reserve of amplification to deal with the signal as it waned. With its more efficient collector the other set was able to bring in Budapest with the manual volume control turned a long way back.

By the time that these notes appear in print Radio-Paris will at long last have become the Emetteur National Français. During the week December 8th—17th the station remained silent pending alterations to the transmitter in preparation for the Lucerne Plan.

Reception on the long waves has been very much better of late; the only station, in fact, that has been seriously heterodyned is Luxembourg. Motala is somewhat below strength, and Kalundborg has suffered in the same way, except on the night already mentioned and a few others. Huizen has been free from the interference that was formerly such a nuisance. Radio-Paris, Zeesen and Oslo have all been well received.

The number of medium-wave stations now receivable with good quality and volume is very large on most evenings. There is a little fading, but it is seldom serious enough to spoil reception on a set provided with automatic volume control. Budapest, Vienna, Prague, Langenberg, Rome, Stockholm, Toulouse, Leipzig, Strasbourg, the Poste Parisien, Breslau, Heilsberg, Trieste and Nürnberg are probably the best stations, but Beromünster, Lyons Doua, Florence, Milan, Göteborg, Bordeaux Lafayette, Hilversum, Frankfurt, Hörby, Fécamp, Rennes and Sundsvall are all giving good reception on most evenings.

D. EXER.



With an aerial current of only 1.8 amperes, this station (J. A. Partridge, 2KF, Merton, London) established two-way communication with Hartford, Connecticut. The two-valve receiver was of the o-v-I type with a vario-coupler type of tuner.

Budapest indulging in the most violent kind of fading, the signal disappearing altogether at times.

In this connection I have something of a curiosity to report. That same evening a friend, whose house is within half a mile of mine, though on rather higher ground, was also listening to Budapest at the same time. When I mentioned the fading he was astonished, for he had held the station for an hour without a sign of it.

We were both using superheterodynes with automatic volume control, but mine was provided with a built-in frame, whilst his was worked from a suspended aerial. Bearing in mind the different ways in which these two types of collector function, I was tempted at first to wonder whether it would be possible for fading to affect a frame but not an outdoor aerial and earth system.

## THE RADIO INDUSTRY

USERS of Philips sets fitted with the well-known "zone-and-number" system of tuning will not be embarrassed by the forthcoming change of wavelength. New calibration cards, showing tuning positions for all the principal stations, are available to owners who care to apply to the makers, quoting type number of set, registration number, and number of the old chart.

Those who are considering the question of converting their receivers for gramophone reproduction will be interested in the offer, by the Bon Marché, of Brixton, of full-sized walnut-finished radio-gramophone cabinets at the remarkably low price of 35s.

Mr. F. E. Attwood, for twenty years associated with the makers of Pye apparatus, has joined the board of C.A.C., and has already assumed the duties of sales director.

Page 481 follows after the Programme Supplement.



# NEWS of the WEEK

## Current Events in Brief Review

### Television in Italy

TESTS with 180-line television are to start shortly at the Rome and Turin broadcasting stations.

### Six Million in Sight

WITHIN the next few days British wireless receiving licences should reach a total of six million. At the end of November the total was 5,871,750, a net increase of 103,500 over the figures for the previous month.

### Proof of the Pudding

A NEWCASTLE listener has inaugurated a new system of reception reports. He recently picked up the test signals from the new Budapest station and transferred them to his home recording device. He then posted the record to the station authorities, to the great delight of the engineers.

### New Transmitter for Motala

IT is announced by the Swedish Postal authorities that an entirely new 150 kW. transmitter is to be erected at Motala to replace the existing 40 kW. long-wave station. The old transmitter will be transferred to another site in Southern Sweden to act as a new regional station.

### Presentation to R.S.G.B. President

AT the annual general meeting of the Incorporated Radio Society of Great Britain, to be held on December 29th at 6.15 p.m. at the Institution of Electrical Engineers, a presentation will be made to the retiring president, Mr. H. Bevan Swift. The presentation will be followed by a lecture on "Transmitting Valves for Amateur Needs," by Mr. L. Grinstead.

### Low-frequency "Static"

THE new French official decree against electrical interference with broadcast reception has been favourably received by the Press and the manufacturers. It is realised that the new regulations admit of a wide interpretation; for instance, it is felt that it will not be necessary to suppress all radiation from electrical apparatus provided that the emanations can be kept below the frequency response of the average loud speaker. However, to keep pace with loud-speaker developments, the Postal Administration will periodically define the frequency band in which radiation is prohibited.

The decree emphasises that steps are to be taken to avoid radiation from electrical apparatus whether or not there are any broadcasting receivers in the neighbourhood.

### Licences Everywhere

WIRELESS pirates have absolutely no excuse in Italy, where radio licences can be obtained not only from the Post Office but from the banks and wireless dealers. Listeners pay 80 lire a year.

### Luxembourg at Bay

ACCORDING to the Brussels "Soir," Radio Luxembourg will refuse to surrender to the Lucerne Plan by withdrawing its long wave and giving up two-thirds of its power. The French influences behind the company, it is stated, will triumph as the International Broadcasting Union "has no punitive power."

### Film Recording at Fécamp

RADIO NORMANDY (Fécamp) is now broadcasting concerts recorded on film. The recording equipment has been mounted on a special lorry which tours the principal towns, such as Havre, Rouen, and Dieppe, to "collect" concerts which the station will subsequently broadcast. It is stated that the scheme is designed to save land line costs and delays.



"IN TOWN TO-MORROW." Henry Hall, leader of the B.B.C. Dance Orchestra, during a rehearsal last week of the St. Dunstan's Dance Band in preparation for its appearance before the microphone to-morrow evening (Saturday) in the "In Town To-night" series.

### Radio in Every School

SPECIAL school sets working on one wavelength only are being built to the order of the Italian Government and the broadcasting authorities. All schools are to be equipped with receivers.

### Wireless Over the Sea

THE much lower resistance to the passage of wireless waves which sea water affords, as compared with dry land, was discussed in a paper presented to the Royal Society by Dr. R. L. Smith Rose on December 14th. In the course of a special investigation, experimental measurements were made at the National Physical Laboratory of samples of sea water taken from the English Channel. The general result of the work has been to establish the electrical resistivity of sea water at a value of about 20 ohms per cubic centimetre.

For ordinary moist garden soil the resistance is nearly 500 times as much, and this accounts for the greater absorption experienced when wireless transmission takes place over land.

### Quarter of an Hour

NORWAY has decided that sponsored programme items shall be limited to fifteen minutes a day.

### Power Transmission by Wireless?

LIKE the problem of perpetual motion, the question of the wireless transmission of power is an ever-beckoning subject for the radio inventor. It is now reported that the Swedish engineer, Balzar von Platen, of Stockholm, has solved the problem very effectively. Unfortunately, no details of the invention are yet available, but leading Scandinavian technicians are stated to have endorsed the merits of the system. A company has been formed to exploit the invention, the President being Count Folke Bernadotte.

### Turin Up to Date

THE work of modernising the old 7-kW. transmitter at Turin, which "feeds" Genoa, Florence, Milan, Bolzano, and Trieste, is completed, and the station now incorporates 100 per cent. modulation, crystal control and push-pull output.

### No Aerials, by Request

THE Republic of Turkey is perhaps the only country in the world where foreigners are not permitted to erect outdoor aerials. The Government wishes to take every possible precaution against the installation of transmitting stations. The regulation does not apply to Turkish Nationals.

### An Adriatic Wonder

ONE of the most remarkable 20-kW. stations in Europe is that at Bari on the Adriatic coast. It is well received in Great Britain, and has been picked up in New Zealand, China, Japan and Vancouver. Bari transmits its own programmes on Mondays, but relays Rome and Naples for the remainder of the week.

### Legion of Honour for Amateurs?

OUR French contemporary, the *Journal des 8*, is vigorously claiming the Legion of Honour for two famous French amateurs, Léon Déloy and Pierre Louis. Déloy was the first to establish short-wave communication between France and America in 1923, while Louis repeated this success some weeks later.

### The Anti-Interference War

THE Secretary of the Newcastle-upon-Tyne Radio Society asks us to correct the impression given by a recent paragraph that the Society was asking for legislation prohibiting the supply of electric current to any premises where plant is installed that causes electrical interference to wireless reception. The Society referred to in the note was that at Newcastle, Co. Limerick.

### More Money for U.S. Broadcasters

"SONG plugging," the disparagement of commercial competitors and the broadcasting of information concerning lotteries, are among the objectionable features in American broadcasting which are being definitely banned by the new National Recovery Code. The radio pay roll is to be increased, says our Washington correspondent, and should be 3 per cent. above that of the peak year, 1931. The estimated increase in employment in broadcasting will be about 765 persons.

Most of the pay roll increase will be among broadcasting engineers, of whom 1,900 are now employed. The operators' pay scale ranges from 40 dollars down to 20 dollars per week, depending upon the class and size of station.

### State Broadcasting: French Fears

THE French Union of Journalists has adopted a hostile attitude to the new Government broadcasting régime. In the Association's official journal it is declared that broadcasting is now "in the stranglehold of the State" and that the stations will very soon lose their individuality, as the professional microphone artistes will be replaced by "bureaucrats and employees mechanically mumbling official communiqués and news telegrams."

We cannot speak for the future, but, so far, the threatened disasters show no signs of taking place.

### Male Announcers Preferred

TURKEY prefers male announcers. A recent questionnaire to decide whether listeners would prefer a male or female announcer resulted in a vote of 280 for the former out of a total poll of 320. This is a personal triumph for the announcer at the Istanbul station, M. Mesut Djemil Bey.

# BROADCAST BRIEVITIES

By Our Special Correspondent

## Rival to Broadcasting House

THE skating rink in Delaware Road, Maida Vale, promises to be a much more serious rival to Broadcasting House than the Waterloo Bridge "warehouse" studio which it displaces. Among the amenities of this new-old building will be a restaurant and a retiring lounge.

## Vast Acreage

As the first "sleuth" to prow around the premises in August last—my exclusive story was "pinched" by the National newspapers who saw copies of the "W.W." at 12.1 a.m. on the day of publication—I saw enough to satisfy me that the B.B.C. could, if it wished, transform this vast covered-in acreage into something really worthy of the Corporation's resources.

## That "Telephone Box" Feeling

It is impossible to imagine overcrowding of artistes and instruments at Maida Vale, and this in itself will be a welcome relief after the cooped-up conditions at headquarters.

Some artistes have confessed that the studios give them the feeling of being imprisoned in a telephone box.

## Henry Hall for Maida Vale

None will welcome the change more than Henry Hall and the B.B.C. Dance Band, who will shortly be staking their claims in Delaware Road.

It is quite likely that listeners will be invited to come and dance in the skating rink, so that the band will get that added zest which comes so much more easily when playing to the dancing couples.

## Brave Engineers

The acoustics of the place, too, are quite good. The engineers have already conducted some interesting tests in this connection and several of them have risked their

necks in climbing ladders to inspect the roof.

Let us think of their courage in days to come when we are sitting at our ease and listening to the pattering feet of four or five hundred Step-Sisters.

## Mr. Pewter

THE mysterious "Mr. Pewter" is, of course, none other than Mr. A. P. Herbert, the famous *Punch* humorist.

"Mr. Pewter" is coming to the B.B.C. microphone shortly to give a series of talks on matters touching the interests of his feminine hearers. For their sakes he wishes to solve the problems of the day.

Good luck to you, Mr. Pewter.

## The "D.G." in Ireland

SIR JOHN REITH took a flying visit last week to Belfast. No sensational inferences are to be drawn from this visit as it was purely a matter of routine.

The Director-General likes to "look up" all the B.B.C. stations from time to time, and I am pleased to think that he gives due notice of each impending visit!

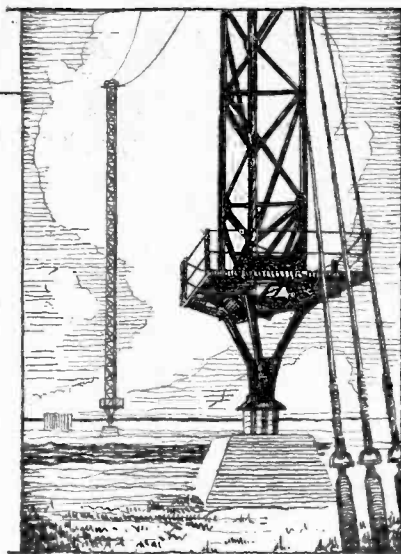
## Spiritualism in the Studio

THE B.B.C. will venture into a new field with the new series of talks to be introduced by Mr. Gerald Heard on January 5th.

The title of the series, "Peeps into the Unknown," suggests the line which the speakers will take. I understand that subjects discussed will include telepathy, dreams, ghosts and survival after death.

## Haunted Houses

On January 19th Mr. Theodore Besterman, of the Society of Psychical Research, will tell "How Psychical Research



is Done." Other speakers in the series will be Lord Charles Hope on "Physical Mediumship"; Professor Seligman on "Primitive Practices and Ideas"; Dame Ethel Lyttelton on "Dreams and Pre-Vision"; Sir Ernest Bennett discussing "Ghosts and Haunted Houses," and Sir Oliver Lodge on "Do We Survive?"

## Wireless on the Stage

A BROADCAST receiver is used to good dramatic effect as a stage "property" in the play "Whistling in the Dark," now appearing at the Comedy Theatre.

As a climax, the resourceful hero, imprisoned by gangsters, uses the loud speaker as a substitute for the disconnected telephone instrument to summon help—which, in the best traditions of the stage, arrives in the very nick of time!

## Artistic Licence ?

After such a happy ending, it would be ungracious to say that technical possibilities have been stretched very nearly to breaking point; I would prefer to call it fair artistic licence, while refusing to believe that we have exhausted all the thrills obtainable by legitimate means from the broadcast receiver.

Wireless "effects" are skilfully arranged by Alexander Black, on whose activities much of the success of the play depends.

## Is the Orchestra Overworked?

THIRTY-FIVE hours a week. This is the amount of time the performer in the B.B.C. orchestra is bound by his contract to serve the Corporation. The figure is interesting in view of the recent rumours that the orchestra is overworked and in need of an understudy.

## How They Work

Actually, no member of the orchestra ever plays for thirty-five hours in one week—even during the hectic "Prom" period, when six rehearsals of three hours a day consume eighteen hours and the actual performance time is no more than twelve hours.

## What the Accountant Thinks

However, I learn that the question of a second orchestra is being seriously considered—by Mr. Lockhead, the B.B.C. accountant! Can the B.B.C. afford another National Orchestra? And is it really necessary?



NOW OR NEVER! A tense moment during the amusing crook play, "Whistling in the Dark," at the Comedy Theatre. Richard Bird and Billie Riccardo, as the hero and heroine respectively, find a new use for the wireless set.

## This Week's Set Review

# Thermo Superjet Three

### An Ambitious Design to Provide Mains Performance Where No Electric Light Supply is Available

THE applicability of mains-driven receivers to A.C. and D.C. mains only has for long been an admitted weakness of the type. Statistics have been brought forward to show that for every householder who is connected to A.C. or D.C. there are several who are not, and who are in consequence deprived of being able to make effective use of mains-driven sets, even if they have bought them. Our enterprising radio industry has fulfilled the expectations we have so often exclusively expressed in these pages, and the Thermo Superjet Three brings the benefits hitherto enjoyed by A.C. and D.C. consumers to the millions who are connected to gas mains only.

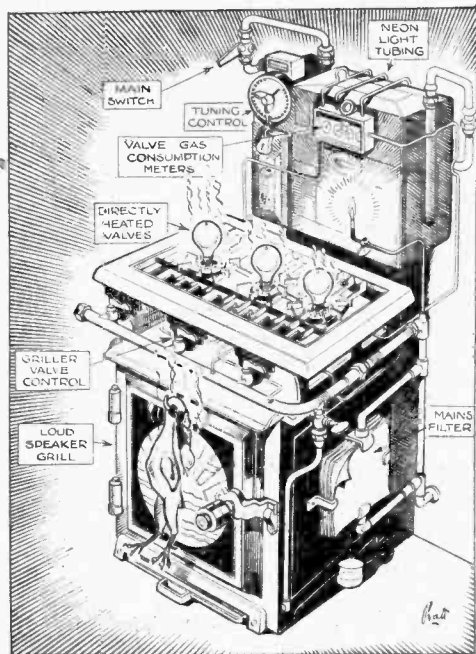
It might be supposed that the designer would impose severe limitations on himself in undertaking a task of this nature; but in the instance of the present receiver he has contrived to introduce a number of important advantages, which will no doubt lead to many all-electric homes being piped for gas at an early date.

The valves are all of the gas-filled type, and have a slope of 5 milliamps per therm. They are directly heated—and so, for the matter of that, is the whole receiver—being provided with incandescent burners at the base. As usual, these are fitted with by-passes, the by-pass condensers having a capacity of 0.005 cu. ft. A pilot light is also fitted, which serves the dual purpose of illuminating the tuning scale and casting a subdued but quite adequate radiance over the whole room. A variety of artistic shades can be obtained to suit most of the less usual decorative schemes.

The power pack consists of a gas-ring and multiple thermo-couple assembly, and this should be lit well in advance of any desired programme. A gasmeter, operating on the push-pull principle, is a feature of special interest to the more technical enthusiasts. The increased consumption when political talks are being broadcast can be readily observed.

The thoroughness with which the design

has been carried out may be gauged from the fact that the wiring is done entirely with gas-filled tubes of the type used for illuminated advertisements, and the different circuits can be identified with the utmost ease by the colour-code that has been standardised by the R.M.A. The



Domestic utility has been the keynote of the designer's effort in producing this revolutionary instrument.

location of any fault can thus be seen at a glance, which greatly simplifies servicing. Though this might seem to render skilled servicemen unnecessary, the manufacturers have made assurance doubly sure by equipping selected plumbers in each district throughout the country with a complete kit of tools for dealing with any fault. It is understood, also, that gas inspectors have been instructed to encourage the use of

**FEATURES. Type.**—General purpose receiver for gas mains only, incorporating almost everything. **Circuit.**—Variable-mew gas-filled valves coupled by neon-tubes. No rectifier needed. **Controls.**—(1) On-off tap, with shilling-in-the-slot orifice. (2) Roast-or-boil switch. (3) Automatic smell control. **Rent.**—2/11½d. per quarter. **Makers.**—The Gas Bright & Choke Co., Ltd.

these receivers by making themselves as helpful as possible, and are to be provided with portable wavemeters and calibration charts. It is also understood that a small gas-producer plant is shortly to be marketed for the benefit of those who are not yet piped.

The difficulties so common in soldered connections, due to dry joints, have been entirely overcome; and in fact wiped joints are used throughout. A mains filter has also been incorporated, consisting of six stages of blotting paper connected in series, with the object of removing every trace of moisture introduced by the mains, and so reducing the damping of the tuned circuits.

### An Unusual Cabinet

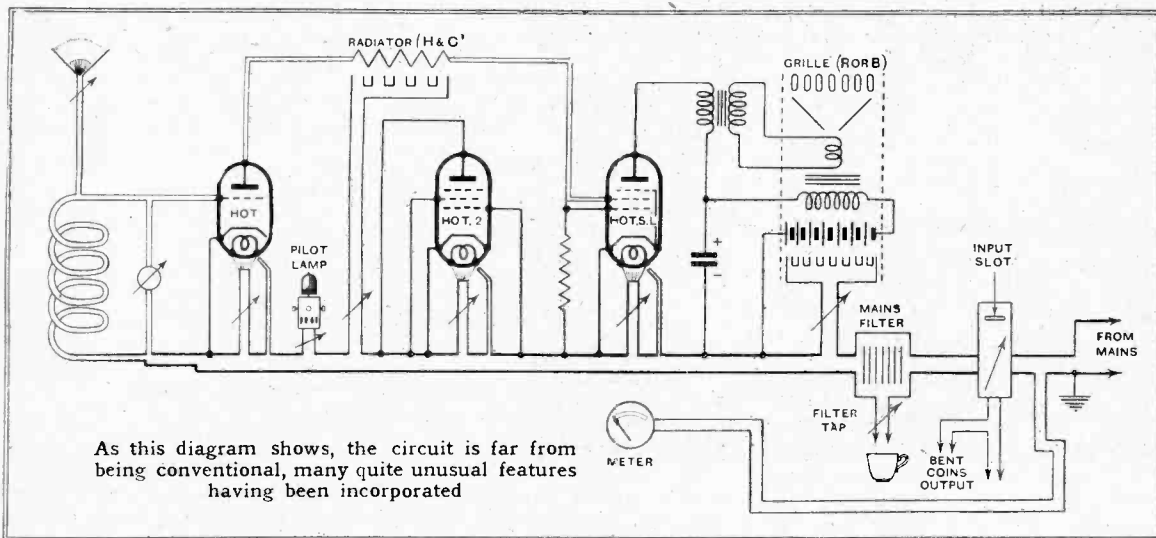
The cabinet is made of cast iron about 2½ inches thick, and is artistically finished in dull black, which has the additional merit of aiding the dissipation of the considerable amount of heat that is given off. This heat would hitherto have been considered a disadvantage, but in this model it has ingeniously been made possible to roast a joint or poultry during reception of the hotter types of dance music by hanging them on a hook provided in front of the loud speaker grille. This gives rise to occasional frying noises, which are not really serious however.

The controls consist of a main on-off tap, with shilling-in-the-slot input circuit, a roast-or-boil switch, and an automatic smell control. Until the taps are turned on, the smell is barely perceptible with the nose two yards from the loud speaker.

An example of the extraordinary attention to detail is the variable-mew valve to prevent mice from nesting in the gasmeter. As cats are not favoured in Germany, sets exported to that country make use, instead, of the well-known Barkhausen effect.

It should be mentioned that six yards of flexible hose are included with each receiver, which should therefore be of some use, even in the most unfavourable localities.

The set was tested on an indoor aerial five miles from the Gas Bright and Choke Co.'s works, at first on a lighting circuit. As there were symptoms of low tension, the connection was transferred to a higher pressure supply by displacing the gas cooker. Because the Model No. EL rendered the cooker redundant, no harm resulted.



As this diagram shows, the circuit is far from being conventional, many quite unusual features having been incorporated

**Thermo Superjet Three—**

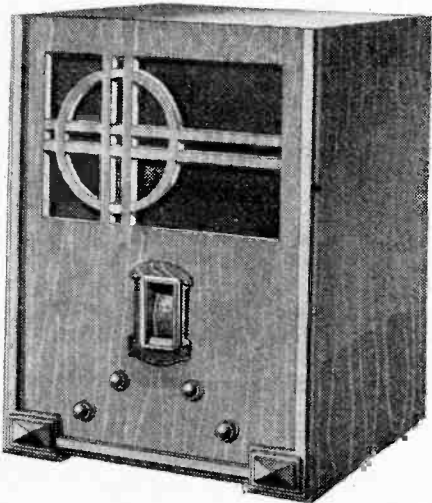
Apart from a good deal of hiss, reception was at first rather poor: but after investigating the fault with the aid of a pocket cigarette-lighter, the whole affair blew up with a loud report, followed by a complete fade-out. The test had therefore to be abandoned at this point, but there is no difficulty in declaring the performance to be outstanding in every direction. The power output was more than adequate for domestic purposes, and the programme was of definite entertainment value to listeners situated at a considerable distance. Reproduction was well forward, with strongly marked transients. It is true that there was a certain amount of break-through, together with side-band cutting, but these were not noticed at the time.

We have hesitated in the past to apply the adjective sensational to any receiver that has passed through our hands, but as the one at present being reviewed nearly passed through our face as well it would be hypercritical to withhold that description any longer.

NOTE.—As our usual set reviewer is on his Christmas holidays, the feature is supplied this week by our contributor, Mr. M. G. Scroggie. We therefore ask the indulgence of our readers in the event of any errors having been included.

**AMATEUR CABINET MAKING****Wood for Home Constructors**

ATTENTION is now being focused on the subject of radio cabinet design, both from the functional and artistic aspects. Amateur woodworking contrasts strongly with receiver construction, and introduces an element of variety; those who feel impelled to exercise their abilities by making not only the set but the container as well will be interested to know that, in the issue of *Hobbies* for November 18th, the building of an up-to-date cabinet in Spanish chestnut was fully described. A supplementary design chart is issued, copies still being available from the address given below.

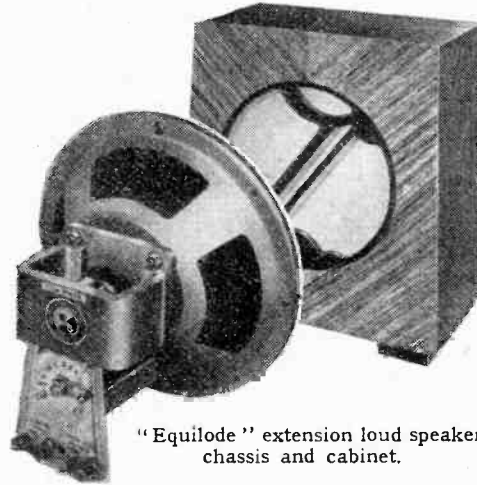


"Hobbies" cabinet for home construction.

The cabinet measures approximately 15in. wide, 19in. high, and 10½in. deep; it is consequently large enough for most modern sets. A parcel containing all the necessary wood is obtainable for 11s. 3d. from Hobbies, Ltd., Dereham, Norfolk.

**"EQUILODE" LOUD-SPEAKER**

FOLLOWING up the success of the "Microlode" unit the Whiteley Electrical Radio Co., Ltd., Radio Works, Mansfield, Notts, have now produced a new model working on the same principle and specially adapted for use as an extension loud speaker. It is fitted with a variable ratio transformer adjustable by means of a single switch arm.



"Equilode" extension loud speaker chassis and cabinet.

An off position is provided so that the extension unit alone may be cut off if desired. The unit is suitable for use with sets requiring either a high impedance or low impedance load on the extension terminals. It may also be used with certain sets, including a Class "B" output stage. The type number is PM5X. It is available in chassis form at £1 13s. 6d., or in a compact cabinet of modern design at £2 8s. 6d.

Photo-electric Cell Applications, by R. C. Walker and T. M. C. Lance, pp. 193, figs. iii. (Pitman, 1933. Price 8s. 6d.)

THIS book, which is largely based on developments carried out by the research laboratories of the General Electric Co., at Wembley, is an expansion of a series of articles which have appeared from time to time in the *Wireless World*. The alkali metal photo-electric cell is now obtainable in a standard bulb similar to a receiving valve, and when used in conjunction with a thyatron forms a compact mains-operated unit capable of handling power up to 20 kilowatts with an input signal of only 1 microwatt.

The variety of applications of such a light-sensitive relay is surprisingly great. The authors take us through various fields of industry and give clear descriptions and circuit diagrams of the layout which is suitable for each particular problem. In order to meet the high standard of performance required for commercial work the unit is invariably arranged to give warning if any failure should occur in the circuit.

It is in the advertising domain that the public is most familiar with photo-electric devices. Window displays are arranged to go into action by light reflected from a hand held up to an indicated part of a shop window. Water flows from a spout when a cup is held in position. Light is thrown on a book as soon as it is opened by a reader. Road signs light up at night by mechanism operated by motor car headlights.

In the section of talking films a very complete account is given of the part played by the photo-cell in reproduction from the sound track. It is shown how the new caesium-on-silver cells obviate troubles due

to frequency distortion and to hum caused by lamps flickering at double the frequency of the supply mains.

Smoke is detected by its effect in reducing the illumination of a cell arranged in a balanced circuit. In Pullman cars this device controls the ventilating system and only pure air is admitted. Cells can be made sensitive to various spectral regions, and the freedom of choice thus obtainable is used, for example, in television transmitters. Here a blue scanning light is used since potassium cells are most sensitive and the eye least sensitive to this colour.

Many other applications are given in the book, which contains sufficient detailed information to enable the experimenter to construct devices for almost any purpose where a beam of light can be made to act as a signal. R. T. B.

**EVERYMAN A.C. SUPER**

(See pages 472-4 of this Issue)

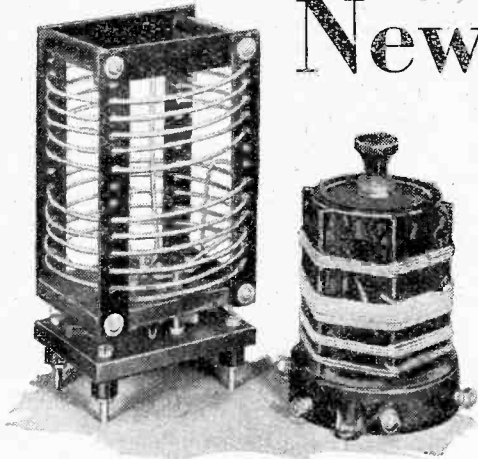
**LIST OF PARTS**

After the particular make of component used in the original model, suitable alternative products are given in some instances.

- |   |  |
|---|--|
| 1 R.F. Super Radiopak, 110 kc/s                       | British Radiophone                         |
| 1 Bulb, 6 volts, 0.15 amp.                            | Bulgin 615                                 |
| 2 I.F. Transformers, 110 kc/s                         | Varley "Nicore" BP.42                      |
|   | (Colvern.)                                 |
| 1 Screened H.F. choke, Ch1                            | Bulgin H.F.10                              |
|   | (R.I. Wearite.)                            |
| 2 Fixed condensers, 2 mfd., 200v., D.C. working       | C7, C8                                     |
|   | T.C.C. 50                                  |
| 3 Fixed condensers, 0.1 mfd., tubular,                | C5, C6, C9                                 |
|   | T.C.C. 250                                 |
| 1 Fixed condenser, 0.005 mfd.,                        | C13 T.C.C. Type "M"                        |
| 1 Fixed condenser, 0.01 mfd.,                         | C15 T.C.C. Type "M"                        |
| 2 Fixed condensers, 0.0002 mfd.,                      | C11, C12                                   |
|   | T.C.C. Type "M"                            |
| 4 Fixed condensers, 0.0001 mfd.,                      | C1, C2, C3, C10                            |
|   | T.C.C. Type "M"                            |
|   | (Dubilier, Peak, Telsen.)                  |
| 1 Electrolytic condenser, 50 mfd.,                    | C10 T.C.C. 521                             |
| 2 Electrolytic condensers, 4 mfd.,                    | C18, C20                                   |
|   | T.C.C. 802                                 |
| 3 Electrolytic condensers, 8 mfd.,                    | C14, C17, C19                              |
|   | T.C.C. 802                                 |
|   | (Dubilier, Peak, Telsen.)                  |
| 2 Metallised resistances, 150 ohms 1 watt             | R8 Dubilier                                |
| 1 Metallised resistance, 400 ohms 1 watt              | R16 Dubilier                               |
| 1 Metallised resistance, 500 ohms 1 watt              | R7 Dubilier                                |
| 1 Metallised resistance, 800 ohms 2 watts             | R17 Dubilier                               |
| 1 Metallised resistance, 4,000 ohms 3 watts           | R4 Dubilier                                |
| 1 Metallised resistance, 5,000 ohms 3 watts           | R5 Dubilier                                |
| 2 Metallised resistances, 10,000 ohms 1 watt          | R10, R11                                   |
|   | Dubilier                                   |
| 1 Metallised resistance, 20,000 ohms 1 watt           | R6 Dubilier                                |
| 2 Metallised resistances, 250,000 ohms 1 watt         | R3, R12                                    |
|   | Dubilier                                   |
| 2 Metallised resistances, 1 megohm 1 watt             | R13, R14                                   |
|   | Dubilier                                   |
| 2 Metallised resistances, 2 megohms 1 watt            | R1, R2                                     |
|   | Dubilier                                   |
| (Erie, Graham-Farish, Claude Lyons, Seradex, Watmel.) |  |
| 1 Tapered volume control, 250,000 ohms                | R15  |
|   | Rothermel Type 1-010-004                   |
|   | (Magnum.)                                  |
| 1 Plain brown knob                                    | British Radiophone                         |
| 1 Potentiometer, 5,000 ohms                           | R9 Watmel T.2                              |
|   | (Haynes Radio, Claude Lyons.)              |
| 1 Smoothing choke, 10 henrys                          | Ch2 Sound Sales                            |
|   | (Bulgin, Ferranti, Heyberd, Rich & Bundy.) |
| 1 Mains Transformer, Primary, 200 to 250 volts,       |  |
| 50 cycles; secondaries, 200-0-200 volts, 75           |  |
| mA, 4 volts, 2.5 amps., centre-tapped;                |  |
| 4 volts, 4/5 amp. centre-tapped.                      |  |
|   | Rich & Bundy Type No. 233                  |
| (Challis, Heyberd, Savage, Sound Sales, Vortexion.)   |  |
| 5 Valve holders, 5-pin                                | W.B. Reversed Terminal Type                |
| 1 Valve holder, 7-pin                                 | W.B. Reversed Terminal Type                |
|   | (Bulgin, Clix.)                            |
| 1 Westector   | Westinghouse W.26                          |
| 1 On-off Toggle switch S1                             | Bulgin S.80                                |
|   | (Claude Lyons.)                            |
| 1 Double-pole double-throw switch S2                  | Bulgin S.98                                |
| 1 5-pin plug  | British Radio Gramophone Co.               |
|   | (Bulgin.)                                  |
| 4 Ebonite shrouded terminals, A, E., pick-up (2)      | Belling-Lee "B"                            |
|   | Harbros                                    |
| 1 Length of Screened Sleeving                         |  |
| 1 Loud speaker with pentode output trans-             |  |
| former and 2,500 ohms field                           | Rola F.6/P.2,500                           |
| Cabinets for set and speaker                          | Peto-Scott                                 |
|   | (C.A.C.)                                   |
| 1 Plymax baseboard, 10½in. x 16in. x ½in.             | Peto-Scott                                 |
| 2oz. No. 20 tinned copper wire, aluminium,            |  |
| 12 lengths Systoflex, wood, etc.                      |  |
| Screws:—  |  |
| 4 ½in. No. 4 R/hd.                                    | 4 ½in. No. 4 R/hd.                         |
| 6 ½in. No. 4 R/hd.                                    | 12 ½in. No. 4 R/hd.                        |
|   | All with nuts and washers.                 |
| 12 ½in. No. 4BA R/hd with metal thread and nuts and   |  |
| washers.  |  |
| Valves:—2 Ferranti VPT4, 1 Ferranti VHT4, 1 Osram     |  |
| or Marconi MPT4 (Catkin), 1 Osram or Marconi          |  |
| MU12.   |  |

# New Apparatus Reviewed

## Latest Products of the Manufacturers



Scientific Supply Stores new dual-range, and plug-in type, short-wave coils.

### SCIENTIFIC NEW SHORT-WAVE COILS

THE Scientific Supply Stores (Wireless), Ltd., 126, Newington Causeway, London, S.E.1, have introduced two new short-wave coils, one of which is of particular interest, as it is wound with Litz wire. The other model is, also, somewhat unconventional, for it is mainly air spaced and constructed from heavy gauge turned copper wire supported on a skeleton former.

The Litz-wound coil is a dual-range type wound on a 2½ in. moulded former, with separate windings for aerial, grid, and reaction circuits. Tested in an orthodox det.-L.F. set fitted with a screen grid detector valve, exceptionally good results were obtained. As in all short-wave receivers of this type, sensitivity depends largely upon reaction, and the most marked feature of this coil is the ease and smoothness with which reaction is obtained over the whole range. Owing to its high efficiency, this is achieved without any considerable change in the reaction condenser capacity between minimum and maximum settings of the tuning condenser, provided the aerial loading is kept small. Using a 0.00015 mfd. tuning condenser and 0.0003 mfd. reaction condenser, the two wavebands covered were 13.5 to 33.3 metres and 31 to 68.8 metres respectively.

It is extremely difficult to differentiate between the performance of the two coils, as the larger air-spaced model was also much above the average. Reaction, however, was not quite so constant, and greater use had to be made of the reaction condenser to maintain the set just on the threshold of oscillation. No doubt this could be improved by a tighter coupling between grid and anode coils.

The range covered by this model was 12.1 to 30 metres, using a series aerial condenser of 0.0001 mfd., the circuit otherwise being the same as for the first coil. It is fitted with a six-pin base, and we understand a second coil will shortly be available to extend the range.

The dual-range model costs 6s. 6d., and the single-range type 4s. 6d. Its baseboard mount costs 1s. 6d.

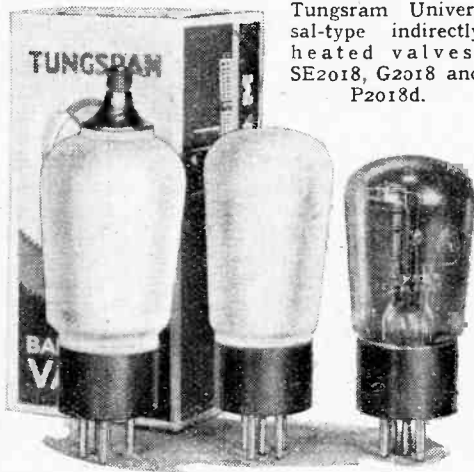
### TUNGSRAM UNIVERSAL VALVES

IN the Tunggram range of valves is a series of indirectly heated types that can be used on either A.C. or D.C. supplies, the customary arrangement being to dispense with the usual filament winding on the transformer and join the heaters in series, using a limiting resistance to drop the surplus volts.

They take 0.18 amp. each and the majority require 20 volts across the heater; of the remainder two are rated at 40 volts each, and one at 10 volts. In all there are 15 different types: three are H.F. pentodes, two variable- $\mu$  S.G. valves, one screen-grid model, three are triodes with one power output valve, two are pentodes and one is a Class "B" type. There are two mains rectifiers and a single-diode-tetrode, so that every type is represented.

Only a few samples could be tested, but these suffice to show that the stated characteristics are well maintained in the production models. The G2018, a general purpose triode, gave on test a mutual conductance of 3.1 mA./V. as compared with the maker's rating of 3.5 mA./V., while its amplification factor was 26.9, the rated value being 25. This brought the A.C. resistance to 8,600 ohms. The glass bulb is metallised and its price is ros. 6d.

A screen grid valve, the S2018, was next tested; this is not a variable- $\mu$  type but operates normally with a grid bias of 1.5 volts. With 200 volts on the anode and 100 volts on the screen and a grid bias of -1.5 volts, its mutual conductance was 1.6 mA./V. and its amplification factor 480. As its rated values are 1.2 mA./V. and 400 amplification, respectively, the specimen tested was even better than normal. With the stated operating voltages the anode current is 7.2 mA. and the screen current 1.5 mA.



Tunggram Universal-type indirectly heated valves, SE2018, G2018 and P2018d.

Finally the characteristics of the variable- $\mu$  SE2018 valve were investigated, its mutual conductance and amplification factor being measured with different values of grid bias. These are given in the table for a

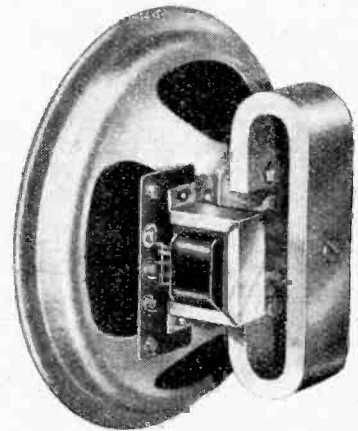
| Valve                     | Grid Bias Volts. | Amplification Factor. | Mutual conductance mA volt. | A.C. Resistance (Ohms). |
|---------------------------|------------------|-----------------------|-----------------------------|-------------------------|
| Tunggram Type SE 2018.... | -2               | 310                   | 1.55                        | 200,000                 |
|                           | -4               | 270                   | 1.08                        | 250,000                 |
|                           | -6               | 245                   | 0.77                        | 320,000                 |
|                           | -8               | 230                   | 0.57                        | 400,000                 |
|                           | -12              | 208                   | 0.33                        | 630,000                 |
|                           | -16              | 195                   | 0.2                         | 960,000                 |
|                           | -20              | 186                   | 0.12                        | 1,500,000               |
|                           | -24              | 180                   | 0.06                        | 3,000,000               |

maintained anode potential of 200 volts and 100 volts on the screen.

According to the makers' figures its mutual conductance should change from 1.4 mA./V. with -2 volts grid bias to 0.03 mA./V. with -40 volts. The average anode current with minimum grid bias is 10 mA. and the screen current 2.1 mA. The price of this valve is 14s. 6d., and the makers are Tunggram Electric Lamp Works (Great Britain), Ltd., 72, Oxford Street, London, W.1.

### MAGNAVOX TYPE 252 LOUD SPEAKER

THIS is the "Senior" model of the permanent magnet series and is fitted with a 9 in. diaphragm and a composite magnet system in which the centre pole is of cobalt alloy and the remainder of the magnetic



Magnavox Type 252 "Senior" permanent magnet loud speaker with dust cover removed.

circuit of chromium alloy. The chassis is neatly finished in grey cellulose enamel and is of rigid construction. A universal transformer gives a range of load impedances from 3,000 to 19,000 ohms and is also fitted with terminals for Class "B" and other types of push-pull output stages.

The efficiency of the unit is comparable with that of a standard energised model and the useful frequency response extends from 75 to 8,000 cycles. The principal bass resonance occurs at 90 cycles, but it is well supported by a group of subsidiary resonances of slightly lower frequency, with the result that coloration is not noticeable. The middle register is uniform and the high-note response is excellent, being maintained to a much higher point than usual yet without undue emphasis of sibilants. The general balance on music is full-bodied without lacking clarity, and we have no hesitation in recommending the unit for its good all-round performance.

The speaker is enclosed in a dustproof bag with an ornamental silk front, and the price is 3 guineas. The makers are The Benjamin Electric, Ltd., Tariff Road, Tottenham, London, N.17.

Next Week's Set Review :

R.G.D. RADIO-GRAMOPHONE Model 1201 A.C.

# Readers' Problems

## Double Diode Pentode

A USER of the New Monodial receiver has noticed that, although the anode current of the DD/Pen second detector is reduced considerably on tuning in a strong signal (according to expectations), there is actually a slight rise in current when a weak transmission is being received. It is asked whether this effect is in any way abnormal.

It is unusual to find that anode current rises slightly when tuned to a feeble signal, or to the "fringe" of a strong one—which amounts to the same thing. The rise in current may be ascribed to the grid current characteristics of the valve, but anode current should fall when the set is tuned to a signal strong enough to put the A.V.C. system into action.

## Niceties of Ganging

THAT divine discontent which marks the true wireless amateur has clearly prompted a query regarding alignment of ganged circuits in a fairly conventional three-valve receiver, of which the sections concerned are reproduced in simplified form in Fig. 1.

Almost everyone knows that, for really accurate ganging, everything must be matched and symmetrical in each one of the tuned circuits; inductance values of all the coils must be identical, each section of the tuning condenser must have the same capacity at all angular settings. Lastly, the value of stray capacity across each circuit must be the same, or provision must be

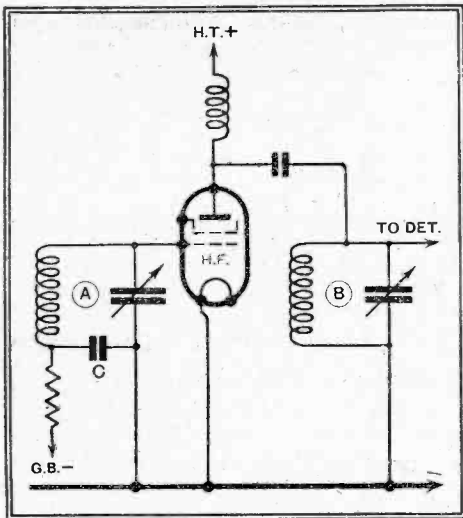


Fig. 1.—Circuits A and B are not entirely symmetrical; the first includes a by-pass condenser C, which may impair ganging unless certain precautions are observed.

made for making it so artificially by means of trimmers. The present problem deals with another disturbing factor—the by-pass condenser in grid decoupling circuits.

Unless a by-pass condenser of the same capacity is included in all the tuned circuits, it is clear that the possibility of misalignment is introduced; the present question is concerned with the fact that the H.F. grid circuit of our querist's receiver includes a by-pass condenser, while the band-pass input circuit and the H.F. intervalve coupling do not. We are asked to say whether the addition of a "padding" condenser in each of the other circuits is likely to improve alignment.

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.

Briefly, it may be stated that, provided the by-pass condenser be of very high capacity in relation to the tuning condenser, it is most unlikely that it will upset ganging. A capacity of 0.1 mfd.—a standard value in H.F. circuits—is 200 times larger than that of the tuning condenser, and so should have a negligible effect when compared with the inevitable discrepancies elsewhere.

A grid by-pass condenser of considerably lower capacity, however, might conceivably upset the relative tuning of the circuit in which it is included. It should be made quite clear that the disturbing effect of the condenser becomes more marked as wavelength is increased, and so its effect cannot in any way be balanced out by adjustment of the trimming condenser.

A final point: an inductive condenser is clearly undesirable in the position in question, for the reason that its inductance will be additive to that of the coil, and so will cause mis-matching.

## A Non-radiating Receiver

A CORRESPONDENT, obviously blessed with a commendably strong sense of his obligations towards his neighbours, enquires whether the New Monodial receiver is likely to cause interference through radiation. He has previously used "straight" sets, and has heard that a superheterodyne may annoy other listeners.

Admittedly, some superheterodynes, that shall be nameless, radiate almost as strongly as they receive! But most modern sets are reasonably free from blame, and the New Monodial in particular should never give trouble on this score. Not only is there a stage of H.F. amplification, but also the tetrode portions of the frequency changer valve are interposed between the oscillator and the aerial. This amounts to very much the same thing as the interposition of two H.F. stages, which would normally prevent any possibility of radiation. Further, the questions of layout and wiring were specially studied with a view to preventing any accidental transference of energy to the aerial circuit.

## The Wireless World INFORMATION BUREAU

THE service is intended primarily for readers meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

## Non-amplifying H.F. Stage

A READER has found by experience that the H.F. stage of his receiver is rendered completely ineffective by disconnecting the anode decoupling condenser. Contrary to expectations, disconnection does not produce instability, but merely seems to have the effect of "reducing H.F. amplification to practically zero."

The effect is quite different from that encountered in any other circuit of the receiver—or in any other receiver—where the experiment has been tried, and we are asked to suggest a reason.

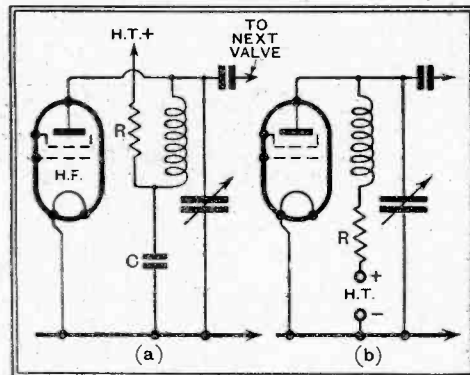


Fig. 2.—By disconnecting condenser C, the resistance R is placed in series with the tuned-anode circuit, as shown in diagram (b).

It seems fairly certain that tuned-anode H.F. coupling is used in the set, and that matters are arranged in the conventional way, as in Fig. 2 (a). As a result of disconnecting the by-pass condenser C, through which the tuned circuit is normally completed, oscillations are diverted through the decoupling resistance R, and also the various resistances and impedances of the H.T. wiring and battery (or eliminator). Fig. 2 (b) represents the circuit under these conditions. As R is likely to have a value of about 1,000 ohms, it is understandable that the circuit will be so heavily damped that the stage can no longer amplify.

## Patchy Instability

IT has often been suggested that when making initial adjustments or tracing certain types of fault, it is a good plan to put the A.V.C. system temporarily out of action. We repeat this advice for the benefit of a correspondent whose newly constructed "2-H.F." receiver is giving trouble. It is complained that the background, when not tuned to a transmission, is excessively noisy, and that many of the signs of instability are present, although the manifestations of uncontrollable self-oscillation are not the same as in a set without automatic control.

From further information given to us we think that there can be no doubt that the set actually is lacking in stability over a large section of the wavebands which it covers. Instability cannot, however, show itself in the ordinary way, because the H.F. valve grids are, under certain conditions, biased well back by A.V.C. action.

It is therefore recommended that the control circuits should be disconnected, and that our correspondents should concentrate on stabilising the H.F. circuits before proceeding farther.

# 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

### Interference

#### France Takes Action

**Y**ET another European country has taken official action to bring about a reduction in electrical interference with broadcast reception, and so makes it all the more imperative that we in this country should make haste to follow suit. In France a Decree has been issued, under the date of December 1st, which makes manufacturers, sellers, and installers of apparatus responsible if interference with reception is caused. The Minister of Posts, Telegraphs and Telephones is to be advised by a specially appointed body as to the measures which should be adopted to suppress the interference, and this body is also to recommend when the amount of interference caused is insufficient to be regarded as a nuisance or where the cost of suppressing the interference would be out of proportion to the importance of the apparatus concerned.

France has certainly gone about the task of suppressing interference on rather different lines from our own. Here it would seem that the procedure will be, first to decide what reasonable action can be taken to suppress interference, and then to consider the framing of legislation to meet the requirements.

In France the immediate effect of the new Decree is to make it an offence to cause interference and to throw the responsibility on to the producers of the electrical plant itself. Any exceptions allowed under this Decree will be as a result of recommendations by the body of experts appointed to advise the French Post Office.

There is, perhaps, a tendency here to approach the matter over-cautiously, and in some quarters we believe it is even considered possible that inter-

ference could be abolished, or substantially reduced, without recourse to legislation. As we have pointed out, however, on previous occasions, legislation alone can ensure that the suppression of interference takes place in an orderly fashion and by means which will operate with fairness to all parties concerned. Any voluntary agreement amongst electrical apparatus manufacturers to make their products interference free would act most unfairly unless legislation were introduced to make this voluntary agreement a compulsory one on every manufacturer.

### Anti-propaganda Efforts

#### Attempt to End an Abuse of Broadcasting

**T**HE Paris Institute of Intellectual Co-operation is considering the possibility of approaching various governments with the idea of calling an international convention to prohibit the broadcasting of radio propaganda of such a character as to endanger the good relations between various nations of Europe.

The extreme desirability of some agreement which would bring an end to propaganda of this nature has been felt for some considerable time, and the longer such forms of propaganda are indulged in the more difficult will it become to agree upon a common policy to end it. Broadcasting has already been responsible for a good deal of friction due to this cause, and it is highly desirable that it should be discontinued. If it is permitted to go on there can only be one effective means of countering it, and this would be for every nation to retaliate by similar means whenever propaganda offensive to their interests was broadcast. The result might indeed be disastrous.

## The Wireless World

# Everyman A.C. Super

### Building and Adjusting the New Four-valve Superheterodyne

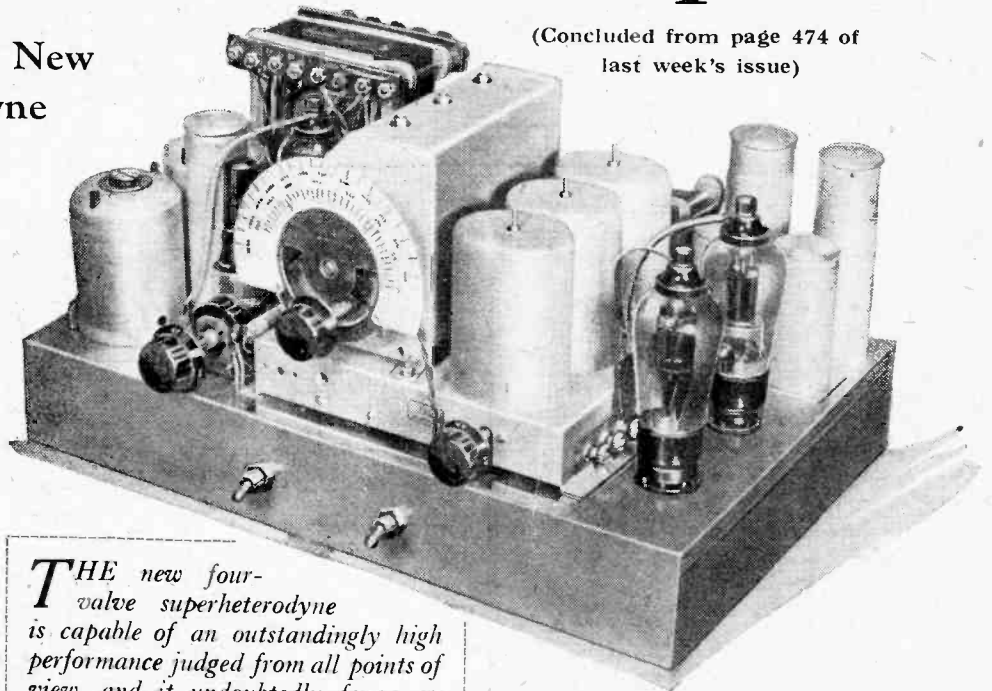
By W. T. COCKING

**T**HE principles underlying the design of the new superheterodyne were described in last week's issue of *The Wireless World*, and it remains to deal with the construction and initial adjustments and to give some notes upon the performance to be expected. There is little in the actual building which calls for comment, since the aluminium-covered chassis is obtainable with the large holes ready drilled, and the same applies to the cabinet. The positions of the various components will be clear from the drawings which accompany this article, and the order in which they are assembled is unimportant. All fixing screws should be made thoroughly tight, not merely for the sake of rigidity, but because some of them are used for earth connections to the chassis. Resistances, small condensers, and the Westectors are, of course, supported by their connections.

The wiring will be found quite straightforward, and it is recommended that tinned copper wire be used and run in insulating sleeving. As far as possible the general run of wiring of the original set should be retained, for deviations in the positions of leads will often have as untoward an effect as alterations in the layout of components. Indeed, in these days of screen coils and condensers, the wiring is usually the more important.

#### The Cabinet

It will have been observed that the cabinet work specified for this receiver is in two parts, one for containing the receiver and the other for housing the loud speaker. Although the chief advantage of this arrangement is one of practical convenience in being able to use the set and speaker in different rooms, it is not without some technical significance. It is a common experience that when speaker and receiver are both included in the same cabinet acoustic reaction to the valves or variable condenser may cause howling or a bass resonance. In order to avoid this the receiver chassis is often mounted on sponge rubber, but this sometimes leads to mechanical difficulties in the construction. With the two unit arrangement adopted for this receiver, there is considerably less chance of acoustic reaction, even when the speaker case is standing directly upon the receiver cabinet, but if it should occur it is a very simple matter to remove



(Concluded from page 474 of  
last week's issue)

**T**HE new four-valve superheterodyne is capable of an outstandingly high performance judged from all points of view, and it undoubtedly forms an ideal type of receiver for all-round purposes. In this article the construction is dealt with and details are given of the best ganging procedure together with operating notes and a description of the performance of the set.

it by placing a sheet of sponge rubber between the two.

Since the speaker field is used for smoothing, four extension wires are necessary if the speaker be used at any distance from the receiver. It might be thought that this would introduce a serious risk of hum, but it has been the writer's experience that this is not so, and he has successfully employed leads up to 50ft. in length with this arrangement. Much depends upon circumstances, however, and there is undoubtedly a possibility of hum pick-up in these leads.

The initial adjustments required are only to the ganging of the signal frequency circuits and to the trimming of the L.F. transformers. The latter should be tackled first, and the best procedure is to tune in a station and then loosen the I.F. couplings as far as possible without losing it altogether. Each I.F. trimmer should then be adjusted for maximum signal strength. If the station selected is a strong one, difficulty may be found in accurately determining the optimum trimmer settings owing to the action of A.V.C. in smoothing out the variations in volume. The difficulty may be overcome in several ways—a weaker station may be selected, the switch S1 may be opened and the volume reduced to a whisper by adjusting R9, or a milliammeter

or voltmeter may be used as a tuning indicator. This last is undoubtedly the best, and a milliammeter should be connected in circuit at the point "X" on the circuit diagram; a low range voltmeter may be used as an alternative, and in this case it should be connected across the bias resistance R8. Whichever be used, the meter will read a maximum with no signal, and its reading will decrease whenever a signal strong enough to operate A.V.C. is tuned in. Trimming, therefore, should be carried out for a minimum reading on the meter. When satisfied with the adjustments, the two couplings should be varied for maximum sensitivity, as indicated either by loudest signals or a minimum reading on the meter.

#### Ganging

The I.F. circuits are now in resonance with one another and the couplings are adjusted for maximum sensitivity, but it is not yet known whether the circuits as a whole are peaked at the correct frequency of 110 kc/s. The next step, therefore, is to make a rough adjustment of the preselector trimmers. A station on as low a wavelength as possible should be tuned in, and the two preselector trimmers (the back and middle gang condenser sections) adjusted for maximum audible response or minimum current on the meter. Even although the ganging may not be accurate, it should now be possible to receive stations over the whole of the medium waveband, but second channel whistles may be evident.

It is with the aid of these that the intermediate frequency is checked, for a strong whistle should be found at this stage when a station working on a frequency



Everyman A.C. Super—

220 kc/s lower than that of the local is tuned in. Under the present arrangement of stations, this means that a whistle should be found on North Regional due to second channel interference from London Regional when the set is operated

at a short distance from the latter station. Should the whistle occur at some other point it is a sign that the intermediate frequency has been adjusted to the wrong value and it should be appropriately altered until it is correct. If the whistle falls on a higher wavelength (lower fre-

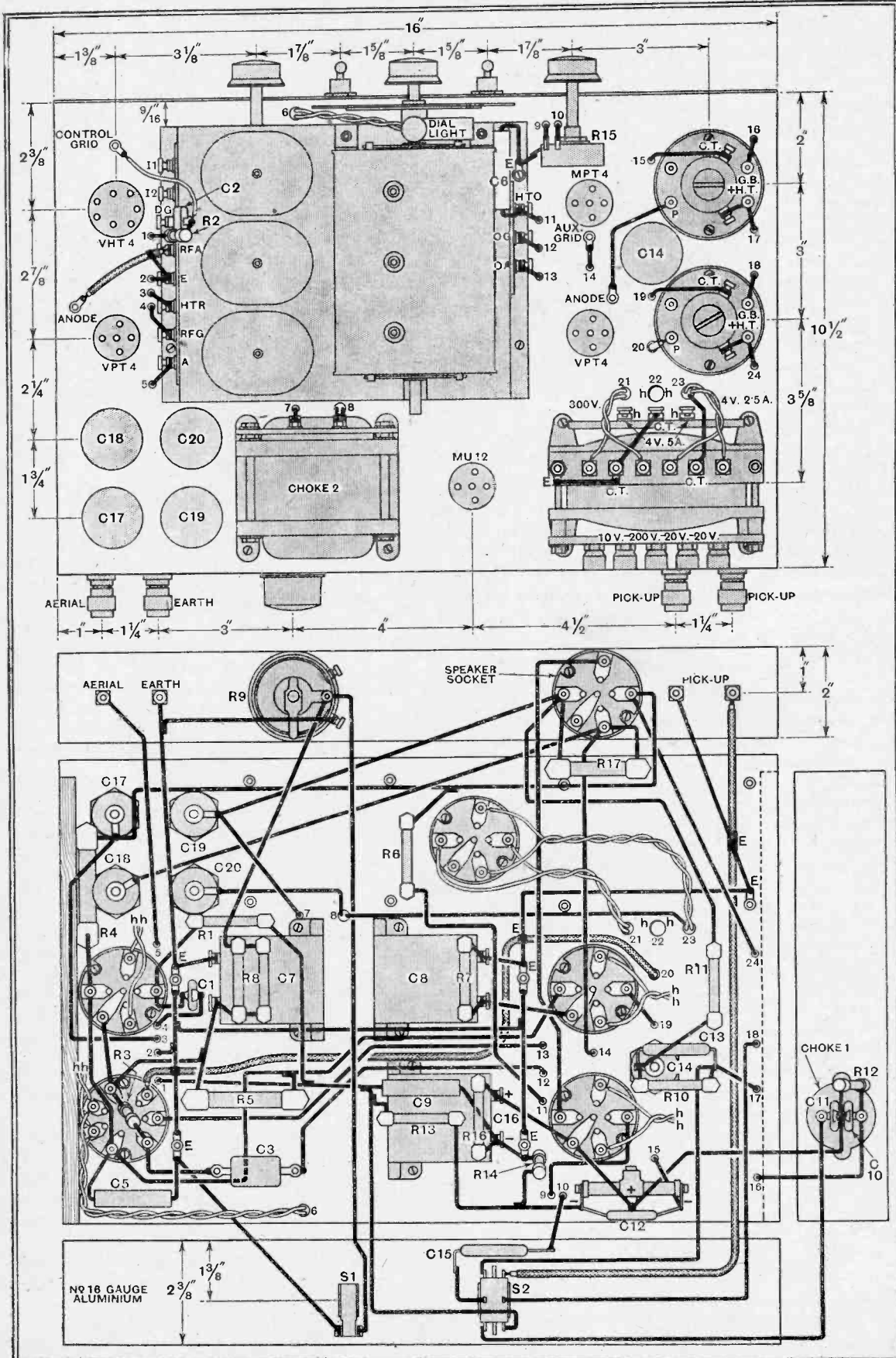
quency) station, the intermediate frequency chosen is too high, and all the I.F. trimmers should be screwed up somewhat.

When the correct frequency has been found in this manner, the I.F. circuits should be trimmed accurately in the way already described, and they will then require no further adjustments, save perhaps to the couplings. In some locations, where there is no local station to produce a second channel whistle, the choice of the correct intermediate frequency is not so easy, and it is fortunate, therefore, that it is then not so important. In this case, the only method of checking the frequency which is possible in the absence of a calibrated oscillator is through the accuracy of ganging of the preselector and oscillator circuits. These should next receive attention, therefore.

As explained already, a low wavelength station should be selected upon which to carry out the adjustments. This station should preferably be working below 250 metres and it should not be one subject to fading. Having tuned it in accurately, adjust each preselector trimmer for maximum response without touching the oscillator trimmer (front section of the gang condenser). Should it be found that either of the preselector trimmers must be fully unscrewed or fully screwed home, the oscillator trimmer must be slightly altered in the opposite direction and the station retuned by the tuning control. This should be repeated until a definite optimum setting for each preselector trimmer is secured. No difficulty is likely to be encountered except in the case of the aerial trimmer (rear section of the condenser); here it might be found that the trimmer has always to be at minimum. This is only likely when the aerial has an unusually high capacity to earth, and the remedy is either to alter the aerial or to insert a condenser in series with the aerial lead to the set. Such a condenser should have a capacity of the order of 0.0002/0.0005 mfd.; normally, or course, it will be unnecessary.

When accurate ganging has thus been obtained at a low wavelength, a station on a higher wavelength around

THE WIRING DIAGRAM



The components and all wiring connections are easily identified in this diagram.

**Everyman A.C. Super—**

500 metres should be tuned in. At this wavelength the preselector trimmers must not be touched, and only the oscillator trimmer must be adjusted. Since the setting of this trimmer controls the dial settings, the trimmer must be adjusted with one hand while the other alters the tuning control so that the station is not lost. At first, try increasing the capacity of the oscillator trimmer, at the same time reducing the dial setting so that the station remains in tune; if signal strength increases, as indicated aurally or by the meter, continue until the optimum combination of settings is found. If signal strength is reduced, however, proceed in the other direction; that is, reduce the capacity of the trimmer while increasing the dial reading.

When this has been done, return to the low wavelength station, and readjust the two preselector trimmers for maximum response. The ganging should now hold quite well over the whole of the medium waveband, but if the greatest accuracy is required the whole process should be repeated. If it should be found that the ganging does not hold, it is a sign, in the absence of a defect in the receiver, that the I.F. circuits are adjusted to the wrong frequency, and it is through this that the correct frequency is found in cases where the set is used too far from a local station for the second channel whistle to occur.

**The I.F. Circuits**

If it be found that after every adjustment at a low wavelength the oscillator trimmer has to be increased for accurate ganging at a high wavelength, it is a sign that the I.F. circuits are adjusted to too high a frequency. The I.F. trimmers, therefore, should be increased. When accurate medium wave ganging has been secured, the long waveband should receive attention, and the ganging here is extremely easy, for the only adjustment required is to the padding condenser C<sub>4</sub>, which can be reached through a hole in the front of the Radiopak. A station such as Huizen or Radio Paris should be tuned in, and the padding condenser adjusted while rocking the gang condenser backwards and forwards over a few degrees until the optimum combination of settings is found. The procedure is the same as that for ganging at 500 metres, save that the padding condenser is adjusted instead of the oscillator trimmer.

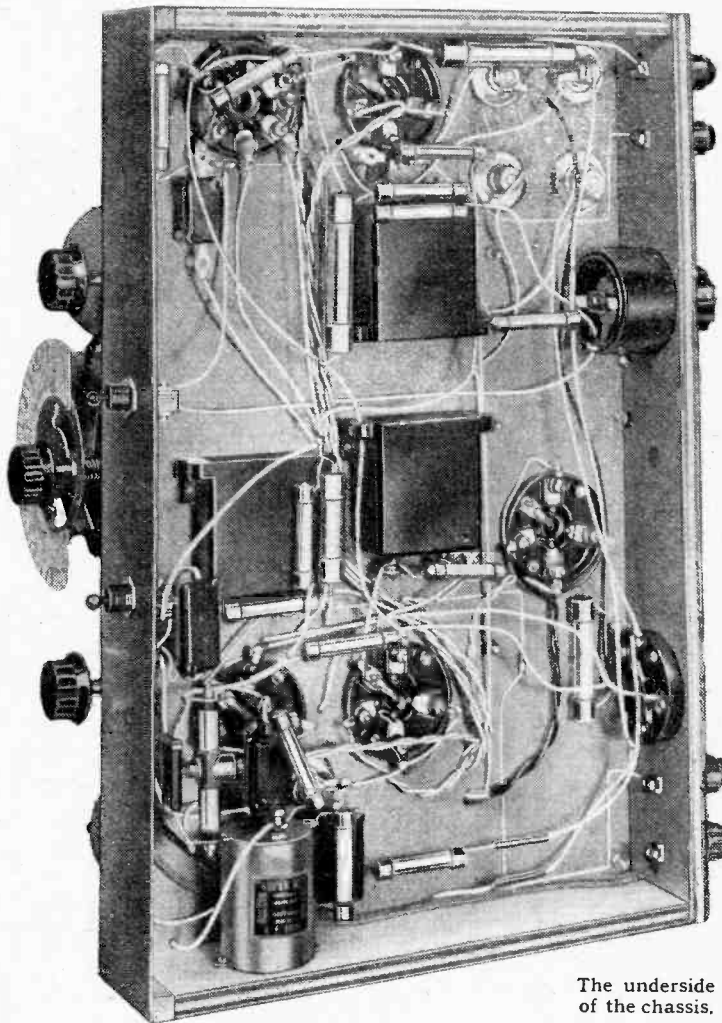
The only adjustments remaining are to the I.F. couplings, and these are normally made for the best quality of reproduction. The adjacent channel selectivity is also controlled by the couplings, and it should be remembered that, in general, the looser the coupling the higher the selectivity, the lower the sensitivity, and the poorer the quality. This does not apply exactly, however, for optimum settings for quality can usually be found, and it is recommended that these be adopted.

A certain amount of sideband cutting in these circuits is to be welcomed, for it is used to compensate for the tendency of the pentode to over-accentuate the

*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.*

upper register. Put in another way, the pentode provides automatic tone correction for sideband cutting. This effect is absent on gramophone, however, so the by-pass condenser in the L.F. coupling is given a sufficiently high value to maintain the correct frequency response.

No adjustments are necessary on the gramophone side, and the manual volume control is operative on both radio and gramophone. Care should be taken, how-



The underside of the chassis.

ever, to keep the pick-up leads well away from the speaker connections, otherwise a high-pitched howl may occur. In order to avoid any possibility of this trouble, it is a wise plan to screen the pick-up connections. Since the I.F. valve is used as a low frequency amplifier for reproducing gramophone records, the tendency for a break-through of radio on gramophone is greater than usual. It may be completely avoided, however, by operating the set on gramophone with the switch S<sub>1</sub> open and the resistance R<sub>9</sub> set to a high value.

The adjustments necessary before the best operation can be secured are not difficult to carry out in practice, but no attempt

should be made to hurry the process of ganging, and it will be found best to proceed methodically, satisfying oneself that each adjustment is satisfactory before going on to the next.

The receiver has been tested in the heart of London and it gave a very good account of itself. The sensitivity proved adequate for the reception of a number of Continental stations, such as Langenberg, Brussels, Fécamp, Huizen, Zeesen and Paris at full loud speaker strength in daylight, while after dark dozens of stations were available. Although stations immediately adjacent in wavelength to the local could not be secured, those

spaced from it by more than about 15 kc/s could be received free from interference, showing that the selectivity is of a sufficiently high order to satisfy most requirements.

The quality of reproduction proved very satisfying and of a sufficiently high order for real musical entertainment. The volume obtainable was great enough for all but the very largest rooms, and hum was completely absent. A.V.C. proved to have a wide range of control and would hold down the local stations to the level of strong Continental transmissions, while removing many of the effects of fading from the latter. For local reception, however, it is advised that the switch S<sub>1</sub> be opened and R<sub>9</sub> adjusted to a suitable value in order to avoid any possibility of distortion due to overloading of one

of the early valves. Since the sensitivity rises between stations, background may be loud while tuning. To overcome this, tuning should be carried out with S<sub>1</sub> open and R<sub>9</sub> adjusted to a convenient value, but when the station has been tuned in, S<sub>1</sub> should be closed in order to secure the maximum immunity from fading.

*A specimen receiver built to the specification described in this article is available for inspection by readers at 116, Fleet Street, E.C.4.*

**VOLTAGES AND CURRENTS.**

| Type.               | Anode Volts. | Screen Volts. | Grid Bias. | Anode Current. | Screen Current. |
|---------------------|--------------|---------------|------------|----------------|-----------------|
| H.F.: V.P.T.4 ..    | 200          | 100           | - 2.9      | 5.0            | 3 mA.           |
| F.C.: V.H.T.4. Tet. | 200          | 100           | - 2.9      | 3.2            | 2.5             |
| Osc.                | 150          | —             | —          | 2.7            | —               |
| I.F.: V.P.T.4 ..    | 200          | 100           | - 4.3      | 5.0            | 2.9             |
| Out.: M.P.T.4 ..    | 250          | 263           | -13        | 40.0           | 8.5             |

# Practical HINTS AND TIPS

IT is common practice to wire the heater circuits of A.C. valves with twisted flex wires. The reason for this is that the leads are in this way rendered more or less non-inductive, and so the possibility of transferring unwanted A.C. potentials to other

**“Go” and “Return” Wires.**

circuits is largely avoided. Incidentally, it may be pointed out that there is no especial virtue in twisted leads; it would be just as satisfactory if the two wires were laid side-by-side.

This principle of running “go” and “return” leads side-by-side in pairs may sometimes be applied elsewhere in a receiver with advantage; at any rate, it may help to minimise hum, or even to prevent actual instability which might otherwise be caused by long connecting leads. For instance, the addition of a milliammeter in the anode circuit of a detector valve will, it is well known, occasionally cause uncontrollable self-oscillation, especially if the instrument be wired with long straggling leads which are allowed to pass close to apparatus associated with preceding tuned circuits. It is therefore safest to wire a testing meter with twisted flex or twin flat-laid wires in the manner indicated diagrammatically in Fig. 2 (a).

In considering this diagram, it will be realised that any H.F. energy flowing through the milliammeter is an unwanted “by-product” which has escaped the filtering effect of the H.F. choke, etc. Therefore it follows that any losses in the twisted leads are of no account. But, even in H.F. circuits where losses do

## AIDS TO BETTER RECEPTION

are both screened, but perforce are mounted some distance apart. If this circuit were wired as suggested in diagram (c), the possibility of interaction between it and neighbouring circuits would be greatly reduced. At the same time, losses and self-capacity might be increased slightly, but not seriously, if bare wires were employed for the connections.

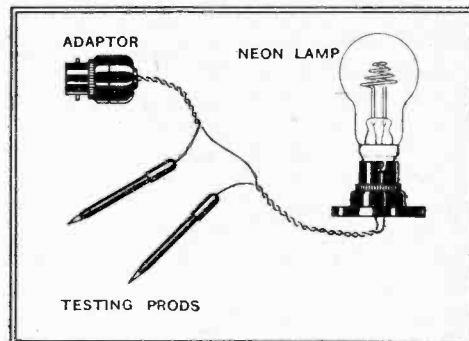
IN addition to its uses for testing condensers in the manner recently described in these columns, the neon lamp makes a satisfactory continuity indicator for testing through resistances of quite high value (fixed or variable), as well as the windings of chokes, transformers, etc.

### Neon Test Lamp

An ordinary Osglim lamp, which is easily obtained, may be arranged as a tester in the manner shown in the accompanying illustration. The source of voltage may be the mains, the H.T. supply unit, or even an H.T. battery when voltage is sufficiently high. It will be observed that the neon lamp, when connected across the component under test, glows with varying brilliancy and area, depending on the value of resistance in circuit; with a little experience one can make a fairly accurate estimate of the actual resistance value.

When connected in series with the source of A.C. voltage, the simple neon

city value. The absence of glow indicates, of course, an internal disconnection or excessively low capacity, while full glow on a supposedly low capacity would indicate a short-circuit.



A neon lamp passes a low current, and can be used with safety as a continuity indicator for many purposes.

THE general rule which says “the more controlled stages the better” is a good one to observe when planning any receiver with automatic volume control. For instance, when dealing with a super-heterodyne, one might even go to the length of fitting a second I.F. stage merely in order to get good A.V.C., and not because the extra valve is necessary from the point of view of amplification. Similarly, straight sets with two H.F. stages always lend themselves much better to A.V.C. than do those with one.

### Over-control

Over-control, which would result in a weak signal being received at greater volume than a strong one, can hardly take place normally except in certain circumstances when a controlled double-diode pentode is employed.

WHEN a background of hum is evident only when the set is being used for gramophone reproduction, it generally means that electrostatic pick-up is taking place in the detector grid circuit. A re-arrangement of the components is indicated, and especial care should be taken to reduce the impedance of the grid circuit as much as possible. This means in practice that the volume control potentiometer should have the lowest possible resistance consistent with good reproduction.

### Radio-gramophones and Hum

Particular care should be taken to see that the radio-gramophone change-over switch and volume control are mounted as far as possible from mains components and any leads carrying mains current. It is always worth while mounting the volume control potentiometer as close as possible to the valve with which it works.

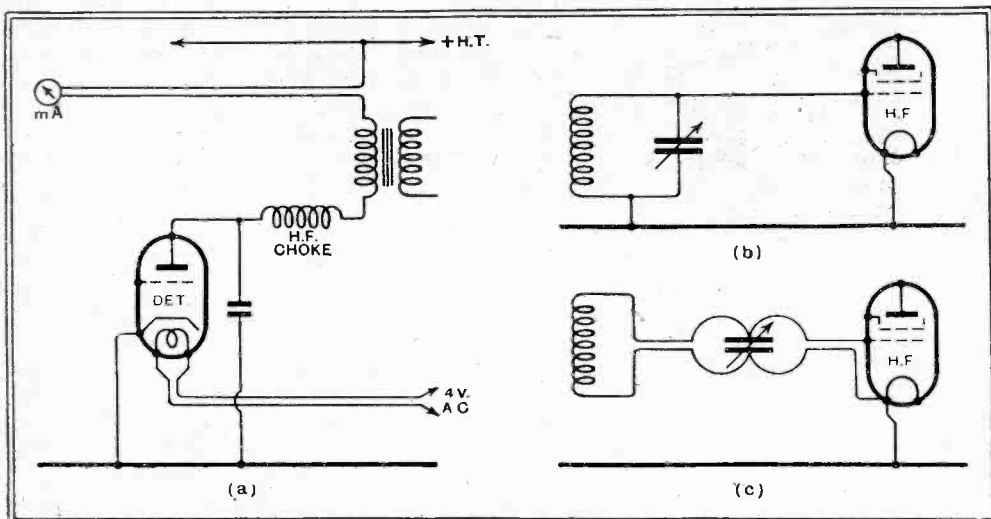


Fig. 2.—Illustrating the uses of non-inductive wiring, in which the field surrounding each wire is neutralised by the flow of current in the other.

matter, it is sometimes worth remembering the possibilities of non-inductive wiring, especially when an unconventional layout of components must be adopted. Take as an example the simple circuit shown in diagram (b), and imagine that the tuning condenser and tuning coil

indicator shown will serve as a condenser tester. On making contact with the test “prods” across a condenser, the lamp will glow with a brilliancy depending upon the capacity: as when dealing with resistances, the user soon acquires the knack of making a rough guess as to the capa-

# Single Coil Tuning

## Iron-cored Coils for the Simple Detector Set

**B**Y taking advantage of recent developments in coil design, a very satisfactory performance may now be obtained from the simplest possible type of receiver having but one tuned circuit. Much practical information is given on the use of iron-cored tuning coils in this type of set.

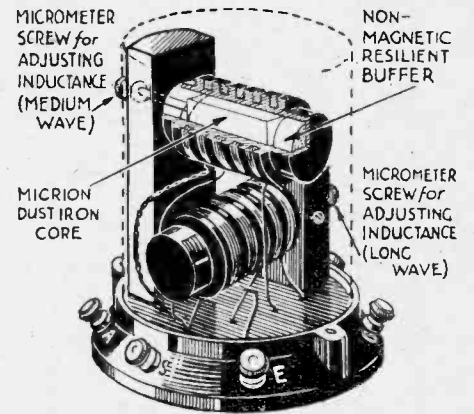
**F**OR quite a considerable time since the ether has been disturbed by the "Battle of the Giants," it has been generally believed that the single-tuned circuit is totally inadequate as a means of selecting stations. This is true enough where small screened air-cored coils are concerned, but it may not be realised that some of the new iron-cored coils can be relied upon to give quite a good account of themselves, provided that

ward many times in this journal, and if profit is taken in the form of selectivity a detector set can be built in which station separation will be immensely superior to that obtained in receivers built, say, a year ago, whilst signal strength will meet most requirements.

There are several single iron-cored aerial coils available, designed for use in special circuits, and as an excellent example we may take the Ferrocart F5 coil, connections for which are given in Fig. 1. The maximum selectivity for this type of circuit has been obtained by reducing both aerial and detector damping to a minimum.

When the whole of the tuned circuit is connected to the grid of a three-electrode detector valve, the damping will be equivalent to a shunt resistance of the order of 20,000 ohms on

the long-wave aerial winding and the aerial capacity resonating within the medium band. A satisfactory way of eliminating



Construction of R.I. Micrion coil.

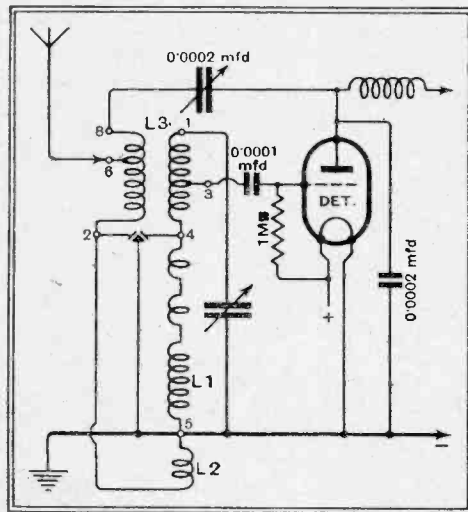
this trouble is to raise the fundamental wavelength of the aerial by the use of a high-inductance aperiodic winding. This expedient is adopted in the F5 coil, in which a 1,200 microhenry winding is included between terminals 5 and 2.

### Novel Coupling System

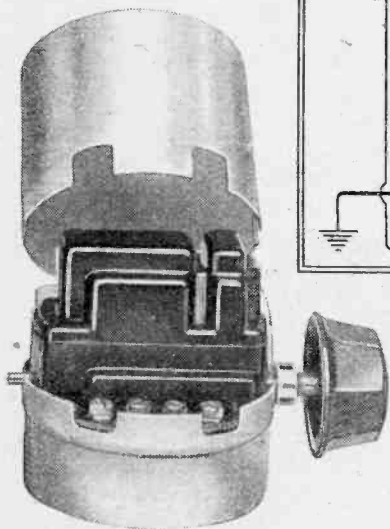
To maintain a selective input, however, this winding must not be too closely coupled to the long-wave tuned coil. Loose coupling a coil of so many turns is no easy matter with a magnetic core, and recourse has been made by the manufacturers to an air-cored bobbin in the base of the coil carrying L1 and L2 tightly coupled together, but not linked magnetically to the iron-cored windings. By this means the requisite small mutual inductance is effected.

On the medium waves an alternative

Fig. 1.—Suggested input circuit for a selective detector set using Ferrocart F5 coil.



(Below) The special Colvern F5 coil for aerial tuning.



medium waves, and it is absolutely necessary, if advantage is to be taken of the high efficiency of the coil, to reduce this as much as possible. Accordingly, a step-

down ratio of 3 to 1 (as shown in Fig. 1) from the tuned circuit to the valve is used, corresponding to a 9 to 1 impedance ratio, or an effective load of some 180,000 ohms. This will not have a great effect on the tuned circuit as far as selectivity is concerned.

One of the most difficult things to avoid with a single tuned circuit is break-through of medium waves at the lower end of the long-wave. This is generally due to

they are not called upon to function under the shadow of a powerful station.

Happily, we do not all live under a shadow, and there are large areas in which a modest detector set with a single iron-core tuning circuit will be capable of providing uninterrupted entertainment from quite a large number of the more powerful transmissions. In various parts of Sussex, Surrey, and other home counties, for instance, the writer has obtained entirely satisfying results from a set built on the lines indicated. There is the advantage also that no ganging is required—a process which often baffles the beginner to whom these notes are intended to appeal.

The great benefits conferred by coils with dust cores have already been put for-

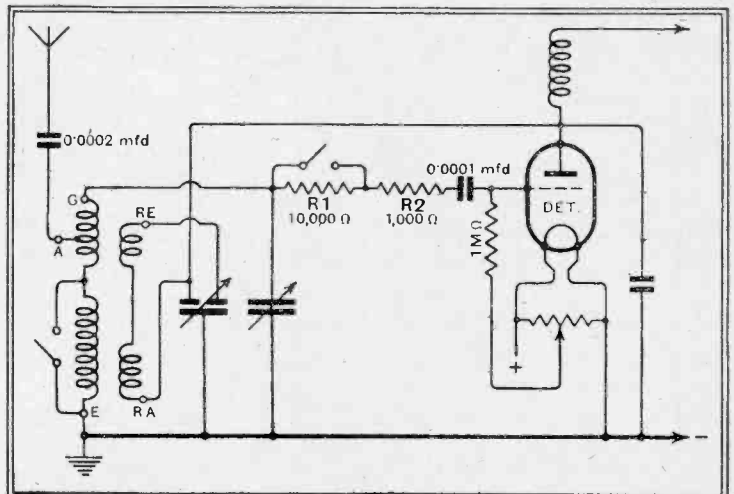


Fig. 2.—Circuit for the R.I. Micrion coil. The grid resistances R1 and R2 act in conjunction with the grid filament capacity to differentiate between two frequencies and thus break-through is minimised.

**Single Coil Tuning—**

aerial coupling is provided, but, to avoid a multiplicity of windings and the neces-

signal strength. Furthermore, reaction control is rendered more gradual.

The higher value of resistance included for long-wave reception readily permits differentiation between signals proper to this band and the higher frequencies at which break-through is liable to occur. This is, of course, due to the relatively lower reactance of the grid filament capacity at the break-through frequency. The makers of the Micron coil recommend that the grid should be returned to the slider of a potentiometer, as shown in the diagram, or, alternatively, a pair of

makers recommend that the anode should be connected directly to the screening grid through a high resistance of 0.25 megohm. As the voltage of the signal increases, so the negative bias becomes greater, and the anode and screen currents together are reduced. At the same time the voltage on the screen will tend to rise, and there will be a compensating effect.

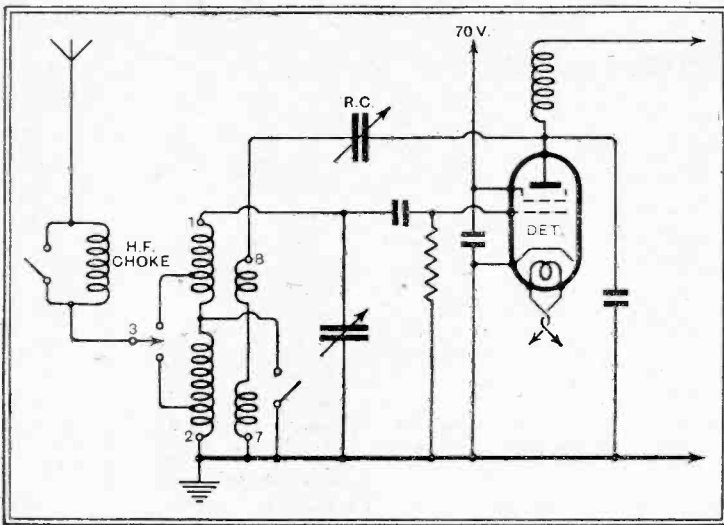


Fig. 3.—The Varley BP30 coil with H.F. choke in aerial circuit to prevent break-through on long waves. A screen grid detector is recommended.

sity of making several tapping points in the Litz coil, the same inductance L3 is used for both aerial coupling and reaction.

Detector sets embodying the F5 coil have been tested at a distance of twelve miles from Brookmans Park, and it has been found possible to separate the two transmissions easily and to obtain quite good reception of one or two stations of intermediate wavelength. The magnification of the coil, when undamped by aerial and detector, reaches the excellent figure of 220 at 550 kc., and 155 at 1,000 kc. An acknowledgment is due to the Colvern laboratories for information supplied on design data.

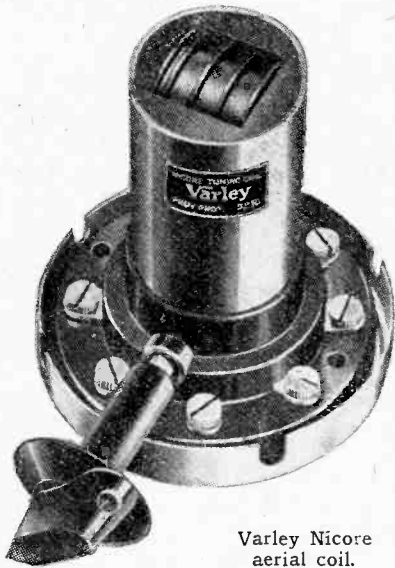
A great deal of work on selective detector circuits has been carried out by R.I. with their Micron coils, and a recommended circuit is given in Fig. 2. The two series grid resistances R1 and R2 are both included for long-wave reception, but R1 is short-circuited by a switch (actuated automatically by the waveband change-over mechanism) when receiving transmissions on the medium waves.

**Alternative Grid Resistances**

These resistances are virtually in series with the grid-filament capacity of the valve, and values may be chosen that ensure a regulated limitation of H.F. input to the grid on each waveband. As a result, grid current damping is reduced, and, although the H.F. input to the grid is also reduced, a decided improvement in selectivity is observed with little reduction of

grid leaks may be used simultaneously, one being returned to the positive L.T. lead and the other to negative L.T.

Another iron-cored coil which has been designed to give satisfactory selectivity when used in a reacting detector circuit is the Varley Nicore B.P.30. Here the circuit arrangement allows a happy compromise between selectivity and signal strength, but it is strongly recommended that a screen-grid detector be used to avoid excessive input damping. The circuit is given in Fig. 3, from which it will be seen that an H.F. choke is included in the aerial circuit to prevent break-through on the long waves. This should be short-circuited when receiving the medium waves.



Varley Nicore aerial coil.

The Wearite I.C.6 coil for detector sets is an example of a well-designed component devoid of "frills." There is no screening can, and the waveband switch is not built into the base. As a result, the coil can be marketed at the modest figure of 5s. Its performance was found to be quite up to the standard set by other similar iron-cored coils and break-through on the long waves was hardly noticeable, which can be attributed to a system of winding giving ultra-low capacity to the core.

There is a new Igranic coil ("Igranicor" type A) available in which only one iron core is used for both the long and short wavebands, this somewhat unconventional scheme being rendered possible by the use of parallel windings. A screen-grid detector is desirable with this coil, and the

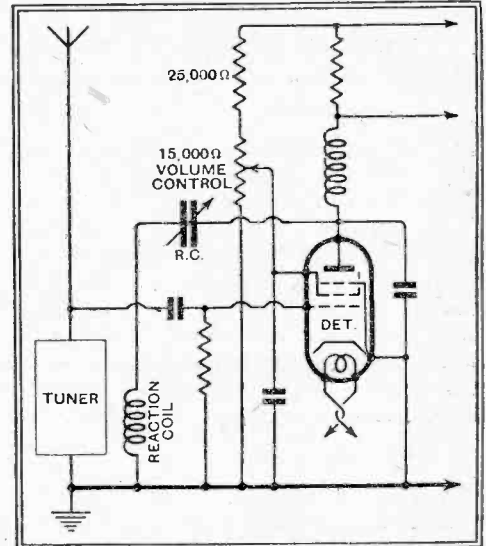
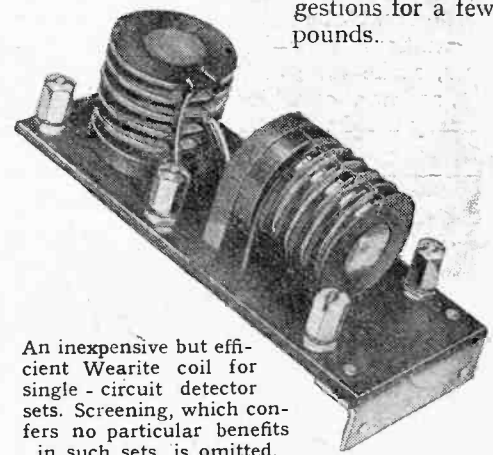


Fig. 4.—Probably the most efficient detector valve for use with single iron-cored coils in the screened H.F. pentode. The volume control can consist of a potentiometer to alter screen volts.

Probably the most efficient detector valve to use with these various iron-cored coils is the screened H.F. pentode, which should be employed in a power-grid circuit (see Fig. 4).

For those whose pockets will not allow the purchase of a more ambitious modern receiver, satisfactory detector sets can be constructed according to the foregoing suggestions for a few pounds.



An inexpensive but efficient Wearite coil for single-circuit detector sets. Screening, which confers no particular benefits in such sets, is omitted.

**Kinematography and Sound Recording**

MR. W. E. L. DAY, better known to his wide circle of friends in the world of wireless and kinematography as Will Day, is preparing an encyclopaedic work dealing with the technical development of the cinema—from the earliest cave drawings to the Ombres Chinoises, or shadow pictures of 5000 B.C., and thence to modern sound films. This valuable historical record is being published by subscription, and those interested are invited to apply for details to the author at 15, Cholmeley Park, Highgate, London, N.6.

# Twelve Months of Progress

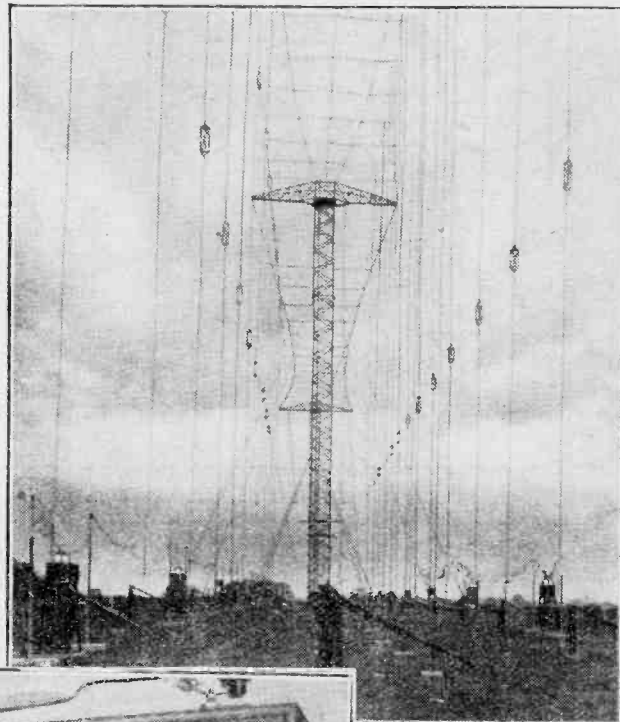
## Commercial Wireless Achievements in 1933

By Lt.-Col. CHETWODE CRAWLEY, M.I.E.E.

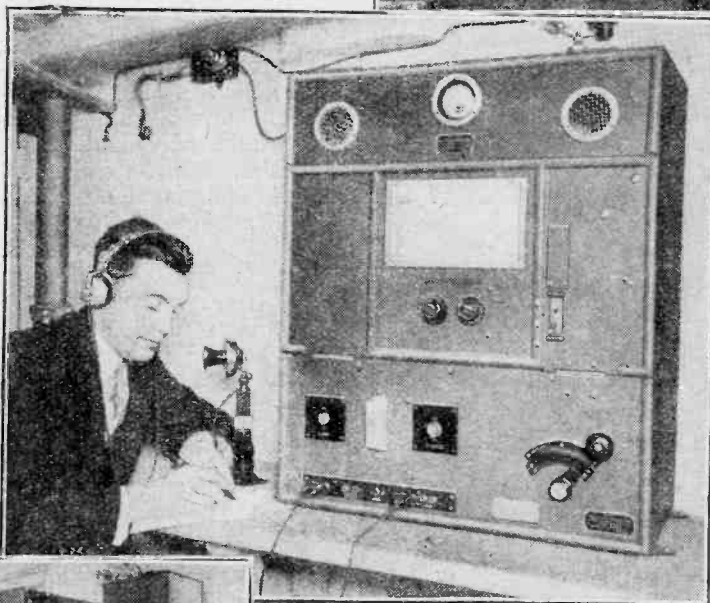
*RADIO telephony, rather than telegraphy, has won the laurels in commercial wireless during 1933. This article outlines the salient features of a year rich in wireless history.*

**T**HE present year has seen the introduction of some of the international regulations agreed to by the Conference held at Madrid in the autumn of last year, and also those laid down by the Merchant Shipping Act of 1932, which was based on the Convention for the Safety of Life at Sea, signed in London in 1929. Officially, the Madrid regulations are not binding until next year, but it is customary to conform in advance to as many of the new regulations of these international conventions as is practicable. The new regulations of the Madrid Convention already introduced have consisted for the most part of variations in signalling procedure. As regards the Safety Convention, all the important requirements have been in force for many years in British ships, and the new ones which it was necessary to introduce this year only concerned the inspection of ships' installations, hours of wireless watch, and the qualifications of operating personnel. This Safety Convention makes it compulsory for passenger ships of 5,000 tons gross and upwards to be fitted with D.F. apparatus, but this important regulation does not come into force internationally until 1935. It will, however, make little difference in this country, as few of our ships in this class are not already fitted with D.F. apparatus.

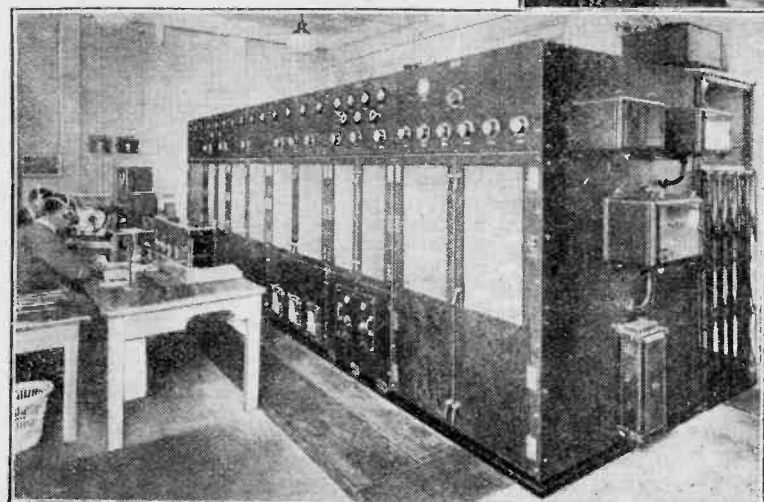
requirements definite working waves were laid down for each of the coast wireless stations in Europe, and a few broadcasting stations were allowed to come into the band reserved for ship-shore work, as it was hoped that no serious interference would result from these particular stations. As readers of *The Wireless World* already



The two-way Marconi beam aerial at the Grimsby beam station for direct working with Australia.



(Above) The Marconi telephone transmitter installed on the Dover lifeboat of the Royal National Lifeboat Institution. The vessel, the fastest of its kind in the world, has been specially designed for use in aeroplane disasters at sea.



(Left) The Post Office coast station at Land's End, showing the main (5kW) and emergency (1 1/2 kW) transmitters.

munication, but nothing else could be expected, telegraphy having been well established for many years before telephony entered the field.

In January, the service with Egypt was extended by wire to Assuan at a tariff of £3 12s. for three minutes, the service to Rio de Janeiro was

extended by wire to other cities in Brazil at a tariff of £6, the wire service to Nice was extended by wireless to Corsica, and a wireless service was opened between Rome and Oslo.

### An Amateur Precedent

In March, the wire circuit to Berlin was extended by wireless to the Philippine Islands, with a tariff of £6 12s., and in April the wireless service to Cairo was extended by wire to cities in Palestine.

The outstanding advance, however, in the progress of wireless telephony during the year was the opening of the direct service with India on May 1st, and, while congratulating ourselves on the attainment of this important Imperial link on a commercial basis, it is interesting to recall that eight years ago the well-known British wireless amateur, Mr. Gerald Marcuse,

There was also, as a legacy from Madrid, an international conference of European powers held at Lucerne in May and June to adjust broadcasting waves in Europe. To meet the broadcasting re-

know, this "Lucerne Plan" is to come into force on January 15th next.

As has been the case for the last few years, telephony has provided the most striking advances in commercial com-

**Twelve Months of Progress—**

maintained two-way communication for many months with an Air Force station in India. The tariff for India, as in the case of the other Empire services, is £6 for three minutes.

This Anglo-Indian channel has completed the main links of the Empire's wireless telephone service, and it may be of interest to glance back at the steps of this great network of Imperial communication. The Australia channel was opened on April 30th, 1930, New Zealand on July 23rd, 1931, South Africa on February 1st, 1932, Egypt on June 22nd, 1932, Canada (which was previously worked via New York) on July 11th, 1932, and India on May 1st, 1933.

In India the terminal is at Bombay, the transmitting station being at Kirkee, and the receiving station at Dhond. The service was rapidly extended to various large cities in India. In England, as for all other overseas telephone services, the terminal is at the Post Office International Telephone Exchange in London, the transmitting station being at Rugby and the receiving station at Baldock.

**The New Centre**

On May 4th an interesting ceremony took place when the Lord Mayor of London opened, and the Prince of Wales visited, the new premises, Faraday Building, for housing this exchange. From this and its sister building close by in Carter Lane, wire and wireless telephone channels radiate to places all over the world, as well as to a number of passenger liners on the North Atlantic.

channels which converge on London can be linked up with one another and with the telephone system of Europe, and as the whole system has been built up in only seven years, there is little wonder that for the last few years, as we have already said, telephony has provided the most striking advances in wireless communication.

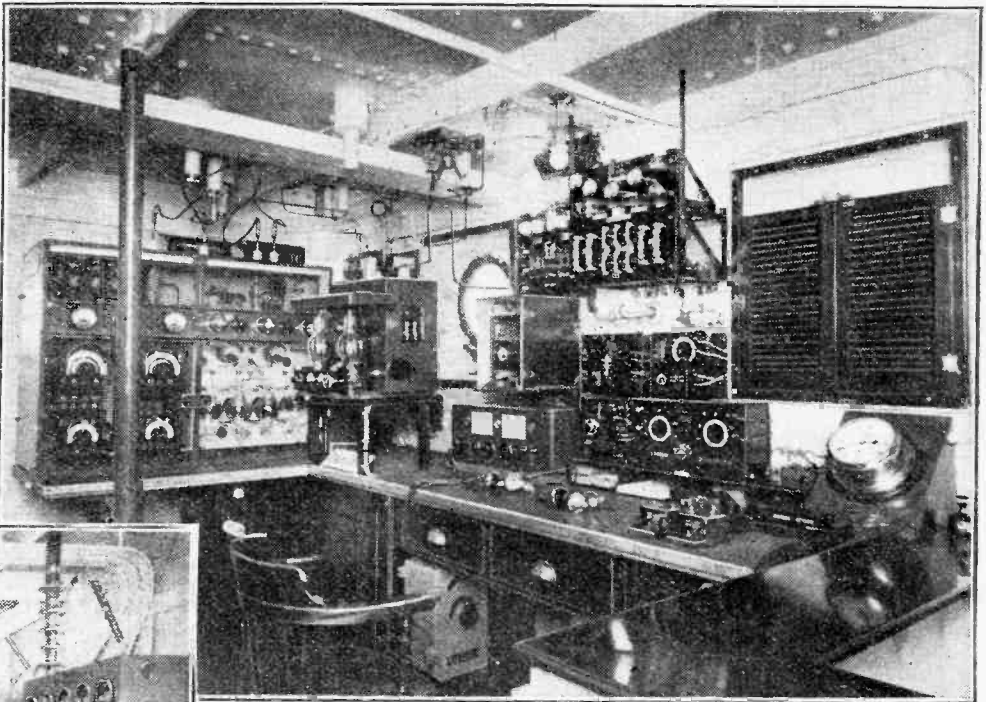
In June, the wireless service to North America was extended by wire and wireless to Costa Rica, Guatemala, Nicaragua, the Republic of Panama and the Canal Zone, at a tariff of £7 16s.

In July, the Buenos Aires channel was extended to Peru at a tariff of £7 7s., and a service was opened between France and Columbia at a tariff of £11 5s.

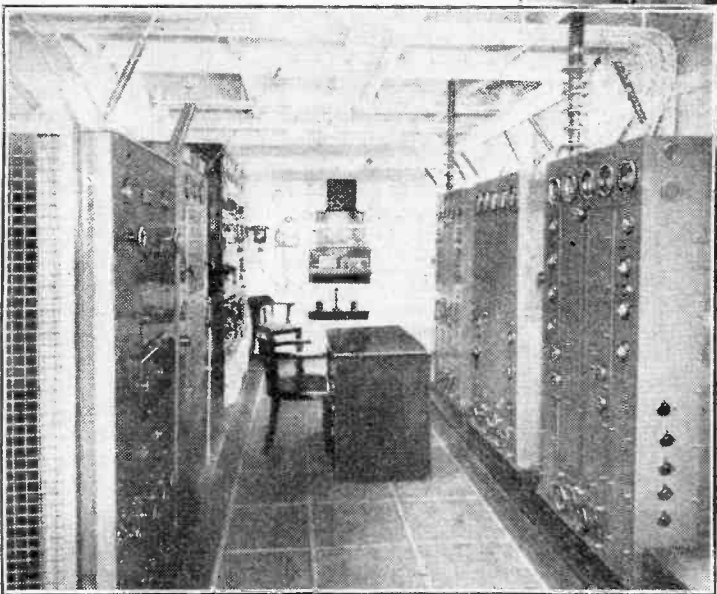
During the latter half of the year, with the exception of extensions to the India channel, there have been no important telephone services opened, at any rate so

In the fishing fleets the possibility of communicating by wireless between ships, and between ships and the shore, without having to carry trained operators has come as a great boon, and there is little doubt that telephony will be much more widely adopted in other small craft in the near future. Up to the present, so far as the ship-shore communication is concerned, it has been possible to telephone messages only between the ships and the coast stations, but arrangements are now being tested by which it is hoped that subscribers in the ports close to the coast stations will be able to converse direct through the stations with the ships, if within fifty, or perhaps a hundred, miles range.

In the case of the telephone channel to the large liners, which is a luxury service, there are elaborate arrangements by which the ships can be connected up to sub-



The wireless cabin of the Orient liner *Orontes*, fitted with Marconi long and short wave transmitters and receivers.



The Marconi Company's wireless telephone transmitting equipment on the *Empress of Britain*.

far as this country is concerned.

In addition to these advances in long range telephony there has been considerable progress during the year in the telephone service of small ships. In 1932 the eleven coast wireless stations situated round Great Britain, and

scribers nearly anywhere in the world, but these arrangements are very expensive and would be out of the question financially for the telephone service of small craft. Indeed, in the present dearth of wealthy passengers this service is quite unattractive, apart from its technical subtleties.

Telephone services between small ships and subscribers on shore are being tried, too, in other countries, but the great difficulty is to make such a service a commercial success, and in this country anything in the nature of a Government subsidy produces little enthusiasm.

**Telegraphy**

There were few striking developments during the year in long range wireless telegraphy. The world is well supplied with long range telegraph circuits, both by cable and wireless, and in present finan-

used for telegraph traffic with ships and in connection with the safety of life at sea, were fitted with telephone sets suitable for communication with small craft, such as fishing and coasting vessels. Some 330 British fishing vessels, but only a few coasters, have already been installed with telephone apparatus.

**Twelve Months of Progress—**

cial conditions there is little call for expansion. In January, services were opened between India and Japan, and between England and Columbia. In July, a service was opened between England and Venezuela, and in November between England and Turkey to replace the wire circuit. All these services are on short waves, and are worked in this country by the Imperial and International Communications Company.

In ships, technical development of apparatus continued to advance, as was apparent in the latest types of installation shown by the various companies at the Shipping Exhibition held in London last September. At this exhibition the Post Office arranged that visitors could send radiotelegrams to ships in any part of the world free of charge, and it was enlightening to see so many people at the exhibition who, in those circumstances, remembered their friends at sea.

The installation of short wave installations in ships for long range working is progressing, and the number of ships capable of using short waves will soon be up to 170, which is about the number of those capable of using long waves. It is not, however, a great number when one remembers that there are more than 3,200 British ships fitted for safety purposes with short range apparatus.

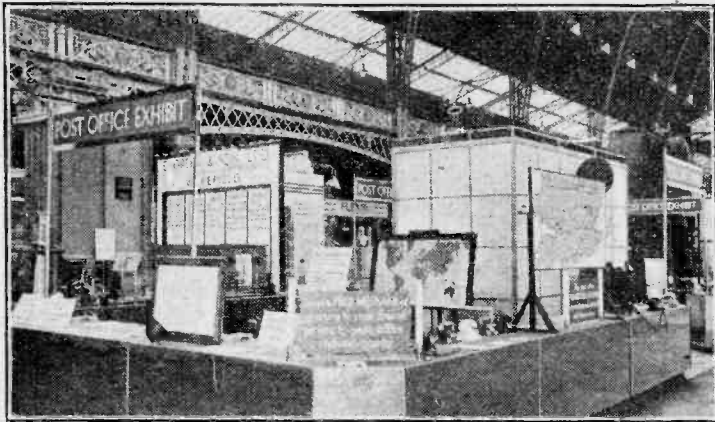
The technical development of apparatus in large ships has certainly been very marked during the last few years; for instance, a large liner will now have four transmitters, one medium wave C.W. for 1,875-3,000-metre band, one medium wave I.C.W. for 600-800-metre band, one short wave C.W. for 18-36-metre band, and one short wave telephony on four spot waves. This outfit, with the receivers, will require eight aerials and, in addition, there will be a broadcast receiving aerial and a D.F. receiving aerial, ten in all, arrangements being made so that simultaneous transmission and reception can be carried out on several waves.

**Air Services**

As air routes continue to multiply so does the provision of wireless apparatus for air ports and aircraft, it being fully recognised that wireless communication and wireless directional apparatus are essential for the safe and regular working of air services. On the African route, short wave communication is carried out on Marconi apparatus up to ranges of 2,000 miles. A fixed aerial is available for short wave working, and this aerial can be switched on for telegraphy or telephony immediately on winding in the

trailing aerial. In this manner messages can still be sent when the aeroplane is landing. A small attachment to the receiver provides a directional arrangement which allows of homing to ground wireless stations along the route up to ranges of over 200 miles.

The wireless station at the Manchester



Radio telegrams could be sent free of charge to ships at sea at this Post Office stand at the Olympia Shipping Exhibition in September last.

Airport, the first to be erected at a municipal airport in this country, has been in operation since May 1st. It is capable of providing aircraft in the Midlands and North-West across the Irish Sea with com-

munication by telegraphy or telephony, meteorological broadcasts, and directional services, on the same lines as are provided by Croydon for aircraft on the Continental routes.

The Air Ministry opened a micro-ray beam service across the Channel in October between Lympne aerodrome in Kent and St. Inglevert in France on a wave of 17.5 centimetres, the apparatus being supplied by Standard Wireless and Cables, Ltd. It can be used for telephony or telegraphy, teleprinters being provided for the latter.

The first service in the world on these very short waves below a metre was opened as a result of the work of Marchese Marconi on February 2nd. It was conducted between Vatican City and Castel Gandolfo, a distance of 20 miles. The service was by telephony and the wave was 60 centimetres.

Marchese Marconi has continued to carry out experiments in signalling with these very short waves of below a metre during the year, and has obtained signals up to as great a range as 250 kilometres. It would have been said a couple of years ago that such a range with waves of that length could not possibly be obtained, and it is refreshing to find that practical results in wireless can even yet have an occasional dig at theoretical decisions.

**DISTANT RECEPTION NOTES****Stations That Have Not Grown "Tired"**

**R**ADIO-PARIS, which has been silent except at odd times for ten days, will have resumed its transmissions again before these notes appear in print. On its reappearance it will be a full-blown PTT station and will probably assume its new name Emetteur National Français, though I expect that most of us will continue to call it Radio-Paris as before.

Other stations that will be at work again are Munich and Stuttgart, both of which will be using their new plants rated at 100 kilowatts. Munich will work on 419 metres and Stuttgart on 533 metres.

The new Berlin station, also rated at 100 kilowatts, will be in full blast on 360.5 metres. One fears that not a few listeners using rather unselective sets may have suffered from interference with the London Regional's programmes over the Christmas holidays.

The references in a recent issue of *The Wireless World* to the point I raised some time ago about "fatigue" in transmitting stations were most interesting. One correspondent confirms my own conclusions, namely, that some kind of electrolysis takes place in the soil in which the earth plates of transmitters are buried. The only other possible causes would seem to be deterioration of the insulating material in the units of the transmitting plant.

If actual changes in the nature of the soil do take place it seems that they occur only under certain conditions. Though one can name a dozen or more important transmitters whose signals have shown a remarkable decline in their field strength, it would be easier to find a still greater number which after several years are as good as ever they

were. There are also one or two which seem to have improved with age!

Conditions for long-distance reception are ideal at the time of writing. There are no atmospherics, fading is almost non-existent, though in previous years it has often been rather severe, particularly on the lower wavelengths, round about Christmas time. One notices, too, much less interference from spark signals both near the top and towards the bottom of the medium waveband. There are certain heterodynes, but most of them are of the occasional kind and no important station is very seriously affected.

Even Huizen has now been free from interference for several days. Heterodynes have been noticed on different nights on Beromünster, Belgrade, the Poste Parisien, Turin and Trieste.

Long-wave reception, which was rather poor a week or two ago, is now definitely good again. The pick of the stations are Huizen (when not interfered with, of course), Zeesen, Warsaw, Luxembourg and Oslo.

On the medium waveband stations coming in at good strength are to be found all round the dial with a sensitive and selective modern set. The best selection is perhaps Vienna, Brussels No. 1 and No. 2, Prague, Langenberg, Lyons Doua, Rome, Stockholm, Toulouse, Leipzig, Strasbourg, the Poste Parisien, Breslau, Bordeaux Lafayette, Hilversum, Heilsberg, Turin, Toulouse PTT, Trieste, Nürnberg, Fécamp, and Lille PTT.

D. EXER.

Page 497 follows after the Programme Supplement.



# NEWS of the WEEK

## Current Events in Brief Review

### New Zealand Decides

**S**PONSORED radio programmes will be forbidden in New Zealand after March 31st next.

### A World's Record

**A**RHODESIAN amateur has just effected communication with a colleague on the West Coast of U.S.A., using telephony with an input of only 9.6 watts. This is believed to be a world's record for low power speech transmission.

### Lucerne Plan : Sweden's Version

**S**WEDEN, it appears, intends to place its own interpretation on the Lucerne Wavelength Plan. The new wavelength list issued by the Post Office announces that Motala will work on a wavelength of 1,354.4 metres instead of the allotted wave of 1,388.9 metres, while Boden and Ostersund will change places in the list.

### Broadcasting Snail Races

**S**NAIL backers are revealing great interest in the broadcast snail races from Radio LL, Paris, to which we referred last week, and it is understood that further contests are to be arranged with the possibility of snail sweepstakes.

The snail races in the "Escargodrome" in the Radio LL studio are the subject of running commentaries which are broadcast.

### As Others Hear Them

**A**"clever little instrument" has made its appearance on the French market which will enable singers, orators and lecturers to hear their own voices "exactly as if they were among the audience." It is called the Vocalphone. Our Paris correspondent says that several purchasers, having heard themselves on the apparatus, have already modestly resigned.

### His "Happy Day"

**S**OME 15,000 taxicabs, which have just been equipped with wireless, have been barred from plying in the streets of New York until the apparatus is removed, reports the New York correspondent of *The Daily Telegraph*.

It is stated that the police action followed an accident in which an elderly man was injured by a taxi in which the wireless set was playing "Happy Days are Here Again."

### Short Waves from Germany

**G**ERMANY'S "World Wide" short wave station at Zeesen has now fixed upon regular schedules for its transmissions. They are as follows, the times given being G.M.T.:-

| Far East:-     |       |           |                    |
|----------------|-------|-----------|--------------------|
| 19.73 m.       | ..... | call sign | DJB 5.35-7.00 a.m. |
| 31.38 m.       | ..... | " "       | DJA 13.00-16.00    |
| Africa.        |       |           |                    |
| 25.51 m.       | ..... | " "       | DJD 17.55-21.30    |
| 49.83 m.       | ..... | " "       | DJA 17.55-21.30    |
| South America. |       |           |                    |
| 31.38 m.       | ..... | " "       | DJA 21.55-0.30     |
| North America. |       |           |                    |
| 49.83 m.       | ..... | " "       | DJC 23.00-3.30     |

The omni-directional aerial is temporarily out of use.

### "R.S.E.A."

**A**MATEURS at Nairobi have formed the Radio Society of East Africa. It will be associated with the British Empire Radio Union, whose headquarters are in London.

### Afternoons at Radio-Paris

**A**T present listeners to Radio-Paris must submit to silent afternoons, but an appeal is now being made for regular transmissions between 2 and 6 p.m. It is expected that the Programme Board will comply with the demand.

### Expensive Error

**A**FINE of 500 pesetas has been levied on an announcer of the Tarragona station for making an unfortunate mistake at the microphone during the recent Spanish elections. At the end of a programme, instead of playing the hymn of the new Republic on the studio gramophone, he inadvertently broadcast the old Royal Anthem. The fine was levied "to

### International DX'ers Alliance

**S**PECIAL Short Wave transmissions for members of the International DX'ers Alliance are to be made as follows:-

January 6th.—5-7 a.m. OA4B. Lima, Peru, 7126 kc/s, 42.11 metres.

January 14th and 28th.—4-6 a.m. PAOASD, Amsterdam, 3770 kc/s, 79.6 metres, 50 kW.

All times given are G.M.T. Reports on PAOASD will be welcomed by Mr. W. R. Jacot, Euterpestraat 73, Amsterdam.

### Wireless for the Blind

**F**OUR years ago, when making the first broadcast appeal on behalf of the "Wireless for the Blind" Fund, Mr. Winston Churchill foresaw a proud British boast: "All blind persons have wireless sets—it is the custom of the country." To-day, according to the Annual Report of the Fund, we are separated from the realisation of this fact by 900 sets only.

The broadcast appeal by Mr. Lloyd George on Christmas Day has probably assisted largely towards the ultimate aim, and the Committee trusts that the supply of new wireless sets for the blind will in future be financed as the result of an annual appeal only.

### Beam Station Design

**"A**N Investigation into the Factors Controlling the Economic Design of Beam Arrays" is the title of a paper to be read and discussed at the meeting of the Wireless Section of the Institution of Electrical Engineers on Wednesday next, January 3rd, at 6 p.m. at Savoy Place, London, W.C.2. The lecturer is Mr. T. Walmesley, B.Sc.

### The Wireless Thief

**T**HAT the modern thief is up to date is once more proved by the escapade of seven safe raiders who looted the Unity Trust and Savings Bank in Chicago last week. While the deposit boxes were being opened one of the thieves stood by operating a short wave wireless set to pick up messages sent out to the police radio cars. The thieves were able to work for three hours before the radio signals revealed that the police were getting uncomfortably close on their track.

### "Studio" Twelve Miles Up

**B**BROADCASTING from the stratosphere can be managed on extremely low power, as was proved during the recent ascent of Messrs. Settle and Fordney in America. During their balloon flight they were able to speak to Washington, Pittsburgh, Akron, and other points quite clearly, their voices being relayed over the broadcasting networks. Their transmitter weighed only 12lb., and their receiver 8lb. Two-way speech was maintained until the balloonists had to drop their batteries to lighten the load.

The use of very low power is possible because of the absence of ground reflection, while the changes in the angle of reflection from the Heaviside Layer greatly increase the transmission range.

### "Empire Broadcasting" from Holland

**S**SIX languages are now used at the microphone of the short-wave station, PH1, at Huizen, transmitting on 16.88 metres. This famous station, the successor to Eindhoven, has broken a silence of two and a half years. Transmissions, although intended primarily for the Dutch East and West Indies, are being picked up by short-wave listeners all over the world. The languages used are Dutch, Malay, English, French, German, and Spanish.

Transmissions are on Monday, Thursday, and Friday from 12.30 to 2.30 p.m. (G.M.T.), and on Saturday and Sunday from 12.30 to 3 p.m. (G.M.T.).



**RECORDING THE KING'S MESSAGE.** By special permission of His Majesty, an H.M.V. record was made of the broadcast message on Christmas Day. The engineers are shown superintending the recording on the wax blank, one checking the volume while his companion examines the sound track through a magnifying glass.

atone for the nervous shock caused to the ex-subjects of Alfonso XIII."

### Exorcising Static

**T**HE city of Baden-Baden is earning the title of "The Radio Paradise," as being the first city in the world to be entirely freed from electrical interference with radio reception. A recent report by the Post Office shows that during the past year filter compensators were supplied to 3,476 flat irons, 1,670 motors of less than ½ kW., 258 motors of higher power, 1,360 vacuum cleaners, 913 electrically heated pillows, 728 hair dryers, 198 massage machines, 185 fans, 56 hair cutters, and 18 X-ray installations. As a result, says a correspondent, only Nature is left to interfere with reception conditions.

# Television Explained

## VIII.—A Survey of Development

**T**HE principal methods which have been proposed for achieving television and which have proved of sufficient value to find practical application have been briefly described in this series of articles, and it remains to consider the most probable trend of future development. Whatever methods are employed for transmission and reception, it is clear that very high frequencies are involved—many hundreds of times higher than we are accustomed to deal with in the highest quality sound transmission. So far as the purely electrical side of the problem is concerned, this need cause no special difficulty. It is quite possible, although not easy, to construct amplifiers with flat frequency characteristics up to at least 300,000 cycles.

The use of such high modulation frequencies necessitates the operation of the transmitter in the ultra-short waveband for two reasons—because modulation at much lower wavelengths is impossible, and because the frequency band occupied by the transmitter would be prohibitively great in any other band. Comparatively little is known about the properties of ultra-short waves, and the technique of transmission and reception is only in its early stages. Even if the purely television apparatus had reached such a stage that it could be operated by the unskilled and would give a picture sufficiently free from distortion to be of entertainment value, reliable television reception would hardly be a possibility on account of the lack of development in ultra-short wave apparatus.

The purely reception difficulties, of course, are not of great importance, and a determined attack by designers and experimenters would soon remove them. It is safe to say that were there sufficient incentive, the major problems of ultra-short wave working could be overcome within a year. Incentive is lacking at the moment, however, on account of the rarity of transmitters, and it is probable that development will proceed only slowly until the greater difficulties of television are overcome or until a regular service of high quality sound broadcasting takes place.

### Television Apparatus

The greatest hope of good reception would appear to lie with the superheterodyne using a very high intermediate frequency, probably one corresponding to a wavelength no higher than 30 metres. Such a receiver could be made very stable in operation, and easy to control, while the high intermediate frequency would permit the passage of the high modulation frequencies which are so essential to television.

The problems of transmission and reception in themselves offer no special difficulty, therefore, and there is every sign that they will be solved by the application of known methods. The same can hardly be said of the television equipment, however, and so many different systems vie with one another that it is even difficult to pick out the one most likely to become the method of the future.

The system in widest use and upon which most work is being carried out is one which may be conveniently termed variable intensity scanning, in distinction



The introduction of drastic contrast in make-up is an important feature of successful presentation in the television studio of to-day.

to variable speed scanning which was described in Part VII of this series. Variable intensity scanning can be carried out in a variety of ways, of which the chief are the Nipkow disc, the mirror drum and the cathode ray tube. Its particular beauty, however, is that one is not confined at the receiver to the same type of apparatus as that used at the transmitter.

A drum may be used at the transmitter, but it is quite feasible to use disc, drum, or cathode ray tube at the receiver, according to taste. The greatest objection to this system, however, is that any developments in transmission which offer an improved performance through a variation in the number of scanning lines or pictures a second, throw all receivers out of date and necessitate extensive alteration if any intelligible picture is to be received.

At the present time, this objection is not of great importance on account of the

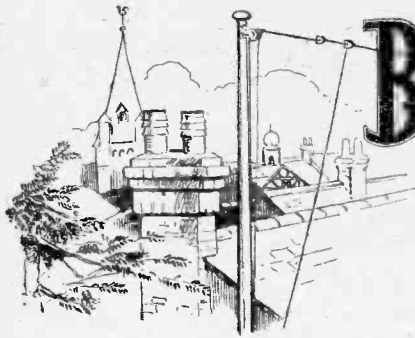
*THE fundamental principles upon which the chief television systems are based have been dealt with in this series of articles, and some of the more prominent difficulties explained. The concluding article is devoted to a survey of the various methods, and an endeavour is made to gauge the trend of development.*

small number of receivers in use. It is easy to see, however, that were a television service of this type to be established which achieved any great measure of popularity it would probably represent the end of development. It should be pointed out, of course, that these remarks do not apply in their entirety to receivers employing cathode ray tubes, for slight modifications to these would render them capable of reception from improved transmitters.

For reasons of this nature, therefore, the variable speed scanning system is particularly attractive, since the receiving equipment consists of little more than the cathode ray tube, and synchronising apparatus appears to be unnecessary. Such a system is more nearly comparable to sound broadcasting, in which development can take place at either transmitter or receiver and without either being rendered useless. For some reason this scheme has attracted less attention than others, and it is not so highly developed. On account of the simplification to the receiving apparatus which it offers, however, it is to be hoped that work on it will continue, and that the final system of television will be either this or some other of equal simplicity.

In this series of articles, the transmissions have usually been assumed to take place with the aid of cinema films rather than by the televising of an actual scene. This has been done for the sake of simplicity, since the difficulties of obtaining adequate illumination at the transmitting end do not occur in the same degree. In cases where transmission of an actual subject, as distinct from a film, is required the difficulties of transmission are greatly enhanced, but it is of course by no means impossible.

It will thus be apparent that one can hardly expect television broadcasting of a quality comparable with that of sound transmissions to take place in the near future. That such broadcasting will take place on the ultra-short wavelengths appears certain, and the difficulties here are certainly not insurmountable. The chief problems lie in the television apparatus, and while there is no doubt that a solution will eventually be found, perhaps by methods now unknown, it will be a long time before anything approaching finality is reached.



# Broadcast Brevities



By Our Special  
Correspondent

## Television "Mysteries"

SOME newspaper stories give one the impression that the folk at Broadcasting House wear masks, crawl about with noses to the ground, and attire themselves as members of the Ku Klux Klan. Television is now being invested with this aura of mystery, though I am assured by the engineers that there is no intention of concealing television tests from the public.

It so happens, that the high definition experiments are being conducted on the ultra short waves, and are, therefore, not available to the general public, though they can be picked up by the many readers of *The Wireless World* who are known to have built up "The Ultra Short Wave Two." Although no fixed schedule is observed, I can say that cinema films are transmitted nearly every evening from 9 to 10 p.m., and are picked up by engineers using cathode-ray receivers in various parts of the Metropolis.

## A Broadcast Workers' Union?

THE fact that members of the B.B.C. staff received no extra pay for working on Christmas Day has led to a discussion as to whether the time has come when all engaged in broadcasting in this country should form themselves into a Union.

There are now upwards of 2,000 people in this country who rely on broadcasting for their bread and butter; yet the monopoly which they serve has the power of absolute dictatorship.

## Similar to Post Office Union

The Union of Broadcast Workers would presumably be run on similar lines to the Union of Post Office Workers, although it is probable that officers in the higher grades would belong to an association of their own.

It would not surprise me if an announcement on this important subject were made in the very near future.

## New Use for the Concert Hall

THE concert hall in Broadcasting House was turned into a polling station last week, when no fewer than 865 members of the staff recorded their votes in favour of four candidates for the position of staff representative on the Pensions Fund Committee. The winner was Mr. G. H. Dunbar, formerly Assistant to the Chief Accountant and now Assistant Manager of Publications.

The concert hall is being used more and more for staff meetings, which, fortunately, perhaps, are never broadcast.

## A Compliment from Abroad

THE B.B.C. studies the needs of its performers to a greater extent than certain broadcasting organisations abroad. I hear from Denmark that the Press in

Copenhagen has dropped heavily on the Danish Radio Board for its alleged refusal to provide the pianist, Victor Schioler, with a Danish piano. Apparently, it was insisted that he should use a German instrument.

The Danish Press points out that the well-known Court pianist, Johanne Stockmarr, who has had similar requests refused in her own country, has been invariably provided with a Danish piano by the B.B.C.

## Studying the Performer

Although the pianos at Broadcasting House are practically all of one well-known English make, the Corporation make it a rule to comply with the wishes of celebrated artistes whose performances are affected by the choice of instrument.

## New Year's Eve

THE last programme of 1933 really begins at 10.30 p.m. on December 31st with a half-hour's recital by Paul Robeson. This will be followed at 11 o'clock with a panorama of recorded sound covering the year that is past. Blattnerphone and wax records of the great events of 1933 will follow each other in rapid succession until, at 11.30, listeners are switched through to the Watch Night service in St. Giles' Cathedral, Edinburgh. Then will follow the bells of Westminster Abbey, into which will be merged the chimes of Big Ben ushering in the New Year.

After midnight more chimes, this time from Canterbury Cathedral.

## Sparing the Children Shocks

THE auditorium at St. George's Hall was empty during the pantomime broadcast on Christmas Day. It had been sug-

gested that poor children should be invited, and the plan had proceeded a long way when it was abandoned with an explanation which, as usual, I graciously accept.

The B.B.C. did not wish to disillusion the children, who would have been appalled at the sight of "Sindbad" in a dress suit.

## If Things Were as They Sound

Incidentally, what a pity it is that we adults were ever told of what goes on behind the scenes. It would be much nicer to believe that things are as they sound.

The point was well put in a cartoon in *Simplicissimus*, Munich, the other day. The announcer in the picture is saying: "I hear the clacking of the mill wheel and the rushing of the stream as I lie stretched on the grass in the shade of the fir trees. From the near-by village comes the echo of the sweet church bell, and on a twig beside me the nightingale pours forth her song."

## Reality

The picture shows an extremely fat announcer reading from a script and simultaneously tapping a set of tubular bells. A lanky companion stands before the microphone with a wooden rattle, and, while blowing a whistle, empties a watering can into a pail.

## North-Eastern Regional

A 1-kW portable transmitter will very soon be exploring the ground west of Newcastle for a site for the new North-Eastern regional station.

## Forty Minutes of Philosophy

THE first National lecture during 1934 is to be given on January 2nd, when Professor S. Alexander, O.M., will treat of "Philosophy and Beauty." The talk will last from 9.20 to 10 p.m., and will go out from the National transmitters.

## Historical Play Series

"THE KING'S TRYALL" is the name of the historical play by Peter Cresswell, which is to be broadcast on January 28th. The subject is, of course, the trial of King Charles the First, and the play coincides with the actual date of the event in the year 1649.

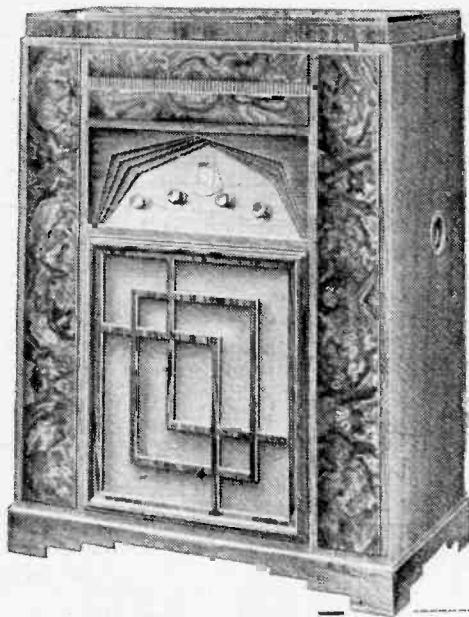
By the way, as I said recently, the B.B.C. is "going historical" like the stage and the films, and this play is the first of a series of plays dealing with great events of the past.

## Now We Know

IT was solemnly announced in the Press last week that a site for the North Scottish Regional station had been chosen at Ardivot, mid-way between Elgin and Lossiemouth. I am now informed at Broadcasting House, with equal solemnity, that the report is absolutely untrue.



CONDUCTING IN HEADPHONES. Mr. Stanford Robinson directing the theatre orchestra last week during the performance of "The Christmas Carol." It was necessary for the conductor to follow the cues in the various studios connected to the Dramatic Control Panel.



# R.G.D. Model 1201A.C. "Supersonic" Radio-gramophone

## A High-grade Instrument Incorporating Every Technical Refinement

set, the level at which the relay comes into operation can be adjusted, so that if one were not satisfied with the programmes of what might be termed the "Grade A" stations, the sensitivity of the relay could be increased to bring in a further batch of stations slightly lower in field strength. Another accessory which makes for easy tuning is the illuminated visual indicator below the main tuning dial. It is really included in the interests of good tonal

is connected in the anode circuit of this first stage, and as it is controlled by the A.V.C. circuit the reading gives an indication of signal strength as well as of the accuracy of tuning. A separate triode oscillator valve is employed, and the output is injected into the cathode circuit of the anode-bend first detector valve. When changing from medium to long waves a section of the grid leak in the oscillator circuit is switched out to ensure constancy of amplitude in the

**N**O introduction is required for a product from the R.G.D. factory.

For many years this firm has enjoyed an enviable reputation for the production of receivers, and more particularly radio-gramophones, of the highest class. Their latest product, the Model 1201 radio-gramophone, incorporates all the latest technical developments and worthily upholds the reputation established by its predecessors.

It goes without saying that the performance on the radio side from the point of view of range and selectivity is as high as it can be made with modern valves and circuits. On the L.F. side, resistance-coupled push-pull amplification has been adopted to obtain the best possible frequency response together with good transient reproduction.

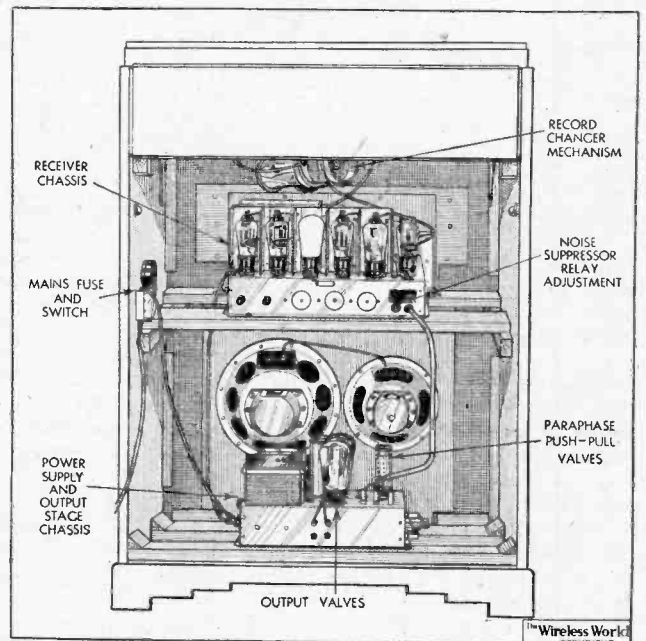
Automatic volume control is, of course, included, and a new feature is the use of an automatic relay to suppress background noise between stations. This device contributes considerably to the enjoyment of handling the set, particularly when in search of stations for their programme value. By means of a set screw at the back of the

### FEATURES.

**Type.**—Twelve-valve radio-gramophone for A.C. mains. Delayed A.V.C. Automatic noise suppressor. Visual tuning indicator. Six-watt output into dual moving-coil loud speakers. Automatic record changer. **Circuit.**—Band-pass coupled H.F. stage, anode-bend 1st detector, separate triode oscillator, I.F. amplifier with six tuned circuits, double-diode-triode second detector and A.V.C. valve, noise suppressor valve and relay, L.F. amplifier, R.C.C. coupled paraphase push-pull stage, push-pull triode output valves. **Controls.**—(1) Tuning with illuminated scale calibrated in wavelengths. (2) Volume control. (3) Tone control and suppressor relay switch. (4) Wave-range switch. (5) Mains on-off switch. **Price.**—95 gns. **Makers.**—Radio Gramophone Development Co., Ltd., 17/20, Frederick St., Birmingham, 1.

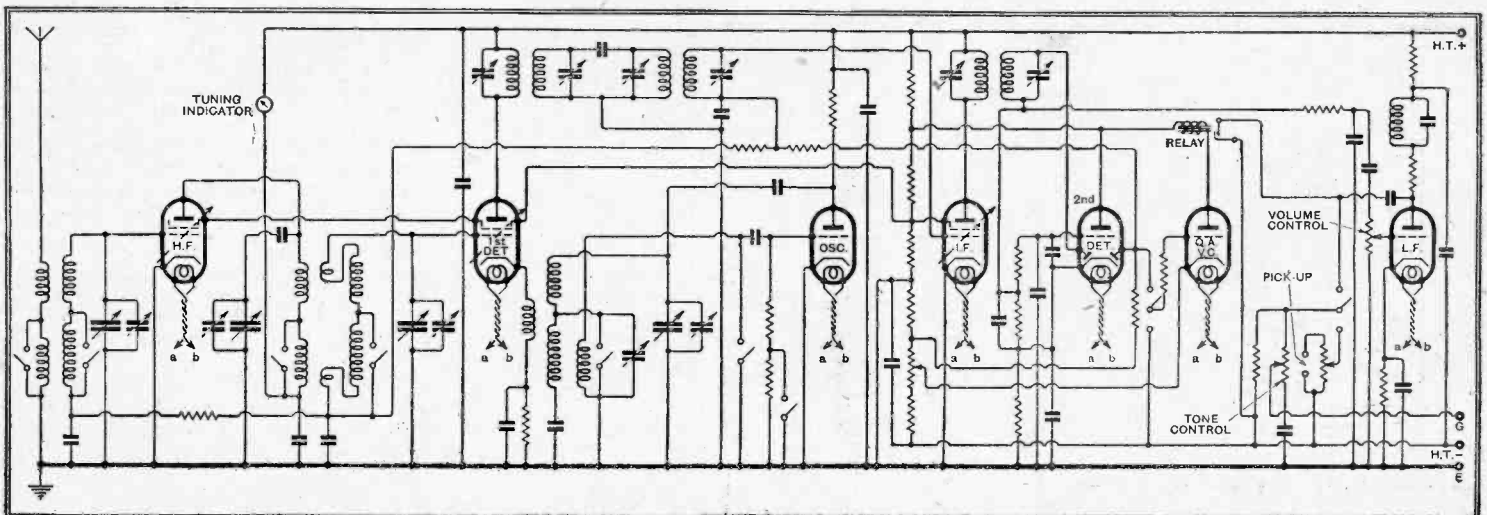
quality, for in a set of such high selectivity the slightest deviation from accurate tuning will result in over-emphasis of the higher frequencies.

Including the rectifier there are no fewer than twelve valves in the circuit. The first stage amplifies the incoming signal at radio frequency and includes three tuned circuits, two of which are connected in the form of a band-pass coupling to the first detector valve. There is thus an unusually high degree of pre-detection selectivity which is conducive to the elimination of second-channel interference. The tuning indicator



Layout of the interior of the cabinet. The massive construction and high-grade finish of the latter are outstanding features of the instrument.

output to the frequency changer valve. Six tuned circuits are associated with the single I.F. stage, a double band-pass filter being used for the input. The performance of the set both from the point of view of



Circuit diagram of receiver chassis which incorporates all stages up to and including the first L.F. stage.



## Letters to the Editor:—

# Stations that Lose Power

## "Hill and Dale" Recording : Home Set Construction

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

### Do Transmitters Get Tired ?

IT seems the general experience that a transmitter does decrease in range and signal strength after some time, and I have wondered whether a point debated some years ago between my brother and myself has any bearing on the subject.

We were discussing the common experience in those days (of inefficient receivers), whereby it invariably happened that when a station was tuned in on a good aerial, neighbouring receivers experienced a loss of signal strength, which used to end in a battle of oscillation, till one of the receivers had to "give up" the station. Our theory then was that it was *not* the power absorbed in the aerial which decreased the signal strength, but that a receiver in tune (even when not oscillating) sends out signals at low power in opposite phase to the transmitter, cancelling out to that extent the power of the transmitter.

It seems to me that if this were the case (the theory can probably be easily exploded!) this would explain the gradual loss in signal strength, as more receivers used a new transmitter, while the fact that ship transmissions are not troubled could be explained by the fact that the numbers of receivers presumably do not vary greatly, in addition to the fact that receivers are not clustered together, but widely separated.

It would be very interesting to hear what the technical people have to say to such a fantastic theory.

Wembley.

W. CROFT.

MR. DINSDALE'S quite intriguing letter in the December 15th issue of *The Wireless World* on the problem of stations that lose power calls, I think, for considerable comment and criticism. I have been closely associated with the radio communication industry for a number of years, and, like your correspondent, spent some years as a sea-going operator, yet I find it impossible to reconcile his assertions with the results of my own experience and observations.

Mr. Dinsdale states categorically that (1) the signals of transmitting stations, *within a few weeks or months* of their opening, fade slowly until they can no longer be heard, or heard only with difficulty.

(2) The phenomenon "affects all types of radio stations—spark. c.w., telegraph, or broadcasting on any wavelength."

(3) "The initial range of the station when first opened slowly decreases after a few months, and is never regained at any subsequent date unless major changes are made in equipment."

With regard to (1) and (2), I maintain that there is insufficient data available to justify such a sweeping statement, and particularly would I call attention to the phrase "*within a few weeks or months*" (the italics are mine). It is a very significant phrase. The next statement (3) calls for really drastic comment, for it is a complete misstatement of fact. If Mr. Dinsdale had written that the initial range of the station when first opened *apparently* slowly decreases, I do not doubt that he could fur-

nish evidence which could be made to substantiate his claim, but the further assertion that the range "is never regained at any subsequent date unless major changes are made in equipment" is definitely incorrect, especially so in respect of long wave high-power transmitters whose performance over long-established commercial channels is known to be subject to a regular cyclic variation. The same is also true of communication over short-wave channels, although here there are additional difficulties in the way of reaching a useful determination of the performance of the transmitter, not the least being a reliable optimum time schedule during which a transitional wavelength should be employed.

On the medium waveband particularly, and all wavebands in general, I think Mr. Dinsdale will find the loss of power of a transmitting station—or, rather, the apparent loss of power—is due to a completely different cause than that which he suggests, viz., electrolytic actions in the vicinity of the earth plates. The *gradual* reduction of apparent range noted (as distinct from transient fluctuations due to existing meteorological conditions) is readily explained by the *gradual* increase in the congestion of the ether and by the fact that the rate of increase of congestion has always kept ahead of the rate of development of selective receivers. And here lies the elucidation of the mystery of why stations seem to lose range—it is the resultant effect of ether congestion plus inadequate selectivity of receiving stations. If Mr. Dinsdale will consider the matter I think he will find that his own experience of the range constancy of ship transmitters supports this view, remembering that the congestion of the ether on the high seas has not increased materially for several years, due partly to the slump in shipping and partly to the reduction of interference through the progressive withdrawal of spark sets.

No, sir; the constant renewal of the ship's earth has no bearing on the performance of the transmitter, and likewise the possibility of electrolytic action at the earth plates of land stations affecting their performance may also be ruled out.

York.

JOHN R. O. JOLLY.

### Alternatives to the Disc Record

I HAVE read with interest the correspondence which you have published concerning gramophone recording.

Recording on either film or tape would require apparatus of such cost that its use would be prohibited to many people. Any system which has not a universal application would not be an economical proposition to the recording companies. Films would not be convenient for those without electricity supply mains, and would be out of the question for portables.

Correspondence, which should be as brief as possible, should be addressed to the Editor, "The Wireless World," Dorset House, Stamford Street, S.E.1, and must be accompanied by the writer's name and address

I would suggest, however, that the old "hill and dale" method of recording offers possibilities for improvement on the present system. By this method it is possible to extend the frequency range up to 8 or 9,000 c/s and put the lower frequencies in at their correct strength. It is not possible at present to give the full range of loudness from *pp* to *ff* at anything like it should be. "Hill and dale" recording would overcome this difficulty and would also practically overcome needle scratch. The length of playing per record would be greatly improved owing to the much narrower groove.

It should be no more difficult commercially to press a record of this type than at present. A start could be made by producing both types for recordings of standard works. With two types of recordings in use it would not be an expensive matter to have two pick-ups on the motor board or an interchangeable sound box for non-electric machines.

It would be interesting to know whether the recording companies have such a scheme in view, and whether they consider that it would be practical.

WILLIAM W. POPE.

Newcastle-on-Tyne, 2.

["Hill and dale" recording is now receiving close attention for gramophone and talking picture requirements. The new wide range system of Western Electric employs this method.—Ed.]

### One Good Reason for Building Your Own

FOR the last six weeks I have been trying to buy a receiver for myself and another for a present. During this time I have been asked to test seven receivers of four different makes, varying in price from 20 guineas to 52 guineas. Only one of these functioned properly. Of the others one was completely silent, another was silent on the long waves, one had the controls jammed and a loud speaker rattle, two were intermittently silent, and one had a faulty valve.

I suggested to my dealer that someone in my household was possessed of the evil eye, but he assured me that my experiences were nothing out of the ordinary. Six out of the last eight sets of a famous make which he had received have had to be returned to the factory. He also said his wholesaler had thirty faulty sets returned in one day.

It does not look as if the wireless trade has progressed far in the last two years. At that time several of my family gave receivers as Christmas presents. One of these "went on fire," and another had a comprehensive breakdown that put it out of action for two months. Two more gave so much trouble that the unfortunate recipients could not afford to keep them in repair.

I used to wonder why you devoted so much space to specification for home-built receivers, but I am wiser now. Protection has given us good motor cars, but it looks as if Free Trade is necessary for a good wireless set.

Manchester.

LOW BROW.

# NEW APPARATUS REVIEWED

## Latest Products of the Manufacturers

### A HANDY WORKSHOP TOOL

ALTHOUGH the construction of a wireless receiver to-day can be undertaken with quite a limited complement of tools there are many odd jobs common to this class of work that will be so much easier if just the right tool for the purpose is available. And an ideal combination tool to have handy for such occasions is the "Eclipse" 4S tool outfit.

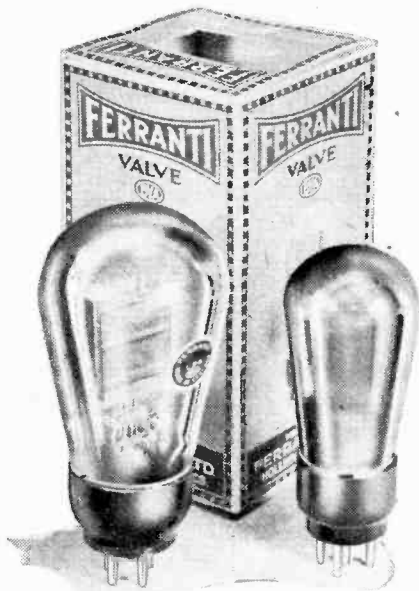
This consists of a nickel-plate holder and a set of sixteen tools comprising saw blades of various pitches of teeth, slotting tools, files, cutting and slitting knives, and sundry other attachments. The outfit in a compact metal case costs 5s.

A useful feature of the tool is that when used as a screwdriver, for sawing or for scraping, the blade is in line with the holder, but is set at an angle for such operations as slotting and cutting, thus providing clearance for the hand when working on the bench. To facilitate working in confined spaces several of the saw blades are tapered.

Only the highest grade steel is used throughout, and the makers are James Neill and Co. (Sheffield), Ltd., Composite Steel Works, Napier Street, Sheffield, 11.

### FERRANTI D4 AND LP4 VALVES

THE D4 and the LP4 appear in the Ferranti list as A.C. valves for in each case the filament consumption is one amp.



Two Ferranti A.C. triodes; the D4 and the LP4.

at four volts. Both are triode valves, the D4 being a general purpose type and indirectly heated, whilst the LP4 is a power valve with a directly heated filament. The rated characteristics of the D4 are: A.C. resistance, 12,500 ohms and amplification factor 41.3, giving a mutual conductance of 3.3 mA. per volt. Its usual function is that of a detector or oscillator in superheterodyne receivers, but it will serve equally well as the input valve in a two-stage amplifier.

The specimen D4 sent in for test when measured at 100 volts on the anode and with

zero grid bias showed an A.C. resistance of 14,000 ohms, an amplification factor of 39.5, and a mutual conductance of 2.8 mA. per volt. With the maximum anode potential of 200 volts and the rated working grid bias of -3 volts, its A.C. resistance increased to 17,500 ohms and the amplification fell to 39.1, giving a mutual conductance of 2.2 mA. per volt. Under these conditions the anode current was 3.5 mA. It has a five-pin base, and the price is 13s. 6d.



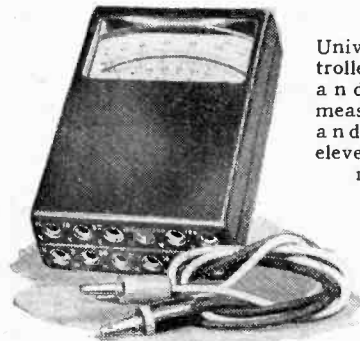
"Eclipse" 4S tool outfit.

In view of the heavy anode current passed by the LP4 without a grid bias potential, even with but 100 volts on the anode, it was not deemed wise to attempt measurements under these conditions, so the valve was tested only with the normal working potentials. Using the stated grid bias resistor of 750 ohms, the equivalent grid bias potential with 250 volts on its anode was found to be -33 volts, the anode current then being 44 mA. The measured A.C. resistance of the valve was 1,100 ohms, its amplification 4.65, and the mutual conductance 4.2 mA. per volt.

The optimum load is about 4,000 ohms, and the A.C. power output 2.5 watts. It costs 16s. 6d., and the makers are Ferranti, Ltd., Hollinwood, Lancashire.

### UNIVERSAL CONTROLLER

THE Universal Controller is a French instrument marketed in this country by M. Benoit, 4, Manor Gardens, Gunnersbury Avenue, London, W.3, and provides eleven different ranges, those for current measurement being 0.3 mA., 0.30 mA., 0.300 mA., 0.1.5 amps., and 0.7.5 amps; whilst the voltage ranges are 0.1.5, 0.7.5, 0.30, 0.150, 0.300, and 0.750. These apply to D.C. and A.C., so that actually twenty-two separate



Universal controller for A.C. and D.C. measurements and giving eleven different ranges.

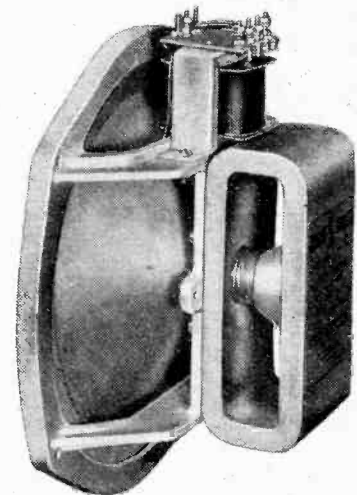
ranges are available. Sockets are fitted on the lower edge of the case for selecting these ranges. The resistance is 333 ohms per volt. A small rectifier is incorporated, and a push-button switch located at the top of the case

brings this into use for A.C. measurements. It necessitates two separate scales, and these are arranged one above and one below a parallax mirror, the upper, the A.C. one, being marked in red. As the scales are divided into 150 divisions, converting scale reading to actual values, involves a little mental exercise, but on the D.C. ranges this is rendered less arduous, for there are two additional scales of 0.3 and 0.7.5, but it is obviously impossible to provide separate scales for every range.

The scale length is approximately 2½ in.; a knife-edge pointer is fitted, and the movement is adequately damped. Compared with sub-standard measuring instruments, the Universal Controller shows good agreement throughout, and the average error is of the order of 1 per cent. at full scale. A slight alteration is being made to the case in future models, but the internal construction will be the same. The price is £9.

### "SOUND" P.M. LOUD SPEAKER

THIS is a recent product of Sound Sales, Ltd., Tremlett Grove, Junction Road, London, N.19, and is notable for several departures from current commercial practice



"Sound Sales" permanent magnet moving coil loud speaker.

in loud speaker construction. Probably the most interesting innovation lies in the form of suspension employed at the periphery of the cone. The edge is cut radially into a number of segments which give adequate lateral support with greater freedom of movement than the usual moulded corrugations. As a result, the fundamental resonance is lower than usual, and the bass response generally is much above the average. At 50 cycles there is a very useful output, which is quite free from distortion at normal volume levels. There is no isolated resonance in the upper register, but a general increase is noticeable between 2,000 and 4,000 cycles. Above 5,000 cycles the output tails off fairly rapidly.

The cone is supported in a cast aluminium frame which is machined to give accurate centring of the diaphragm. Due to the non-magnetic nature of the chassis, full use is made of the flux available from the permanent magnet, and the efficiency is good.

A universal output transformer for triodes, pentodes, and Class "B" valves is included, and the price of the unit is 40s.

# Readers' Problems

## Double De-sensitising

A READER, referring to the possibilities of using a single potentiometer as a more-than-usually drastic H.F. volume control, asks for suggestions as to how the system may be applied to his own battery-fed three-valve receiver. Simple variation of S.G. valve bias is insufficient to cope with the excessively strong signals received from the local station.

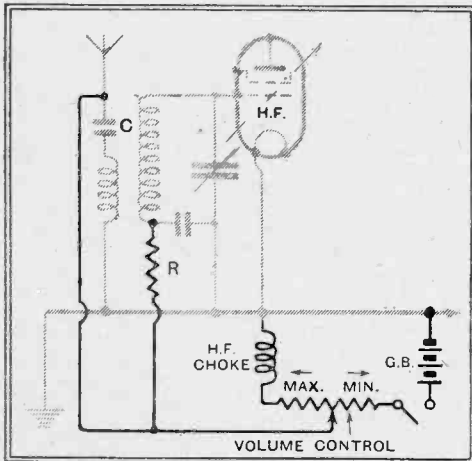


Fig. 1.—One potentiometer combining two functions. Volume is regulated by controlling both bias and aerial input.

Assuming that the ordinary method of controlling the bias of a variable-mu H.F. valve is at present in use, it should not be a difficult matter to arrange a more effective control by adopting the circuit arrangement shown in Fig. 1. As the potentiometer slider is moved from the end of the resistance element marked "max." towards "min." negative bias is increased, and at the same time the amount of resistance shunted across the aerial circuit is progressively reduced. With the potentiometer slider at the "minimum" position the aerial is virtually short-circuited through the grid bias battery, which has negligible resistance.

In order that sensitivity may not be affected noticeably at the "maximum" position, an H.F. choke must be interposed as shown, and also the grid decoupling resistance R must be of high value—say 50,000 ohms, in place of the more usual 5,000 ohms.

Further, to prevent a virtual short-circuit of the bias battery in the "minimum" position, a fixed condenser C must be inter-

## The Wireless World INFORMATION BUREAU

THE service is intended primarily for reader's meeting with difficulties in the construction, adjustment, operation, or maintenance of wireless 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 addressed 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. The enquirer's name and address should be written in block letters at the top of all communications.

posed in the aerial circuit if not already fitted; 0.001 mfd. will do.

## Half a Push-pull Stage

SOME time ago we commented on the experiences of a reader who found that the removal of one of his push-pull output valves had the effect of producing motor-boating, although the set still went on working. It was pointed out that this state of affairs is quite usual, the motor-boating being explained by the fact that signal-frequency anode currents are allowed to pass through the source of H.T. supply, and thus give rise to L.F. reaction.

Another reader has now noticed that the removal of one valve gives rise to motor-boating, but on replacing this and taking out the other, the set works almost normally, without any sign of instability. Again, this effect is not abnormal; with one of the valves inoperative, serious feed-back in a positive (or pro-reaction) sense is taking place, while with the other removed the sense of reaction is reversed.

## Improving the "Baby Super"

THE user of a *Wireless World* "Baby Super," described in August, 1932, asks whether it would be worth while replacing the present pentode frequency-changer valve by the latest type of Heptode or Pentagrid.

It is to be anticipated that a great improvement in performance would result from this change; the necessary modifications are of a comparatively simple nature, and all the existing coils, etc., could still be used. As shown in Fig. 2, alterations are confined to the circuits directly associated with the detector-oscillator valve.

As the oscillator coil assembly used in the original set has a reaction winding of which both the extremities are led out to separate

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the I.F. transformer primary will no longer be used as an oscillator "feed" condenser, it will be joined directly across the primary by joining terminals 2 and 3 as shown.

With regard to the bias resistance for the Heptode valve it is worth while, in a set of this nature, to try the effect of different values within the limits shown.

## 1 H.F. or 2 H.F. ?

ALTHOUGH the sensitivity of a receiver with two H.F. stages is vastly greater than that with one, the difference is seldom so outstanding as to place the two types in entirely different classes.

This remark is prompted by a question from a reader who proposes to add another H.F. stage to his receiver, and who apparently thinks that, without taking any special precautions, the present H.F. amplification, estimated at eighty times, will be increased to  $80 \times 80 = 6,400$  times.

In practice it is hardly so simple as that. Comparatively seldom is it possible to obtain full amplification from each of the stages of a two-stage set: more often than not, instability sets a much lower limit, and it becomes necessary to "tap down" some of the connections on the tuning coils or to sacrifice amplification in some other way. Again, reaction is not often used in 2-H.F. receivers, and its absence tends to make the comparative sensitivity of these sets somewhat less.

We say this merely to sound a note of

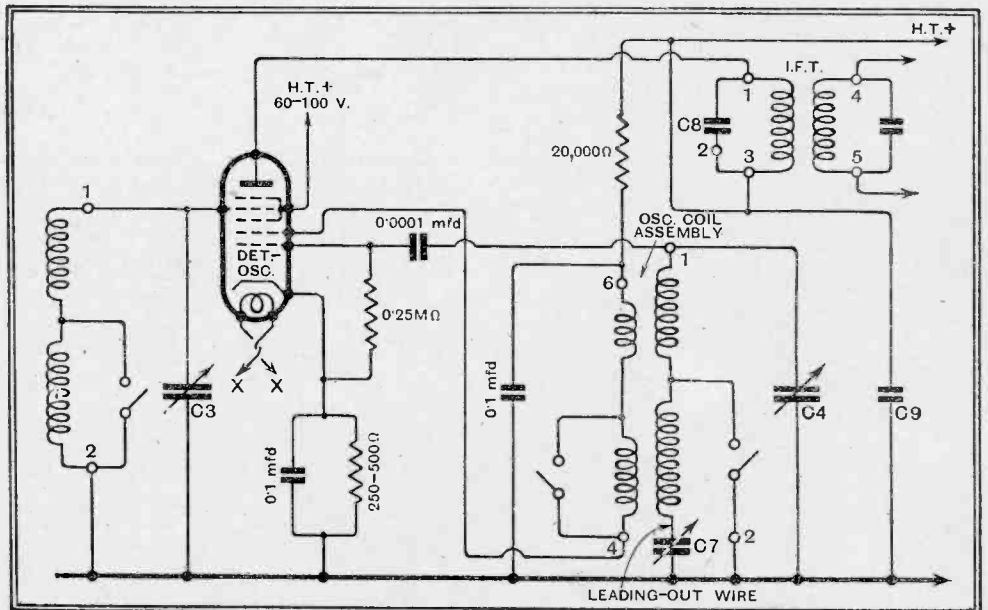


Fig. 2.—Modernising the A.C. "Baby Super" by fitting a Heptode. Values of new components are given, while existing parts bear the original reference numbers.

terminals, it becomes possible to employ a series-connected circuit instead of the parallel-fed arrangement which has been more generally adopted with Heptode valves. As the trimming condenser across

warning and not in any way to belittle the advantages of two H.F. stages. The extra stage makes a world of difference, but its inclusion calls for much more care in screening and decoupling.