The Wireless World

THE PRACTICAL RADIO JOURNAL

26th Year of Publication

No. 897. FRIDAY, NOVEMBER 6TH, 1936. VOL. XXXIX. No. 19.

Proprietors : ILIFFE & SONS LTD.

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

GLASGOW: 26B, Renfield Street, C.2.
Telegrams: "Iliffe, Glasgow." Telephone: Central 4857.

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

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

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WHETHER or not you were able to go to this year's Exhibition at Olympia you have by this time, no doubt, a pretty good idea of the new season's receiving sets in general and very possibly you have wondered within yourself what the future of British radio is going to be. Are we progressing in receiving set design and manufacture? If so, is our progress as rapid as it should be and is it entirely in the right direction? Everyone must find his own answers to those questions, but few, we think, will feel that the answers are one hundred per cent. satisfactory.

What may be called the standard receiver of to-day is a superheterodyne consisting of three—or, at the outside, four—"working" valves, plus a mains rectifier. The most usual layout is heptode frequency changer—pentode IF—double-diode-pentode AVC—*cum*-second detector-*cum*-output. From some points of view there is a very great deal to be said in favour of the set of this type. It can be sold at from £10 to £12 in two-waveband form, covering the medium and the long waves and from £12 to £18 as an "all-wave" receiver, taking in as well a short-wave band from about 15 to 60 metres. It will receive all the stations that are worth receiving on the medium and the long waves and, if it is an "all-wave" set, a considerable number of short-wave stations when conditions are favourable. It can have almost all the selectivity that is usefully employable; a measure of automatic volume control, and the output volume is sufficient for the ordinary living-room. But the outstanding advantage of the arrangement is that it enables the man of moderate means to purchase a receiver of very fair all-round performance. For that reason in particular the superheterodyne containing three or four complex valves is likely to continue in wide demand and it is only natural that it should figure largely in manufacturers' programmes.

But it is tragic that it should be almost the only kind of set—as distinct from radiograms—that the majority of them now make. Tragic, too, that the public should come to believe that £10 or so is as much as anyone should pay for a radio set. To put the matter bluntly there are only certain things that can be done with a limited number of multi-electrode valves and, so far as one can see, all of these things have already been done. In other words, there can be no real progress in receiving set design in this country until our manufacturers realise that they are not yet catering for a big market both here and in many parts of the Empire where the larger set with all possible refinements is in strong demand.

Limitations of Small Sets

The drawbacks to the use of a small number of complex valves are many. It is obvious, for instance, that to obtain the necessary over-all amplification every stage of the set must be screwed up to give the highest gain that can be obtained from it. Both this and the nature of the wiring connections required by such valves often leave a small margin of safety as regards stability. But the main objection is that almost the only refinements that can be introduced into such a set are good selectivity, fair sensitivity and automatic volume control, which must be limited in its action owing to the small number of valves to which it can be applied.

Editorial Comment—

Not uncommon difficulties in the small superheterodyne are background noisiness, self-generated whistles, oscillator wobble (particularly on the short waves), susceptibility to man-made interference (due to the absence of sufficiently complete screening) and last, but most important of all, poor quality of reproduction.

With few valves at his disposal the set designer must lay aside all thoughts of producing a receiver capable of showing anything like faithful reproduction. A large proportion of the total cost must be devoted to sensitivity. He knows that intending purchasers will insist that the set must be able to receive a large number of stations, even though most of those who buy will use it mainly for bringing in one or other of the local programmes. This is one of the curiosities of broadcast reception to-day. Any retailer will tell you that the first question asked by a prospective customer is: How many foreign stations will this set receive? Yet the average listener—in so far as there is an average listener—spends at least ninety per cent. of his "wireless time" with the receiver tuned either to local National or local Regional.

Bigger Sets Essential to Efficiency

To obtain high quality of reproduction is an expensive business from the manufacturer's aspect and it needs not few, but many valves. The man in the street does not demand high quality: so long as speech is fairly clear and music has plenty of bass he is satisfied—and it is comparatively easy to satisfy him with the moderately priced set, since he does not realise that there can be anything better. Unfortunately, perhaps, the human ear is extraordinarily accommodating. Those who have never heard genuine high-quality reproduction are content with something that falls far short of what it might be.

So long as British radio manufacturers suffer from their present three-valve complex as regards receiving sets and offer their larger receiving sets only in radiogram form, one cannot help feeling that they are missing a large and important potential market, partly because they underestimate the spending powers of the most prosperous nation in the world to-day, and partly because they have a fixed and apparently unshakable belief that the man who wants a first-rate wireless set will automatically buy a radiogram. Sometimes he will, but more often he won't.

What are the advantages of using many valves in a receiving set? They are manifold. Sensitivity—and this applies particularly to the short-wave range—can be brought up to something worth while. Noisiness and self-generated whistles disappear. Automatic volume control becomes far more effective. Quality of reproduction is enormously improved and *undistorted* output volume can be vastly increased.

All kinds of refinements can be introduced, refinements that are genuinely worth while but quite out of the question with a small number of valves. True QAVC is one of them, automatic tuning correction another, automatic contrast expansion a third. And there are many others. What it comes to, in a word, is that your designer can produce a receiving set incorporating the big advances in radio receiving technique that have been made in recent years, that he can keep pace with progress. These things cannot be done if he is limited to three or four already overworked multiple-electrode valves.

British radio stands at the cross-roads to-day. The time has come for those concerned to take stock of the position and to look to the future in planning their policy. Are they going to continue to blind their eyes to the demand for first-rate receiving sets that exists already in this country and would become so much larger if the public realised the possibilities of the set of many valves? Are they going to remain content with seeing the pages of radio journals published in many countries of the Empire filled with references to the foreign sets and advertisements of their virtues, to the exclusion of the British-made receiver? The bigger receiving set would not be for home consumption alone; it is exactly what is required to meet the Empire's demand.

Television

Inauguration of Service

ALTHOUGH still described as "experimental," the regular television service was opened by the B.B.C. last Monday and sufficient public interest has been aroused to justify the opinion that, so long as good programmes can be maintained, television will make steady progress towards a wider popularity. As readers are aware, the opening ceremony was conducted alternately by the Baird and the Marconi-E.M.I. systems, no doubt because it was felt that on such an auspicious occasion both concerns should be given an equal opportunity.

It is still difficult to understand why there should be two systems when by some arrangement the rivals might pool their technical knowledge, just as was done by various manufacturers in the early days of sound broadcasting. It is gratifying that a similarly happy position in the sphere of television was foreshadowed in the speech delivered by Lord Selsdon at the inaugural ceremony.

Broadcast Distribution

No Case for Proportional Representation

ONE of the strongest arguments against broadcast advertising as a national policy was disclosed in the course of a conference on station power recently held in the United States of America.

A speaker was complaining of the readiness of the broadcast licensing authorities to permit a constantly increasing number of stations to operate in those areas where the population was densest, resulting in the neglect of rural and less-populated districts. Broadcasting stations in America are run for profit, the profit coming from advertising revenue. Advertisers naturally tend to take "time" on the stations serving the largest number of listeners and then design their programmes to interest the type of listener they want to reach.

With our own broadcasting organisation or, in fact, any system which is independent of advertising revenue, the broadcasting service is planned to cover the whole country as evenly as possible and ensure that every district is equally well served. As soon as the principle of broadcasting supported by advertising is introduced, immediately the position is created that nobody wants to run a broadcasting station unless they can do so at a profit, and sparsely populated districts are neglected.

Incidentally, we have here yet another reason why it is desirable to suppress the idea still foolishly put forward, but fortunately at less frequently recurring intervals, that the broadcast licence fee of 10/- is in the nature of payment for a programme service as if it were a theatre ticket. If this were the position we ought at once to grade the licences as stalls, dress circle, and gallery at different prices, according to whether the listener is or is not well within a service area, and various other considerations.

Wireless sets are popular because of the broadcasting service, but the licence fee certainly constitutes no sort of contract between the listener and the B.B.C.

Negative Feed-back Amplifiers

A NEW DEVELOPMENT IN HIGH QUALITY REPRODUCTION

By W. T. COCKING

THE attainment of a high standard of reproduction is by no means difficult in the case of equipment designed for operation from the AC supply mains, for it is easy to secure ample power in suitable form for the valves. The DC mains user, however, has hitherto been at a serious disadvantage for, although he can obtain plenty of power economically, it is at too low a voltage for the best use to be made of it. As a result, he has had to tolerate a considerably greater amount of amplitude distortion than his brethren having AC supplies need do.

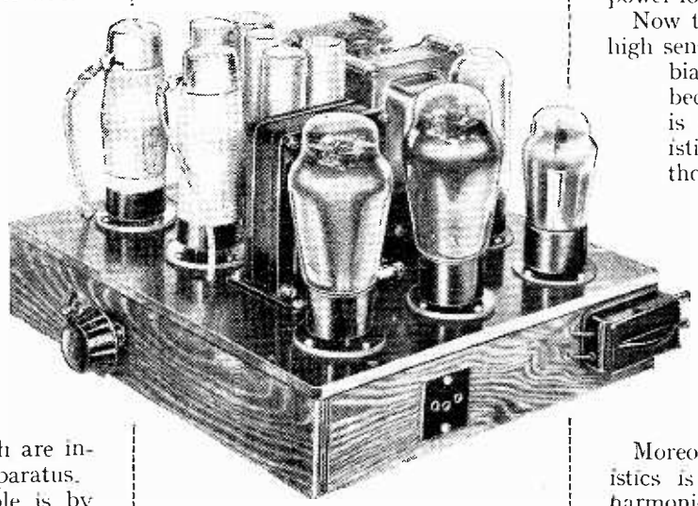
This has now been changed, and the development of the negative feed-back principle has made it economically possible to build a DC mains amplifier which is strictly comparable from the point of view of quality with the best AC apparatus. The principle is not, of course, confined to DC sets, and should lead to a considerable improvement when applied to battery-operated equipment. Its advantages will also manifest themselves when it is used in AC equipment of the same type. They are, however, less important in this case, for there is no necessity to use this same type of equipment, and the high standard of quality required may be, and often is, obtained by other methods which are inapplicable to DC and battery apparatus.

The negative feed-back principle is by no means new, being developed by Black some years ago,[1] and has been used in communication work both in this country and in America; it is, however, only just finding application in broadcast reception. As applied to any individual stage of an amplifier, it means that a portion of the output voltage is fed back to the input so that it opposes the input voltage. The amplification of the stage is consequently reduced, but so are both amplitude and frequency distortion. Moreover, the effective output impedance is altered, and the input impedance may be also.

The Output Stage

Before the advantages of negative feed-back can be appreciated it is necessary to be familiar with the characteristics of existing amplifiers. The greater part of the distortion in well-designed equipment occurs in the output stage, and it is certainly this stage, more than any other, which worries the designer of DC and battery equipment. There are two general types of valves which can be used, the triode and the pentode.

The triode has characteristics such that the amplitude distortion which it introduces consists chiefly of second harmonics. These can be balanced out by the use of two valves in push-pull, and an output stage causing an extremely small degree of amplitude distortion can readily be obtained. Furthermore, the valves require a load resistance which is high compared with their own internal AC resistance, with the result that the dynamic valve characteristics are much straighter than the static. As a corollary of this, the loud speaker is heavily damped by the valve resistance, for in effect the AC resistance of the valves is connected across the output transformer primary, and is much lower than the impedance which the transformer presents to the valves.



THE negative feed-back principle is one of the most important of recent developments and its principles and applications are discussed in some detail in this article. It is in the output stage of AC/DC equipment that it seems likely to prove of greatest advantage, and elsewhere in the issue will be found an announcement of an amplifier incorporating the principle.

A valve having an AC resistance of 1,000 ohms, for instance, usually requires a load impedance of some 4,000 ohms, and the transformer ratio is chosen to give this load. Looking backwards from the loud speaker, however, the speech coil is effectively shunted by one-quarter its own impedance (the valve resistance divided by the square of the transformer ratio), and is consequently heavily damped. The importance of this is evident when it is remembered that damping the loud speaker reduces the effect of resonances in the speaker at low audio frequencies.

In spite of its good characteristics from a distortion viewpoint the triode suffers from three disadvantages. Its sensitivity is low, that is, it requires a large signal input for its output; its grid bias is often as high as 12-25 per cent. of its anode voltage; its efficiency is fairly low, that is, only some 20-25 per cent. of the DC anode power can be converted into useful AC power for operating the loud speaker.

Now the pentode has the advantage of high sensitivity, a comparatively low grid bias and higher efficiency, and it is because of these advantages that it is so widely used. Its characteristics are not nearly as straight as those of a triode, however, and as the load impedance must be much less than its AC resistance, it exercises a negligible straightening effect on the characteristics. Because of this low load impedance, the valve does not damp the loud speaker appreciably, and speaker resonances are not reduced.

Moreover, the shape of the characteristics is such that both odd and even harmonics are introduced, and in consequence the use of push-pull is not of great advantage, while the magnitude of load impedance becomes quite critical.

In spite of its disadvantages, the pentode is widely used because of its high sensitivity, which often permits the saving of one AF stage. In the case of DC sets, however, there is little alternative because its low value of grid bias enables a higher anode voltage to be obtained, and consequently a greater output. With automatic grid bias, the bias voltage is necessarily subtracted from the HT supply, the available anode voltage being equal to the HT voltage less the grid bias. With DC mains the HT supply is limited, and must be less than the mains voltage by the drop in the smoothing equipment. After smoothing, there is often less than 180 volts available for the receiver.

It is easy to see that if out of this 180 volts some 20-30 volts must be used for grid bias, we shall be able to supply the output valve with perhaps 150-160 volts only for its anode. A pentode, however, needs only about 7 volts bias, with the result that an anode voltage of some 173 volts

[1] Stabilised Feed-back Amplifiers, by H. S. Black. Bell System Technical Journal, Jan., 1934, and Electrical Engineering, Jan., 1934.

Negative Feed-back Amplifiers—

may be obtained. This increased anode voltage coupled with the somewhat greater efficiency of the pentode enables an appreciably greater output to be obtained.

It is clear that the main disadvantages of the pentode are the high harmonic content of the output and the high output impedance of the valve. If these can be overcome, then it will not suffer in a comparison with a triode, and may even have advantages over it. The use of negative feed-back enables some or all of the defects to be overcome, and thus it is a real contribution towards better quality.

Feed-back by Cathode Resistance

There are several ways of obtaining negative feed-back, but they do not all offer the same advantages. It is, therefore, necessary to consider them in some detail. One of the simplest arrangements is shown in Fig. 1 (a), and will be seen to consist merely of the omission of the usual bias resistance by-pass condenser. The resistance R is the bias resistance, and since the AC component of the anode current flows through it, AC voltages are developed across it. The input voltage of the stage is that which appears across the secondary of the input transformer, but this is not, as is usually the case, the voltage effective in operating the valve. This last is the voltage between grid and cathode, and is equal to the input voltage less the voltage across R.

If R were perfectly by-passed so that no feed-back took place, the voltage amplification between the input transformer secondary and the output transformer primary would be $\mu R_L/(Ra+R_L)$, where μ and Ra are the amplification factor and AC resistance respectively of the valve and R_L is the load impedance presented by the transformer. For simplicity this is assumed to be a resistance. When the by-pass condenser is omitted, as in Fig. 1(*a*) the gain becomes $\mu R_L/\{Ra+R_L+R(1+\mu)\}$. The gain is reduced in the same proportion as if the valve resistance were increased from Ra to $Ra+R(1+\mu)$.

We have seen, however, that a high valve resistance is undesirable, and that the normal resistance of a pentode is too high. It would seem, therefore, that this circuit is undesirable, since it appears to increase rather than reduce the AC resistance. We must be careful in defining the AC resistance, however, for what we really want to know is the apparent output resistance Ro which would be measured between the output terminals when the output transformer is disconnected. This is the resistance which is effective in damping the loud speaker.

Assuming the grid to be shorted to the cathode, the value of Ro would obviously be $R+Ra$, but with the connections of Fig. 1(*a*) it is different because a change of anode current alters the grid voltage which in turn reacts on the anode current. Suppose we increase the anode voltage slightly, what happens? Obviously there is first of all an increase of anode current, and consequently a greater voltage across R. The cathode, however, becomes more positive than before with respect to the earth line, and hence the grid, so that the grid becomes more negative with respect to the cathode. This change in grid potential tends to reduce the anode current and so offset the original increase. The change in anode current for a given change in anode voltage is thus less than it would be if feed-back were absent, and the effective output resistance is higher. Actually $Ro=Ra+R(1+\mu)$.

This circuit is consequently of use only when the high value of Ro is not objectionable. The amount of feed-back is controlled by the value of R, but as this must be fixed by the grid bias needed some modification is often required. When R must be less than the value needed to provide bias, it can be made up to the required total by an additional series resistance which can be shunted by a large capacity condenser. When the bias resistance is not large enough, however, the arrangement of Fig. 1(b) can be adopted. Here C and R3 can be assigned arbitrary values of some 2 mfds. and 50,000 ohms while in the equations $R=R1+R2$. Only R1 is effective for producing grid bias, however.

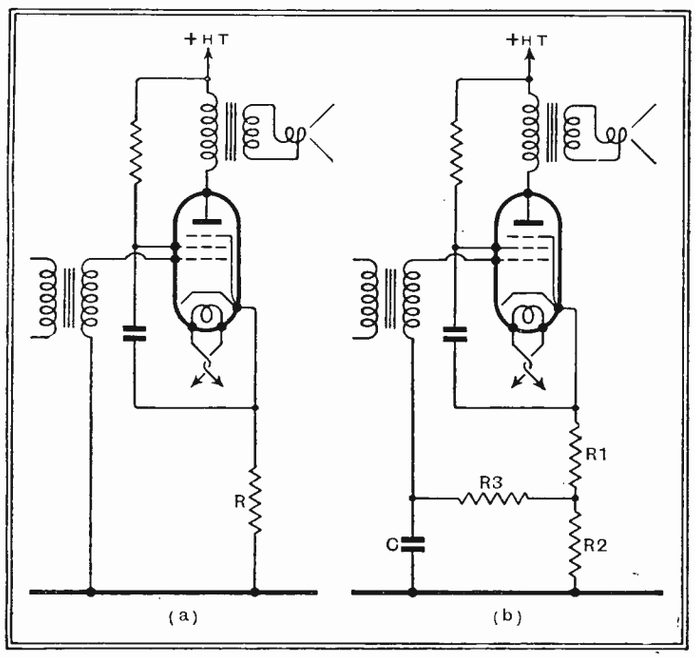


Fig. 1.—Negative feed-back is most readily applied by omitting the usual by-pass condenser across the bias resistance R as shown at (a). A greater amount of feed-back can be secured by adopting the connections of (b).

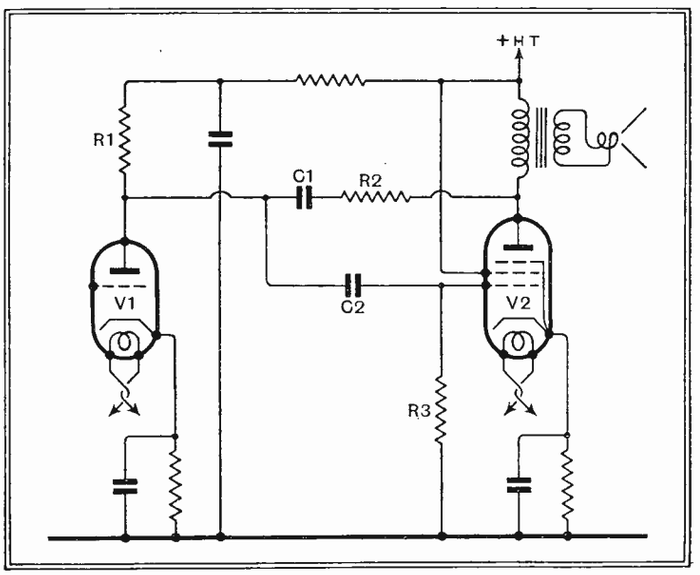


Fig. 2.—A feed-back circuit which has the advantage of greatly reducing the apparent AC resistance of the output valve. As explained in the text, this circuit is unsuitable for general use.

Another scheme which at first seems particularly attractive is shown in Fig. 2. The circuit is that of a normal resistance coupled stage except for the addition of C1 and R2. Actually C1 plays no part in the operation save that of insulating two points of different DC potential. It must, however, be large enough for its reactance to be negligible compared with the resistance of R2 at the lowest frequency required.

Circuit of Low Output Resistance

Actually, this resistance R2 forms a potentiometer across the output with the resistance of V1, R1, and R3 all in parallel. The proportion of the voltage developed across the output transformer which is fed back to the grid is $R/(R+R2)$ where R is the combined value of the resistances enumerated above. It is also easy to see that a rise in anode voltage causes a positive change in grid potential with the result that the effective AC resistance of the valve is lower than its normal value.

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A rise in anode voltage is a normal accompaniment of an initial grid voltage change in a negative direction, so that the feed-back is in the correct phase to oppose any voltage change applied to the grid, and to assist any voltage change due to the injection of voltage in the anode circuit. As a result, we can have the combination of negative feed-back with a low output resistance, which is just what we require.

Unfortunately, the circuit has one disadvantage, and it is one which is serious enough to prevent its use in practice. It is clear that as the anode and grid of the two valves are joined together through a condenser, they must be always at the same AC potential. Now the feed-back necessarily reduces the voltage changes on the grid of the output valve, and, consequently, it is clear that with this circuit it will also reduce the voltage changes on the anode of the preceding valve. This is equivalent to reducing the anode circuit load impedance of V1, and, in consequence, this valve may easily be overloaded.

Owing to this fault, the circuit is not one which can be recommended, and there would be no useful purpose in giving the design equations. It is sufficient to say that with the degree of feed-back necessary to give an output resistance of 1,000 ohms with a pentode and a distortion reduction to about one-fifth, the effective input resistance of the pentode is about 2,500 ohms only. The preceding valve can only give an undistorted output if it has a load resistance of at least 30,000 ohms. It cannot amplify without distortion if it has to work into a load of 2,000-3,000 ohms only.

A Practical System

A little thought soon shows the reason for the defects of the two arrangements which we have considered. The system of Fig. 1 has an infinite input impedance, or rather the normal input impedance of an amplifying stage, because the signal and feed-back voltages are introduced in series into the grid circuit, but it has a high output impedance because the valve and source of feed-back voltages are in series across the output transformer. Now with Fig. 2, the low input resistance is due to the signal and feed-back voltages being in parallel, while the low output resistance is due to the valve and source of feed-back voltages being in parallel.

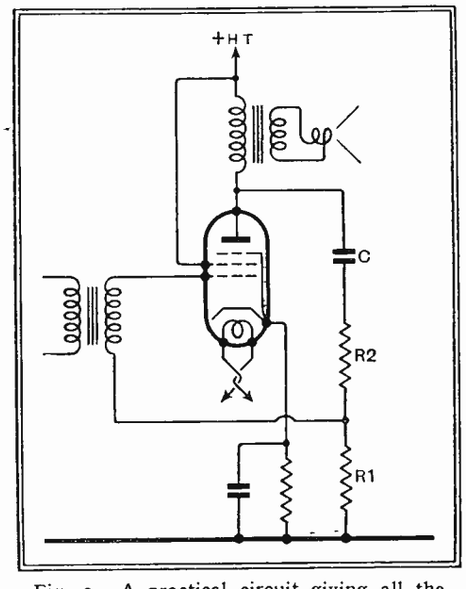

Fig. 3.—A practical circuit giving all the advantages of negative feed-back and a low output impedance.

It is thus clear that for the desired conditions of high input and low output resistance we must adopt the series input feed of the first circuit with the parallel output of the second. This can be done if we adopt transformer coupling to the output valve, and the circuit of Fig. 3 is free from the limitations of the earlier ones. The input resistance is that measured between the secondary terminals of the input transformer, and is obviously no different from that of any ordinary valve. For most purposes we can call it infinite.

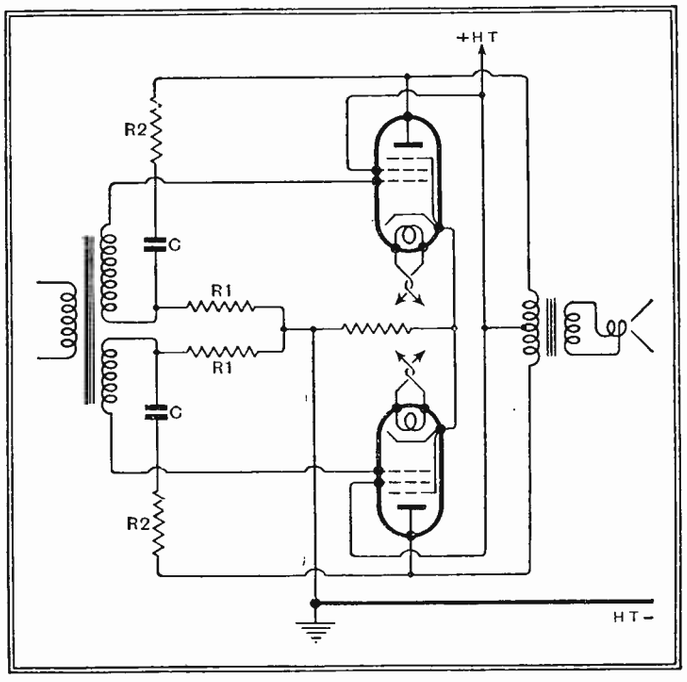

Fig. 4.—The circuit of Fig. 3 applied to a push-pull amplifier necessitates the use of an input transformer with a split-secondary. It is sometimes necessary to shunt the secondaries with high resistances to maintain an even frequency response.

The output impedance is the same as that of Fig. 2, when the resistances have appropriate values. Actually, $Ro = Ra/[1+(Ra+\mu R1)/(R1+R2)]$.

The stage gain from the input transformer secondary to the output transformer primary is given by $A = gR''/[1+gR''R1/(R1+R2)]$ where g is the mutual conductance of the valve (A/V.) and $R'' = R'(R1+R2)/(R'+R1+R2)$ and $R' = RaRL/(Ra+RL)$.

In design, we require most generally to start off by reducing the output resistance to a known level. The equation for output resistance is consequently best written in the form $R2 = R1\ [(1+\mu+Ra/R1 - Ra/Ro)/(Ra/Ro-1)]$. In addition $R1+R2$ must be much larger in value than RL, otherwise some of the power output of the valve will be wasted in these resistances. The values of these resistances must not be higher than necessary, however, otherwise stray capacities will upset the performance at high audio frequencies.

Let us as an example take a concrete case of a Mazda Pen. 3520 valve. Under average conditions we may expect anode and screen voltages of about 185 volts, and the valve then requires a grid bias of 7.25 volts. The optimum load resistance is 4,400 ohms, and the normal output 2.45 watts for 4.5 per cent. second harmonic and 4 per cent. third harmonic distortion. The input is 5.8 volts peak, and the valve curves show Ra to be approximately 89,000 ohms with $g = 7.25$ mA/V. and $\mu = 650$.

In order to find R2 we have to decide on Ro and fix an arbitrary value for R1. We know from experience with triodes that a valve resistance of 1,000 ohms damps the loud speaker satisfactorily, so let us say $Ro = 1{,}000$ ohms and try $R1 = 5{,}000$ ohms.

We then have $R2 = 5{,}000\ [(1+650+17.8-89)/(89-1)] = 33{,}000$ ohms. The nearest standard value is 30,000 ohms, and this will lead to a somewhat lower value of Ro and make $R1+R2 = 35{,}000$ ohms, which is eight times the load resistance.

Now as to the stage gain; we have $R' = 4{,}190\Omega$ and $R'' = 3{,}740\ \Omega$, so that $A = 0.00725 \times 3740/[1 + 0.00725 \times 3740 \times 5{,}000/(5{,}000+30{,}000)] = 5.56$. Normally if feed-back were not used and R1 and R2 were absent the gain would be $gR' = 30.4$ times, so that the use of feed-back reduces the gain to 1/5.45 of its normal value. As the valve usually needs an input of 5.8 volts peak, it will now need $5.8 \times 5.45 = 31.6$ volts peak. This is about the value required by an average triode output valve, so that in effect the use of feed-back converts a pentode into a triode, for the stage has the same output impedance and requires the same input voltage.

Now as to distortion. An exact analysis is much more difficult than is the case when dealing merely with amplification, but the general effect is to reduce the distortion in the same ratio as the reduction of amplification. In this case, therefore, where we started with 4.5 per cent. second and 4 per cent. third harmonic and the reduction of gain is 1/5.45, we should expect with feed-back to obtain only 0.825 per cent. second and 0.735 per cent. third harmonic distortion. This is actually a

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lower distortion level than one would expect from a single triode.

It would seem that from a pentode with negative feed-back one can expect somewhat less distortion than with a triode when the conditions are adjusted so that both valves require the same input and give the same output. Both stages will have similar input and output impedances, but the triode stage will require more HT voltage. With two valves in push-pull, there should be less to choose between the two, and either system should give the same output with equally low distortion and require the same input. Again, however, the triode stage will need about 100 volts more for the total HT supply.

It is, of course, necessary to use an input transformer, and with push-pull a split secondary winding must be used as shown in Fig. 4. Practical experience indicates, moreover, that the transformer must have its secondaries shunted by resistances, otherwise a phase-shift occurs at high frequencies which leads to an excessive response around 10,000 c/s. With such a circuit, it should not be difficult to obtain a performance on the limited voltage of DC mains which is truly comparable to that which AC users have long enjoyed from a pair of triodes of the PX4 type, that is, a truly undistorted output of some 3-4 watts and good damping of the loud speaker.

In conclusion, it may be remarked that negative feed-back also reduces frequency distortion by rendering the gain less dependent on the anode circuit load impedance. It also lends itself to tone-control circuits of simple nature, provided that one does not object to some increase in amplitude distortion of the frequencies which are boosted.

It is clear, however, that the circuit is much less useful with triodes than with pentodes, for the gain of the former is already low, and cannot well be further reduced without leading to difficulties in the penultimate stage. At the present time the chief advantage of the arrangement is to give a pentode a performance which approaches that of a triode as regards quality of reproduction.

DISTANT RECEPTION NOTES

New Stations' Power Ratings

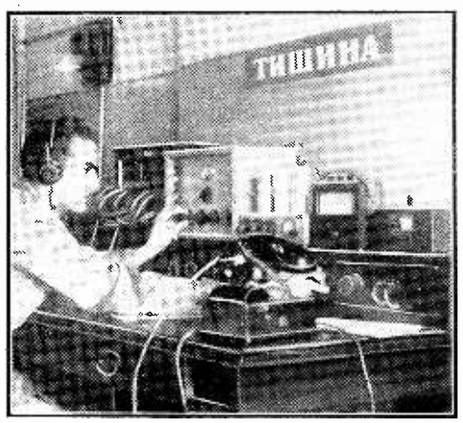
IT was announced some days ago that the new Rennes-Bretagne transmitter had taken over the full programme service from the old plant. So far, though, I have not found the voice of Rennes-Bretagne very loud, and I cannot believe that it is yet using its full 120 kilowatts. Certainly the volume obtainable is nothing like that from the 60-kilowatt Poste-Parisien or the 10-kilowatt Radio-Normandie. But then, Radio-Normandie has always appeared to use a very special brand of kilowatts. I doubt whether reception from Rennes will ever be very good, except at times when its neighbours are silent, for it is sandwiched between the 50-kilowatt Scottish National and the 100-kilowatt Königsberg, so that sideband splash is almost inevitable. There is a 10-kilocycle separation from the Scottish station, but one of only 9 kilocycles from Königsberg.

Elasticity of Output

Has anyone yet managed to log Klaipéda? This is a Lithuanian station, which started business in the early summer. It shares the wavelength of 531 metres with Athlone and Palermo; it is only at odd moments, therefore, that one may chance upon it working by itself. I have not managed to do so up to now, but I live in hopes. Given the right conditions Klaipéda should come in well, for it is rated at 10 kilowatts and the wavelength is favourable for long-range reception.

The new Deutschlandsender continues to be something of a mystery, and rumours are flying. It is said that though it may normally use 120-150 kilowatts, there will be very much more than that in hand for use if and when required. It is rather the fashion nowadays for new stations to be so designed and constructed that large increases in the output are very easily managed. The French Radio-National will have one of these "elastic" transmitters, and I believe that Toulouse P.T.T. could almost double the tale of its kilowatts in a very short space of time if the need arose.

The question of the limitation of power is likely to be raised at the next conference of European broadcasting authorities, and I should not be at all surprised if some of them press for a good deal more latitude. Under the present Lucerne plan long-wave stations may not exceed 150 kilowatts (though Moscow No. 1 is rated at 500). On the medium waves the maximum power originally allowed between 272.7 metres and 545 metres was 100 kilowatts, with special exceptions in favour of Budapest, Leipzig, Paris P.T.T., Prague, Rennes, Toulouse and Vienna, all of which were authorised to use 120. Rome No. 1 will shortly come into full service with 120 kilowatts, and the authorities in several other countries feel that the service areas of their big stations cannot be what they should so long as a limitation of 100 kilowatts is imposed.



RADIO-BELGRADE II.—A low-powered short-wave transmitter, adapted to the needs of broadcasting by the Government Press Department, and used for the transmissions of programmes intended for countries outside Yugoslavia.

For a country large in size, though not thickly populated, Finland is very well off in the matter of broadcasting stations. Most of us, I expect, have logged at one time or another its bigger stations on the long and medium waves. These are the 150-kilowatt Lahti on 1807 metres and the 10-kilowatt Helsinki on 335.2. But there are two other Finnish 10 kW stations, Oulu on 696 metres and Viipuri on 569.3, that have probably eluded us, since few sets nowadays will tune in the wavelengths between about 560 and 900 metres. On the medium waves there are some Finnish small fry, the pursuit of which should delight the D-X man who glories in logging difficult stations. Here they are: Pietarsaari, 0.25 kW, 200 m.; Turku, 0.5 kW, 209.9 m.; Vaasa, 0.5 kW, 211.3 m.; Tampere, 0.7 kW, 226.6 m.; Pori, 1 kW, 400.5 m.; Sortavala, 0.25 kW, 400.5 m.

D. EXER.

TELEVISION PROGRAMMES

The principal items only of each day's programmes are given. The system to be used each day is given below the date. Transmission times are from 3-4 and 9-10 p.m. daily.

Vision 6.67 m. Sound 7.23 m.

FRIDAY, NOVEMBER 6th.
(Baird.)

3.5, Silver Fox Breeding. **3.20,** British Movietone News. **3.35,** From the London Theatre—Sophie Stewart in scenes from "Marigold."

9.5, British Movietone News. **9.15,** Boxing Training demonstrated by members of the Alexandra Amateur Boxing Club. **9.40,** Film, "Television Comes to London."

SATURDAY, NOVEMBER 7th.
(Baird.)

3.5, Zoo Animals introduced by David Seth-Smith. **3.20,** British Movietone News. **3.35,** Cabaret.

9.5, Pictures and Sculpture from Forthcoming Exhibitions. **9.20,** British Movietone News. **9.35,** Cabaret.

MONDAY, NOVEMBER 9th.
(Marconi-E.M.I.)

3.5, The Mobile Post Office. **3.20,** British Movietone News. **3.35,** Picture Page.

9.5, Film, "Television Comes to London," **9.25,** Picture Page. **9.50,** British Movietone News.

TUESDAY, NOVEMBER 10th.
(Marconi-E.M.I.)

3.5, Performing Alsatians. **3.25,** Major Faudel Phillips demonstrating Show Pony Jumping. **3.40,** British Movietone News. **3.50,** Lisa Minghetti (violin).

9.5, British Movietone News. **9.20,** Pageant Reconstructing Lord Mayor's Show. **9.50,** Movietone Magic Carpets: Giants of the Jungle.

WEDNESDAY, NOVEMBER 11th.
(Marconi-E.M.I.)

3.5, Armistice Programme: A Document of War and Peace. **3.20,** British Movietone News. **3.35,** The Vic-Wells Company in "Job."

9-10, Repeat of afternoon programme.

THURSDAY, NOVEMBER 12th.
(Marconi-E.M.I.)

3.5, London Characters: "Josh" Cairns (the busker) and ex-Pipe Major Massie (from Trafalgar Square). **3.20,** British Movietone News. **3.35,** Championship exhibits from the International Poultry Show. **3.50,** Movietone Magic Carpets: Giants of the Jungle.

9.5, Repetition of 3.5 and 3.20 programmes. **9.35,** Ballroom Dancing—Demonstration of steps.

Beautiful Baffles !

SYMMETRICAL SHAPES FOR UNIFORM SPEAKER RESPONSE

By D. W. ASHWORTH

TO reduce and distribute interference effects due to a baffle it is necessary to have as wide a variation as possible of the shortest path between back and front of the diaphragm. The author shows that the satisfaction of this condition need not result in a baffle of ugly appearance.

IT often happens that a thing designed for utility alone is not good to look upon. Yet if we consider the *Queen Mary* or a 'plane like the one which won the air race from London to Melbourne we see that this is not always the case. The writer hopes to show that the principle which led to the design of the irregular loud speaker[1] baffle, if carried to its logical end, leads to a shape which, if not passable as "beautiful" to a critical artistic eye, is at least much nearer to that ideal than its predecessor.

In the recent article, which described the irregular baffle which has been developed to eliminate irregularities of response found with conventional square baffles, it was pointed out that the worst shape is a circle concentric with the speaker cone. With such a baffle the length of the path of the sound waves from the front of the cone to the back is the same, in whichever direction it is measured. In other words, all paths are the same in length. Therefore, the inevitable reinforcement and weakening frequencies of all paths are the same, and add together to cause marked irregularities in the response curve. Fig. 1 (a) shows the fundamental or first pair in the series of such irregularities, as one would expect them to appear in the otherwise smooth curve of a speaker in a baffle whose diameter is 13 inches greater than that of the cone. Note that they are concentrated in narrow bands of frequency.

In a conventional square baffle the sides are tangents to a circle which is almost invariably concentric with the cone. The centre portions of the sides therefore constitute a considerable portion of baffle edge providing paths of about the same length and resonating at about the same frequency. But some of the edge near the corners is at greater distances from the cone, so the irregularities in the curve are spread out towards lower frequencies as shown in Fig. 1 (b). Note that there are four portions of the edge of this baffle at one distance from the cone, but the curve is not so bad as the one in Fig. 1 (a) where there is only one such portion. Of course, what counts is not the number of such portions but the angle they subtend at the centre of the cone.

The *Wireless World* baffle places the four sides at four different distances, so that there are four sets of irregularities in the curve, but as there is only a quarter of the angle subtended at each distance, each irregularity is of only a quarter the intensity. Moreover, two of the fundamental dips in the curve occur at nearly the same frequencies as two of the fundamental humps, so that they partly cancel out as in Fig. 1 (c).

Now, to carry the process to its logical conclusion let us have, not four quarter-size humps or even twenty twentieth-size humps, but a slight increase in response spread *evenly* over a range of frequencies. By this means the reinforcement or weakening at any frequency is kept small, and the curve is made smoother. The greater the range of frequencies chosen the smaller the modification of the ideal curve; so the distance of the baffle edge from the cone should be spread between limits as widely separated as possible. The lower limit will affect the bass cut-off, so it cannot be made too small; and the upper limit will be determined by the allowable size of the baffle. The shape should be the one which distributes the baffle edge (as measured by the angle it subtends at the centre of the cone) most uniformly between the chosen limits, that is, the common spiral. All the portions of such a baffle between d in. and, say, (d + 1) in. from the cone, added together, subtend the same total angle at the centre, whatever d may be.

If the spiral runs from a minimum of 13in. from the cone out to a maximum of 45in., the fundamental reinforcement is spread from 75 c.p.s. to 260 c.p.s., and the fundamental dip from 150 c.p.s. to 520 c.p.s. Between 150 c.p.s. and 260 c.p.s. the two cancel as shown in Fig. 1 (d).

The baffle may be bounded by two spirals of opposite hand to form the heart shape of Fig. 2, which is equally effective, and which many people will regard as superior in appearance to the rectangular forms.

[1] *The Wireless World*, May 22nd, 1936.

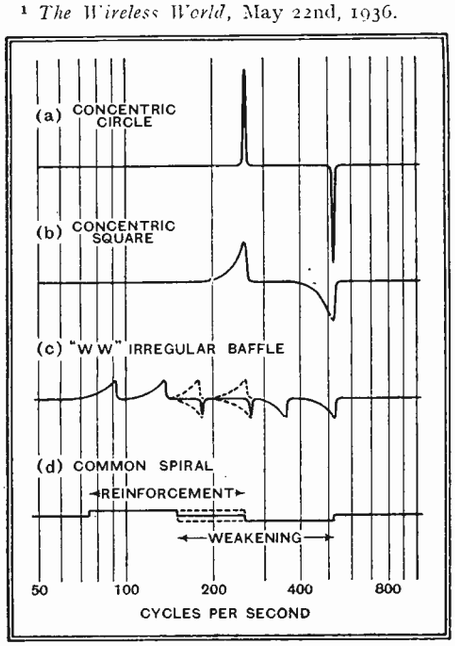


Fig. 1. Diagrammatic response curves showing the interference effects in baffles of various shapes. For simplicity the bass cut-off has been ignored.

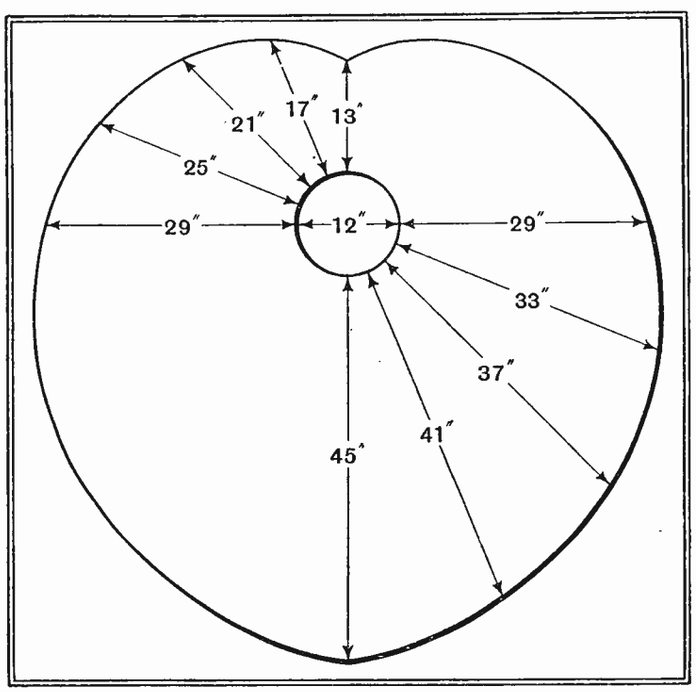


Fig. 2. Suggested heart-shaped baffle developed from two common spirals.

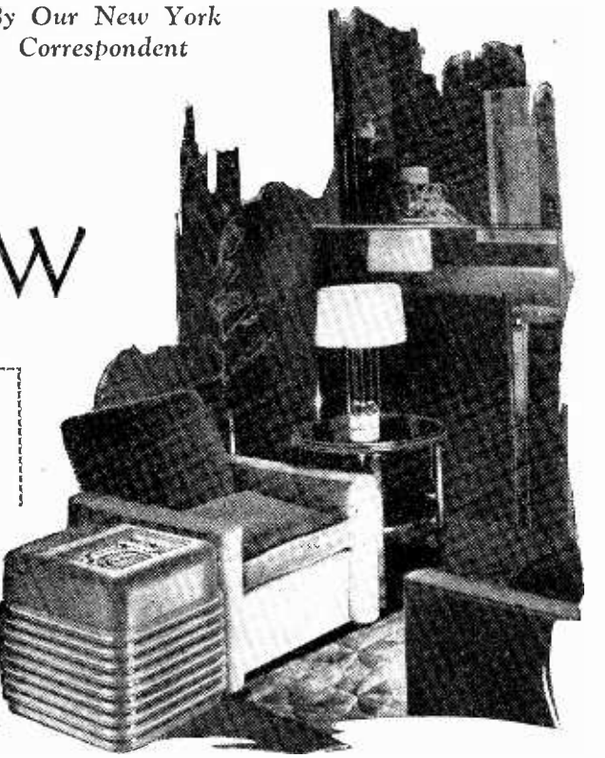
New York Radio Show

By Our New York Correspondent

DISAPPEARANCE OF THE COMPONENT

▽

LACK OF TECHNICAL INFORMATION

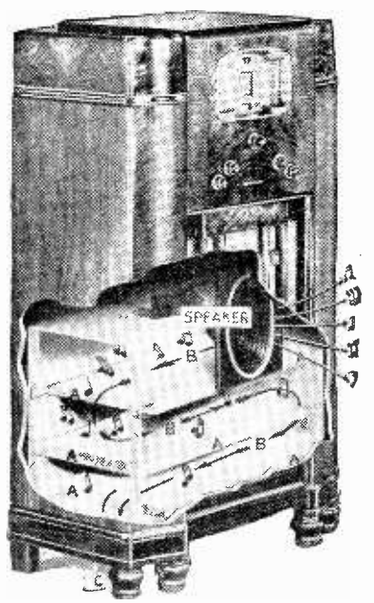


The Zenith Zephyr 10-valve all-wave receiver, seen in appropriate surroundings

THE retail radio season was ushered in on September 9th, when the National Radio and Electrical Exposition opened at Grand Central Palace for its ten-day showing. Its purpose was to tell the advance story of radio and to feature in addition lighting, refrigeration, heating ranges, air-conditioning, oil burners, laundry equipment and other domestic and industrial appliances.

To the radio fan there was little reminiscent of the shows of five to ten years ago, which were largely devoted to exhibits by parts manufacturers for the set builder. This year not a part could be found, and little technical information.

To the writer, the 1936 "show" struck a new low level from the point of view of interest—although there were four fine exhibits of receiver manufacturers, and several miscellaneous electrical and radio exhibits of interest.



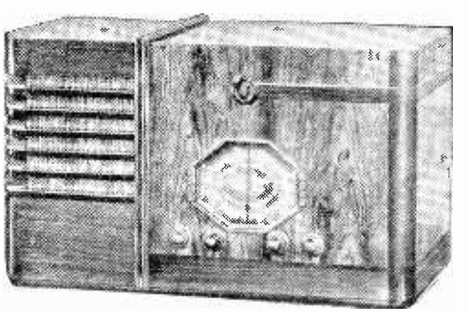
A view of a Stromberg-Carlson receiver with the cabinet cut away to show the acoustic labyrinth

Stromberg-Carlson had an outstanding booth, from both an artistic and radio viewpoint. In addition to their complete line of receivers and radio-gramophones, they displayed many interesting features of their receivers, such as the "Acoustic Labyrinth" in cross section; their single and dual high-fidelity speakers, with particular emphasis paid to their new Carpinchoe leather surround on all of their better single-unit and low-frequency speakers. As usual, their chassis were gems of construction and design. Their exhibit also included a 20ft. square demonstration booth—soundproof and furnished in the style of an average living room. This, strange as it may seem, was the *only* place in the entire show where it was possible to listen to a receiver in operation; and although we passed this demonstration booth of Stromberg-Carlson several times we failed to see anyone putting the receivers through their paces. This may have been a coincidence, as our visits were all made in the afternoon, when the visitors to the show were at a minimum. Perhaps the evening told a different story. Also, in their demonstration room Stromberg had one of their high-fidelity radio-gramophones (with automatic record changer) equipped with the only remote control in the show. This control can select any station, and is equipped with a remote tuning meter for correct tuning, or it can be used to bring in one of a dozen preselected stations. In addition, the volume is controlled by a second motor. Other functions performed at a distance are the selection of loud speakers —if the house is equipped with several—and the operation of the phonograph. Once it has been loaded with records, it may be started and stopped, and records may be rejected from the distant point.

Next of interest was the General Electric exhibit. This featured their new Colorama Dial, which automatically flashes from red to green when the receiver is tuned to resonance, and in connection with the G-E automatic frequency control (similar to R.C.A.'s development, which R.C.A., strangely, are not using in their own receivers) should ensure perfect tuning, even by the careless layman. Other features are the local station personaliser, one of the few arrangements in America whereby the station letters are flashed as you tune in; G-E. silent tuning, which is a simple switch operated by the tuning knob so that the receiver is silenced while a hand is grasping the knob, and operates normally once the knob is released; sentry box, which is a cleverly designed RF tuning unit; G-E. sliding rule tuning scale, which lists all stations in a straight horizontal line, using an entirely separate scale for each band; and the G-E. stabilised loud speaker, in which the magnetic structure, pole piece, etc., are keyed into place and welded, thus stabilising the structure magnetically and mechanically.

Zenith also had an interesting exhibit which featured their very attractive and readable 10in. to 12in. dials and their acoustic adapter, a bell-shaped device which could be moved over the back of the low-frequency speaker to control its low-frequency resonance—adapting its frequency response to rooms of different size. Inspection of their chassis also showed the explanation of the fast, smooth action—almost effortless—of their tuning mechanism. On the shaft with the tuning knob was a sizable flywheel, which seemed to remove the usual laborious dial twisting. Several of the Zenith receivers featured multiple speakers—their Stratosphere was equipped with two 12in. speakers and one moving-coil tweeter of the diaphragm type. Others employed a single low-frequency speaker in conjunction with a direct radiator cone type of tweeter.

R.C.A.'s exhibit featured their Magic Voice, record reproduction, service oscillators and the cathode ray tube.



Stromberg-Carlson three-band receiver

Sparton (Sparks-Withington) were one of the few exhibitors who featured volume expansion. Their representative stated that expansion, with its increased volume, range and reduced background was of great

New York Radio Show—

value when demonstrating receivers—either to dealers or to the public. Their large and attractive dials of clear glass with band scales and figures in harmonious tints were of interest.

Crosley showed for the first time their new 37 tube receiver—a high fidelity model equipped with Jensen's super efficient 18in. low-frequency speaker (Woofer), two middle frequency reproducers and three of the finest exponential horn-moving coil tweeters. As might be imagined, volume expansion was included in this $1,500 masterpiece. Four chassis are used—the tuner, audio-frequency amplifier, power supply and a separate power supply for the six speaker fields. The three speaker systems were each fed from a separate audio-frequency channel, each channel having panel gain controls so that the balance could be adjusted to suit the user.

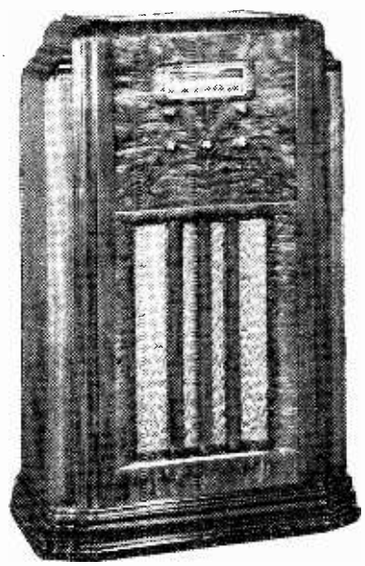
The Output Stage

Fairbanks-Morse stressed their "Turret Shield," an overall shield to prevent the pick-up of man-made static by the radio-frequency circuits. In the centre of their exhibit was a shielded booth with signal generator, output meters and several chassis —with and without the Turret Shield. Unfortunately, no one connected with their exhibit had the slightest idea of the purpose of the shielded booth and equipment.

Emerson and Fada displayed many attractive receivers, the former concentrating on the small personal receiver.

Neither Philco nor Grunow, with their telephone dial type of tuning were on show.

The return of the triode output tube in large numbers, almost always in push-pull, is certainly a significant step. Not forwards,



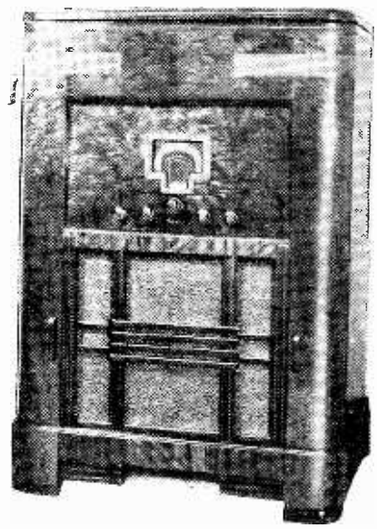
A General Electric receiver of the all-wave type

perhaps, as we were using many such output stages in 1928-29, but at least in the right direction!

Of possible interest is the fact that many receivers employing our new "Beam Power" tube employ split-load inversion, which has been endorsed by Mr. W. T. Cocking in *The Wireless World*, so that 10-15 watts of good quality output can be secured from a resistance coupled p-p amplifier at fairly low cost. This is largely due to the power sensitivity of these tubes.

It would seem that the trend of this year's receivers is toward separate radio-frequency assemblies of the type employed in the "W.W." All-wave Super Seven. Also, many manufacturers are going to overall or box shields entirely enclosing the radio-frequency circuits. Next in importance would seem the use of much better loud speakers by most manufacturers. Although a few flimsy units could still be found, most of the medium-priced receivers employed well-built speakers, with ample fields. This is partly due to the increase of power available.

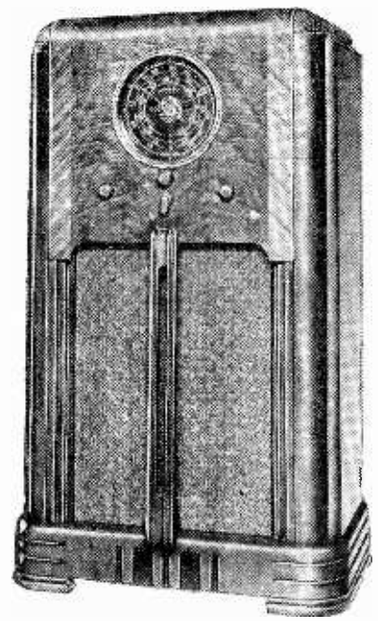
As in England, the all-wave receiver has swept the country by storm. In fact, it would appear to be impossible to secure a broadcast band receiver with the exception of a few $10 to $15 models. Strange as it may seem, we seldom run across anyone who enjoys short-wave reception, the majority leave their receivers on the broadcast band, and, in fact, spend 95 per cent. of their time listening to three or four local stations (in and around New York). To the writer this would seem to indicate a market for a pre-tuned switch or button-controlled local receiver. However, none of our manu-



The RCA-Victor receivers include a cathode-ray tuning indicator

facturers has had the courage to produce such a model. Also, some form of remote control would seem highly desirable, so that the receiver could be tuned, volume adjusted, etc., at a distance from the speaker, where listening at moderate level is most enjoyable; but with radio used as a continuous background, operated so softly in many cases that it is difficult to tell whether it is on or off, such measures are probably unnecessary.

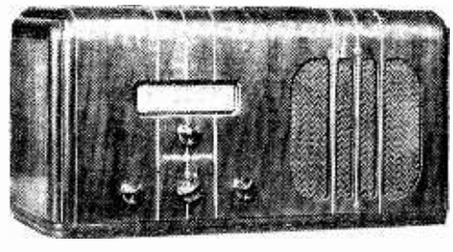
Although several manufacturers are featuring the new "Beam Power" tubes in circuits designed to deliver from 10 to 60 watts, others are using medium power triodes and pentodes in class A or AB. Variable selectivity is also included by the majority—even in their low- to medium-priced merchandise. The above changes should certainly note a trend toward better fidelity, if not "high" fidelity. In connection with high fidelity, it would appear as though the American dealer is the weak link in the chain between manufacturer and the public, including the broadcaster. The dealer apparently knows nothing and cares little about such matters, and is in no position to point out to his customers the greatly heightened pleasure which might be experienced from listening to our fine programmes when reproduced by a truly high fidelity receiver. Many of our receivers which are advertised as "high fidelity" do not give a very pleasing impression when operated in the "high fidelity" position. In several cases known to the writer the electrical or chassis fidelity is nearly perfect, so that it is logical to expect that the high



Crosley 7-valve 3-band receiver with a 6-watt output stage

frequency response of many so-called high fidelity speakers is very rough or peaked. This gives the "high fidelity" a black eye, and it is the writer's hope that the high frequencies which distinguish the high fidelity receiver from the average "radio" may be made smoother and more pleasing in the near future, so that everyone will enjoy and consider the high fidelity reproduction to be more "natural" rather than shrill or harsh as so many do at present.

Tuning to resonance of this year's receivers should be simpler than ever before. Four or five of our largest manufacturers have adopted automatic frequency control, which eliminates the necessity for careful tuning. However, there is some feeling that is not the final answer for high-fidelity reception, as cross modulation becomes a much more serious problem when AFC is used in conjunction with receivers operating with wide-band selectivity. Noise may be



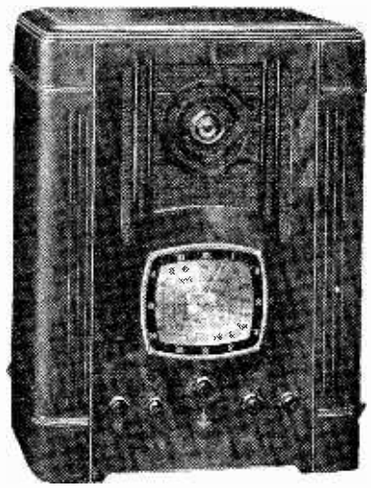
A table model receiver It is the General Electric E-72 with seven valves

another consideration, as with the high-frequency stages detuned by nearly 10 k/c, noise will be greater and quality distinctly poorer than when properly tuned.

New York Radio Show—

Resonance indicators are being used on more receivers than heretofore. Almost all medium-priced receivers have some sort of indicator; the "Magic Eye" or cathode-ray tube is finding general favour, although meters and shadow tuning are still used by a number of manufacturers. Many of these devices (Magic Eyes, too) are operated from sharply tuned circuits tuned exactly to the intermediate frequency, so that indication is accurate regardless of the setting of the fidelity control. There seems to be room for improvement here, however, as it is still impossible to tune many receivers properly, when their IF band-width is a maximum. As the public is reluctant to learn any routine such as a method of tuning by adjusting the selectivity to a maximum, tuning to resonance and then expanding the band-width each time a shift is made (which with our many local stations in a number of the larger cities means frequent tuning, sometimes at fifteen-minute intervals), they will either content themselves with leaving the receiver adjusted for maximum selectivity (minimum fidelity) or will not be tuned to resonance much of the time.

Metal tubes are a selling point, admit most of the receiver manufacturers, but no more vital than dial design or other features of a similar nature. A few of the more radical buyers demand them, but the majority accept a receiver which suits their artistic, financial or musical taste, whether it uses metal tubes or not. Last year's



The Emerson M-140 12-valve AC/DC receiver covering 16-2,000 metres

failures with defective tubes have also reacted against them in the eyes of many. As an example, Sparton in most of their models employ but two metal tubes, the high-frequency amplifier and first detector or mixer; the others all being glass. Many receivers are equipped with the octal base, and are sold with either metal or glass tubes, according to the preferences of the individual customer.

Dials and tuning mechanisms are much easier to operate than formerly, and the dials have been greatly improved in appearance. Many of this year's receivers employ two-speed tuning with but a single knob. This is so worked out that, while tuning in one direction, the condenser is rotated at high speed, but as soon as the direction is reversed a clutch operates, allowing the tuning-in to be completed at slow speed.

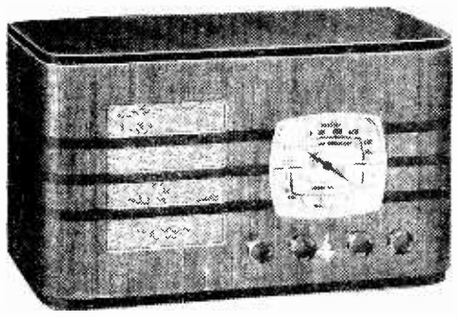
Many dials also have ports or openings in which appear frequency-band designations, selectivity or fidelity settings, and perhaps an indication of the tone-control setting. There is still a division of practice between many frequency scales on one dial, with its attendant confusion, and the newer and more complicated practice of exposing only one scale at a time. Whereas the latter is much more expensive (many ingenious schemes for this are in use), its use would seem destined to grow because of the simplicity of operation.

Cabinets are improving both in finish and construction, although there were very few on display which the writer would care to have in his home. The end table vogue seems to be spreading, and in this connection there were a number that combined modernistic lines with simplicity and ease of operation.

Six-volt accumulator operation of receivers for farm use is developing rapidly. In most of these receivers, vibrator high-tension supply is used. The majority of these receivers are intended to be sold with wind-chargers (generators operated by the wind through a windmill or propeller), thus reducing the operating cost to a negligible figure. For those living in localities where the average wind speed is insufficient to keep a battery charged, a number of inexpensive compact gas-engine-driven generators have recently made their appearance. In general, these units, consisting of single-cylinder engines with electric starters coupled to generators of 150 watts at six volts, sell for approximately $45. Others can be obtained delivering up to 1 kW or more, DC or AC, at proportionally greater cost. These should also increase the use of appliances and electric light in the farm home.

To depart from the radio receivers, there were two studios from which a number of broadcasts originated. As these studios were provided with glass walls a large crowd could always be found with noses pressed to windows, fascinated by the ever-mystifying process of broadcasting.

The New York Police department had a very interesting display consisting of police transmitters and receivers, traffic-signalling systems, etc. An officer was present who explained the manner of despatching police cars, and their *modus operandi*. The New York Y.M.C.A. also had a fascinating display of photo-cell devices such as speed traps for the catching of speeding motor cars, infra-red and capacity-operated burglar alarm systems. These latter devices puzzled the crowds, who continuously attempted to creep up on a very shiny watch which was offered to anyone who could touch it without ringing the bell. However, they were all forced to depart baffled. An



The Emerson L-122 is a 5-valve set covering 40-136 and 172-555 metres

electronic organ was among the exhibits, and was played upon by one of our leading cinema-organ virtuosi. This same gentleman attempted to explain its operation, attack, wave form, and other phenomena, but, unfortunately, was not making much progress at last report.

One other phase of possible interest was the number of car radios shown. Nearly all of the exhibitors included one or more such models, but, so far as we were able to learn, there was little interest displayed in these. It is possible that the car radio has been so widely accepted that little of former novelty remains.

In conclusion, it would seem that Mr. Hartley's "Whither Exhibitions?" is just as applicable in America as in England. Even more so, on second thought, as no provision has been made in several years for any sort of demonstration, although it is possible for the exhibitor to secure a demonstration room for a large increase in booth rental. It would seem to the writer that the "Radio Show" should provide the opportunity to educate the public toward the final peak of "natural" reproduction, instead of the carnival side shows of to-day!

Records for Testing and Demonstration

New H.M.V. Album of Five Special Discs

IN the record No. DB4033 reviewed in our issue of April 10th, 1936, H.M.V. have already provided a very useful source for the demonstration of pitch, amplitude, beats, harmonics, etc. This record is now available with four others in an album (No. 252), priced 34s. The four new records (DB4034 to DB4037) provide a series of 57 constant tones, ranging in frequency from 25 to 8,500 cycles. A calibration table is given showing the corrections to be applied below 250 cycles, and the maximum error on the outside grooves is within ±0.25 db.

The second side of the last record gives a gliding tone from 8,500 to 25 cycles, and a groove indicator is provided showing the frequency in relation to the position of the playing needle. Space is left on the indicator strip for pencil notes during the course of playing. The markings can be erased if desired.

There are innumerable applications for records of this type, and the instruction leaflet gives particulars of experiments to demonstrate pick-up tests, Chladni dust figures, the formation of nodes in Kundt's tube, and room reverberation tests.

New Technical Service

WITH the co-operation of a number of dealers throughout the country, the Mullard Wireless Service Company has instituted a new scheme whereby home constructors are encouraged to make the fullest possible use of the Mullard Technical Service Department. These special dealers will give help in solving any problem relating to home-constructed receivers, particularly in regard to valves; where the required information cannot be supplied on the spot, the query will be dealt with promptly from headquarters.

Broadcast Brevities

NEWS FROM PORTLAND PLACE

The Continent Listens

A BELGIAN visitor to Broadcasting House last week, asked whether he had heard the inaugural broadcast of the new concert organ in St. George's Hall, burst out laughing. The question, it seemed, was ridiculous.

Of course he had heard the organ. All Belgium, all the Continent, had been listening. And why?

Where Britain Leads

Strange though it may appear to our modest ears, Europe as a whole seems to put British cinema organs and organists in the front rank. The few organs of this type on the Continent lack the versatility of the British instruments and are rarely played with the same brilliance of execution—and the same applies to dance bands.

Jazz band leaders over-there listen attentively to the British dance music broadcasts, modelling their own methods on those of the acknowledged leaders in this country. Hence there is the Henry Hall style, the Jack Payne style, and half a dozen others.

It is doubtful, though, whether the Continent as a whole studies the other B.B.C. broadcasts with the same assiduity.

A Leg-pull ?

EIGHT bars of music manuscript, beautifully written, reached the B.B.C. Music Department from a French newspaper last week. With it was a letter of enquiry.

"Is it," asked the writer, "a Welsh, Scottish or Irish national air that the British broadcasting stations are using as their interval signal? I enclose a transcript of the tune as we hear it on our receivers."

The tune was "Ol' Man River."

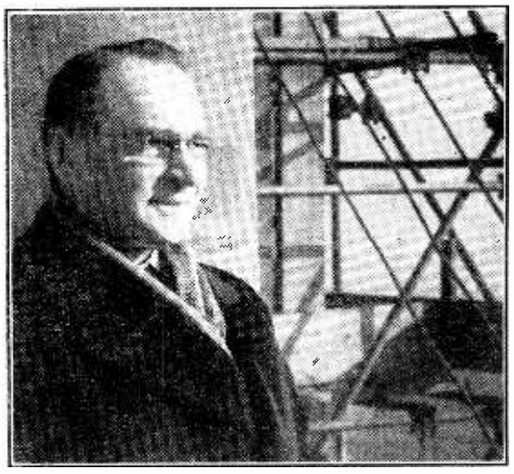
"Interest" Features in Television

IN Wardour Street an "interest film" is any strip of celluloid which successfully avoids news, love, or adventure—a somewhat rare feat. What exactly constitutes an "interest" feature in television must be left for individual televiewers to decide, but there is no doubt that the producers at Alexandra Palace are anxious that those sections of the programmes coming under this description shall really merit the term.

Demonstrating Anti-Aircraft Guns

One of the most promising is the first television gardening demonstration which Mr. C. H. Middleton, of sound broadcasting fame, is to give on November 21st. Mr. Middleton will offer illustrated hints on Autumn Pruning in the Baird spotlight studio. Historical inn signs through the ages will be shown and described by a student of the subject on November 17th.

Two big shows to be expected during the M.-E.M.I. week, November 23rd to 28th, are a fencing lesson by women champions and an anti-aircraft gun display in Alexandra Park.



"Television comes to London." — Dr. Zworykin, the iconoscopic inventor, in a "still" from the film first transmitted last Monday, and . . .

Broadcast from a Motor Factory

NEARLY a hundred employees in a Midland motor factory have speaking parts in a broadcast feature programme which Robin Whitworth is producing towards the end of November. The broadcast will give a vivid sound picture of how cars of to-day are turned out by mass-production methods. The Mobile Recording Unit is already at work in the factory.

A Freak Report

THE report that a Johannesburg amateur has been picking up the television transmissions—more than 4,000 miles away—is regarded with the greatest equanimity by the B.B.C. engineers.

That the thing may have been done is not disputed, for reports of freak reception from odd corners of the world have been expected ever since the transmissions began. As contributions to the strange history of ultra-short-wave work such reports are interesting; but their true significance cannot yet be determined.

What Did He Hear ?

Meanwhile, confirmation of the Johannesburg feat is lacking; the only programme item to which the distant listener draws attention, viz., a tour of Southampton docks, has never featured in a transmission from Alexandra Palace.

And yet, if he was not hearing London, what *was* he picking up?

A tantalising question.

Seeing and Hearing "Pickwick"

TELEVISION is to provide the world *première* of "Pickwick," Albert Coates' new opera at Covent Garden, excerpts being presented in the Alexandra Palace studios on November 13th; but for most set owners the first radio performance will be on November 30th, when Act I of "Pickwick" will be relayed from the Opera House in the Regional programme. The scenes to be depicted are "The Pickwickians at the Manœuvres"; "Manor Farm, Dingley Dell"; "Jingle's Intrigue," and "The Inn and Sam Weller."

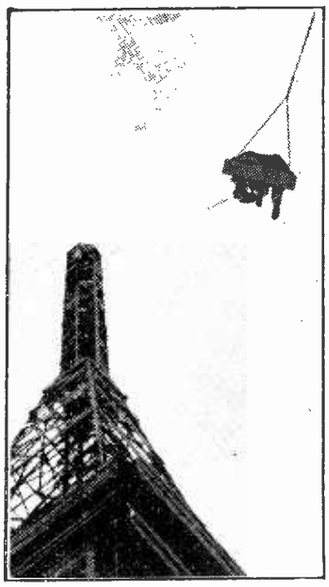
The Players

The part of the immortal Pickwick falls to that fine singer, William Parsons. Stanley Pope plays Snodgrass and Dennis Noble appears as Sam Weller. Aunt Rachel is played by Enid Cruickshank.

Acoustic Tests at Sadler's Wells

ONE of the pleasant reminders that winter broadcasting is back in full swing is the renewal of the operatic relays from Sadler's Wells.

The "O.B." engineers take a lot of care over these broadcasts, and have conducted some interesting experiments in order to obtain the best possible acoustic effects. It is generally realised that orchestra pits in theatres are not ideally placed from a broadcasting point of view, there being a tendency for the stage singers and chorus to overwhelm the instruments, or vice versa, depending upon the position of the microphones.



". . . the camera-man, working under difficulties, makes an impressive "shot" of the Alexandra Palace aerials, during the making of the film.

"Stereophonic" Effects

In the case of the Sadler's Wells broadcasts, the engineers have hit upon a happy solution. The output from the orchestra "mike" is conveyed to a loud-speaker in the Concert Hall at Broadcasting House, where it is picked up by another "mike" to be "mixed in" with the output from the stage. In this way additional resonances are introduced and an almost "stereophonic" effect is obtained.

Airmen in a Variety Bill

AN imaginary aerodrome "somewhere in France" will be the scene of a novel variety programme on November 25th, in which all the artists will be men who have actually served in the Royal Air Force, the Royal Flying Corps, or the Royal Naval Air Service.

The "bill" includes Hugh Wakefield, the stage and film star (who "finished up" as a Wing Commander), Laddie Cliff, Roy Royston (who won the M.C.), G. H. Elliott, the coloured singer, Jack Warman, and many others. Alan Russell and Charles Brewer, who also appear, were Wing Commanders in the R.A.F. The occasion will be a "dud night," when stormy weather makes flying impossible, and the men get together for a rousing "sing-song."

Armed revolt of listeners

UNBIASED

By FREE GRID

The B.B.C.'s Own Scrap Book

I SUPPOSE that a great many of you have been busy of late furtively inserting a knife into the slot of the children's money-box in order to obtain the necessary cash to purchase a television receiver? Undoubtedly the stuff which is coming over is remarkably clear and well-defined considering the relatively short time that television has been an accomplished fact, but this is not, of course, by any means the same thing as saying that it is without blemish.

I think, however, that it is fully as good as were the B.B.C.'s earliest efforts at sound broadcasting way back in 1922, but there is little doubt that ten years hence we shall all raise a laugh at what we shall regard as the crude efforts of 1936 just as nowadays, when we think back to the days of Marconi House, or even of Savoy Hill, we wonder how we put up with the terrible lack of quality associated with the early sound transmissions. I do hope that the B.B.C. will have the sense to stand a cinema camera in front of a television viewing screen and make a permanent record of a typical programme of to-day, so that a decade hence they can stick the film on the air and show us what tremendous advances, both technical and artistic, will have been brought about since the film was made.

It is, I think, a tremendous pity that nobody thought of making gramophone records of the earliest B.B.C. sound programmes, since they would be both amusing and instructive nowadays and serve to silence those critics who believe that no great technical advances in the matter of quality of transmissions have been made during the time that broadcasting has been with us. There is, however, one thing which the B.B.C. might do as a change to the various scrap books which are served up to us from time to time, and that is to re-create for us some of the programmes of the very early days of broadcasting, thus giving us a scrap book of their own.

They surely must have in their archives full details of the items and artistes associated with the earliest concerts, and in any case they could find them in their file copies of the Radio Times. They could in all probability get together a large proportion of the original artistes, and failing that they could obtain help from some of the ancient gramophone discs preserved in the libraries of the big recording companies or, at the worst, they could provide suitable substitutes.

There is only one snag which would prevent the B.B.C. from adopting my suggestion and putting one of their old-time concerts on for us, and that is that the comparison between the bright and breezy programmes of those early days and the efforts of 1936 would be so striking that it would lead to an armed revolt of listeners.

"There Are More Things in Heaven and Earth . . ."

AS most of you know I have from time to time been compelled to say a few unkind things concerning wireless manufacturers and their playful little ways, but I must confess that, as a result of a conversation I had the other day with one of them, it was brought home to me that, when all is said and done, their life is not entirely a bed of roses and they have their trials and troubles like human beings.

The particular annoyance which this manufacturer was telling me about was the trouble there was to gauge accurately the public demand for the various gadgets which are associated with the design of a set. Sometimes, it appears, a certain style of tuning dial will, for some obscure psychological reason, become all the rage, and sets not possessing it degenerate into an absolute drug on the market. At other times some patent tuning indicator which has been in strong demand seems to lose all popularity and becomes useless as a selling point.

The most recent example of the apparent fickleness of the public taste is of such a striking and unusual nature that at first I frankly declined to credit it when my manufacturer friend related it to me, and had not he given practical proof of the truth of his words I should still have been an unbeliever. It appears that for some considerable time past there has been a growing demand for the supply of sets without their cabinets. At first it was not unnaturally supposed that this was an indication that the public were thoroughly fed-up with the design of existing cabinets and were purchasing the chassis alone so that they could put them into cabinets of their own choosing.

As a result of this the cabinet-designing department wallahs were sacked *en bloc* and a new lot engaged, but to the great surprise of everybody this did not have the desired effect. The next move was to farm out the design of the cabinets to world-famous artists and furniture designers, but this, if anything, made matters worse. Eventually it was discovered that several other set makers were in a similar predicament, and they also had not improved matters by engaging highly paid specialists.

At an emergency conference of these manufacturers it was decided to call in the help of an American firm of business efficiency experts which apparently exists for the purpose of finding out who has had the money when a firm goes bust and for doing similar kinds of detective work. The money paid out in paying the rather high fees to this firm proved to be very well spent, however, since they soon had the solution of the mystery all cut and dried. It appeared that the increasing demand for sets without cabinets had been due to the growing popularity of broadcast listening among colonies of what I may term super-nudists which are springing up in certain parts of the country. I use the term super-nudists advisedly, for it seems that there are certain followers of the nudist cult who carry their ideas to such extremes that even their possessions must, where possible, be bereft of their outer covering, and, of course, one of the first articles to suffer was the wireless set.

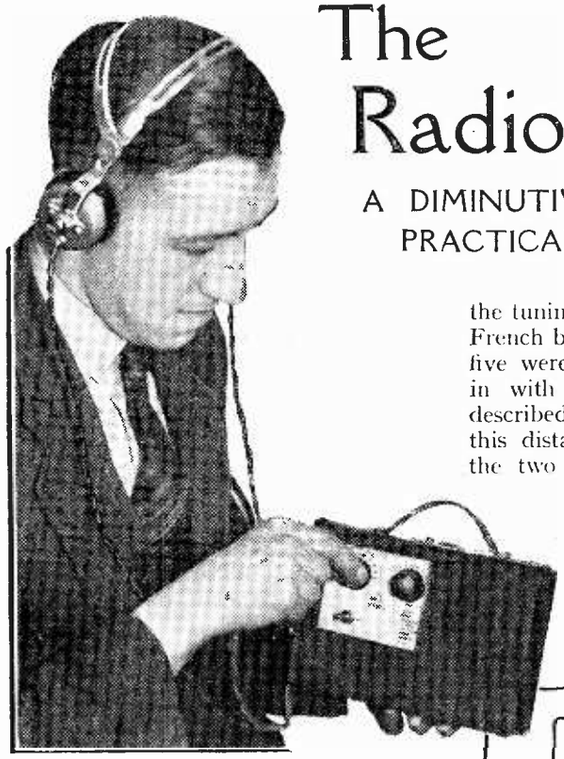
A well-known psychologist who was consulted on the matter explained that, except that it was 180 degrees out of phase, the idea was similar to the early-


180 degrees out of phase.

Victorian fashion for concealment of the nether limbs which certain of the more fanatical of our grandparents carried to extremes by extending to the legs of chairs and pianos, etc., which used to be encased in frilly pantaloons. If, therefore, in future, any of you dealers are asked to sell a chassis only, you will, no doubt, look upon your customer with renewed interest.

The Radio Tourist

A DIMINUTIVE BUT VERY PRACTICAL PORTABLE

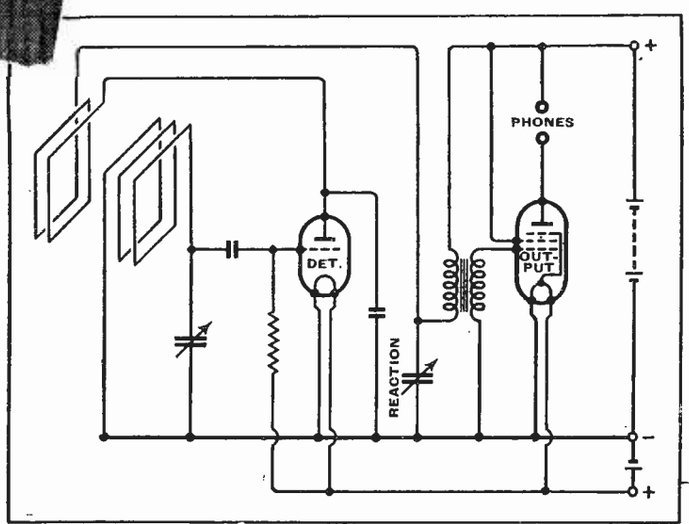


**FEATURES.—*Type.*—*Portable battery receiver for use with headphones.* *Circuit.*—*Triode detector (with reaction)—pentode output valve.* *Controls.*—*(1) Tuning. (2) Volume (reaction). (3) On-off switch.* *Price (with valves and batteries, but excluding 'phones), £3 17s. 6d.* *Makers.*—*Transreceivers Ltd., 444, Ewell Road, Surbiton, Surrey*

THE idea of a wireless set which can be concealed about the person is one which has never failed to stimulate the imagination of the general public. In the "Radio Tourist" a serious attempt has been made to give that idea practical expression. By calling upon the user to forgo on his part one or two of the features to which he has been accustomed in his permanently installed domestic receiver, the makers have succeeded in return in giving a really useful performance.

In the first place the wave-range of the set has been limited to the medium-wave band. This is a wise precaution, as the efficiency of the small self-contained frame-aerial is very much greater on the medium waves than it would be on the long-wave band. Secondly, the set is designed for use with headphones instead of a loud speaker, and as a result the simple two-valve circuit is able to supply all the volume required with a current consumption well within the capacity of the miniature HT and LT batteries.

The set was first tested in a steel-framed building in Central London. It is well known that marked differences in field strength are found within a few feet of each other under such conditions, but by first moving the set about to discover the blind spots to be avoided, no difficulty was experienced in getting good signals from the Brookmans Park stations with a moderate degree of reaction. As soon as the set was taken outside the building, however, a surprising improvement in signal strength was obtained, and at this distance (15 miles) very little reaction was required and very little attention was necessary to the directional properties of the frame in order to obtain full volume in the headphones. Subsequently the set was tried out in the Solent area. Here the tuning scale was predominated by the French broadcasting stations, and at least five were sufficiently strong to be tuned in with certainty by what might be described as casual methods. Even at this distance of approximately 75 miles the two London programmes were still available, though a good deal of attention to the reaction control was necessary, and allowance had to be made for hand capacity effects. The three-valve model with its additional LF stage would undoubtedly give the extra range necessary to ensure regular reception of weather forecasts, etc., along the South Coast, though in skilful hands the two-valve model might be expected to give reasonably good results on the East Coast. It is safer, however, to assess the normal working range of the model under review at 25 to 35 miles from a B.B.C. regional station, according to the degree of skill which is brought to the handling of the set.

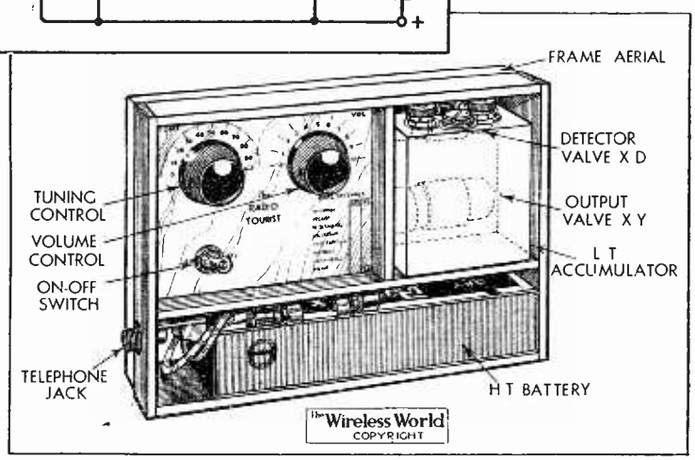


There is nothing freakish in the two-valve circuit, the only deviation from conventional practice being the use of "throttle" reaction control instead of the usual series feed.

The various component parts of the set have been fitted into the Rexine-covered carrying case with considerable skill. Actually the over-all dimensions are $7\frac{3}{4} \times 5\frac{1}{4} \times 1\frac{3}{4}$, and the total weight is only $2\frac{3}{4}$ lb. The chassis occupies about half the available volume, and the panel is sunk so that the tuning knobs and switch are flush with the side of the case. The headphones, which, incidentally, are an extra, are connected through a plug and jack at the side. The fixing screw for the bush of the jack serves also to hold the receiver frame in place. The miniature valves are situated at the bottom of a compartment to the right of the receiver unit, and the LT accumulator fits over them, being separated from the glass by felt pads. At first sight this may seem a rather drastic procedure, but after due consideration we are convinced that it is quite practical, as the weight of the accumulator is small and it fits the case so closely that there is no chance of any movement developing which might cause damage to the valves.

The accumulator is of the jelly electrolyte type and has a rated capacity of 3 amp. hours. As the valves take only 0.2 amp., the continuous service on a single charge should be at least fifteen hours. The HT battery, which is little larger than a grid bias battery, supplies HT current at 36 volts, the consumption, according to measurements made on the model tested, being only 2.3 mA.

Although novel this receiver is no mere toy; its performance is such as to invite long and continuous use.



Letters to the Editor

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

Television Signals at 67 Miles

IT may interest you to know that the television transmissions are audible here at any time during the day from the Baird or EMI transmitters. The vision transmitter is stronger than the sound, which is spoilt by modulation hum, which so far I have been unable to cure, and almost drowns the speech, although the 1,000-cycle note, which is sent out for long periods, is easily audible.

The receiver consists of an autodyne SG frequency changer, three IF stages at 430 kc/s, diode detector, amplified AVC, and a three-stage 10-watt amplifier; aerial is a 74-foot horizontal wire with no down lead, the receiver being approximately 20ft. above ground level. I have not tried a dipole, which should give considerably greater signal strength.

I have also tried a 2-valve frequency changer, consisting of a separate oscillator and using suppressor grid injection to an ACVP1. This, however, was not so satisfactory as the autodyne, although over 10 metres it is much better, and is my normal frequency changer on short waves.

Other transmissions heard and identified by announcement between midday and 7 p.m. have been the second harmonics of JUH, W2XAD and W3XAL, and numerous police transmitters from U.S.A. around 9.5 metres. H. P. STAUNTON.

Felixstowe.

Interference from Rotary Converter

IT has occurred to me that an experience in the use of a DC-AC rotary converter may be of some value to other readers of your journal.

I have not seen the particular matter referred to in your "Hints and Tips" or "Readers' Problems" features, but as many of your readers must be using similar machines, the matter will be of some interest to them.

The difficulty has been to prevent strong interference from the converter when in use with a SW superheterodyne receiver. Although the machine is fitted with a good filter unit and silence cabinet, the interference, which was in the form of a strong machine gun-like ripple, occurred at frequent intervals, completely destroying any signal.

It was discovered that the source of the trouble was one of the brushes on the AC side. None of the usual cures had any effect. Ultimately it was found that the cause was due to the converter being *underloaded*. It is rated at 180 watts output, and was loaded to only 70-80 watts. As soon as a 100-watt lamp was added to the load the trouble ceased, and it has not recurred after three months' daily use. C. W. TIDD.

Sudan.

Operator's Problem

REFERENCE was made in the issue of October 16th of *The Wireless World* to a query you had received from a ship's wireless officer. As an ex-operator myself, perhaps my own experiences will be helpful.

What your correspondent appears to fail to understand is not that the signals from GBR (Rugby) on 18,740 get weaker at night, but that the signal to noise ratio decreases and atmospheric noise sometimes completely drowns signals from GBR during certain hours of darkness, which vary in time with the season and geographical position.

In the days when valve receivers were first supplied to ordinary vessels, as apart from the regular liners, a single valve was the rule, and a very poor one at that. Under good atmospheric conditions GBR was received at night regularly when beyond the daylight range (over 5,000 miles).

Again, with a two-valve receiver GBR was receivable right across the Pacific Ocean both day and night, with the exception of a small area on the 180th meridian during the winter in the Northern Hemisphere, but in summer was unreadable at all hours—being drowned by atmospheric noises—until within about 500 miles north of New Zealand, when conditions became better and signals quite readable.

Of course, there are parts of the world where, owing to high atmospheric noise level, GBR on 18,740 m. is hardly ever readable, whilst GIC on 36 m., with a very much lower power, is a really powerful signal.

The signals from the station GIA on, I believe, approximately 14 m., are very peculiar and seem to vary in different parts of the world in no regular manner, but, unfortunately, my observations of this station were not extended enough to form any definite opinion, and I should be glad to hear any of your correspondents' opinions on this.

Bath. B. M. TOWNSEND.

Television Scanning

CAN you, or any of your readers, tell me whether any attempt has been made to use reflecting surfaces on piezo-crystals for television scanning by direct illumination? I have protected the idea, but don't wish to waste time if it has already been tried and found wanting. R. L. SMITH.

South Shields.

Television Costs

I HAVE read with interest Mr. E. W. A. Mackenzie's letter in your issue of October 16th with regard to "Television Costs."

He has said much of what I have felt for a long time.

I think that if it were possible to take a census, not only from among the readers of your journal but also from among the huge majority of set owners who take in nothing better than the daily papers, it would be found that the most they could afford to spend on the domestic set is between £10 or £12, including the speaker.

For such, television receivers are out of the question; they might as well sigh for the moon.

It is not equitable for them to be called upon to bear the cost of a service the benefits of which they cannot enjoy.

To hark back for a moment to the controversy of a few years ago over the question of licence fees and the proportion withheld from the B.B.C. by the Treasury, you will remember that the fact that these fees were a payment on account of future entertainments was at the time generally stressed by the technical Press.

The legal right of the P.M.G. to withhold more than an amount sufficient to cover the expenses of administration was then questioned as being a diversion of money from the purpose for which it had been subscribed.

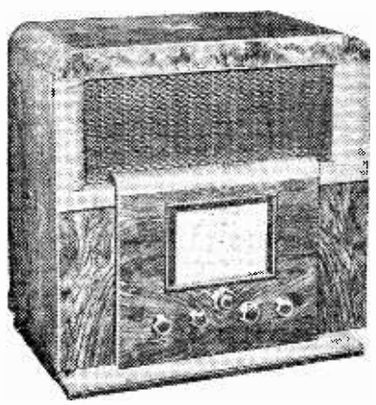
In these circumstances, I cannot help feeling that your editorial of October 16th is based to some extent on a misapprehension of the true position, and it would be of interest to hear what others think.

E. E. S. EARNSHAW-WALL.

London, N.W.2.

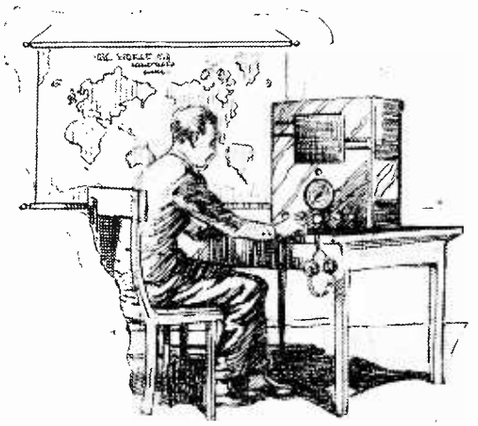
WHERE THE PUBLIC CAN SEE TELEVISION DEMONSTRATIONS

Place.	Particulars.	Accommodation.
Science Museum, South Kensington.	Free...	About 400
Waterloo Station	Free to railway ticket holders (Southern).	About 40
Army & Navy Stores, Ltd., 105, Victoria St., S.W.1.	Free...	Between 30 and 35
Bentalls, Kingston-on-Thames.	Demonstrations shortly.	—
Bon Marché, Ltd., Brixton Rd., S.W.9.	From Nov. 9th for two weeks, in the Restaurant.	—
John Barker & Co., Ltd., High St., Kensington, W.8.	Demonstrations shortly.	—
A. W. Gamage, Ltd., Holborn, E.C.1.	Free...	At least 100
Harrods, Ltd., Brompton Rd., S.W.1.	Free...	About 30
A. Imhof, Ltd., 112, New Oxford St., W.C.1.	Free...	250, in a Concert Hall.
Gramophone Co., Ltd., 98–108, Clerkenwell Rd., E.C.1.	By arrangement with their local H.M.V. dealer, readers of THE WIRELESS WORLD can have free demonstrations.	—
Murdoch, Murdoch & Co., 463, Oxford St., W.1.	Free, by invitation...	40-50
E. Rogers & Sons, Ltd., 56, 58 & 64, High St., Weybridge.	Free...	40
Royal Arsenal Co-operative Society, Ltd., various branches in S. London.	Free...	—
Selfridge & Co., Ltd., Oxford St., W.1.	Free. Appointments have to be booked.	8
Thomas Wallis & Co., Ltd., Holborn Circus, E.C.1.	Free...	40 56
Wm. Whiteley, Queen's Rd., Bayswater, W.2.	Free...	120



POPULAR FIVE-BAND RECEIVER.—The H.M.V. Model 481, which covers three short wavebands (7-16, 16.7-53, and 46-140 metres) in addition to the normal medium and long broadcasting wavelengths. Separate bass and treble controls are fitted. This model, which was inadvertently omitted from last week's classified list of all-wave receivers, is for AC supplies, and costs 18½ gns.

Short-Wave Listening



By "CATHODE RAY"

FOR the guidance of those who may be more or less experienced in medium- and long-wave reception, but are new to the "shorts," I have been pointing out the peculiarities of the latter, which call for a different tuning and listening technique. There is the fact that nearly 95 per cent. of the tuning scale is allocated to non-broadcasting services. And even the broadcasting transmissions, which presumably are the desired "catch," are subject to various special kinds of effects.

Some of the other sorts of transmission are not without a certain amount of interest. In fact, to those taking part in them, the amateur transmissions are, of course, the primary interest, broadcasting being regarded as so much unavoidable padding. Even the broadcast listener may be intrigued by the quaint *lingua franca* that enables amateurs of all nationalities to chat to one another understandably within certain limits of subject matter. But he is unable to sample more than a very dilute form of it, for it is chiefly in morse that this international medium of communication has been developed. The amateur bands are easy to remember, in approximate wavelengths, for, beginning at 160, they are obtained by successive halvings right down to 5 metres. This, by the way, has certain technical advantages. For instance, an aerial designed to respond primarily to 80 metres can be used effectively at 40, 20, etc.

"Machine Gun" Morse

Then there are police transmissions. With a regrettable lack of consideration of the public's entertainment, our own police communicate in code. And it is only during very exceptional conditions that one can join in the excitement of rounding up an American gangster. But over there the ability to "listen in on" the police is held forth as a definite inducement to buy a "Blank" radio.

It is nearly always possible to tune in some of the long-distance telephone conversations. These are fearfully distorted; so much so that, although they usually sound as if attentive listening would enable the words to be distinguished, and (perhaps) some bit of scandal to be disclosed, they remain curiously unintelligible. The conversationists, however, are—or should be, if there is no technical hitch—quite unaware that their voices sound to would-be eavesdroppers like the grunting of pigs, because the authorities obligingly undistort it all again at the receiving end. The technical term for the distorting process is "scrambling."

The various aforementioned varieties of speech, intelligible and otherwise, are decidedly in a minority on the short-wave bands. Both in number and power, morse predominates. And the most prominent transmissions are such that even expert telegraphists cannot make much of them, being high-speed automatic. Even though most of it is unmodulated, and therefore (as one would think) quiet, the keying clicks contrive to make a noise that might be likened to an exceptionally busy pneumatic drill or machine gun. These transmissions carry some of the telegrams that at one time had to go by cable.

Going back once more to intelligible programmes, and considering their afflictions, there is fading. On the longer waves it usually takes from several seconds to several minutes to go through one complete fade. On short waves it seldom takes much more than a second, and commonly much less. The distortion that occasionally takes place on longer waves is also characteristic. The effect of fairly rapid fading, with the background noise consequently coming up each time, produces a sound frequently mistaken by the non-technical listener for the Atlantic billows over which the transmission is passing. It is generally accompanied by changes in the tone of the reproduction very much like that due to periodical mistuning.

More Things Heard on the "All-Wave"

Although it is conceivable that people who live in countries where there are medium- and perhaps also long-wave programmes might turn to short waves for sustained listening, I suspect that the object generally is to identify some far-off station. That being so, there is value in any clues by which to distinguish distant programmes from comparative locals. It is irritating to spend a quarter of an hour listening for an announcement and then finding that the time has been wasted on Daventry or Zeesen.

It is not nearly so easy to form a reliable estimate of distance on short waves as on the longer ones, for strength of reception and fading are very uncertain indications. It is quite common for stations in America or even farther away to be stronger and steadier than those at short range. Daventry at sixty miles often fades badly. But the "seashore effect" is a moderately reliable clue to a distant station. The mistuning or "apparently swinging aerial effect" is an even safer guide. Sometimes by great efforts in precise tuning one picks up an extremely faint and presumably enormously distant programme, only to find with disgust that it is the National or Regional. It is probably a harmonic of the local station. It is as well to make a note of each submultiple of the local station's wavelengths, so as to keep out of this trap. A further safeguard against them, and also such Empire transmissions as are doing the same programme, is to have means of rapid reference to whatever they are sending out at the moment, so as to compare it with the programme under examination.

Globe-Trotting Signals

One of the most remarkable short-wave phenomena that can be observed is a striking illustration of the fact that reception does not become progressively weaker the greater the distance from the transmitter. Occasionally, programmes from the local Empire transmitters, particularly those working on the shortest wavebands, appear to be issuing from a large bare cavern giving such a fearful echo that it is difficult or impossible to make out a word of what is being said. Knowing the care the B.B.C. takes over such matters as studio acoustics, it may not be easy to imagine the cause of such a defect; and it may be still more perplexing to know that the same programme received in Australia or wherever it is aimed at is probably quite normal!

It *is* an echo, but on an enormously greater scale than the usual sort. It is due to waves going round the world, perhaps several times, and arriving at the receiver an appreciable fraction of a second later than those coming direct. Once round the world takes a seventh of a second, but I have heard echoes following at decidedly greater intervals—almost as if a second speaker were butting in. Of course, it is only noticeable under conditions which render the direct wave abnormally weak and the globe-trotting waves exceptionally strong.

If you use your imagination, there is surely something very impressive in such a result as this. You are listening to a speaker whose voice literally runs around the world and echoes to and fro in it. A man is talking, and his auditorium is vastly greater than any the classic orators dreamed of. The last time I heard this world echo, the speaker was soliloquising on the feeling of uncertainty, when talking to the ends of the earth at queer hours of the night, as to whether anybody was really listening. If he could have heard, as I did, the etheric vaults sending back his voice, it surely would have given the right dramatic atmosphere for his words!

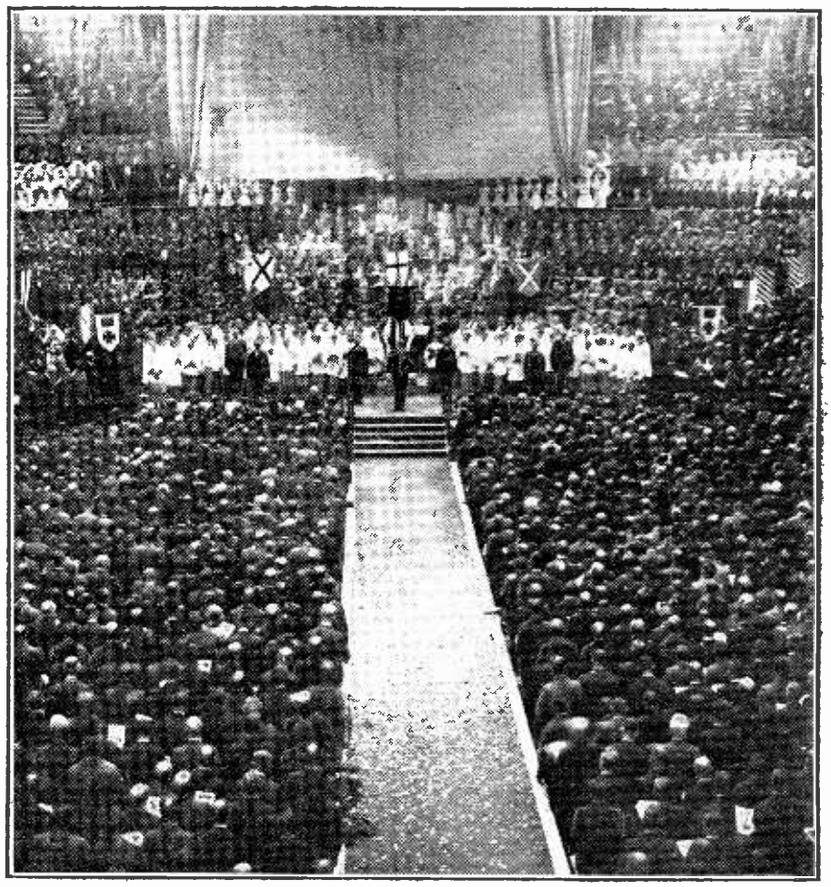
Listeners' Guide for

IT is doubtful whether at any other time during the year there is such unanimity among listeners as on November 11th. Armistice Day is again marked this year by commemorative programmes.

In the morning the ceremony at the Cenotaph will be broadcast. This begins at 10.25 and ends at 11.10, and will be heard on National and Regional wavelengths. The massed bands of the Brigade of Guards will be heard playing appropriate music prior to the Two Minutes' Silence which will be followed by a short service conducted by the Bishop of London.

The evening programmes from 8 to the early closing down at 10.5 will also be radiated by both National and Regional stations. At 8 listeners will be switched over to the British Legion Festival of Empire and Remembrance at the Albert Hall. The programme opens with a fanfare of trumpets by the trumpeters of the Household Cavalry, after which comes the singing of the National Anthem. Then follows the entry of the various sections of the Services. The scenes will be described for listeners by Capt. H. B. T. Wakelam. Immediately following this, at 9.10, a special studio broadcast will be produced by Val Gielgud.

Through the medium of music, poetry and drama, it is hoped to create a period of mental solace for those who suffered loss through the war and for those who hope that war may not come again in their time.



LEST WE FORGET. The scene during a previous Festival of Empire and Remembrance which will, for the seventh year, provide a large part of the Armistice Night programme.

RICHARD STRAUSS

TWICE during this week listeners are to be treated to broadcasts conducted by the great composer, Richard Strauss. He first appears to-night (Friday) at 8.30 and 9.30 (Reg.) conducting his opera "Ariadne on Naxos," played by the Dresden State Opera Company at Covent Garden. The Prologue to this one-act opera has its scene set in a spacious but sparsely furnished hall in the town mansion of a great noble, with the Island of Naxos as the scene for the opera.

On the following afternoon in the Queen's Hall at 3.15 (Nat.) Strauss will be heard conducting the Dresden State Opera Orchestra in a concert of his own compositions, including "Till Eulenspiegel" and "Don Quixote."

MADAME FLORENCE BAGA DE JONG, of the New Gallery Cinema, who will be the first lady to play the B.B.C. Theatre Organ when she broadcasts to-night at 9.40 (Nat.).

ANOTHER SCRAPBOOK

THIS time the collaborators, Leslie Baily and Charles Brewer, have chosen the year 1908 for their eleventh Scrapbook programme to be given on Tuesday and Wednesday at 8 (Reg.) and 7.30 (Nat.) respectively. It was a big musical comedy year, including the "Waltz Dream," "The Merry Widow," and Leslie Stuart's "Havanna." The suffragettes were showing great activity, and the year included the famous trial at Bow Street of Mrs. Pankhurst, Miss Christabel Pankhurst and Mrs. Drummond. These and many other features of 1908 will be presented in this programme.

SPORTS COMMENTARIES

FROM the Empire Pool and Sports Arena, Wembley, Lionel Seccombe will give a punch-by-punch description at 9.35 on Monday of the match between John Henry Lewis (the holder) and Len Harvey for the Light-Heavyweight Championship of the World.

On the following evening what is undoubtedly the fastest game will provide a commentary for Regional listeners at 9.30. It will be the occasion of the ice-hockey match between Earl's Court All-Stars and Toronto Dukes in the Empress Stadium, Earl's Court.

THE DEAF HEAR

Wireless World readers are familiar with the work of the Department of Education of the Deaf at the University of Manchester by reason of the articles which have appeared in the pages of this journal. A talk on this work entitled "Science is Helping the Deaf" will be given by Irene R. Ewing for National listeners on Thursday at 8.15.

ADVERTISING

"THAT advertising is a burden to industry and harmful to the community," is the motion on which a debate takes place on Saturday at 9.20 (Reg.). The proposer will be C. P. Snow, Fellow and Tutor of Christ's College, Cambridge, and he will be opposed by Barrington Hooper, a well-known publicist, whose activities have included the organisation of the War Bond Tank Campaign in 1916, the Victory Loan, and the Food Economy campaign. Sir Michael Sadler will be chairman. The subject is a very controversial one, and this debate should be listened to by all who enjoy a battle of wits.

Details of the week's Television programmes will be found on p. 478.

the Week

Outstanding Broadcasts at Home and Abroad

HIGHLIGHTS OF THE WEEK

FRIDAY, NOVEMBER 6th.

Nat., 5.15 The Continentals. 6.25, Recital: Mrs. Tobias Matthay (poetry) and Tobias Matthay (piano). 8, The White Coons.

Reg. 6, Alfredo Campoli and his Orchestra 7.30, Savoy Hotel Orpheans. 8.30 and 9.30, The Dresden State Opera.

Abroad.

Radio-Paris, 8.45, "Le jour et la nuit," three-act opéra-bouffe.

SATURDAY, NOVEMBER 7th

Nat., 3.15, Dresden State Opera Orchestra. 6.45, Brian Lawrence and his Dance Orchestra. 7.30, "In Town To-Night," 9 20, Music Hall, including Billy Bennett, and Wee Georgie Wood.

Reg., 4.15, The White Coons. 7.30, The Broadhurst Septet. 10.25, Henry Hall's Hour.

Abroad.

Kalundborg, 7.40, A Trip round Copenhagen's Restaurants and Amusement Centres.

SUNDAY, NOVEMBER 8th.

Nat., 5.30 The Prague String Quartet. 6.30, "The Table Under the Tree." 7.55, Service from St. Martin-in-the-Fields

Reg., 5, Callender's Senior Band. 6, The Vienna Wireless Orchestra—from Vienna. 6.30, Sunday Orchestral Concert

Abroad.

Leipzig, 7, Leipzig Symphony Orchestra—opera and light music.

MONDAY, NOVEMBER 9th.

Nat., 7.20, "The Music Shop"—III. 9.20, The Lord Mayor's Banquet.

Reg., 6.40, From the London Theatre. 8, From Jungle to Jazz. 9.35, Boxing Commentary

Abroad.

Strasbourg, 9 Soudant Society's Concert from the Salle Braun, Metz.

TUESDAY, NOVEMBER 10th.

Nat., 6.25, 'Cello Recital: Anthony Pini. 7, "Feminine Fame." 9.40, "The March of the '45."

Reg., 7.30, B.B.C. Dance Orchestra. 8, Scrapbook for 1908. 9.30 Ice Hockey Commentary

Abroad.

Paris PTT, 8.30, "Boris Godunov" from the Salle Pleyel.

WEDNESDAY, NOVEMBER 11th.

Nat., 10.25, a.m., Relay from the Cenotaph. 7, B.B.C. Orchestra (E) and William Parsons. 8, Festival of Empire and Remembrance from the Albert Hall.

Reg., 6, B.B.C. Dance Orchestra. 7.50, "The World Goes By."

Abroad.

Strasbourg, 8.30, Armistice Day concert from the Palais des Fêtes.

THURSDAY, NOVEMBER 12th.

Nat., 6.40, "The Young Broadcasters" 7.30, Scrapbook for 1908.

Reg., 7.30, Variety—Fiftieth Broadcast from the Empire Theatre, Belfast. 8.30, "The March of the '45."

Abroad.

Munich 9.40, German Folk Songs.

"THE MARCH OF THE '45"

THE North and Scottish Regional stations are combining in the revival of D. G. Bridson's feature programme, with the above heading which was broadcast last February. It is to be given on Tuesday at 9.40 (Nat.) and on Thursday at 8.30 (Reg.). It takes the form of a radio programme in verse and song, in which the march of Prince Charles Edward is followed from the landing at Loch Nan Uamh to the final defeat at Culloden. Part I comes from Scotland, Part II from the North, and Part III is shared by the two Regionals.

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FROM MOSCOW

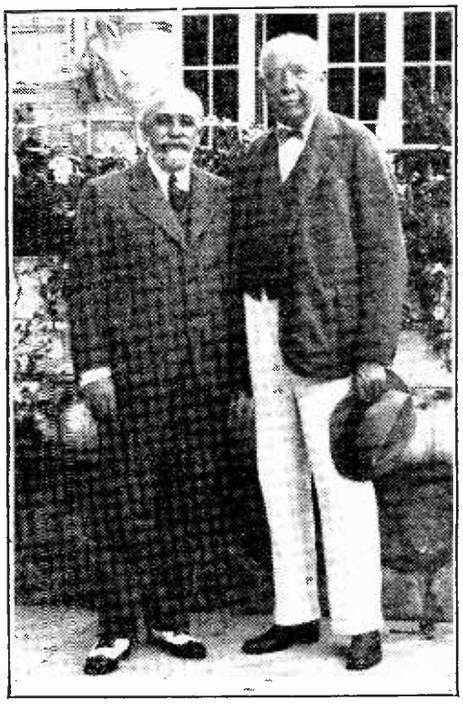
TO-NIGHT (Friday) being the eve of the nineteenth anniversary of the October Revolution, Moscow will be ablaze with light and colour. Hundreds of thousands of its citizens will be parading the streets, rejoicing on this anniversary. Short descriptions in English of the scenes will be broadcast from 9-10 by Moscow. Between these descriptions will be heard some of the bands, national dance music and popular songs with which the streets will be ringing.

OPERA

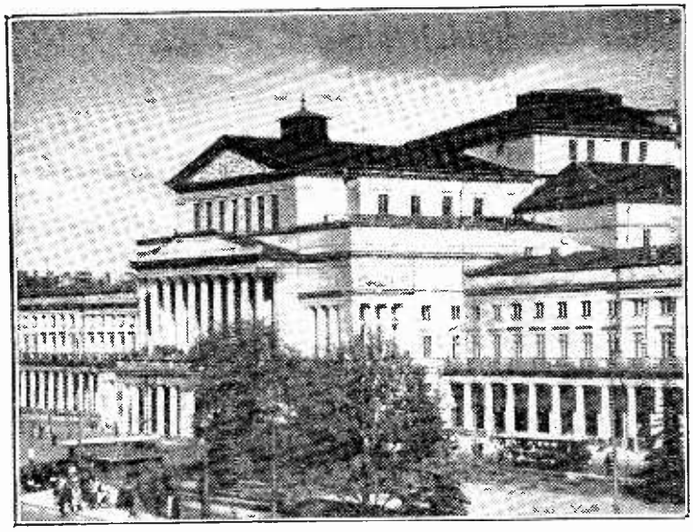
ON Friday (tonight) Warsaw honours a national composer, Kurpinski, by relaying "The Forester of Kozienica" at 7.15. Frankfurt and Stuttgart offer a magnificent performance of Verdi's "Othello" at 11 the same evening by the cast of La Scala, Milan.

Radio-Paris gives the delightful "On ne badine pas avec l'amour" by Pierné at 8.45 on Saturday. Mussorgsky's famous opera "Boris Godunov" will be given by Paris PTT and other French stations at 8.30 on Tuesday.

Frankfurt and Stuttgart on Wednesday night at 11 again offer a recorded version of a classical opera. This time it is Mozart's "The Magic Flute."



RICHARD STRAUSS, here seen with M. René Chauvet (left), Director of the Vichy Casino, will twice this week be conducting the Dresden State Opera Orchestra.



THE OPERA HOUSE, WARSAW, whence will be heard Kurpinski's "The Forester of Kozienica," relayed by Warsaw.

For those who may wonder why November 7th is the anniversary of the *October* Revolution, it is perhaps worth mentioning that Russia was using the Old Style calendar at that time.

VIENNA

A NEW series of Adult Education programmes will be launched by the Danish broadcasting organisation on Sunday at 8.10 under the heading of "World Cities Described in Word and Music," and the first city to be dealt with will be Vienna. The broadcasts will take the form of lectures with "incidental" music.

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THE REFORMATION

FOUR hundred years have passed since the Reformation took place in Denmark and tonight (Friday) Kalundborg relays a concert of ecclesiastical music at 7.10 from the ancient cathedral Vor Frue, of Copenhagen.

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DANISH "IN TOWN TONIGHT"

THE Scandinavian countries are always keeping a close watch on the B.B.C., with the result that British broadcasting ideas are very often adopted by Scandinavian programme directors. The latest is that Denmark has found it worth while trying the "In Town Tonight" feature in Copenhagen on Wednesday at 8.45.

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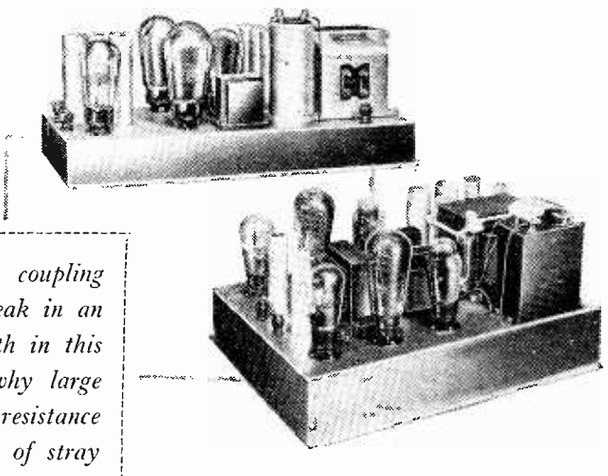
BIRTHDAY CONCERTS

FROM Berlin on Sunday at 7 comes a concert in honour of the seventieth birthday of Paul Lincke, who is the most popular composer of light music and operettas in Northern Germany.

Another septuagenarian birthday concert comes from Frankfurt on Thursday at 10. This time it is in honour of Georg Schumann, who will conduct the station orchestra.

THE AUDITOR.

Resistance-Coupled Amplifiers



Part II.—The Coupling Condenser and Grid Leak

THE action of the coupling condenser and grid leak in an RC amplifier is dealt with in this article, and it is shown why large values of capacity and resistance are necessary. The effects of stray circuit capacities are also considered.

AS explained in Part I, it is customary to join the anode of one valve to the grid of the next through a condenser in order to isolate the grid from the HT supply. A grid leak is also used to permit the application of grid bias to the second valve. This arrangement is shown in Fig. 4, and it is in regard to the action of the new components C1 and R2 that much confusion arises. It is, for instance, commonly stated that the capacity of the condenser and the resistance of the grid leak must be large if the lower frequencies are not to be attenuated. This is quite correct, but a large capacity and a high resistance mean that the time constant of the combination is high, and it is often believed that this will prevent high frequencies from being dealt with faithfully. This idea is quite erroneous, but there is some excuse for its prevalence since it is admittedly sometimes difficult to see how a circuit with a high time constant can deal with the rapidly changing potentials found at high frequencies.

It is consequently necessary to investigate the circuit in some detail, and to do this we shall go back to first principles and see what happens in the various parts of the circuit. Consider first of all the arrangement of Fig. 4 under static conditions. The voltage and current distribution around V1 are exactly the same as in the case of the simpler circuit of Fig. 1 (Part I), for the new components C1 and R2 in no way affect the direct current circuit of V1. Using MHL4 valves with −4 volts grid bias and 290 volts HT as before, therefore, the anode of V1 is at a potential of 146 volts with respect to its cathode when R1 has a value of 25,000 ohms.

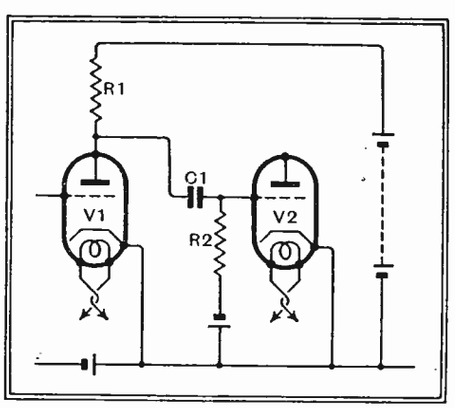


Fig. 4.—A typical RC coupling, showing the coupling condenser C1 and the grid leak R2.

Now, the grid of the second valve is returned to its cathode through the resistance R2 and the bias battery, which we shall again assume to be −4 volts. As the valve receives a negative grid bias it does not pass grid current, and there is no current flowing through R2; the bias on the valve is consequently unaffected by the value of R2 and is equal to the voltage of the battery. We can, therefore, make R2 any value we like without affecting the bias on V2.

It will be observed that, since the left-hand plate of C1 is joined to the anode of V1 and the right-hand plate to the grid of V2, the voltage existing across it is the difference between the anode and grid voltages measured with respect to the earth line. In the case which we are using as an example, the voltage across C1 is thus 146 − (−4) = 146 + 4 = 150 volts. The condenser is consequently charged and stores a quantity of electricity, the exact amount depending upon its capacity and upon the voltage across it.

Now suppose that we change the grid potential of V1 by a fixed definite amount; suppose we change the bias to −2 volts. We know from Part I that V1 will pass a greater anode current and that its anode voltage will be lower; actually the current will rise from 5.76 mA. to 6.87 mA., and the voltage will fall from 146 volts to 118 volts. The conditions in V2, however, are not affected in any way, but there is now a potential of only 122 volts across C1, and it consequently stores a smaller quantity of electricity than before. The conditions as regards V2 are exactly the same before and after the change, but are they the same while the change is actually taking place?

While the anode current of V1 is increasing in value, the potential of the anode and hence the voltage across C1 are falling. But the electricity stored in a condenser cannot be discharged instantaneously; a certain time is always needed for the discharge of a condenser, and the larger the capacity, and the higher the resistance of the path through which it must discharge, the longer it will take.

The Coupling Condenser

Now if R2 is of very high value, so that the total resistance between the two sides of the condenser is very large, the condenser cannot change its charge quickly. When the anode potential of V1 falls, therefore, the potential of the left-hand plate of C1 changes in a negative direction, that is, electrons flow into it. Electrons are consequently repelled from the right-hand plate, leave it and accumulate on the grid of V2. We see that when the anode potential of the valve changes in a negative direction, that is, falls, the left-hand plate of C1 acquires a negative (or less positive) charge, and the right-hand plate an equal positive charge. The grid of V2 is not at the same potential as the right-hand plate, but at an equal and opposite potential, for the electrons driven out of the right-hand plate, by virtue of which it becomes positive, must accumulate on the grid and make it negative, for if R2 is infinite there is nowhere else for them to go. When R2 is not infinite a certain proportion of them escape through it, and the voltage on the grid of V2 is reduced.

It can thus be seen that while the grid potential of V1 is being changed so that the anode current is rising and the anode voltage falling the grid potential of V2 is also changing and moving in a more negative direction so that the anode

Resistance-Coupled Amplifiers—

current of this valve falls and its voltage rises. When the change is accomplished, the conditions in V1 settle down to new values, and the electrons accumulated on the grid of V2 gradually leak away through R2 so that the grid potential of this valve returns to its normal value. It will, of course, be clear that had the initial change of grid voltage to V1 been taken in the opposite sense the changes throughout would also have been opposite.

The conditions are illustrated diagrammatically in Fig. 5. The initial grid and anode potentials are represented by the lines *a* and the final potentials by the lines *b*. The changing conditions are represented by the lines joining the *a* and *b* lines. Two sets are shown for the grid potential of V2, for large and small values of C2 and R2, and it will be seen that with large values the grid potential tends to remain at a different value for an appreciable time before returning to normal.

Now, in practice we are concerned with alternating current of various frequencies; neither current nor voltage is steady, but is continually changing in value. It is, therefore, not difficult to see that the grid of V2 can faithfully follow the anode voltage excursions of V1. As long as the grid voltage of V1 is changing the anode voltage of this valve is changing, and there is consequently a varying electron flow into or out of the left-hand plate of

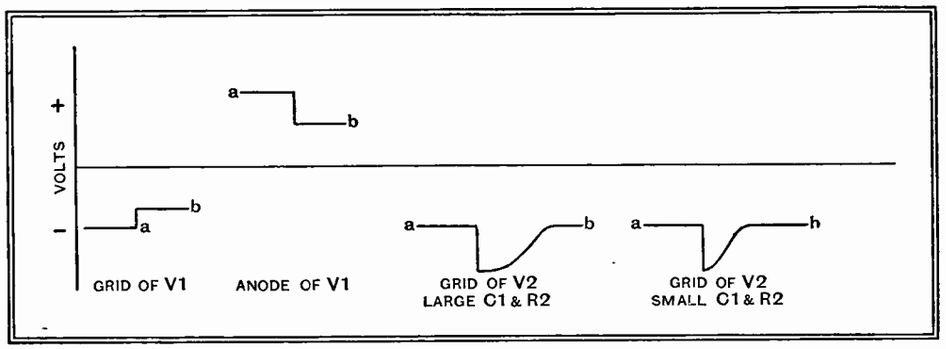


Fig. 5.—The voltage changes on a valve are clearly shown here. If the grid voltage is changed from (*a*) to (*b*), the anode voltage changes in the opposite sense. The grid voltage change of the following valve depends on the values of the coupling components and varies in the manner shown.

C1. As a result electrons are repelled from or attracted to the right-hand plate in a varying degree and move to and from the grid of the valve, the potential of which varies in a negative or positive direction. This process is carried out to perfection if R2 is infinitely high in value or if C1 is of infinite capacity, for then the full number of electrons which move in or out of C1 affect the grid and there is no loss through R2.

In practice R2 is necessary, but the loss in it is negligible if the values of R2 and C1 are large enough, for it takes time for the charge to leak away. If the time constant (R2 C1) is large compared with the time taken by the signal impulse which it is desired to amplify, then R2 has a negligible effect. This is easily seen, for if R2 were infinite, and the grid potential of V1 were changed to a new fixed value, then, as already explained, the grid potential of V2 would change, but it would remain indefinitely at that new value, for the charge on the grid would have nowhere to leak away. In practice, of course, an infinite value for R2 is impossible, for there is always some leakage across the valveholder and valve itself. It is, however, quite possible with a little care to insulate the grid of V2 so well that it will hold a charge for several seconds at least. For reliable operation, however, it is necessary to avoid extremes in component values, and R2 must be given a value much lower than the insulation resistance of other components. If this is not done the operation will be inclined to vary from day to day, since the insulation resistance is likely to vary with the humidity of the atmosphere.

Efficiency of the Coupling

It is not generally convenient to work in terms of the circuit time constant, for the reason that calculation of circuit values is much more easily carried out by means of impedance calculations on the assumption that the voltage variations follow a sine law. On this basis, which is equally accurate, the coupling efficiency given by C1 and R2 is equal to $R2/\sqrt{R2^2+1/\omega^2C2^2}$ where $\omega=6.28$ times the frequency. When inserting values, resistance must be in ohms, capacity in farads, and frequency in cycles per second, and indeed this holds for all equations unless otherwise stated.

Under normal operating conditions it is not possible to use too large values for C1 and R2, unless, of course, the valve maker places a limit to R2. However large they may be, the performance will not deteriorate at any frequency. Under abnormal conditions, however, large values may be a disadvantage. If too large a signal is permitted to reach the grid of V2, this valve may pass grid current and the condenser C1 will acquire a charge. The grid potential will become much more negative than usual and, as long as the charge on C1 lasts, V2 may have such a heavy bias that very serious distortion results. The time which the charge lasts depends on the time constant R2C1, and the smaller this is the quicker will the charge leak away and normal operation be restored.

When an amplifier is properly operated on broadcast transmissions, the input to a valve should never be large enough for this effect to occur, and experience shows that it is possible to use large enough values for the components to enable the response to be maintained down to as low a frequency as 20 c/s without any trouble from this effect. For distant reception under conditions of bad atmospheric or severe local interference, however, it is another matter, and with large values for R2 and C1 a sudden peak of interference may easily overload a valve so that it passes grid current, and the receiver may then be momentarily paralysed. If several such peaks of interference follow one another the set may be almost out of action until they have passed. The effect has, however, the advantage of acting as a volume limiter on very severe interference.

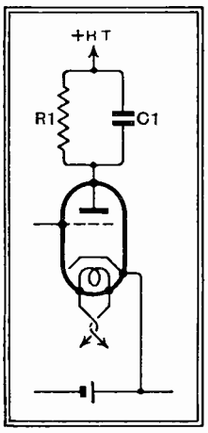


Fig. 6.—The stray capacities can be represented by a condenser C1 in parallel with the coupling resistance.

At low frequencies the response of the amplifier is determined by the relative values of the coupling condenser and grid leak, and, as already explained, there is no difficulty in making the loss negligible at the lowest frequency required. This portion of the coupling can cause no loss at high frequencies, and the upper limit of response would consequently extend indefinitely were it not for the effects of stray capacities. It is inevitable that there should be some capacity shunting the coupling resistance, and this is made up of the anode-cathode capacity of V1, the grid-cathode capacity of V2, and the stray wiring capacities.

We can represent these capacities with sufficient accuracy by shunting R1 of Fig. 1 by a condenser; this gives us the arrangement of Fig. 6. Under static conditions, the capacity C1 has, of course, no effect, and the voltage between its plates is that across R1, perhaps 144 volts, to take the example we have been using. Now suppose that the grid voltage is changed suddenly to a new value such that the anode current would rise and the anode voltage would fall from 146 to 118 volts if C1 were absent. This means that the voltage across R1 would rise to 172 volts. As soon as the voltage across R1 rises, however, C1 starts to take current, for, with a higher voltage applied to it, it can hold a greater quantity of electricity. This current must come from somewhere, and it actually comes through the valve. Instead of the valve current being equal to that through the resistance it is equal to the sum of the current through the resistand and the current taken by the condenser. Although the valve current may be slightly larger than if C1 were absent it is true to say that the condenser robs

Resistance-Coupled Amplifiers—

the resistance, and the current through the latter is less than it would be if C1 were not connected across it. Hence the voltage drop across it is also less.

This refers only to the instantaneous condition, of course, but it is easy to see that the whole time the grid voltage is changing and the anode current is rising the condenser is taking current, and the changing voltage across C1 is less than if this component were absent. When the grid voltage is changed in the reverse direction the anode current falls, and the voltage across R1 falls also. The condenser C1 must then reduce its charge by discharging through R1, and this naturally means that the current through R1 does not fall as rapidly as it should.

After a small fraction of a second these effects disappear, and if the grid voltage be held at its new value the voltage and current distribution will be the same as if C1 were not present. Under normal operating conditions, however, the input to the valve is continually varying, so that C1 always plays some part. If the input voltage changes slowly so that the condenser is given time to adjust its charge, then it has a negligible effect. But if the grid voltage changes are very rapid the condenser charge can only change a little before that half-cycle is over and the next, of reverse polarity, comes along and tries to make it vary in the opposite direction. The charge on the condenser cannot then change rapidly enough to keep up with the grid voltage changes on the valve, and, in consequence, the voltage changes across R1 are not as large as they should be.

It can be seen, therefore, that if the response is to be maintained at high frequencies the condenser must be able to change its charge very rapidly. The ease with which it can do this depends on its capacity and upon the value of the various resistances of the circuit, and the larger these are the slower is it in responding to variations in current.

THE RADIO INDUSTRY

TEWKESBURY ABBEY has recently been wired for sound reinforcement; a G.E.C. 14-watt speech amplifier is used, together with two moving-coil microphones, two projector speakers and two small cabinet speakers.

Exclusive designs for cabinets are shown in a new catalogue issued by Halford Radio, 39, Sackville Street, Piccadilly, W.1. These designs include examples of modern and "period" styles.

Reception of Sir Malcolm Campbell's television broadcast was carried out on a large scale by Marconiphone in the Exhibitors Club at Olympia during the recent Motor Show. The demonstration was witnessed by about 120 people.

RANDOM RADIATIONS

By "DIALLIST"

Record Range for A.P. ?

THE report (so far unconfirmed) that a Johannesburg amateur has received signals from the Alexandra Palace raises a whole crop of interesting points. It is stated that so far from being feeble the signals were as strong as those normally picked up from the Daventry Empire transmitters. Though there is no doubt that intervening hills and even buildings can act as very effective screens to ultra-short-wave transmissions, the original belief that these waves are quasi-optical in character seems no longer completely tenable. Reception from the London Television Station has, in fact, been reported from Bournemouth and several other localities in which, theoretically, it should not have been possible. A long time ago I predicted in these notes that when more experimental work had been done on the ultra-shorts it might be found that impulses reappeared again outside a "skip area." That is what seems to have happened. Future investigations may tell us the size of the skip area, and whether it varies at different times and seasons.

Is D X Television Possible ?

Ten years or more ago, when television was in its early infancy, it was boldly foretold that ere long we should be able to "look-in" at test matches in Australia. This idea was ridiculed, particularly when it became evident that the future of television was inseparably bound up with the ultra-short waves. But now that transmission on wavelengths as low as 5 metres have been received at enormous distances, does world-wide television become a possibility? One understands that outside the normal service area of 30 miles or so synchronisation becomes more and more of a problem. The Johannesburg experimenter has not a television receiver, so that it is not known whether the synchronising pulses would be adequate in South Africa.

"An Operator's Problem"

SEVERAL correspondents have been kind enough to send me suggested explanations of a problem mentioned in these notes some weeks ago. It may be remembered that a ship's wireless officer reported that at distances over about 1,500 miles the 18,750-metre signals from Rugby were well received in daylight but poor, or even quite unreceivable, after dark. He asked whether anyone could give a reason for this. One reader suggests that "normal behaviour," that is, almost equally good reception at all times, is the property of only a limited band of wavelengths between, possibly, 1,000 and 5,000 metres. As you reduce the wavelength below 1,000 metres the effects of daylight and darkness become more and more noticeable. He thinks that similar queer goings-on are to be expected as you increase the wavelength above what may be called the upper limit of normality. Reducing the wavelength brings you nearer and nearer to the frequencies of light; increasing it takes you farther away from light and closer to sound. What are your views?

Battery Standardisation

IT seems to me rather a pity that those who design battery sets can't come to some agreement about the working HT voltage. As it is we have all kinds of queer voltages required by different sets: 120 (including grid bias), 120 (not including grid bias), 135, 150, 165, and so on. Battery valves are pretty well standardised; most makers publish replacement lists showing which of their valves will do the same work as the equivalent product of other makers. This being so, the same working HT voltages should be satisfactory all round. It would be a great advantage to set users if all portables were designed for a 120-volt HTB and all non-portable sets for, say, 150. There would then be no trouble about getting a replacement battery anywhere when one was required. It would also be a boon if agreement could be reached about matching the capacity of the HTBs supplied with sets or needed for renewals to the load imposed on them; say standard capacity for loads up to 8 milliamps, medium capacity for those between 8 and 12 milliamps, and large capacity for bigger loads. Running costs would then be far easier to work out.

Little Pictures, Loud Noises

WHILST engaged in watching reception of the television programmes in recent weeks, I've been rather struck by the incongruity of presenting Lilliputian human figures on the viewing screen and providing them with Brobdingnagian voices! This defect was first pointed out in a leader in *The Wireless World* as far back as April, 1935. The other day, for instance, I watched Miss Jasmine Bligh and Mr. Leslie Mitchell having a dancing lesson. The televised Miss Bligh was, I suppose, some four inches in height, but when she opened her minute lips the loudspeaker endowed her with a voice that was rather more than full sized. Strictly speaking, I take it, we should reduce the sound to match the image, or magnify the image to suit the sound. Neither of these alternatives is, however, quite practical politics. Luckily, the human eye and ear are very accommodating in their association. After a while one ceases to notice anything very peculiar about a midget dance band producing volume enough to fill a biggish room, or a tiny motor car, no bigger than a nursery toy, having an ear-splitting exhaust roar.

Keeping a Check on Valves

FEW of us in practice keep sufficient check on the condition of our valves, and that is rather a pity, for a "tired" valve can ruin the performance of any set. It is very easy to discover whether your valves are up to the mark or not if you care to make up a little testing panel such as I constructed years ago. In its simplest form for triodes it consists of a valve-holder and four pairs of terminals. The first pair are for a plate-circuit milliammeter, the second for a 100-volt high-tension battery, the third for a 2-volt (or 4-volt) accumulator, and the last for a grid battery. The important thing to know about valves is the mutual conductance, which is found by dividing the change in grid volts into the change in plate current. Now suppose that we take a reading of the milliammeter with the grid at zero volts and then make the grid one volt negative and re-read; it is obvious that the mutual conductance is the difference between the two readings (change in plate current), since the divisor (change in grid volts) is one.

Obtaining 1-volt Negative

Thinking for the moment of battery valves, how is one to obtain a negative bias of one volt on the grid? Actually it's quite easy, without using any special kind of cell. Use a 3-volt dry grid battery and connect its positive to LT positive. Then the grid potential is +2 volts −3 volts = −1 volt. A simple switching arrangement enables you to turn instantly from zero grid bias to one volt negative. My suggestion is that a valve when brought into service should be tested in this way and its mutual conductance noted on a piece of stamp edging stuck on to bulb or cap. There's then no difficulty in seeing how it is getting on when it is re-tested under similar conditions in, say, six months' time.

The Importance of Band-spreading

THE other evening I was at the house of some friends, who complained that they had never yet heard an American station on the short-wave range of their "all-wave" set installed a month or two previously. Could I show them how it was done? I *did* succeed in getting W2XAD at good loud speaker strength, but it is some years since I have had to do so difficult a feat of fine tuning. The slow-motion dial wasn't so very slow and, what was worse, it had a serious amount of back-lash. As the set had no RF stage, and wasn't particularly sensitive, you can imagine what I was in for! Just to see what would happen, I told them the setting of the station as near as it could be read on the rather small dial and asked them to try their hands at tuning it in. They failed completely to find it at all! I am quite sure that any "all-wave" receiver intended for use by the ordinary man or woman should have effective band-spreading on the short waves. Absence of this is apt to mean that the short-wave range is given up as too hopelessly difficult by Mr. and Mrs. Everylistener.

Period Pieces

MY fancy is always immensely tickled when I read of such a thing as a Jacobean wireless set or a Chippendale radiogram. One pictures the gay Stuarts twiddling the knobs, imagines Mr. Samuel Pepys as Director Generall of the Brittish Broadcastinge Corporacion (of which high post he would have made no small success), or dreams of the great Doctor Johnson discoursing to Mrs. Thrale on the curse of crooning! "Crooning, Madam," he might have said, "is the noise produced by those who cannot sing but will. 'Tis said that swans sing before they die; it were no bad thing could these crooners die before they sing."

Radiogram, by the way, is a queer word that has entirely changed its meaning in recent years. It used to mean a telegram sent by wireless. If I remember aright, they were called Marconigrams first, and, later, radiograms. What is the correct term nowadays I don't think I know. But I did hear one man say the other day that he had received a wireless cablegram—which, somehow, didn't seem quite right.

Scottish Regional and Burghead

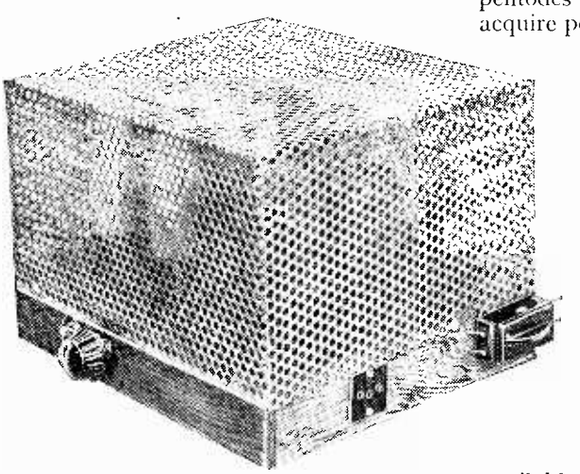
I QUITE expected to find "common-wavelength wobble" pretty badly in evidence when I tuned to the Scottish wavelength of 391.1 metres, which is now shared by the 60-kilowatt Scottish Regional and the 70-kilowatt Burghead. Rather to my surprise, there is no sign of anything of the kind at my home in Hertfordshire. Reception of the Scottish programmes, whether in daylight or after dark, is, in fact, just what it was before the Burghead station came into operation. I daresay, though, that in other localities things are not so good. How, I wonder, are listeners faring in the neighbourhoods of, say, Perth or Fort William? Will readers in those parts tell us? It's curious how, in some places at any rate, reception is quite good from fairly distant stations which are conducting synchronous working. I notice, for instance, no wobble on 203.5 metres, where Bournemouth and Plymouth are partners, and, on 251 metres, Frankfort manages successfully to drown all signs of five smaller German stations.

In Next Week's Issue

THE NEGATIVE FEED-BACK AMPLIFIER

Quality Equipment for AC/DC Mains

HITHERTO it has been a matter of extreme difficulty to secure high quality reproduction from apparatus operating from DC supply mains owing to the low HT voltage available.



The amplifier is enclosed in an earthed metal screen to prevent any risk of shock.

This low voltage necessitates the use of pentode output valves on account of their high efficiency and the small grid bias which they require, and the drawbacks attached to the pentode are well known.

By the application of the principle of negative feed-back, which is treated elsewhere in this issue, the disadvantages of pentodes are largely removed and they acquire performance characteristics similar to those of triodes while retaining the efficiency and low grid bias of pentodes. A considerable improvement in the standard of reproduction thus follows its application.

In the Negative Feed-Back Amplifier, two pentodes are used in push-pull in the output stage, and provide a good 3 watts output. Two triode AF stages are used, so that adequate amplification is provided for the use of even insensitive types of gramophone pick-up and the more sensitive microphones. Where a sensitive pick-up is available, provision is made for connecting it after the first AF stage.

The Amplifier is self-contained and operates from AC or DC mains of from 200 volts to 250 volts.

LIST OF PARTS

2 Smoothing Chokes, 10 henrys, 210 ohms, 120 mA. **Wearite HT11**

1 LF transformer, 1 : 3½ **Ferranti AF5(CS)**

Condensers

2 1 mfd. non-inductive, 200 volts DC working **T.C.C. 50**
1 0.1 mfd., tubular **T.C.C. 250**
1 0.01 mfd., tubular **T.C.C. 300**
2 50 mfds., 12 volts, electrolytic **T.C.C. FT**
5 8 mfds., 450 volts, electrolytic **T.C.C. 502**

Resistances

½ watt	Dubilier F½
2 100 ohms	1 10,000 ohms
1 1,000 ohms	2 30,000 ohms
1 2,000 ohms	2 50,000 ohms
2 5,000 ohms	

10 watts

1 80 ohms **Bulgin AR80**

1 Volume control potentiometer, tapered, 500,000 ohms **Reliance SG**

1 Switch, SPDT **Bulgin S81T**

4 Valve-holders, 7-pin (without terminals) **Clix Chassis Mounting Standard Type V2**

1 Valve holder, 5-pin (without terminals) **Clix Chassis Mounting Standard Type V1**

1 Valve holder, 4-pin (without terminals) **Clix Chassis Mounting Standard Type V1**

1 3-pin plug and socket **Belling-Lee 1119**

1 Fused mains input connector with 1 amp. fuses **Belling-Lee 1114**

2 Lengths screened sleeving **Goltone**

5 Ebonite shrouded terminals, E(1), PU(4) **Belling-Lee "B"**

2 Screened connectors **Bulgin P64**

Paxolin baseboard, 10×11×¼in. **Micanite and Insulators**

Miscellaneous:—

Peto-Scott or Scientific Supply Stores

2 ozs. No. 18 tinned copper wire; 4 lengths systoflex; piece of copper foil; wood; perforated zinc cover 11×10×6½in., etc. (The Paxolin baseboard already drilled is also available.)

Screws: 8 No. 4 ¾in. c/sk; 4 No. 4 ⅜in. r/hd., 36 6BA ½in. r/hd., 2 6BA 1¼in. r/hd., all with nuts.

Valves

2 Pen. 3520, 2 HL1320 **Mazda**
1 UR1C **Mullard**
1 Barretter C2 **Philips**

PRINCIPAL BROADCASTING STATIONS OF EUROPE

Arranged in Order of Frequency and Wavelength

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

Station.	kc/s.	Tuning Positions.	Metres.	kW.
Ankara (Turkey)	153		1961	5
Kaunas (Lithuania)	153		1961	7
Brasov (Radio Romania) (Romania)	160		1875	150
Hilversum No. 1 (Holland) (10 *kW.* till 3.40 p.m. G.M.T.)	160		1875	100
Lahti (Finland)	166		1807	150
Moscow, No. 1, RW1 (Komintern) (U.S.S.R.)	172		1744	500
Paris (Radio Paris) (France)	182		1648	80
Istanbul (Turkey)	185		1622	5
Irkutsk (U.S.S.R.)	187.5		1600	20
Deutschlandsender (Germany)	191		1571	60
Droitwich	200		1500	150
Minsk, RW10 (U.S.S.R.)	208		1442	35
Reykjavik (Iceland)	208		1442	16
Motala (Sweden)	216		1389	150
Novosibirsk, RW76 (U.S.S.R.)	217.5		1379	100
Warsaw, No. 1 (Poland)	224		1339	120
Luxembourg	232		1293	150
Leningrad, No. 1 RW53 (Kolpino) (U.S.S.R.)	232		1293	100
Kalundborg (Denmark)	240		1250	60
Vienna, No. 2 (Austria)	240		1250	0.5
Tashkent, RW11 (U.S.S.R.)	256.4		1170	25
Oslo (Norway)	260		1153.8	60
Moscow, No. 2, RW49 (Stchelkovo) (U.S.S.R.)	271		1107	100
Tromsö (Norway)	282		1063.8	10
Tiflis, RW7 (U.S.S.R.)	283		1060	35
Finmark (Norway)	347		864.6	10
Rostov-on-Don, RW12 (U.S.S.R.)	355		845.1	20
Budapest, No. 2 (Hungary)	359.5		834.5	18
Sverdlovsk, RW5 (U.S.S.R.)	375		800	40
Boden (Sweden)	392		765	0.6
Banska-Bystrica (Czechoslovakia) (15 *kW.* after 5 p.m. G.M.T.)	392		765	30
Geneva (Switzerland)	401		748	1.3
Moscow, No. 3 (RCZ) (U.S.S.R.)	401		748	100
Ostersund (Sweden)	413.5		726	0.6
Voronezh, RW25 (U.S.S.R.)	413.5		726	10
Oulu (Finland)	431		696	1.2
Hamar (Norway)	519		578	0.7
Innsbruck (Austria)	519		578	1
Tartu (Estonia)	522		575	0.5
Ljubljana (Yugoslavia)	527		569.3	6.3
Viipuri (Finland)	527		569.3	10
Bolzano (Italy)	536		559.7	10
Wilno (Poland)	536		559.7	16
Budapest, No. 1 (Hungary)	546		549.5	120
Beromünster (Switzerland)	556		539.6	100
Athlone (Irish Free State)	565		531	60
Palermo (Italy)	565		531	3
Stuttgart (Germany)	574		522.6	100
Alpes-Grenoble, P.T.T. (France)	583		514.6	15
Madona (Latvia)	583		514.6	50
Vienna No. 1 (Austria)	592		506.8	100
Rabat (Morocco)	601		499.2	30
Sundsvall (Sweden)	601		499.2	10
Florence (Italy)	610		491.8	20
Cairo, No. 1 (Egypt)	620		483.9	20
Brussels, No. 1 (Belgium)	620		483.9	15
Lisbon (Portugal)	629		476.9	15
Tröndelag (Norway)	629		476.9	20
Prague, No. 1 (Czechoslovakia)	638		470.2	120
Lyons, P.T.T. (France)	648		463	100
Petrozavodsk (U.S.S.R.)	648		463	10
Cologne (Germany)	658		455.9	100
North Regional (Slaithwaite)	668		449.1	70
Sottens (Switzerland)	677		443.1	100
Belgrade (Yugoslavia)	686		437.3	2.5
Bodö (Norway)	686		437.3	0.5
Paris, P.T.T. (France)	695		431.7	120
Stockholm (Sweden)	704		426.1	55
Rome, No. 1 (Italy)	713		420.8	50
Kiev, RW9 (U.S.S.R.)	722		415.4	35
Kharkov, No. 1, RW20 (U.S.S.R.)	722		415.4	10
Tallinn (Estonia)	731		410.4	20
Madrid, EAJ2 (Spain)	731		410.4	3
Seville (Spain)	731		410.4	5.5
Munich (Germany)	740		405.4	100
Marseilles, P.T.T. (France)	749		400.5	90
Pori (Finland)	749		400.5	1
Katowice (Poland)	758		395.8	12
Scottish Regional (Falkirk)	767		391.1	70
North Scottish Regional (Burghead)	767		391.1	60
Stalino (U.S.S.R.)	776		386.6	10
Toulouse P.T.T. (France)	776		386.6	120
Fredrikstad (Norway)	776		386.6	1
Leipzig (Germany)	785		382.2	120
Barcelona, EAJ1 (Spain)	795		377.4	7.5
Lwow (Poland)	795		377.4	50
West Regional (Washford Cross)	804		373.1	70
Milan, No. 1 (Italy)	814		368.6	50
Bucharest (Romania)	823		364.5	12
Moscow, No. 4, RW39 (Stalina) (U.S.S.R.)	832		360.6	100
Agen (France)	832		360.6	0.5
Berlin (Germany)	841		356.7	100
Norwegian Relay Stations	850		352.9	—
Sofia (Bulgaria)	850		352.9	1
Valencia (Spain)	850		352.9	3
Simferopol, RW52 (U.S.S.R.)	859		349.2	10
Strasbourg (France)	859		349.2	100
Poznan (Poland)	868		345.6	16
London Regional (Brookmans Park)	877		342.1	70
Linz (Austria)	886		338.6	15
Graz (Austria)	886		338.6	7.5
Helsinki (Finland)	895		335.2	10
Limoges, P.T.T. (France)	895		335.2	1.5
Hamburg (Germany)	904		331.9	100
Dniepropetrovsk (U.S.S.R.)	913		328.6	10
Toulouse (Radio Toulouse) (France)	913		328.6	60
Brno (Czechoslovakia)	922		325.4	32
Brussels, No. 2 (Belgium)	932		321.9	15
Algiers (Algeria)	941		318.8	12
Göteborg (Sweden)	941		318.8	10
Breslau (Germany)	950		315.8	100
Paris (Poste Parisien) (France)	959		312.8	60
Bordeaux-Sud-Ouest (France)	968		309.9	30
Odessa (U.S.S.R.)	968		309.9	10
Northern Ireland Regional (Lisburn)	977		307.1	100
Genoa (Italy)	986		304.3	10
Torun (Poland)	986		304.3	24
Hilversum No. 2 (Holland). (15 *kW.* till 3.40 p.m. G.M.T.)	995		301.5	60
Bratislava (Czechoslovakia)	1004		298.8	13.5
Midland Regional (Droitwich)	1013		296.2	70
Chernigov (U.S.S.R.)	1013		296.2	5
Barcelona, EAJ15 (Spain)	1022		293.5	3
Cracow (Poland)	1022		293.5	2
Oviedo (Spain)	1022		293.5	0.7
Königsberg No. 1 (Heilsberg) (Germany)	1031		291	100
Parede (Portugal)	1031		291	5
Leningrad, No. 2, RW70 (U.S.S.R.)	1040		288.5	10
Rennes-Bretagne (France)	1040		288.5	120
Scottish National (Falkirk)	1050		285.7	50
Bari No. 1 (Italy)	1059		283.3	20
Paris (Radio Cité) (France)	1068		280.9	0.8
Tiraspol, RW57 (U.S.S.R.)	1068		280.9	4
Bordeaux-Lafayette (France)	1077		278.6	12
Zagreb (Yugoslavia)	1086		276.2	0.7
Falun (Sweden)	1086		276.2	2
Madrid, EAJ7 (Spain)	1095		274	5
Vinnitsa (U.S.S.R.)	1095		274	10
Kuldiga (Latvia)	1104		271.7	50
Naples (Italy)	1104		271.7	1.5
Moravska-Ostrava (Czechoslovakia)	1113		269.5	11.2
Fécamp (Radio Normandie) (France)	1113		269.5	10
Alexandria, No. 1 (Egypt)	1122		267.4	0.25
Newcastle	1122		267.4	1
Nyiregyhaza (Hungary)	1122		267.4	6.25
Hörby (Sweden)	1131		265.3	10
Turin, No. 1 (Italy)	1140		263.2	7
Trieste (Italy)	1140		263.2	10
London National (Brookmans Park)	1149		261.1	20
North National (Slaithwaite)	1149		261.1	20
West National (Washford Cross)	1149		261.1	20
Kosice (Czechoslovakia)	1158		259.1	10
Monte Ceneri (Switzerland)	1167		257.1	15
Copenhagen (Denmark)	1176		255.1	10
Kharkov, No. 2, RW4 (U.S.S.R.)	1185		253.2	10
Nice-Corse (France)	1185		253.2	60
Frankfurt (*and Relays*) (Germany)	1195		251	25
Prague, No. 2 (Czechoslovakia)	1204		249.2	5
Lille, P.T.T. (France)	1213		247.3	60
Bologna (Radio Marconi) (Italy)	1222		245.5	50
Narvik (Norway)	1222		245.5	0.3
Gleiwitz (Germany)	1231		243.7	5
Cork (Irish Free State)	1240		241.9	1
Saarbrücken (Germany)	1249		240.2	17
Riga (Latvia)	1258		238.5	10
Rome, No. 3 (Italy)	1258		238.5	1
San Sebastian, EAJ8 (Spain)	1258		238.5	1
Nürnberg (Germany)	1267		236.8	2
Juan-les-Pins (Radio Côte d'Azur) (France)	1276		235.1	2.7
Christiansand (Norway)	1276		235.1	0.5
Stavangar (Norway)	1276		235.1	0.5
Dresden (Germany)	1285		233.5	0.25
Aberdeen	1285		233.5	1
Klagenfurt (Austria)	1294		231.8	5
Vorarlberg (Austria)	1294		231.8	5
Danzig	1303		230.2	0.5
Swedish Relay Stations	1312		228.7	—
Magyarovar (Hungary)	1321		227.1	1.25

Station.	kc/s.	Tuning Positions.	Metres.	kW.
German Relay Stations	1330	.....	225.6	—
Montpellier, P.T.T. (France)	1339	.....	224	1.2
Lodz (Poland)	1339	.....	224	2
Dublin (Irish Free State)	1348	.....	222.6	0.5
Rjukan (Norway)	1348	.....	222.6	0.15
Salzburg (Austria)	1348	.....	222.6	2
Tampere (Finland)	1348	.....	222.6	0.7
Cairo No. 2 (Egypt)	1348	.....	222.6	0.5
Königsberg (Germany)	1348	.....	222.6	2
Nottoden (Norway)	1357	.....	221.1	0.15
Italian Relay Stations	1357	.....	221.1	—
L'Ile de France (France)	1366	.....	219.6	0.7
Basle (Switzerland)	1375	.....	218.2	0.5
Berne (Switzerland)	1375	.....	218.2	0.5
Warsaw, No. 2 (Poland)	1384	.....	216.8	2
Lyons (Radio Lyons) (France)	1393	.....	215.4	25
Stara-Zagora (Bulgaria)	1402	.....	214	2
Vaasa-Vasa (Finland)	1420	.....	211.3	0.5
Alexandria, No. 2 (Egypt)	1429	.....	209.9	0.5
Turku (Finland)	1429	.....	209.9	0.5
Miskolc (Hungary)	1438	.....	208.6	1.25
Paris (Eiffel Tower) (France)	1456	.....	206	5
Pecs (Hungary)	1465	.....	204.8	1.25
Antwerp (Belgium)	1465	.....	204.8	0.1
Courtrai (Belgium)	1465	.....	204.8	0.1
Bournemouth	1474	.....	203.5	1
Plymouth	1474	.....	203.5	0.3
Binche (Belgium)	1487	.....	201.7	0.1
Chatelineau (Belgium)	1492	.....	201.1	0.1
Wallonia (Belgium)	1492	.....	201.1	0.1
Nimes (France)	1492	.....	201.1	0.7
Albacete (Spain)	1492	.....	201.1	0.2
Santiago (Spain)	1492	.....	201.1	0.5
Liege (Radio Cointe) (Belgium)	1500	.....	200	0.1
Verviers (Belgium)	1500	.....	200	0.1
Pietarsaari (Finland)	1500	.....	200	0.2
Radio Alcalá (Spain)	1500	.....	200	0.2
Karlskrona (Sweden)	1530	.....	196	0.2
Liepàja (Latvia)	1737	.....	173	0.1

SHORT-WAVE STATIONS OF THE WORLD

Station.	Call Sign.	kc/s.	Tuning Positions.	Metres.	kW.
Ponta Delgada (Azores)	CT2AJ	4,000	.....	75.00	0.05
Kharbarovsk (Russia)	RV15	4,273	.....	70.20	20
Sourabaya (Java)	YDB	4,470	.....	67.11	1
Caracas (Venezuela)	YV2RC	5,800	.....	51.72	1
San Jose (Costa Rica)	T2CPH	5,820	.....	51.52	1
Maracaibo (Venezuela)	YV5RMO	5,850	.....	51.28	1
Vatican City (Vatican State)	HVJ	5,969	.....	50.26	10
Trujillo (Domenica)	HIX	5,980	.....	50.16	0.2
Mexico City (Mexico)	XEBT	6,000	.....	50.00	1
Moscow (Russia)	RNE	6,000	.....	50.00	20
Montreal (Canada)	**CFCX**	6,005	.....	49.96	75
Havana (Cuba)	COCO	6,010	.....	49.92	0.5
Singapore (Malaya)	ZHI	6,018	.....	49.85	0.09
Medellin (Colombia)	HJ4ABP	6,018	.....	49.85	1.6
Zeesen (Germany)	DJC	6,020	.....	49.83	5
Panama City (Panama)	HP5B	6,030	.....	49.75	0.1
Calgary (Canada)	VE9CA	6,030	.....	49.75	0.1
Boston (U.S.A.)	W1XAL	6,040	.....	49.67	10
Miami (U.S.A.)	W4XB	6,040	.....	49.67	2.5
Pernambuco (Brazil)	PRA8	6,040	.....	49.67	3
Barranquilla (Colombia)	HJ1ABG	6,042	.....	49.65	0.15
Daventry (Gt. Britain)	GSA	6,050	.....	49.59	15
Cincinnati (U.S.A.)	W8XAL	6,060	.....	49.50	10
Philadelphia (U.S.A.)	W3XAU	6,060	.....	49.50	1
Skamlebaek (Denmark)	OXY	6,060	.....	49.50	0.5
Bogota (Colombia)	HJ3ABF	6,067	.....	49.45	1
Vienna (Austria)	OER2	6,072	.....	49.41	1.5
Penang (Malaya)	ZHI	6,080	.....	49.33	0.05
Chicago (U.S.A.)	W9XAA	6,080	.....	49.33	0.5
Nairobi (Kenya)	VQ7LO	6,083	.....	49.31	0.5
Toronto (Canada)	CRCX	6,090	.....	49.26	0.5
Johannesburg (South Africa)	ZTJ	6,097	.....	49.20	5
Bound Brook (U.S.A.)	W3XAL	6,100	.....	49.18	35
Chicago (U.S.A.)	W9XF	6,100	.....	49.18	10
Belgrade (Yugoslavia)	.....	6,100	.....	49.18	1
Manizales (Colombia)	HJ4ABB	6,105	.....	49.15	1
Daventry (Gt. Britain)	GSL	6,110	.....	49.10	15
Calcutta (India)	VUC	6,110	.....	49.10	0.5
Medellin (Colombia)	HJ4ABE	6,099	.....	49.19	1
Wayne (U.S.A.)	W2XE	6,120	.....	49.02	1
Havana (Cuba)	COCD	6,130	.....	48.92	0.25
Halifax (Canada)	CHNX	6,130	.....	48.92	0.2
Pittsburgh (U.S.A.)	W8XK	6,140	.....	48.86	40
Winnipeg (Canada)	CJRO	6,150	.....	48.78	2
Lisbon (Portugal)	CSL	6,150	.....	48.78	0.51
Caracas (Venezuela)	YV3RC	6,150	.....	48.78	1
Parede (Portugal)	CT1GO	6,198	.....	48.40	5
Trujillo (Domenica)	HIZ	6,316	.....	47.50	1
Caracas (Venezuela)	YV4RC	6,375	.....	47.05	1
San Jose (Costa Rica)	TIPG	6,410	.....	46.86	0.5
Barranquilla (Colombia)	HJ1ABB	6,447	.....	46.52	1
Cali (Colombia)	HJ5ABD	6,490	.....	46.21	0.1
Valencia (Colombia)	YV6RV	6,520	.....	46.00	0.5
Riobamba (Ecuador)	PRADO	6,620	.....	45.31	1
Guayaquil (Ecuador)	HC2RL	6,667	.....	45.00	0.2
British Amateurs	.....	7,000 to 7,300	.....	42.86 to 41.10	0.01
Georgetown (British Guiana)	VP3MR	7,080	.....	42.36	0.15
Tokio (Japan)	JVP	7,510	.....	39.95	20
Prangins (Radio-Nations) (Switz'Rd)	HBP	7,797	.....	38.48	20
Quito (Ecuador)	HCJB	8,945	.....	[illegible]	0.25
Hong Kong (China)	ZCK3	8,750	.....	[illegible]	0.5
Budapest (Hungary)	HAT4	9,125	.....	[illegible]	5
Havana (Cuba)	COCH	9,428	.....	[illegible]	1
Rio de Janeiro (Brazil)	PRF5	9,501	.....	[illegible]	12
Daventry (Gt. Britain)	GSB	9,510	.....	[illegible]	15
Melbourne (Australia)	VK3ME	9,510	.....	31.55	1.5
Jeloy (Norway)	LKJI	9,530	.....	31.48	1
Schenectady (U.S.A.)	W2XAF	9,530	.....	31.48	30
Zeesen (Germany)	DJN	9,540	.....	31.45	50
Zeesen (Germany)	DJA	9,560	.....	31.38	5
Bombay (India)	VUB	9,565	.....	31.36	4.5
Millis (U.S.A.)	W1XK	9,570	.....	31.35	10
Daventry (Gt. Britain)	GSC	9,580	.....	31.32	15
Lyndhurst (Australia)	VK3LR	9,580	.....	31.32	1
Buenos Aires (Argentina)	LRX	9,660	.....	31.06	5
Philadelphia (U.S.A.)	W3XAU	9,590	.....	31.28	1
Sydney (Australia)	VK2ME	9,590	.....	31.28	20
Eindhoven (Holland)	PCJ	9,590	.....	31.28	20
Prangins (Radio-Nations) (Switz'Rd)	HBL	9,595	.....	31.27	20
Moscow (Russia)	RAN	9,600	.....	31.25	20
Rome (Italy)	2RO	9,635	.....	31.13	35
Lisbon (Portugal)	CTIAA	9,655	.....	31.07	2.5
Lisbon (Portugal)	CT1CT	9,677	.....	31.00	0.5
Madrid (Spain)	EAQ	9,860	.....	30.43	20
Bandoeng (Java)	PMN	10,260	.....	29.24	1.5
Ruysselede (Belgium)	ORK	10,330	.....	29.04	9
Tokio (Japan)	JVN	10,660	.....	28.14	20
Tokio (Japan)	JVM	10,740	.....	27.93	20
Medellin (Colombia)	HJ4ABA	11,710	.....	25.62	1
Winnipeg (Canada)	CJRX	11,720	.....	25.60	2
Paris (Radio-Colonial) (France)	TPA4	11,720	.....	25.60	12
Daventry (Gt. Britain)	GSD	11,750	.....	25.53	15
Zeesen (Germany)	DJD	11,770	.....	25.49	5
Boston (U.S.A.)	W1XAL	11,790	.....	25.45	10
Rome (Italy)	2RO	11,810	.....	25.40	25
Daventry (Gt. Britain)	GSN	11,820	.....	25.38	15
Wayne (U.S.A.)	W2XE	11,830	.....	25.36	1
Lisbon (Portugal)	CTIAA	11,830	.....	25.36	2
Daventry (Gt. Britain)	GSE	11,860	.....	25.29	15
Pittsburgh (U.S.A.)	W8XK	11,870	.....	25.27	40
Paris (Radio-Colonial) (France)	TPA3	11,880	.....	25.23	12
Moscow (Russia)	RW59	12,000	.....	25.00	20
Lisbon (Portugal)	CT1CT	12,082	.....	24.83	0.5
Reykjavik (Iceland)	TFJ	12,235	.....	24.52	7.5
Parede (Portugal)	CT1GO	12,396	.....	24.20	0.35
Suva (Fiji)	VPD	13,075	.....	22.94	1
Warsaw (Poland)	SPW	13,635	.....	22.00	10
British Amateurs	.....	14,005 to 14,395	.....	21.42 to 20.84	0.01
Vatican City (Vatican State)	HVJ	15,123	.....	19.84	10
Daventry (Gt. Britain)	GSF	15,140	.....	19.82	10
Daventry (Gt. Britain)	GSO	15,180	.....	19.76	15
Zeesen (Germany)	DJB	15,200	.....	19.74	5
Pittsburgh (U.S.A.)	W8XK	15,210	.....	19.72	40
Eindhoven (Holland)	PCJ	15,220	.....	19.71	20
Paris (Radio-Colonial) (France)	TPA2	15,243	.....	19.68	12
Daventry (Gt. Britain)	GSI	15,260	.....	19.66	10
Wayne (U.S.A.)	W2XE	15,270	.....	19.65	1
Zeesen (Germany)	DJQ	15,280	.....	19.63	50
Buenos Aires (Argentina)	LRU	15,290	.....	19.62	5
Daventry (Gt. Britain)	GSP	15,310	.....	19.60	15
Schenectady (U.S.A.)	W2XAD	15,330	.....	19.57	18
Szekesfehervar (Hungary)	HAS3	15,370	.....	19.52	20
Zeesen (Germany)	DJE	17,760	.....	16.89	5
Wayne (U.S.A.)	W2XE	17,760	.....	16.89	1
Huizen (Holland)	PHI	17,770	.....	16.88	23
Bound Brook (U.S.A.)	W3XAL	17,780	.....	16.87	35
Daventry (Gt. Britain)	GSG	17,790	.....	16.86	10
Bandoeng (Java)	PMA	19,345	.....	15.51	60
Daventry (Gt. Britain)	GSH	21,470	.....	13.97	10
Wayne (U.S.A.)	W2XE	21,520	.....	13.94	1
Daventry (Gt. Britain)	GSJ	21,530	.....	13.93	10
Pittsburgh (U.S.A.)	W8XK	21,540	.....	13.93	40

Recent Inventions

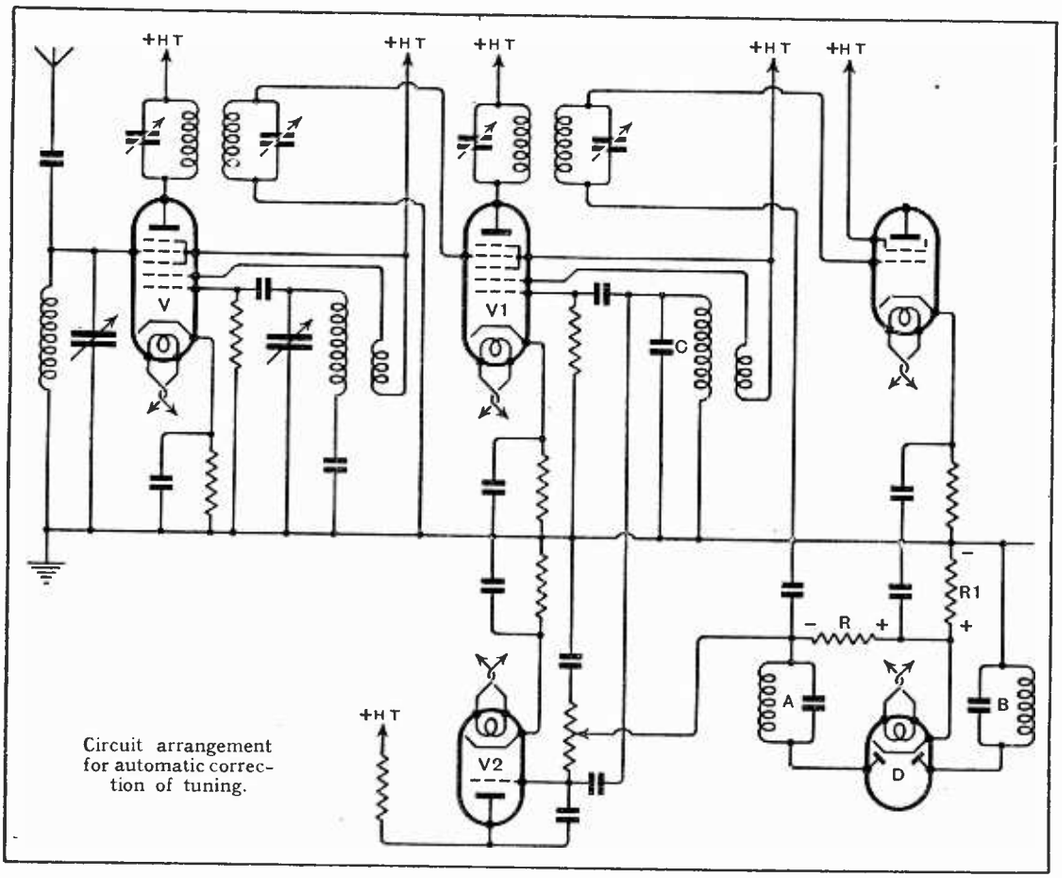
Brief descriptions of the more interesting radio devices and improvements issued as patents will be included in this section.

AUTOMATIC TUNING

THERE is a method for automatically correcting the tuning of a superhet set in which the "false" beat-frequency created by the mistuned circuit is utilised to vary the grid bias of a control valve. This valve is shunted across the local-oscillator circuit, and either increases or decreases its frequency until the circuits are brought correctly into tune. Such a method is, however, dependent, to some extent upon the actual wavelength which the set is receiving, and is, therefore, not equally effective at all wavelengths.

In order to remove this drawback, the ordinary superhet is replaced by a circuit in which there are two frequency-changers, so that for all wavelengths within the tuning range the second intermediate-frequency remains constant. As shown the first frequency-changer V feeds a second frequency-changer V1, the output from the latter being fed to a double-diode rectifier D. The two circuits A, B are tuned so that one is a little above and the other a little below the second intermediate frequency. Any initial mistuning thus produces a resultant EMF across the two balanced load resistances R, R1. This is applied to a control valve V2 which is shunted across the tuning condenser C of the local oscillator circuit. The consequent change in the effective grid-cathode capacity of the valve V2 provides the correcting factor which brings the set accurately into tune.

N. V. Philips Gloeilampenfabrieken. Convention date (Germany), 18th June, 1935. No. 450664.



Circuit arrangement for automatic correction of tuning.

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TRANSMISSION LINES

RELATES to installations where the aerial is located at some considerable distance from the receiver, and where both the aerial and RF circuits are tuned from a common point. In practice the intervening distance may be of the order of 300ft., which is sufficient to minimise the risk of interference by induction from supply cables and other local sources of disturbance.

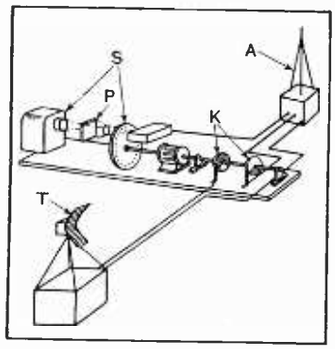
In order to ensure efficient operation under such circumstances, the aerial is coupled to the set through a high-frequency cable connected in series with a phase-changiug circuit, such as a high or low pass filter, which is terminated at the receiver end by an inductance. The electrical length of the transmission line is made approximately one-half or one-quarter the received wavelength, so that the aerial is tuned by the capacity "load" thrown back by the input circuit of the receiver.

Marconi's Wireless Telegraph Co., Ltd., and N. M. Rust. Application date January 25th, 1935. No. 450520.

o o o o

"BLIND-LANDING" FOR AIRCRAFT

A RADIO installation at an aerodrome is designed to inform an approaching pilot what gliding angle he should choose, so as to land safely in fog or at night, and also to give him other necessary information by television. As shown in the Figure, short waves, say of 50 c.m., are radiated from the directional transmitter T, the beam being swung up and down through a predetermined arc so as to give alternative gliding paths, each of which is distinguished by a particular modulating signal.



Schematic layout of ground apparatus for "blind landing" of aircraft.

A second non-directional aerial A, is interlocked with the first transmitter through rotating contacts K, and transmits on a 9-metre wave, through suitable scanning apparatus S, a picture showing (a) the name of the aerodrome, and (b) the prevailing wind conditions, or any other useful information, as printed on a template P. The aeroplane carries two receivers, one for the 50-c.m. wave, and the other for the 9-metre wave, the output from both being combined on a common indicator which shows (a) the televised information, and (b) a pattern of black and white lines which identify the particular tone modulation of the beam radiated from T.

Marconi's Wireless Telegraph Co., Ltd., and R. J. Kemp. Application date January 25th, 1935. No. 450975.

o o o o

PICTURE AND SOUND RECEIVERS

THE aerial and input circuits are designed so that a single amplifier may be used to receive sound and television signals transmitted either on widely different wavelengths or on closely adjacent wavelengths. In the former case a part of the installation may be used to receive medium-wave broadcast programmes alone.

Both the sound and picture signals are heterodyned to produce intermediate frequencies which are different, though of the same order, so that they can both be fed to a common amplifier having the requisite breadth of response. Two separate aerials may be used, one earthed for normal or medium-wave working, the other being a dipole, on which both the picture and sound signals are received when transmitted on the 6-7-metre range. A single aerial may be made to serve for the whole range of reception by inserting a short-wave choke in the down-lead, so as to insulate it from the upper limb when receiving the ultra-short waves.

G. V. Dowding. Application date February 25th, 1935. No. 450263.

MISCELLANEOUS ADVERTISEMENTS

NEW RECEIVERS AND AMPLIFIERS

A
A
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A
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DEGALLIER'S, Ltd., the Firm for Reliable Short Wave Radio (1937), have on show in London the largest selection of fully guaranteed brand new all-wave receivers; callers invited to handle all at their leisure without obligation to purchase; all S.W. receivers guaranteed to get stations on the low bands, including the Americas, etc. Hours of business 10 a.m.-7 p.m., Saturdays 9 p.m. Early closing day Mondays. All goods cash with order for c.o.d.; send 2d. stamp for beautifully illustrated catalogues and full reports by technical department of this journal on Challenger receivers.

WE Guarantee to Receive the American Transmissions at full programme strength after 4.30 p.m. daily; those interested welcomed without obligation.

6/6 Each.—Valves, "never before such a bargain," every one a first, no throw-outs or seconds, metal, metal glass, glass counterparts and glass; 1a6, 1b5/25s, 1c6, 1y, 2a3, 2a5, 2a6, 2a7, 2b7, 5y3, 5z4, 6a6, 6a8, 6b5, 6b7, 6c5, 6c6, 6d6, 6e5, 6e6, 6f5, 6f6, 6f7, 6h6, 6j7, 6J7, 6k7, 6l6, 6L7, 6R7, 6Q7, 6X5, 6z5 12Z5, 10, 12a, 12a5, 12a7, 12z3, 15, 18, 19, 22, 24a, 25A6, 25y3, 25z5, 26, 27, 30, 31, 32, 33, 34, 35, 51, 36, 37, 38, 39 44, 41, 42, 43, 45, 46, 47, 48, 49, 50, 53, 55, 56, 57, 58, 59, 71A, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 89; 6r7, 25a6, 25z6, 6n7, 6X5, 5W4. Line cords for American Midgets, 4/9.

£3/10.—5-valve Midget T.R.F., medium and long wave, 7X, 10X6, A.C. D.C., 200-250 volts, carriage 1/4; also several others at £2/15, £4, £4/10, and £4/2/6.

£8.—"Challenger" Table Grand Model 6-valve superhet, "Mono-vision" tuning control, A.C. 200-250 volts, 3 bands, 18-55, 190-550, 800-2,000 metres, 3½ watts output, tone control, delayed A.V.C.; carriage 4/6; (16½×16×8).

£9.—"Challenger" Table Model 6-valve superhet, 3 bands, 16-52, 190-550, 900-2,000 metres, A.V.C. tone control, P.U. terminals (17×13×9), A.C. D.C., 200-250 volts; carriage 4/-; also available in A.C., same price.

£9.—Challenger Car Radio 6-valve superhet, no interference, A.V.C., remote control, definitely no suppressors needed on plugs, carriage 4/3; also the R.C.A. Car Aerial, "the last thing," 15/- post paid; also Emerson 6-valve, same price.

13 Guineas.—The new Challenger 8 (type 800) table model de luxe, 22×18×12, high fidelity 8-valve superhet, A.C., 200-250 volts, 4 distinct bands, 11-39, 39-64, 190-550, 900-2,000 metres; this receiver has the following improvements and additions over the last series of the famous Challenger 8; wave bands calibrated in metres and station names, simplified centralised tuning, super Vernier, slow-fast tuning, self-contained control panel, perfect tone quality at low volume, new type 10 inch M.C. speaker, from a whisper to 8 watts pure undistorted tone, no overloading at full volume, oscillator fundamental without use of harmonics, persistent oscillator of highest output, isolating filters eliminate oscillation and motor-boating, fully delayed A.V.C. bias, absolute minimum of noise and sensitivity control for noise suppression, A.V.C. re-entered capacitators prevent drift, pre-aged intermediate frequency transformers, I.F. barrier, discs anchor coil leads, plug in loud speaker, also provision for external speaker, moisture sealed out by tropical zone impregnation, self heating electrolytic condensers, one complete chassis of dreadnought construction, moderate voltages assure full valve life, economical to operate (consumption 65 watts), long life eliminates repairs, correct valve selection, no compromise, no hum, full weight transformers, true push-pull, stabilised high tension supply, stabilised bias-es, ceramic coil insulation, fully loaded plate coils give maximum gain, pre-balanced coil assembly, matched sets of individual coils, no taps, sealed insulation, thin laminations of special silicon steel, 7 K.C. selectivity, fractional microvolt sensitivity, shielded switching permits high-gain, positive silver-plated contacts, eliminate switch noises, audio frequency range 30-8,000 cycles, diode detection, prizmatone high fidelity R.F. preselector stages on all bands, carriage 6/- for experimenters, less cabinet deduct 15/-; if public address Rola, 12in. G.12 supplied in place of standard speaker, add £2. (Note.—This speaker cannot be incorporated in table model cabinet.)

£17/17.—Challenger 8 Console 800C., height 3 feet 6 inches, width 24 inches, depth 12½ inches, chassis as incorporated in 800 model but incorporating the G.12 high fidelity 12in. speaker; carriage and crate 10/-.

29 Guineas.—"Challenger 800 R.G." radiogram with automatic record changer, measurements, height 2 feet 8 inches, width 3 feet, depth 21 inches; this also incorporates the G.12; carriage and crate 15/-.

NOTE.—The Challenger 800 is available for A.C. D.C. 200-250 volts, employing 11 valves, at an additional cost of 20/- on each model.

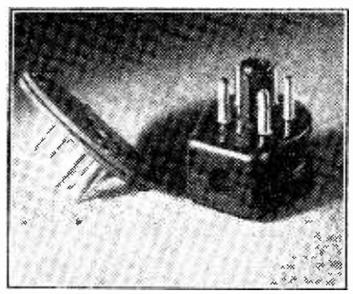
CHALLENGER Model 381 Coming Shortly with Refinements over the 800 Series, 8 valve, 13-2,060 metres, R.F. preselector stages over all bands, Polychromatic dial scale, magic eye tuning, improved vision master, beam power output valve, 10 watts undistorted, band speed Magna dials and second-hand, full range, tone control, automatic band indicator, high image frequency suppression, hair line selectivity, ultra sensitivity; the price will be: table model, 14 guineas; Console, 18 guineas; automatic radiogram, 30 guineas, or, in chassis form for the experimenter, chassis, dials and standard speaker, £13 18; or with Rola 12in. G.12 public address job, £15/18; the 381 is available in A.C. only; we would point out that this receiver does not in any way replace the 800 model.

(This advertisement continued in third column.)

No. 11

Notes on radio and electrical connections

Just in case readers forget that our activities extend beyond the Suppression of Electrical Interference with Broadcast Reception, we propose to devote alternative announcements to the most important section of our business, the design and manufacture of radio and electrical accessories and spares for sale to the public, not forgetting that nearly every reputable manufacturer of radio and other electrical appliances incorporates something of ours in their designs. We treat with respect every electrical accessory or component. Even the humble wanderplugs we make by the million are the best that can be made.



The latest additions to our range are the 5- and 10-pin connectors. No longer is it necessary to improvise by using a valveholder and base, and fiddle about trying to find the right way round. Our connectors are key products and, like a key, they will go in one way only. No single pin can make contact until the locating key has found its position. Can be connected with eyes shut. They are carefully designed and really do go together nicely, all pins making contact every time. All metal parts silver-plated, giving low resistance contact and facilitating soldering. The flex part is in black moulded bakelite with side entry and properly designed cord grip. Pins ⅛in. and semi-floating. Single screw assembly. The socket panel has shielded socket entry, and standard fixing holes. Well worth using even with idle pins.

No. 1260 5-pin Connector, complete **2/6**
No. 1251 10-pin Connector, complete **3/6**

It is customary in "Wireless World" set designs to couple the power unit or the energised speaker to the receiver chassis by a 4- or 5-way multiple cable. For the sake of standardisation we recommend that the numbered contacts in our 5-pin connector be used as follows:—

Pin No.	Power Plug and Socket.	Speaker Plug and Socket.
1	Heater	Plate
2	Heater	2nd Plate if P.P.
3	HT —	Field smoothed
4	Audio	½ HT (smoothed)
5	HT ½ (smoothed)	Field unsmoothed

Where Field is in — HT lead pin 3 is earthing and pin 5 connects to centre tap of mains transformer HT secondary.

These follow the same numbering convention as used when a 5-pin valve base is improvised for this purpose.

The illustration above is one of 150 illustrations including 75 blue prints of curves, diagrams, circuits and constructional details and specification of all our standard products in the accessory class. Of particular value to Radio Engineers, Designers, and those engaged in any section of the radio industry as well as to every amateur constructor of radio or television apparatus. Send 8d. for copy, post free.

BELLING-LEE
FOR EVERY RADIO CONNECTION

Belling & Lee Ltd.
Cambridge Arterial Road,
Enfield, Mddx. Phone: 3322

NEW RECEIVERS AND AMPLIFIERS

(This advertisement continued from first column.)

£16.—Challenger 12 A.C. D.C. 200-250 volts, 4 bands 11-2,050 metres, the first time that D.C. users have been able to get 10 watts undistorted from their speaker, which is a large 12in. K. type Rola, triple parallel rectification, push-pull parallel four pentode output; carriage and crate 7/6; chassis, valves and speaker alone, £15.

£37/10.—V.T.18 Midwest 18 valve chassis, valves and speaker, 6 bands, 4½-2,400 metres, A.C., 100-250 volts; this receiver has many improvements over the 1936 model; carriage paid; available in various console cabinets; 1936 model still available at £26/5; carriage 10/-.

£50.—Midwest Royale 24-valve chassis valves and three speakers, carriage paid.

£50.—Challenger "Model 5240" 24-valve superhet, twin chassis valves and "2" Public address speakers, with 60 watts undistorted output, sensitivity ¼ microvolt absolute, tuned H.F. stages on all bands, 3 I.F. stages, the last one being used for selectivity only, frequency response at the speakers within 2db over whole range, wave band coverage 5-2,050 metres in 5 bands, Magic-eye tuning, variable selectivity, receiver chassis heavily shielded and chromium plated, Centro-Master automatic control unit, dual rectifiers, signal channel separate from A.V.C. system, linear diode detection, separate rectifier to provide A.V.C. voltage, radio frequency pre-amplifier stages eliminate repeat points and whistles, and provides maxim signal to noise ratio, beam power output valves, polychromatic dial scale, prizmatone high fidelity, uni-control 2-speed free-wheeling tuning, band spread Magna dial and second-hand, automatic band indicator, automatic interstation noise suppression, separate bass boosting amplifier, automatic frequency control, iron core I.F. transformers, code interference filters, automatic volume control, beat frequency oscillator; carriage 18/-; also available in various gramophone and console cabinets.

DEGALLIERS, Ltd., 18, Connaught St., Marble Arch, London, W.2. Paddington 2745. [3120

A
AIR KING Introduces Sensational Models for 1937, featuring
BEAM Tuning Exclusive to Air King Receivers.
MAGIC Edge Illuminated Dials Enabling Station Names to be Clearly Read.
CATHODE Ray Magic Eye Tuning Indicator on all Models.
LATEST G Type Octal Base Valves, which are interchangeable with the metal prototype.
SPECIAL Output Valves for A.C./D.C. Models, giving undistorted output equivalent to that of an A.C.
CUT Out that Interference with an Air King All-wave Doublet Aerial, doubles signal strength and increases reception range, especially on short waves; price 15/-.
ALL the Latest Type American Glass and Metal Valves Stocked.
TRADE Enquiries Invited.
CALL, write or 'phone for further particulars to:—
AIR KING RADIO, 115, Shaftesbury Avenue, Cambridge Circus, W.C.2 (1st floor above Barclays Bank). 'Phone: Temple Bar 4875 (two lines). All receivers assembled in England. [2702

A.
HARMAUR RADIO for Economical All American All Guaranteed American Bosch "Centromatic" All-wave Receivers, Freed Eisemann ("Famous since broadcasting began") Midget receivers, De Wald Motortone car radio receivers and Raytheon valves.
THE HARMAUR RADIO Co., Ltd., 8, Clifford St., New Bond St., London, W.1. Regent 4336. [0499

ALERT RADIO Co.
5-VALVE A.C. All-wave, table model, 10 gns.; 6-valve A.C. all-wave, 12½ gns.; 7-valve A.C. all-wave, 4 bands, chassis, valves and speaker, 9 gns.; Midgets and other receivers up to 23 valves; new models arriving shortly, 11 and 16 valves, high fidelity. D.X. fans, we can supply you with the latest communication receivers, such as the Hammalund Super-Pro, R.M.E. 69, National H.R.O., etc.; any type of American valve in stock; send for lists.—21, East Rd., N.1. Clerkenwell 4871. [2835

STOP Hesitating.—Radiographic offer radios, biggest values.
LOOK at Our All-Wave Superhet., 6 valves, 110-250 volts A.C., £8/8; A.C. D.C. model, £5 19/6.
LISTEN to the World During Day or Night; quality and volume.
OTHER Mains Receivers from 49/6 to £100; any purchase is covered by our satisfaction or money refunded guarantee.
WRITE for Catalogue, it's free.
RADIOGRAPHIC, Ltd., 66, Osborne St., Glasgow, C.1. [3111

SIX-VALVE Superhet Chassis, with A.V.C. 3.5-watts pentode output, at £6/5.
SIX-VALVE All-Wave A.C. Superhet Receivers, with cabinet and speaker, 3.5-watts pentode output, station marked dial, A.V.C., waves ranges 16.5, 50, 200 to 600, and 1,000 to 2,000 metres; price £9.
WE Can Supply Kits of Specified Parts with Valves for any "Wireless World" Receiver or Amplifier, including the "1936 Monodial A.C. Super Receiver," "Quality Amplifier," Imperial Short Waves Six and All-Wave Super-Seven. Hire purchase terms can be arranged on the above goods and any other radio equipment; details upon application.
UNIVERSAL Amplifiers, with undistorted output of 8 watts, 2 pentodes in parallel in output stage, £6 10; A.C. amplifiers, double R.C.C. push-pull, with 2 triodes in output stage, undistorted output of 5 watts, £7.
WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0453

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

NEW RECEIVERS AND AMPLIFIERS

ARMSTRONG Announce 2 New Model All-wave Superheterodyne Chassis Described Hereunder.

ARMSTRONG Universal 6v. Radiogram Chassis, with efficient 3½ watts output, and designed to cover American and English short wave amateurs as well as short wave broadcast; long, medium and short wave scale calibrated in station names and wavelengths; price £7 17/6, includes 6 British valves and Rola 8in. speaker, aerial tested and ready to switch on.

ARMSTRONG Battery All-wave Superheterodyne Chassis, has a really efficient short-wave performance and covers both amateur and broadcast shorts, and the usual broadcast medium and long bands; iron cored intermediate transformers and the latest technical specification throughout; price £5 17/6, including valves, aerial tested and ready to switch on with the addition of speaker.

ARMSTRONG Co. Will Willingly Send Illustrated Technical Data Sheets of Above New Chassis on Application.

ARMSTRONG 6-valve All-wave Superheterodyne Radiogram Chassis, for A.C. mains, complete with Rola speaker; £7/10. (See displayed advertisement.)

ARMSTRONG 8-valve 4 Wave-band Radiogram Chassis, with phase-reversed push-pull output; £9/17/6.

ARMSTRONG 6-valve 4 Wave-band Radiogram Chassis, with large triode output; £8/17/6.

ARMSTRONG 8-valve 4 Wave-band Radiogram Chassis, with radio-frequency stage and push-pull output; £11/11.

ARMSTRONG 7-valve 4 Wave-band Radiogram Chassis, with radio-frequency stage and single triode output; £10/10.

ARMSTRONG 8-valve 2 Wave-band Radiogram Chassis, with 8 watt push pull output; £8/10.

ARMSTRONG 6-valve 2 Wave-band Radiogram Chassis, with single large triode output; £7 10.

ARMSTRONG 10-watt Amplifier, fitted with microphone pre-stage, complete with Rola G.12 speaker; 10½ guineas.

ARMSTRONG Chassis Carry 12 months' Guarantee; no charge for material, labour or carriage for 12 months (valves carry makers' guarantee).

ARMSTRONG Chassis are Sent 7 Days' Trial, carriage, packing, and crate free.

ARMSTRONG MANUFACTURING Co., 100, King's Rd., Camden Town, N.W.1. [3112

"SERVICE With a Smile."

HENRY FORD RADIO, Ltd.,

ELECTRONIC House, 22, Howland St., Tottenham Court Rd., W.1. Museum 5675. [0511

ROYAL RADIO COMPANY.

ESTABLISHED 1908.

THE Cheapest House for all the Latest 1937 Models with Metal Valves; from £3/10.

AS it is Impossible to Give Full Specification of all Models in This Advertisement, send stamp for illustrated catalogue.

£3/10.—5-valve R.F., long and medium, 200-250 volts.

£4/15.—5-valve Superhet., long and medium, 200-250 volts.

£5/15.—5-valve Superhet., 19-2,000 metres, 200-250 volts.

£7/15.—6-valve Table Model, 16-2,000 metres, A.C. or D.C. any voltage.

£7/15 and £9/9.—All-wave receivers, suitable for ships, as supplied to the P. and O., B.I., and other shipping lines, guaranteed free from interference.

£13/10.—8-valve Table Model, 11-2,000 metres, A.C., the set that gets America at full volume on an indoor aerial.

£9.—Latest 6-valve car radio, A.V.C., remote control, no suppressors required.

A FULL Range of the World-famous Ferguson and Pilot Models Stocked.

ALL Sets Fully Guaranteed by Ourselves.

ALL Types of American Valves in Stock.

PAY Us a Visit Any Time, week-end included. Fares paid up to £1 to customers spending £13 or over. Nearest station George Lane, L.N.E. Rly.

ROYAL RADIO COMPANY, 5, Buckingham Rd., South Woodford, London, E.18. 'Phone: Buckhurst 2736. [3010

1936 Regentone 5-valve Superhet., thermometer tuning, unused and boxed; list price £11/10, A.C. model £5/10, universal £5/15.

1936 Regentone Battery Set, list £7/10/6, Var., Mu., screen grid det. and pent. output, P.M. speaker, thermometer tuning; £3; unused and boxed.

HENRY'S, 72, Wellington Av., N.15. Stamford Hill 2907. [2952

TRANS-ATLANTIC RADIO Offer Finest Radio Value; send for lists; attractive A.C. D.C. compacts from £2/16; 6-valve all-wave superhets from £6/15.

TRANS-ATLANTIC RADIO Co., 15, Percy St., W.1. Museum 3096. Agents for "Philco." American Radio Service Specialists. [3124

ROUND the World Receivers, Pilot, Ferguson, Ace, Stewart, Warner, Zenith, etc.; all American valves; traders only.—Perseus Radio, Burton-on-Trent. [2918

SPECIALIST.—Car radio only. Expert fitting and repairs. Sets from £7 10 to 40 guineas.—St. John Chesney, 38, Hugh St., London, S.W.1. Victoria 0780. [0534

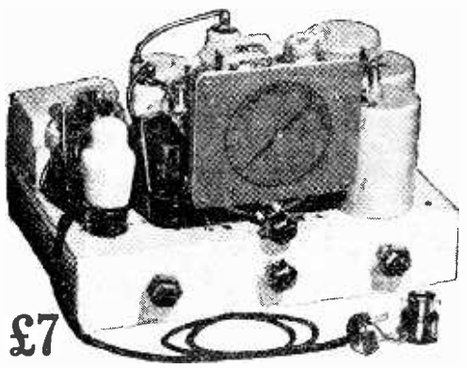
FOR the Finest Value in All-wave Rectifiers, see McCarthy advertisement on this page.—McCarthy Radio, Ltd., 44a, Westbourne Grove, London, W.2. Telephone: Bayswater 3201. [0510

PILOT, Belmont, Pegasus and Air King all-wavers lead the field; our deliveries are prompt in original cartons with full guarantees; your trade card will bring our wholesale catalogue from the authorised distributors.—Leonard Heys, 36, Henry St., Blackpool. [0530

6-VALVE 9-stage All-wave Superhet Manx Chassis, comprising large micro-dial, volume control and variable tone control, pick-up connections; circuit; tuned H.F. stage on all wave-bands. Octode mixer, band pass I.F.'s, double diode triode detector, giving full A.V.C. 3-watt pentode output, complete and ready to use with 6 Dario valves; chassis and valves carry 12 months' guarantee; cash with order; £8/10, on 7 days' approval, or c.o.d. FREE with Above Chassis.—Mains energised 8in. moving coil loud speaker.—Hulmes, Station St., Birmingham. [3032

McCARTHY

for the finest value in All-Wave Receivers!



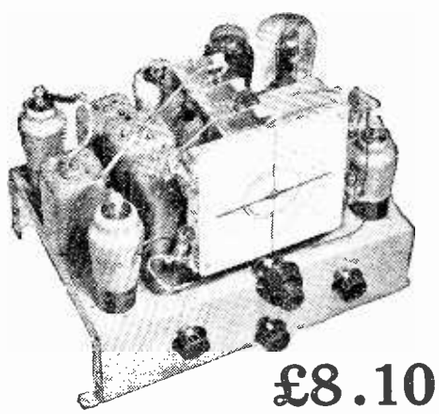
£7

6 VALVE ALL-WAVE SUPERHETERODYNE

(complete with B.V.A. Valves)

Most popular receiver with "Wireless World" readers. The "Wireless World" says; "Sensitivity of the set on all three wave bands cannot fail to give satisfaction . . . excellent results on the short-wave band."

Brief Specification: 8-stage, all-wave band-pass superheterodyne, 7 tuned circuits. D.A.V.C. with "squelch" circuit valve for noise suppression. Illuminated "Airplane" dial. Octode frequency changer. 3-5 watts pentode. Switching for gramophone pick-up. Wave ranges: 16.5-50, 200-550, 800-2,000 metres.



£8.10

6 VALVE ALL-WAVE SUPERHETERODYNE

(with radio frequency stage)

Performance (made possible by use of multi-electrode valves) equal to that of many 8 valve receivers. 8 stages, 8 tuned circuits, covering 3 waveband—16.5-2000 metres. Illuminated "Airplane" dial (different coloured lights automatically switched in for each wave range), giving principal station names, with micro-vernier 2-speed drive.

Circuit in brief: Pre-selector circuit, radio frequency amplifier (operative on all three wavebands), triode-hexode frequency changer, double bandpass I.F.T. coupled I.F. amplifier, double diode-triode detector and L.F. amplifier. D.A.V.C. applied to 3 preceding valves. 3 watt pentode output. Variable tone control and volume control operative on radio or gramophone.

All McCarthy receivers supplied complete with valves, knobs, pilot lamps, leads, mains cable and plug. 12 months' guarantee. Deferred terms on application, or through London Radio Supply Co., 11, Oat Lane, E.C.2. Cash with order on 7 days' approval. Also write for illustrated catalogue of complete range of all McCarthy receivers.

McCARTHY RADIO LTD.

44a, Westbourne Grove, London, W.2

Telephone: Bayswater 3201/2.

RECEIVERS AND AMPLIFIERS

CLEARANCE, SURPLUS, ETC.

CLEARANCE List (Trade Only).—Write Leonard Heys, 36, Henry St., Blackpool [0527

SEND for Bargain List of Brand New Decontrolled Receivers; amazing prices.—P. A. C., Ltd., 54, Lamb's Conduit St., W.C.1. [2243

£9.—King of the Air, 1937 model, £18/18; A.C. all-waver, 14-2,100 metres, 5 watts output, 6 valves, 8in. Jensen, 110 250 volts, 21×16×11½; worth double of what we are asking.—Philip Kay, 1, Old Church Lane, London, N.W.9. [3121

69/- for Brand New 8-guinea Table Grand 4-valve Band Pass Receiver, very powerful, selective, guaranteed, magnificent walnut case, 1936 model, carriage paid or c.o.d.; have other similar bargains.—Kay, 1, Old Church Lane, N.W.9. Colindale 8266. [0535

BATTERIES & CHARGING PLANT

CARFAX Minor 30v. 5a.; £5/5; guaranteed 5 years.—British Rectifiers Engineering Company, Vernon Place, Cheltenham. [3052

PUBLIC ADDRESS EQUIPMENT

H. J. LEAK.

LEAK HIGH-GAIN AMPLIFIERS, the result of 6 years' practical P.A. experience plus a spot of idealism; as an engineering job they are not approached at any price, and are guaranteed one year; list prices, 5-watt at £11/10, 13-watt at £13/13, 30-watt at £19/10, 60-watt at £35; all Class A push-pull, of course, with genuine Leak watts delivered to your loud-speakers.

H. J. LEAK, Sound Engineer-Technician, 124a, Dalling Rd., Hammersmith, W.6. Riverside 5981. [3113

SPECIAL Offer!!!

8½ Guineas Assembled; Vortexion 20 watt 4-stage P.A. amplifier, in steel case, 8in.×10in.×9in. high, with carrying handle, input with controls for microphone and pick-up and tone control, output for 7½ and 15 ohm speakers, weight 25lb.; only 8½ guineas, with valves.

4 Input Model, with mixers; £10.

HEAVY Duty Model, as fitted to cinemas and dance halls; £15.

CALL and Hear the Rumble of an Organ as Never Before on our Wide Frequency Range Models, the best yet.

VORTEXION, Ltd., 182, The Broadway, Wimbledon, S.W.19. See also New Mains Equipment. [3127

PUBLIC Address Work Undertaken.

P.A. Vans for Hire, stationary equipment for fetes, conferences, etc., portable equipments for small dances, etc.

ROSS and ROBINSON, Ltd., 8, Western Circus, W.3. [0521

PARTRIDGE P.A. Manual is a Handbook for the Man who Actually Does the Job; it is not a theoretical treatise for the academic student.

IT Explains Pre-amplifier Design, mixing, line technique, speaker grouping, etc.; it tells where to obtain suitable cable, microphones, speakers, etc.; free trade only from:—

N. PARTRIDGE, B.Sc., A.M.I.E.E., King's Buildings, Dean Stanley St., London, S.W.1. [3065

POWERFUL High Quality A.C. Amplifier, turntable, pick-up, carrying case, two matched speakers; £12.—373, London Rd. St. Leonards, Sussex. [3108

12 Watt P.A. Amplifier on Demonstration with Crystal Microphone, Piezo pick-up, at Holiday, Hemmerdinger, 2, Dolefield Bridge St., Manchester. [2912

USED SETS FOR SALE AND WANTED

FERGUSON

8V. Ferguson, 1936, £16; all-wave A.C./D.C. push-pull, £6/10; also Radiolab, 22 range, A.C./D.C. meter, £3/15.—41, Norman Rd., London, E.3. [3092

SCOTT

15-VALVE Scott, world's finest receiver; must sell, going abroad.—Offers 4c, Grovend House, London, N.W.8. [3095

W.W. MONODIAL

W.W. Monodial 1936 Receiver, unit only, complete, professionally built; £9.—Forcellini, 25, Fairmount Rd., Brixton. [3089

EXCHANGE OR WANTED

WANTED, Marconi 2-valve A.C., all mains, No. 248.—Box 9817, c/o *The Wireless World*. [3126

WANTED, all-wave A.C. receiver, sound make and condition.—Vicar, Abbotskerswell, Devon. [3090

"WIRELESS World" All-wave Super Seven; state price.—Box 9803, c/o *The Wireless World*. [3096

MISCELLANEOUS

FERRANTI Battery S.W. Superhet., 6-valve; £6.—See below.

TRIX "Explora" S.W. A.C. Superhet., new; listed £24, £9.—91, Flat, Mantell St., N.1. [3087

NEW MAINS EQUIPMENT

PARAMOUNT Mains Transformers.

PARAMOUNT in Quality, lowest in price; example, 250v. 60 m.a., 4v 1a., 4v. 4a., open type 9/-, shrouded 11/-, post 9d.; 350v. 75 m.a., 4v. 2.5a., 4v. 4a., open type 12/-, shrouded 14/-, post 9d.

WRITE for List, "Paramount Mains Transformers."—R. H. Salter, 66, Hartfield Rd., Wimbledon, S.W.19. 'Phone: Liberty 3226. [2303

TANTALUM for A.C. Chargers, H.T. and L.T.—Blackwell's Metallurgical Works, Ltd., Garston, Liverpool. [2729

NEW MAINS EQUIPMENT

V

V

VORTEXION Lead Again.

VORTEXION Supply the B.B.C., G.P.O., L.P.T.B., and Borough Councils, etc., so why not you?

FOR the Best Reproduction it is Possible to Obtain, see also advert. under Public Address Equipment.

ALL Fitted Screened Primaries and Tapped 200-250v., with centre tapped filaments, guaranteed one year.

250-0-250 60 m.a., 4v. 1·2a., 4v. 2·4a.; 10/- open, 12/6 shrouded.

350-0-350v. 60 m.a., 4v. 1·2a., 4v. 2·4a.; 12/6 open, 15/- shrouded.

350-0-350v. 120 m.a., 4v. 2.5a., 4v. 2·4a., 4v. 2·5a.; 14/6 open, 16/6 shrouded.

425-0-425v., 120-160 m.a., 4v. 5·10a., 4v. 2.5, 4v. 1·2, 4v. 1·2, supershrouded model, 2½% regulation; 26/-.

500-0-500v. 120 m.a., L.T.'s, as above; 19/- open, 23/- shrouded; 400 or 450, same price.

500-0-500v. 150 m.a., 3v, 4v. 2a., 4v. 2·5a., 4v. 4a., 26/- open, 30/- shrouded; 400 or 450, same price.

CHOKES, 30h. 60 m.a., 5/6; 7-13h., 10/6; 30h., 150 m.a., 12/6; regulation, 7/6.

OUTPUT Transformers, 4-10 watt, W.W. Q.A., 17/6; 20-watt super shrouded, 30/-.

AUTO Transformers, 100-120 to 200-240v., 60 watt, 9/-; 120 watt, 12/6; 200 watt, 16/6; 500 watt, 30/-.

TELEVISION, 4,000v., 5-10 m.a., and 2.5-4v.; 27/-.

QUOTATIONS for Specials by Return.

VORTEXION, Ltd., 182, The Broadway, S.W.19. Tel.: Lib. 2814. [3123

ALL

POWER

TRANSFORMERS, Ltd.—Transformers and chokes embodying all the best in design; no better value at any price; Radiolympia models; tapped and screened primaries, filaments, centre tapped.

250-0-250v. 60 m.a., 4v. 1·2a., 4v. 2·4a., 12/6, post 7d.; extra filament, 4v. 1a., 12/6.

350-0-350v. 60 m.a., 4v. 2·3a., 4v. 2·4a., 15/-, post 8d.; extra filament, 4v. 1a., 16/-.

350-0-350v. 120 m.a., 4v. 2·3a., 4v. 4·6a., 4v. 1·2a., 19/-, post 1/-; extra filament, 20/-.

WRITE for List; special quotations by return.

ALL POWER TRANSFORMERS, Ltd., 8a, Gladstone Rd., Wimbledon, S.W.19. Tel.: Liberty 3303. [2771

CABINETS

MANUFACTURER'S Clearance.

"**U**LTRA" Tiger Radiogram Cabinets, 35×21×16, 35/-; undrilled (reconditioned).

HALCYON Radiogram Cabinets, rich, dark, figured walnut, 33×23×19½, 45/-; many others, 30/- upwards; photos for selection sent on request.

"**U**LTRA" Table Cabinets, 20×16½×9½ (undrilled), 10/6; many others from 4/6.

SPEAKER Cabinets; 4/6 upwards.

SEND Particulars of Your Requirements (giving size of set, etc.), or call and make your choice from our stocks of over 100 different types; from 3/6 to £4/10.

H. L. SMITH and Co., Ltd., 287-9, Edgware Rd., London, W.2. Tel.: Padd. 5891. [0485

DYNAMOS, MOTORS, ETC.

½h.p. A.C. B.T.H. Motors, 1,425 revs., self-starting, all voltages; 53/-.—Easco, 18, Brixton Rd., S.W.9. [0455

ELECTRO-DYNAMIC Converter, 100 D.C. to 230 A.C., 60 watt, filter and cabinet; £3.—Grant, 3, Evelyn St., Stamford. [3109

ELECTRO Dynamic Rotary Converters, complete with smoothing and silence cabinet, input 200-240 D.C., output 220 volts A.C., 50 cycles, 90 watts, in new condition; £6; similar machine, with 65 watts output, £4/18, carriage forward; many other converters in stock; send for details.

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

NEW GRAMOPHONES, PICK-UPS AND RECORDERS

PERMAREC Home Units.—Discs—Permarec, acetate and glass base coated; cutters—steel and sapphires; frequency records; amplifiers; microphones—carbon, moving coil, piezo; matching transformers.—Holiday-Hemmerdinger, Dolefield, Bridge St., Manchester. [3015

NEW LOUD-SPEAKERS

HULBERT for Quality Surplus Speakers.

THE Following Genuine Bargains are Made by One of the Best-known Manufacturers of high-grade moving coil speakers. All are brand new and offered at considerably under half list prices. The Auditorium models are fitted with latest dual curved cones, giving remarkably wide and even frequency response, resulting in quality reproduction of both speech and music.

37/6 Only, usual price £5; Auditorium permanent magnet speaker, with Alni magnet and die cast frame, large 12in. dual cone, comprising latest curved cone with auxiliary bakelite cone; complete with large 25 ratio transformer.

59/6 Only, usual price £6; Auditorium electro-magnet speaker, 1,000, 1,250, 2,000, or 2,500 ohms field; exceptionally large magnet of high permeability steel, giving enormous flux density; 2in. moving coil; large dual cone, comprising latest curved cone with auxiliary bakelite cone, giving wide frequency response; complete with universal transformer; the ideal speaker for use with "Wireless World" and other quality amplifiers.

(This advertisement continued in third column.)

RADIOMART

SHORTWAVE SPECIALISTS

COILFORMS.—Moulded in RD4 natural loloss material, hollow resilient pins 1½ in. diameter ribbed; identification disc in top. Four types, 4-pin, **1/6**; 6-pin (standard or to fit 7-pin valveholders), **1/9**; 7-pin (for bandspread tap), **1/10**; Machine threading **2d.** extra.

SHORTWAVE COILS.—(RD4) CA 11-25, CB 20-45 metres **2/6**. CC 44-100 metres **2/9**. Open Coils: 6-pin types, CA6, CB6, **2/9** each, CC6 **3/-**; Same range as 4-pin.

MICROVARIABLES.—All brass construction; latest ceramic insulation. The finest condensers made; 15 mmfd, **1/4**; 40 mmfd, **1/7**; 100 mmfd, **1/10**. **Transmitting Type.**—.070 in. spacing, 15 mmfd. (neutralising), **2/9**. 40 mmfd. Tuning **3/6**. These are quality.

UTILITY 8/6, Microdise Dials, **3/11**; Radiophone, 0.00016 Shortwave Condensers, **3/6**; series gap, twin, **3/9**. Shortwave HF Chokes 5-100 metres **9d.**

FEATHERWEIGHT Headphones, **2/6**; Varley Bifocal Iron-cored Coils, **2/6**; matched pair, **4/6**.

SPECIAL OFFER, worth 30/-. Class B Kit, comprising: Driver Transformer, Valve and Holder, **5/-**.

AMERICAN Mains Transformers, 230 v., fully shrouded, 350-350, 6.3 v., 5 v., **6/11**; Majestic, 250-250, 2.5 v., 5 v., **4/11**.

HEAVY DUTY Mains Transformer, worth 35/-, 350-350, 150 m.a., 4 v., 2.5 ACT., 4 v., 6 ACT., **12/6**.

465 KC. IF Transformers, **2/11**; Telsen Ace, **1/11**; RG4 Radiogrands, **2/9**.

UTILITY straight line Wavelength Dials, **3/11**; Telsen HF Chokes, **1/11**.

UTILITY 2-gang Uniknob and Dial, **3/11**.

PUSHBACK Wire, 6 yds. **6d.**; heavy, **9d.**; 2 gross Solder Tags, **6d.**; Resin-cored Solder, 9ft. **6d.**; Screened Flex single, **6d.** yd.; twin, **9d.** yd.

ELECTROLYTICS, 8+8+4 500v., wkg., **3/6**; 6+6 **2/6**; 8+8 **3/-**; Helsby 8 mfd. 500 v., **2/11**; 4 mfd., **1/6**; 8 mfd., 350 v., **1/11**; 25 mfd., 25 v., **1/-**; 2 mfd., 300 v., **9d.**

SMOOTHING CHOKES, 20 hy., 120 m.a., **3/11**; 100 m.a., **2/11**; 40 m.a., **1/11**. Centralab Pots, all sizes **1/6**; switched **2/-**; Tubular glass fuses **2d.**

LISSEN 3-gang Superhet Kit Coils, two IFs, ganged Condenser, ditto Bandpass, ditto 2-gang All-wave. Any of the above kits **10/-** each.

TRADERS! Monster Bargain Parcels, value £4/10/0 for **10/-**; also **5/-** parcels. State battery or mains. Telsen Screened Dual Range Coils **2/6**; per pair **4/6**; Milliammeters 25 m.a. upwards **5/9**; super **6/9**.

FAMOUS CONTINENTAL A.C. Valves, **4/6**; Battery types from **2/3**; American Duotron, etc., all types, **3/6**; All types of RCA Licensed first grade tubes, metal and glass, in stock from **5/6**.

Order 5/- post free. Get our Bargain Catalogue, 1½d. post free. All enquiries and requests for catalogue must send 1½d. stamp.

AN ANNOUNCEMENT

We have pleasure in announcing that the 1936-7 Editions of the

RAYMART
CRAFT A CREED

MANUAL and Enlarged CATALOGUE are now ready for distribution.

RAYMART CATALOGUE FOR 1937

Enlarged to three times its previous size and now the largest and most comprehensive wholly Shortwave Catalogue published but still only 1½d. Post free.

RAYMART SHORTWAVE MANUAL

48 Pages of practical circuits and data on Shortwave Receivers, transmitters, modulators, transceivers, etc., including information on transmitting licences, "class B" modulation, aerials, etc. Price with Catalogue 6d. or 7½d. post free.

BIRMINGHAM RADIOMART (G5N1)

19, John Bright Street and Dale End

MAIL ORDER DEPT. "W"

44 HOLLOWAY HEAD,

BIRMINGHAM. **TELE.: MID 3254**

NEW LOUD-SPEAKERS

(This advertisement continued from first column.)

75/- Only, usual price £9; as above, but for use on A.C. mains; complete with Westinghouse rectifier and full smoothing equipment.

24/- Only; permanent magnet speaker, Alni magnet, die cast frame, 10in. cone, Universal transformer.

15/6 Only; permanent magnet speaker, Alni magnet, 8in. cone, Universal transformer.

12/6 Only; permanent magnet speaker, as above, with 7in. cone.

11/6 Only; extension permanent magnet speaker, 8in. cone, complete with large cabinet, suitable for low impedance outputs.

2/9 Only; brand new cabinets.

8/6 Only; electro-magnet speakers, with 8in. cone, 6,500 ohms field, Universal transformer.

IF You are Requiring Quality Reproduction at Low Cost Order Now from:—

HULBERT, 6, Conduit St., W.1. Cash or c.o.d. [2895

VAUXHALL.—Best quality speakers; see other column.—Vauxhall Utilities, 163a, Strand. [0520

LOUD-SPEAKERS

SECOND-HAND, CLEARANCE, SURPLUS, ETC.

BAKER'S Cinema Speaker, 14in. cone, the real thing; what offers?—106, Wildwood Rd., N.W.11. [3078

VAUXHALL.—Magnavox mains energised, 2,500 or 6,500 field coil, 10in. cone, 17/6; 7in. cone, 12/6.

VAUXHALL.—Magnavox permanent magnets, universal, suitable for Class "B" power or pentode, 7in. cone, 16/6; 10in. cone, 22/-.

VAUXHALL.—American Rolas, 2,500, 8in. 15/-, 9½in. 19/6. Permanent magnets, 8in. 19/6, 9½in. 24/6

VAUXHALL.—Above, fully guaranteed, complete with humbucking coils; state power or pentode transformer; unused manufacturers' stock.

VAUXHALL. Immediate delivery, carriage paid; lists free; cash with order or c.o.d.—Vauxhall Utilities, 163a, Strand, W.C.2. Temple Bar 9338. [0456

HARTLEY TURNER Standard, 1,250 ohms; £3 10, or near offer.—Hewer, 59, Dunstans Rd., Dulwich, S.E.22. [3081

AS New, 1936 Hartley-Turner P.M., Tweeter cone, output transformer; £5 10.—Irving, 6, Sandy Hill Rd., Wallington, Surrey. [3091

OFFERS Invited Quantity Goodman's Moving Iron Relay Speakers, complete, v.c, lead, all excellent condition, any quantity.—Johnson's, 67, Charles St., Milford Haven. [3023

MAGNAVOX D.C. 152 (9in. cone), 22/6; Magnavox 154 (6½in. cone), 16/3; all with humbucking coils, power or pentode transformers, and 2,500 or 6,500-ohm fields; Magnavox P.M.254, 18/-; Magnavox P.M.252, 22/6.

ATTENTION to All Orders Within 48 Hours; carriage paid; cash with order or c.o.d.; send for list.

WARD, 46, Farringdon St., London, E.C.4. Tel.: Holborn 9703. [0451

MOVING Coil Loudspeakers, manufacturer's type, 6½in. cones, tested and guaranteed, permanent magnet, W.B., 11/6; W.B. new type magnet, 13/6; Rola, 15/6; mains energised, W.B., 6/6; Rola, 10/6; state whether for power or pentode; cabinet for same, 2/6; c.o.d. or c.w.o. send by return post; postage 1/-.

H. L. SMITH and Co., Ltd., 287-289, Edgware Rd., London, W.2. [3107

VALVES

ANDERSON.

ALL Types of American Valves, fully guaranteed first grade Raytheon, Sylvania, Philco, Triad Impex; 5/- each; also line cords, American type condensers and replacements for American sets; stamp for list.

J. F. ANDERSON, 35, Lansdowne Rd., Walthamstow, E.17. Telephone: Walthamstow 0827. [2947

AMERICAN Valves, first grade, in all types; trade supplied.—Metropolitan Radio Service Co., 1021, Finchley Rd., N.W.11. Speedwell 3000. [0436

HIVAC, TUNGSRAM, and all Reliable Americans, a complete service to traders; orders c.o.d. or send for lists.—Leonard Heys, 36, Henry St., Blackpool. [0529

ALL Types of American Valves in Stock of Raytheon, Sylvania, and Arcturus makes, at competitive prices, guaranteed for six months; send for full list; 350 ohms line cords, 2/8.

WARD, 46, Farringdon St., London, E.C.4. Telephone: Holborn 9703. [0452

NOTHING Better Available; six months' guarantee; complete range of battery, A.C. mains, rectifiers, always in stock; 2-volt det., H.F., L.F., 2/3; power, 2/9; screen grid, pentode, H.F. pentode, 5/-; American types, fully guaranteed, 5/6 each: Nos. 80, 42, 43, 57, 58, 77, 78, 6C6, 6D6, 25Y5, 25Z5.—Write for other prices to Dulci Electrical Co., Ltd., 7, Lizard St., London, E.C.1. [0501

METERS, ETC.

UNIVERSAL Avominor, unused; £3/5.

HENRY'S, 72, Wellington Av., N.15. Stamford Hill 2907. [3062

PAIR of Special Laboratory Meters, 0-250v., 0-100 m.v., 0-20 m.a., 0-100 m.a., 500 m.a., 1 amp., 2 amp., 5 amp., 10 amp., 20 amp., 7½in. scale, locked needles, listed £35, new; £10.—Grosher, 91 Flat, Mantell St., N.1. [3101

NEW COMPONENTS

ALL Standard Makes, wholesale only, write for lists.—Leonard Heys, 36, Henry St., Blackpool. [0523

IMPROVEMENTS and Spares for Transverse-current Microphones; silver-soldered gilded electrodes, 3/3 pair; also finest granules and all detail parts.

A. HINDERLICH, 2, Bridge Rd., London, N.W.10. [3102

COMPONENTS
SECOND-HAND, CLEARANCE, SURPLUS, ETC.

VAUXHALL.

ALL Goods Previously Advertised are Standard Lines Available for Immediate Delivery.
VAUXHALL UTILITIES, 163a, Strand, W.C.2, over Denny's, the Booksellers. Temple Bar 9338. Send post card for new lists, free. [0453

HYAMS RADIO.

EX-MARCONI A.C. Gramo Motors for 100-250 volt Mains, new, less turntable; 16/6.
B.T.H. Carbon Mike on Stand, with rubber suspension, perfect condition; 45/-.
EPOCH Super Cinema Speaker, 6-volt field, one only, nearly new; 55/- to clear.
HYAMS RADIO, 23, Lisle St., W. Ger. 2969. [3125

SOUTHERN RADIO'S Wireless Bargains; all goods guaranteed and sent post paid.
G.E.C. 3-valve Battery Sets, "Battery Compact Three," with 3 Osram valves, moving coil speaker in beautiful bakelite cabinet, brand new, in sealed cartons, fully guaranteed; 50/- each (list £5/10).
MULLARD M.B.3 Battery Sets, complete with 3 Mullard valves (3 pentodes), moving coil speaker, Exide batteries and accumulator, contained in handsome walnut cabinet, brand new, in sealed cartons; £4/10 each (list £8/8).
TELSEN Short Wave Kits, can be used as S.W. converter, receiver or adaptor for battery or mains, brand new and boxed; 20/-
SPEAKERS.—Celestion Soundex permanent magnet, 10/-; Telsen permanent magnet, with 10-ratio transformer to suit any receiver, 12/6; Telsen loud speaker units, 2/6; all brand new and in sealed cartons.
COILS.—Telsen, iron core, W349. Midget size, 4/-; Type W478 (twin), 9/- pair; W477 (triple), 16/- set; Type W476 (triple superhet selector and oscillator), 16/- set, all ganged coils complete on base with switch. Telsen I.F. transformer coils, W482. 5/-; Telsen dual range aerial coils, with aerial series condenser incorporated, W76, 4/-; Telsen aerial series condensers, with shorting switch, 2/-; Telsen L.F. transformers, Type R.G.4 (4 to 1), 3/-; all brand new, in sealed cartons.
MICROPHONES.—Ace (P.O.) microphones, complete with transformer, ready for use with any receiver, 4/6 each; Ace concert microphone, complete on chromium stand with volume control, ready for use with any receiver and amplifier, 11/-.
RESISTANCES.—Tru-ohm 1-watt, colour coded and marked, 36 assorted capacities on card; 6/- per card.
POTENTIAL Dividers.—Lissen wire wound 3-section, 60-watt, 4,500 ohms, 3,000 ohms and 2,000 ohms; 3-section, 5 watts, 20,000, 20,000, and 20,000 ohms; 2-section, 5 watt, 50,000 and 30,000 ohms; 1-section, 5 watt, 3,000 ohms, all at 1/3 each; brand new and guaranteed.
AMERICAN Valves.—A full range of valves for all American receivers; 6/- each.
HEADPHONES, Lightweight headphones, double pole type, 4,000 ohms each ear piece; 3/- pair.
REPAIRS.—Any type of receiver, American, British, etc., repaired by expert staff.
IMPORTANT Announcement.

WE Have Purchased the Complete Component Stock of a Well-known Radio Dealer and Manufacturer, and we are offering the complete stock in parcel lots as under:—
5/- Parcel, containing components to the value of at least 20/-, comprising chokes, resistances, coils, switches, condensers, wire and circuits, 5/- per parcel.
10/- Parcel, containing components to value of at least 45/-, comprising variable condensers, screened chokes switches, resistances, screened coil, wire, circuits, etc., etc; 10/- per parcel.
ALL Articles Included in These Parcels are Brand New and Modern.
SOUTHERN RADIO.—Branches at 271-275, High Rd., Willesden Green, N.W.10; 46, Lisle St., London, W.C.2. All mail orders to 323, Euston Rd., London, N.W.1.
SOUTHERN RADIO, 323, Euston Rd., London, N.W.1 (near Warren Street Tube). 'Phone: Euston 3775. [3043

MAINS RADIO'S Superb Bargains are now Displayed on page 7. Don't miss them.
MAINS RADIO DEVELOPMENT COMPANY, 4-6, Muswell Hill Rd., London, N.6. Tudor 4046. [2914

RYALLS RADIO. Ryalls Radio. Ryalls Radio. Ryalls Radio.—280, High Holborn, London, W.C.1.
WE List Here a Few Items from our Large Stock, unobtainable elsewhere, and at a fraction of the usual price, post extra.
WEARITE Q.R.T. Coils, screened for chassis mounting, coils have Litz wound secondaries, and we give connections; H.F., Det., two coils, 4/-; Det. with reaction, one coil, 2/6; H.F. bandpass, three coils, 5/-; correct type multi-contact switches, with gram position, 2/6.
TELSEN Iron Core Matched Coils, type W422, twin, 5/6; type W423, triple matched, 8/3; switch for twin pair, 6d.; for triple, 1/-.
EBONITE, polished black, mahogany reverse side, 18×8, 1/9; 18×7, 1/6; 16×8, 16×7, 1/6; 12×8, 1/-; 12×6, 8d.
MAGNAVOX 2,500 ohms Speakers, DC144, with power, pentode transformers, 7/6, 8in., also well known make, 6in., cone, 5/9 with Pentode transformer, 2,500 ohm.
PENTODE Transformers for Moving Coil Speakers, 3/-; 2,500 ohm field coils with magnet, etc., complete, 3/6.
BRITISH Made Transformers for American Type Valves, 350-350 60m., 6.3v. 4a., and 5v. 2a., screened primary, and L.T. C.T., 6/6.
ELECTROLYTIC, B.I. 50 mfd. 12v., 9d.; B.I. 50 mfd. 50v., 1/-; T.C.C. 25 mfd. 25v., 9d.; B.I. 8 mfd. dry type, upright fixing, 550v. P.W., 2/-; ditto, 4 mfd., wet, 1/6.
VOLUME Controls, well-known make, with double pole mains switch, 10,000 ohm wire wound, 1/9; ditto, 100,000 ohm, less switch, 1/-.
SPECIAL Low Capacity 5-point and Gram Switches, 6in. long, and 1¼in. bush and spindle, 3/-; also 2-pole double throw, rotary, 1/-.
BULGIN 0.3 amp. Mains Resistances, with tappings, 2/3; Helsby Mansbridge block condensers, 500v. D.C. working, 2×6×8, 4/-.
RYALLS RADIO. Ryalls Radio. Ryalls Radio. Ryalls Radio. [3116

COMPONENTS—SECOND-HAND, CLEARANCE, SURPLUS, ETC.

RADIO CLEARANCE,
63, High Holborn, W.C.1. Holborn 4631.
LARGE Purchase of Bush Receivers.
£3/12/6.—Model S.B. 21 3-valve battery superhet, 4 stages, listed 9 guineas, complete with valves, aerial tested.
£4/15.—Model S.B. 4, 4 valves, 6 stages, battery superhet.
ALL the Above Guaranteed in Perfect Working Order.
ORDER Early to Avoid Disappointment; past experience has shown us that these sets are cleared very rapidly; remember, Bush sets are trouble free, and sell on reputation.
30/-.—Lissen 100 station set, B.A. speaker, complete with 3 valves, screen grid, detector, pentode, slightly shop soiled.
35/-.—Ditto, with P.M. moving coil speaker.
12/6.—Lissen 3-valve straight receiver, detector, L.F. pentode, B.A. speaker, complete with valves, slightly shop soiled.
EXCLUSIVE British Rights Held by Us for Constructrad Short Wave Kits; all kits supplied valves free, 5 interchangeable coils covering a range from 15 600 metres; complete set—not a converter.
29/6.—One-valve battery kit.
37/6.—Two-valve battery kit.
37/6.—One-valve A.C./D.C. kit.
£5/19/6.—Ever Ready 5-valve battery superhet, incorporating A.V.C., large square type dial, provision for pick-up and extension speaker, listed 12 guineas; stocks are limited; order at once to avoid disappointment.
57/6.—Lissen battery Band Pass 3, complete with valves, screen grid, detector, pentode.
75/-.—A.C./D.C. American Midget, 5-valve type, a real quality job, Jensen moving coil speaker, etc, brand new, boxed.
BRYCE Mains Transformers and Chokes; standard for the season, finest made, British and guaranteed.
8/6.—250-0-250, 80 m.a., 2-0-2 volts 2.5 amp., 2-0-2 volts 4 amp.
10/6.—350-0-350, 120 m.a., 2 0 2 volts 2.5 amp., 2-0-2 volts 4 amp.
12/6.—350-0-350, 150 m.a., 2-0-2 volts 2.5 amp., 2 0-2 volts 4 amp., 2-0-2 volts 2 amp.
17/6.—500-0-500, 150 m.a., 2-0-2 volts 2.5 amp., 2-0-2 volts 6 amp., 2-0 2 volts 2 amp., 2-0 2 volts 2 amp.
8/6.—H.T.8 transformer, 250 volts, 60 m.a., 2-0 2 volts 4 amp.
17/6.—Ditto, with H.T.8 metal rectifier.
ALL Transformers are Fully Shrouded.
MAINS Chokes.
4/6.—40 m.a. 30 hys.
6/-.—60 m.a. 40 hys.
10/6.—150 m.a. 40 hys.
21/-.—250 m.a. 15 hys.
6/-.—60 m.a. 8 hys. 2,500 ohms, for speaker replacement, etc.
12/6.—Special clearance choke, 250 m.a. 12 hys. 100 ohms, heavy duty type, interleaved windings, etc., cannot be repeated.
TRIAD American Valves, highest quality, all types, 5/6 each, as follows: 01A, 24A, 27, 30, 31, 33, 32, 35, 37, 38, 39, 41, 43, 45, 46, 47, 53, 55, 56, 57, 58, 59, 71A, 75, 78, 80, 6A6, 1C6, 6F7, 2A3, 523, 12A7, 6A7, 6C6, 6D6, 1223, 2525.
ALL These Valves Carry a 90-day Guarantee and Free Replacement, provided that the filament or heater is intact and the glass not broken when returned to us.
6D.—American 5-6-7-pin valve holders, chassis type.
3/6.—Lissen Class B valves, brand new, boxed.
8/-.—Lissen all-wave coils, complete with circuit, switching, etc., sent out in matched pairs, covering two short bands, medium and long.
4/6.—Single coils ditto.
1/-.—Lissen 126 K.C. iron cored oscillator coils, screened.
2/6.—8 mfd. and 4 mfd. electrolytics, 450 volt working, 500 volt peak.
3/6.—8+8 cardboard wire end electrolytics, 450 volt working, 500 surge, well known manufacture.
1/-.—50 mfd. 12 volt working condensers, well known manufacture.
1/6.—50 mfd. 50 volt working condensers, well known manufacture.
1/3.—50 mfd. 25 volt working condensers, well known manufacture.
1/-.—25 mfd. 50 volt working condensers, well known manufacture.
3/11.—8+8+4 electrolytic cardboard condensers, wire ends, 450 volt working.
2/6.—14+8 450 volt working electroletic condensers, metal cased, wire ends, by well known manufacture.
1/-.—25 volt 25 mfd. electrolytic condenser, tubular type, by well known manufacture.
8/11. P.M. moving coil speaker, 7½in. cone, by well known manufacture.
7/6.—P.M. moving coil speaker, 6in. cone, by well known manufacture.
3/6.—Multi purpose valve, suitable for H.F. pentode, listed at 21/-.
1/-.—Lissen intervalve chokes, brand new, boxed.
4/-.—Midget 2-gang 0.0005 condensers, fully screened, top trimmers, by well known manufacture.
ENQUIRIES 1½d. stamp if Reply Expected.
HOURS of Business 9 a.m. to 7 p.m., Saturday 9 a.m. to 1 p.m.
ALL Orders Value 5/- and over Post Free; orders under 5/- must be accompanied by reasonable amount for postage.
RADIO CLEARANCE, 63, High Holborn, W.C.1. Holborn 4631. [3119

COMPONENTS—SECOND-HAND, CLEARANCE, SURPLUS, ETC.

PREMIER SUPPLY STORES,

THE Largest Radio Mail Order House in the World,

OFFER the Following Manufacturers' Brand New Surplus Goods at a Fraction of the Original Cost; all goods guaranteed perfect; carriage paid over 5/-; under 5/- postage 6d. extra; orders under 5/- cannot be sent c.o.d.

SHORT-WAVE Coils, 4- and 6-pin types, 13-26, 22-47, 41-94, 78-170 metres, 1/9 each, with circuit; special set of 3 S.W. coils, 14-150 metres, 4/- set, with circuit; Premier 3-band S.W. coil, 11-25, 19-43, 38-86 metres, simplifies S.W. receiver construction, suitable any type circuit, 2/-.

COIL Formers, in finest plastic material, 1½in. low-loss ribbed, 4- or 6-pin, 1/- each.

SUPER Ceramic Condensers, S.L.F., .00016, .0001, 2/9 each; double spaced, .00005, .000025, .000015, 3/- each; all brass, with integral slow motion, .00015 tuning, 3/9; .00015 reaction, 2/9; British Radiophone 2-gang .00016 with trimmers, 5/6.

H.F. Chokes, S.W. 10-200 metres, 9d.; S.W. screened, 1/6; standard screened, 180-2,000 metres, 1/6.

SHORT-WAVE Kit for 1-valve Receiver or Adaptor, complete with chassis, 4 coils, 14-150 metres, condensers, circuit and all parts, 12/6; valve given free! De Luxe model, 17/6, superhet converter kit, 13/6.

2-Valve S.W. Kit, 19/6; valves given free! 3-valve S.W. kit, S.G. Det. and Pen., 42/-; valves given free!

ALL-WAVE "All-World Range" 3-valve Kit, 12-2,000 metres in 4 wavebands without coil changing, complete kit of parts with 3 valves, S.G., H.F., S.G. det. and pentode (2 volts), 50/-; Q.P.P. model, 6/6 extra.

BAND-PASS Tuning Pack, comprising set of Telsen 3-gang iron-cored coils with switching, mounted on steel chassis with 3-gang condenser, illuminated disc drive and 4 valve holders; 25/- the lot. All mains or battery circuit. Free!

LISSEN All-wave Coils, 12-2,000 metres, complete with switching and wiring diagram; 12/6.

PREMIER Mains Transformers, wire-end type with screened primaries, tapped 200-250 v., centre-tapped filaments, guaranteed one year; H.T. 8 and 9 or H.T. 10 with 4 v. 4 a. C.T. and 4 v. 1 a. C.T., 8/6; 250-250 v. 60 m.a., 4 v. 1 a., 4 v. 2 a. and 4 v. 4 a., all C.T., 8/6; 350-350 v. 120 m.a., 4 v. 1 a., 4 v. 2 a. and 4 v. 4 a., all C.T., 10/6; any of these transformers with engraved panel and N.P. terminals, 1/6 extra; 500-500 v. 150 m.a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v. 2-3 a., 4 v., 3-4 a., all C.T., 19/6; auto transformers, step up or down, 60 watts, 7/6; 100 watts, 10/-.

SMOOTHING Chokes. 25 m.a., 2/9 40 m.a., 4/- 60 m.a., 5/6; 150 m.a., 10/6; 2,500 ohms 60 m.a. speaker replacement chokes, 5/6.

MILLIAMMETERS, moving iron, flush, 2½in., all ranges from 0-10, 5/9; visual tuning, 6 or 12 m.a., 5/9; moving coil meters, 2½in.-0-1 m.a., 18/6; 3½in. 0-1 m.a., 22/6; multipliers, 1/- each.

ELECTROLYTICS, U.S.A., 4, 8 or 12 mfd., 530 v. peak, 1/9 each; Dubilier, 4 or 8 mfd., 500 v., 3/-; 50 mfd. 50 v., 1/9; 12mfd. 20 v., 6d.; 25 mfd. 25 v., 1/-; T.C.C. 4 or 8 mfd. 650 v., 4/-; 15 mfd. 50 or 100 v., 1/-; 50 mfd. 12 v., 1/-.

PAPER Condensers, W.E., 250 v. working, 4 mfd., 2/-; 2 mfd. 1/-, 1 mfd. 6d.; 350 v. working 4 mfd., 2/6; 2 mfd. 1/6; Dubilier 500 v. working 4 mfd., 4/-; 800 v. 4 mfd., 6/-; Wego 450 v. working 1 mfd., 1/-, 2 mfd. 1/9, 4 mfd. 3/-; 700 v. working 2 mfd. 2/-, 4 mfd. 3/6.

TRANSFORMERS, latest type Telsen R.G.4 (list 12/6), 2/9; Lissen Hypernik Q.P.P. (list 12/6), 3/6.

ELIMINATOR Kits for A.C. Mains, 120 v. 20 m.a., or 150 v. 25 m.a., 10/-; tapped S.G., det. and output; complete kit with long-life valve rectifier (replacement cost only 2/-).

PREMIER L.T. Charger Kits for A.C. Mains, including Westinghouse rectifiers and tapped mains transformers, 8 volts at ½ amp., 14/6; 8 volts 1 a., 17/6; 15 volts 1 a., 19/-; 15+15 volts 1 a., 37/6; 15+15+15 volts 1 a., 50/-; 8 volts 2 a., 29/6.

TELSEN Iron-cored Screened Coils, W.349, 4/- each. Electric soldering irons, 200-250 v., A.C., D.C., 2/3.

PREMIER (Reisz Pattern) Transverse-current Mike, high output, straight line response, 30/-; transformer, 5/-; table stand, 7/6.

PREMIER Amplifier Kits, 3-watt A.C. amplifier, 2-stage for mike or pick-up, complete kit of parts with 3 valves; 40/-.

SPECIAL Offer!—12/6 P.M. speaker, 35/- transverse current mike, complete with transformer and 7/6 stand; if purchased with above kit, 25/- the lot.

7-Watt A.C./D.C. Amplifier, 3-stage, high-gain, push-pull output, complete kit of parts with 5 specially matched valves, £4/4/-.

SPECIAL Offer!—21/- pair matched speakers, 35/- transverse current mike, complete with transformer and 7/6 stand; if purchased with above kit, 35/- lot.

10-Watt 3-stage A.C. Amplifier Kit, with 5 valves; £5 5/-.

SPECIAL Offer!—21/- pair matched speakers, 35/- transverse current mike, complete with transformer and 7/6 stand; if purchased with above kit, 35/- the lot.

20-Watt 3-stage A.C. Amplifier Kit, with 5 valves; £8 8/-.

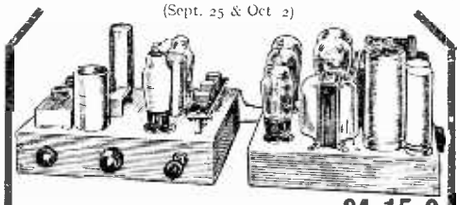
SPECIAL Offer!—£6 pair P.M. exponential horn speakers, 35/- transverse current mike with transformer, and 7/6 stand; if purchased with above kit, £5/10/- the lot.

MAINS Valves, famous Europa 4 v. A.C. types, 4/6 each; HL., L., S.G., Var.-Mu-S.G., H.F.-Pens., Var.-Mu-H.F. Pens; 1, 3 and 4-watt A.C. directly heated output pentodes, full-wave rectifiers, 250 v. 60 m.a. A.C./D.C. types; 20-volt, .18 amp. S.G., Var.-Mu S.G., H., HL., power. Following types all 5/6 each, full-wave rectifiers, 350 v. 120 m.a. and 500 v. 120 m.a. 2½ watt indirectly heated pentodes; frequency changers, octodes and heptodes.

(This advertisement continued in third column.)

PRE-TUNED QUALITY RECEIVER

(Sept. 25 & Oct 2)

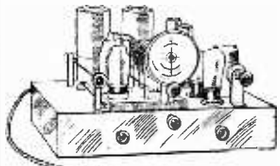


COMPLETE KIT, with drilled Chassis ... **£4-15-0**
2 specified valves 22/- extra.

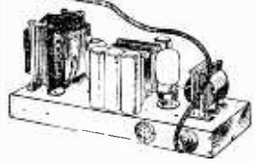
QUALITY AMPLIFIER for above Receiver, or as basis for P.A. amplifier. Complete Kit with drilled Chassis ... ... **£5 - 5-0**
5 Specified Valves 67/- extra.

ALL-WAVE SUPER 7

Aug. 7 & 14.



COMPLETE KIT including drilled Chassis.
£11-10-0
6 Specified Valves 67/6 extra.



POWER UNIT KIT Complete with drilled Chassis.
£7-4-0
2 Specified Valves 27/6 extra.

COUPLING UNIT KIT (Cct. 23) for coupling ALL-WAVE SUPER 7 to QUALITY AMPLIFIER. **34/4**
Valve 9/6 extra.

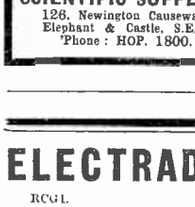
30 W. LOW-LOADING AMPLIFIER (Partridge design). Built, wired and tested with Valves ... ... **£15 - 15 - 0**
12 W., built, wired and tested, with Valves... ... ... **£12 - 18 - 6**

ALL "W.W." KITS SUPPLIED—SEND FOR LISTS—

SCIENTIFIC SUPPLY STORES (Wireless) LTD.

126, Newington Causeway, Elephant & Castle, S.E.1. 'Phone: HOP. 1800.
33, St. Martin's Court, Charing Cross Road, W.C.2. 'Phone: TEMple Bar 1923

ELECTRADIX BARGAINS



RCGI.

BATTERY CHARGERS for A.C. Mains, 200 to 250 v. 50 cycles. Metal Rectifier Types, all with Steel Cases, double-wound transformers, full-wave metal rectifiers, Circuit meters, voltage regulators, charge rate adjusters, etc.

£40 WESTINGHOUSE BATTERY CHARGER RCGI, 200/230 v. A.C. mains, very posh, as new, and 4 meters, 4 controls and auto circuit breaker, 4-circuit Charger, size 20"×24"×27" for H.T. ¼ amp. and 120 Radio Cells and 5 Car Batteries at once. Earns big money.
150 v. 250 m.a. for H.T. Cells, 60 cells at ¼ amp., 60 cells at 1 amp. and 40 volts at 5 amps. Extra circuit breaker and supply switch guaranteed 5 years. **£21 10/-.**

MODEL R. WESTINGHOUSE single circuit, wall type, 9"×10"×11", 230 v. A.C., for D.C. 110 v. at ¼ amp. D.C. Sale **£5 10/-.** Ditto, larger model, for 230 v., 250 m.A. output, size 10"×12"×24". **£7 10/-.**
Another R. Type for 200/250 input, with outputs of two 30 volt ¾ amp. circuits, as new, 22"×12½"×7". **£7 10/-.**
Ditto for 48 v. 1 amp., **£6 10/-.** Ditto, to 15 v. 3 amps., D.C., **£7 10/-.**

B.T.H. TUNGAR, 200/250 v. to 75 v. 6 amps., **£9.** Ditto, 110/125 v. A.C. to 70 v. 10 amps., 2 circuits, **£12.** Car Chargers, 200/250 v. A.C. to 6/12 v. 5/3 amps., **£4 17 6.** Ditto, 2 amps., **75/-.**

FOR HOME USERS. We have new 10-watt Chargers, 230 v. A.C. to 2 v./6 v. 1½ amp. D.C. for **30/-** and A.C. Trickle Chargers for H.T. and L.T. cells for **37/6.** Car Chargers, **77/6.**

SWITCHGEAR BUILT TO ANY SPECIFICATION AT LOWEST PRICES.

OVERLOAD CIRCUIT BREAKERS replace fuses now. Magnetic Trip, 2 to 4 amps., **7/6**; 6 amps., **10/-**; 10 amps., **12/-**; 15 amps., **14/-**; 20 amps., **16/-.** Useful for remote control jobs. Illustration shows cover removed. D.P. and triple poles with trips and thermal delays. Cheap. Reyrolle Power Plugs, 15 amp., shrouded panel wall two pairs on iron box, unused, **10/-.** Transmitters, 10 amp. Key Relays, **15/-.**

TIME SWITCHES. CLOCKDRIVE. Switch on-off any time, 6 amps., **35/-**; 10 amps., **40/-**; 25 amps., **55/-.**

MEGGERS, 100 to 500 volts, 1,000 ohms to 20 megs. cheap. Wheatstone Bridges and Galvos. Oscillations and Cathode Tubes in stock. 500 cycles 250 watt Alternators, **£3 10/-.** **SET TESTING OSCILLATORS AND ANALYSERS, WAVEMETERS, ETC.**

COMPASSES. Boat Binnacle Mariners' 6" Boat Compass, floating, gimbal glass case. **35/-.** Magnetic Compass 14in. Brass Case, bevel glass, plain dial, unsealed, new, **9d.** War Office Prismatic, **25/-.** Travellers' pocket, **15/-.**

MICROPHONES. 25 models in stock. Crystal, Condenser, Mov. Coil, Transverse, Reisz, etc., All cheap.

Illustrated Bargain List "W" free.

ELECTRADIX RADIOS

218, Upper Thames St., London, E.C.4.
'Phone: Central 4611

COMPONENTS—SECOND-HAND, CLEARANCE, SURPLUS, ETC.

(This advertisement continued from first column.)

BATTERY Valves, 2 volts, H.F., L.F., 2/3; power, super-power, 2/9; S.G., Var.-Mu-S.G., 4- or 5-pin pentodes, H.F. pens., V.-Mu-H.F. pens., 5/-; Class B, 3/6.

AMERICAN Valves.—Genuine American Hytron first-grade valves, 3 months' guarantee; all types 5/6 each; 210 and 250, 8/6 each; new metal-glass valves, all types, 6/6 each; genuine American Duotron valves, all types, 3/6 each.

VALVE Holders for All Above Types, 6d. each; octa bases, 9d. each.

MAGNAVOX Moving Coil Speakers, mains energised, "154," 7in. cone, 2,500 ohms 4 watts, 12/6; "152," 9in. cone, 2,500 ohms, 17/6; "152 Magna," 9in. cone, 2,500 ohms, 6 watts, 37/6; Magnavox P.M.s, "154," 7in. cone, 16/6; "252," 9in. cone, 22/6; reliable P.M.s, 10/6; Cossor P.M.s, 13/6.

ROLA Latest Type P.M.s, 18/6; KB 7in. mains energised, 1,500 or 2,500 ohms, 7/9; Goodmans' 8in. mains energised, 1,000 ohms field, 10/6 each.

R. and A. Energised Speakers, 7in. cone, 2,500 ohms, pentode transformer, 9/6.

MAGNAVOX P.M. Speaker, complete with output transformer, specially suitable for battery sets, 8/9.

DIALS. Clarion illuminated S.W. slow-motion dial with 2in. knob, 2/-; Premier all-wave 2-speed dial, full vision straight-line, dual ratios, 10-1 and 150-1, 6/6, with escutcheon.

POTENTIOMETERS by Well Known Makers, all values up to 1 meg., 2/-; with switch, 2/6.

GRAMOPHONE Motors.—Collaro gramophone unit, consisting of A.C. motor, 100-250 v. high quality pick-up and volume control, 45/-; Collaro motor only, 30/-; Collaro universal gramophone motor, 100-250 v. A.C./D.C., with high quality pick-up and volume control, 67/6; Collaro universal motor only, 49/6; Edison Bell double-spring motors, including turntable and all fittings, 15/-; Cosmocord gramo. unit, comprising A.C. motor, pick-up and volume control (list 55/-), 35/9.

TUBULAR Condensers, non-inductive, all values up to .5 mfd., 6d. each.

WIRE-END Resistors, any value, 1 watt, 6d.; 4 watts, 1/-; 8 watts, 1/6; 15 watts, 2/-; 25 watts, 2/6 each.

RELIABLE Morse Keys with Morse Code engraved on Bakelite Base, 2/- each.

BAKELITE Case Buzzers, 1/6; "Loud-tone," 2/6 each; super quality lightweight headphones, 3/9 pair.

BRITISH Radiophone 2-gang (2 x .0005) Condenser, screened, with full vision dial and uniknob trimmer, 7/6.

BRITISH Radiophone 2-gang Condenser (2 x .0005), screened, with disc drive and top trimmers, 5/6.

HAVE You Had Our Latest Giant Illustrated Catalogue and Valve List? If not, send 4d. in stamps for this amazing list of bargains!

ALL Post Orders Should be Addressed to Jubilee Works, 167, Lower Clapton Rd., London, E.5. Amherst 4723. Callers as usual to:

20 22, High St., Clapham, S.W.4. Open till 9 p.m. Saturdays, Wednesdays 1 p.m. Macaulay 2381.

165 and 165a, Fleet St., E.C.4 (next door to Anderton's Hotel). Early closing Saturday 1.30 p.m. Central 2833. [0488

WARD for Unparalleled Bargains in Set Manufacturers' Surplus; all goods are guaranteed unused and perfect; immediate delivery.

GARRARD Universal Gramophone Motors, with auto-stop, etc., £3/10/; Blue Spot Class "B" output chokes, 3/-.

BRITISH Radiophone Condensers, fully screened, superhet or straight types 3-gang and 2-gang; 7/6.

CENTRALAB Resistance, 1-watt type, 6d.; 2-watt type, 1/2; 3-watt type, 1/9; B.I.C. 8 mf. and 4 mf 550 volts peak electrolytic condenser, 3/3.

WEARITE 110 K.C. I.F. Transformers; price 2/9 each or 2/3 each in lots of six.

CLIX Chassis Type Valve Holders, 4- or 5-pin, 6d.; 7- or 9-pin, 6d.; R.C.A. American valve holders, 4-, 5-, 6-, or 7-pin, 9d.

ASSORTED 1 gross Parcels or 1-watt and ½-watt Resistances by N.S.F.; 12/-.

MARCONI Model 25 Pick-ups, 21/-; Cosmocord, 12/-; B.T.H. pick-up tone arms, 3/-.

CONVERSION Units for Converting D.C. Receivers to A.C. mains operation, up to 100 watts improved full wave type; £2/10/.

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MAINS Transformers.—350-0-350v. 60 m.a., 4v. 3 amps., 4v. 25 amps., 12/-; 425-0-425v. 120 m.a., 4v. 1 amp., 4v. 1 amp., 4v. 7 amps., 4v. 2.5 amps., for "W.W." Quality Amplifier, 26/-; L.T. transformers, with two 4-volt 3a. C.T. windings, or 2.5v. 8a., 5v. 2.5a., 8/6.

VOLUME Controls, with or without switch, by Rotor-ohm, Centralab, and other good makers, any value 2/6; steel chassis, "Wireless World" Quality Amplifier, 8/6; Partridge 32 watt amplifier, 11/-.

WE Stock All Parts for "Wireless World" Quality Amplifier, Quality Amplifier Receiver, Imperial Short Wave Six, and 1936 "Monodial."

"EUROPA" Continental Valves, all types in stock; A.C. or A.C./D.C. (20 volts, 0.18 amps.), variable-mu, output triodes, detectors, etc., 4/6 each; output pentodes, 5/6; 500-volt rectifiers, indirectly heated or otherwise, 7/-; we can also supply a correct replacement for any British type of valve, including side-contact universals, and 60-watt output triodes; price upon request.

CARRIAGE Paid, cash with order or c.o.d.; send for list.

VARLEY 3-gang Coil Sets, type BP13 and BP19, superhet or straight; 13/6.

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"Radio Receiver Measurements." Price 4/6 By post 4/9

COMPONENTS—SECOND-HAND, CLEARANCE, SURPLUS, ETC.

TRANSMITTING APPARATUS

CINEMA EQUIPMENT

MISCELLANEOUS

ELECTRIC CLOCKS

EXTENDED PAYMENTS

EXCHANGE

COSMIC RADIO SERVICES, Ltd., 23, Water St., Liverpool, accept quality mains equipment, meters, components, etc., in part exchange. Meters purchased. [2904

I BUY, sell, exchange good quality receivers, accessories, components; H.P. facilities; promptness, efficiency.—Bostock, 1, Westbourne Terrace, S.E.23. Forest Hill 2236. [0529

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GEE and Co.—Patent and Trade Marks throughout the world.

H. T. P. GEE, Mem. R.S.G.B., A.M.I.R.E., 51-52, Chancery Lane, London, W.C.2. Established 1905 (2 doors from Government Patent Office). 'Phone: Holborn 4547 (2 lines). Handbook free. [0001

H. N. and W. S. SKERRETT, Chartered Patent Agents, 88-90, Chancery Lane, London, W.C.2 (Hol. 8837), and 24, Temple Row, Birmingham. [2461

PATENTS

PATENTS and Designs Acts, 1907 to 1932.

NOTICE is Hereby Given that Marconi's Wireless Telegraph Co., Ltd., of Marconi Offices, Electra House, Victoria Embankment, London, W.C.2, seek leave to amend the specification (including the drawings) of the application for Letters Patent No. 451,345 for an invention entitled "Improvements in or relating to modulated carrier wave receivers."

PARTICULARS of the Proposed Amendment were set forth in No. 2494 of the Official Journal (Patents), published on November 4th, 1936.

ANY Person, or persons, may give Notice of Opposition to the amendment by leaving Patents Form No. 19 at the Patent Office, 25, Southampton Buildings, London, W.C.2, within one calendar month from the date of publication of the said journal.—M. F. Lindley, Comptroller-General. [3118

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"PRACTICAL Hints on Patents," free on application.—The Imperial Patent Service, First Avenue House, High Holborn, W.C.1. Preliminary consultation free. [0481

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DISTAVOX SERVICE.

TRADE Service.—All makes of English and American receivers; quotation by return.

REWINDING.—Mains, L.F. and output transformers, speakers, headphones, etc.; keenest terms for contracts.

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HENRY FORD RADIO, Ltd.,

LEADING Service Specialists for American Receivers, also British; trade work particularly; estimates free.

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DEGALLIER'S, Ltd., radio repairers on British and American receivers, 3 days' service, lowest prices with best workmanship, all repairs guaranteed.

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REPAIRS AND SERVICE

GRAHAM'S Radio Repair and Rewinding Service, 24 hours' service guaranteed.—See below.

ANY Moving Iron Loud Speaker, L.F. transformer, or pick-up, 2/6; output transformer, 4/-; postage extra; mains transformers, moving coils, electric clocks quoted; trade discounts.—See below.

RECEIVERS, including American, serviced promptly and efficiently, quotations by return.—Graham's Repairs, 194, Tolworth Rise, Kingston By-Pass, Surrey. 'Phone: Derwent 2060. [2632

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CLARION and Majestic Service Depot.—L.F. and mains transformers rewound. American valves and parts; trade supplied.—Metropolitan Radio Service Co., 1021, Finchley Rd., London, N.W.11. Speedwell 3000. [0435

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

L.T.P. (LONDON TRANSFORMER PRODUCTS, Ltd.), Willesden, N.W.10. Wil. 3568 and 7743. [1650

SCOTLAND'S Rewind Service; mains and output transformers, chokes, speaker fields, etc., rewound; estimates free, trade terms.—S. and W. Ross, 95, Douglas Street, Glasgow. [3114

F. E. GODFREY, A.M.I.R.E., qualified to build, repair and convert "Wireless World" sets, etc.; 25 years' experience; prompt service guaranteed.—30, Kemplay Rd., Hampstead. Hampstead 1104. [2878

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

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RADIO Training.—Marine, aircraft, broadcast; prospectus free.—Hull Municipal Technical College. [0523

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WANTED, Milnes H.T. battery, super capacity.—Box 9312, c/o *The Wireless World*. [3106

WANTED for Cash.—Modern radio receivers; also meters, etc.—M. R. E., 6, Pentonville Rd., London, N.1. [2939

WANTED.—P.A. mobile unit for car, 5-10 watts output.—Farron, 223, Bolton Rd. W., Ramsbottom, Manchester. [3079

WANTED, several superhet, battery sets, non-associated make.—Write for details, stating quantity available, Box 9302, c/o *The Wireless World*. [3088

FERRANTI and Weston Meters Wanted, also clean surplus components; best prices paid.—Newport Surplus Stores, 24a, Newport Court, Charing Cross Rd., W.C.2. Ger. 2791. [3123

WE Buy for Cash All Types of Modern Second-hand Radio Sets and Accessories, test meters, parts, etc.; we pay more than any other dealer; part exchanges; bring, send, or will call.—University Radio, Ltd., 82, Hampstead Rd., London, N.W.1. 'Phone: Euston 3810. [2879

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REPRESENTATIVE Required; knowledge of relay and P.A. essential, but connection unnecessary.—Write Box 9795, c/o *The Wireless World*. [3085

YOUNG Man with Some Drawing Office Experience and Technical Knowledge Required for Radio Laboratory.—Write, giving full particulars, to Box 9805, c/o *The Wireless World*. [3098

SITUATIONS VACANT

DRAUGHTSMAN, experienced in detailing wireless apparatus, capable of working to fine limits.—Write, stating age, experience, and salary required, to Box 9797, c/o *The Wireless World*. [3086

TECHNICAL Engineer Required for Development Work on Television Test Equipment.—Give full particulars of age, experience, and salary required, to Dept. 44/TE, Pye Radio, Ltd., Cambridge. [3073

RADIO Engineers Required, thoroughly competent, keen, conscientious; permanent situations, with good prospects to right men.—Write, stating age, salary, experience, to Hickies, 153, Friar St., Reading. [3076

VACANCIES for Sales Engineers for Interference Suppression Service; N.E., East Midlands and London; own car essential.—Write for questionnaire, Belling and Lee, Ltd., Cambridge Arterial Rd., Enfield. [3093

RADIO Engineer Required; must be capable of preparing literary matter suitable for students; residence in Sheffield not necessary.—For full particulars apply to The Governors, The Bennett College, Sheffield. [3082

RADIO Engineers, with experience and technical knowledge, requiring situations, should apply to the Registrar, Employment Department, 179, Clapham Rd., London, S.W.9. (346 situations obtained since June, 1933.) [2937

REPRESENTATIVE Calling Radio Manufacturers Required by Components Firm; connection essential; give full details and remuneration required in confidence; our staff are aware of this advertisement.—Box 9795, c/o *The Wireless World*. [3084

TESTER-TECHNICIAN Wanted for Component Work and Modern Receivers; experience essential, television knowledge an advantage; age about 20.—Write fullest details, experience, etc., to Box 9804, c/o *The Wireless World*. [3097

FAULT Finders Required; large radio factory, S.W. London; up-to-date experience on mass production methods; permanent positions for right men; 1/6 per hour.—Write, stating age and experience, to Box 9701, c/o *The Wireless World*. [3029

DYNATRON High Fidelity All-Wave Radio-Gramophones, receivers, and amplifiers.—First-class technical salesman with car required, also competent service engineers and testers; excellent opportunities.—H. Hacker and Sons, Ray Lea Rd., Maidenhead. [3110

JUNIOR Radio Engineer Required for Valve Factory, Enfield district; wireless set circuit experience essential and University Degree or equivalent.—Write, giving full particulars of training, experience, and wages required to Box 9768, c/o *The Wireless World*. [3075

GOODMANS INDUSTRIES, Ltd., require an assistant for loud speaker development work; applicants must have practical experience.—Write, giving full details of activities during last three years and present rate of remuneration, Goodmans Industries, Ltd., Lancelot Rd., Wembley, Middx. [3082

A FEW Vacancies Exist for Skilled Radio Engineers who consider themselves above the usual standard, to augment our television personnel; some knowledge of cathode ray technique an advantage, but not an essential; an excellent opportunity for really good and ambitious men.—Write, with complete details of training and experience, Box 9810, c/o *The Wireless World*. [3104

WANTED for Small Company Building High-class Luxury Radiograms, technician capable of designing the very best radio receivers and amplifiers where cost is a secondary consideration; thorough knowledge of all-wave sets in addition to amplifiers and practical constructional experience is essential; progressive position assured; our employees know of this advertisement.—Reply, in first instance, to Box 9767, c/o *The Wireless World*, with full particulars of experience and salary required. [3074

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ASSISTANT Works Manager, experience production electrical apparatus, similar position required, disengaged.—Box 9775, c/o *The Wireless World*. [3080

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"WIRELESS World," October, 1923, to present volume (two missing, 1927); divide if necessary; any offers?—Moffat, 19, Gateswell Rd., Birmingham, 11. [3100

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