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EDITORIAL COMMENT

Next Year's Sets

Midgets and Universal A.C.-D.C. Receivers

WITH the Olympia Exhibition not much more than a month ahead of them, most manufacturers will already have decided on all the main details of their programme for next season. Valves have now an all-important influence on receiver design, and, if only for the reason that so many multi-electrode types have recently been introduced, we are bound to have an exhibition that will be full of technical interest.

Is the "midget" set, with a frontal area of about half the size of this page, and a depth no greater than that of a fair-sized book, to figure prominently on the programme? In spite of suggestions that this phase of development might well be short-circuited, so far as this country is concerned, many British manufacturers, influenced by the undoubted commercial success of this type of set in America, have gone to the length of developing experimental models.

Whether many of these "squeak-boxes," as they are now contemptuously called in the land of their origin, will finally get on the market is uncertain; if they are offered to the public purely as auxiliary sets, there will be little cause for complaint, but unless some genius manages to obtain better quality than that of the average specimen, the prestige of broadcast reproduction is bound to suffer in the long run.

There can, of course, be no valid objection to a set merely because it is small; on the contrary, compactness is obviously to be wished for. Uneasiness on this subject is felt only because hitherto it has been found impossible

to combine extreme compactness and quality. The permissible size of the loud speaker and its baffle area is too small, and is, indeed, the main limiting factor.

This naturally suggests the possibility of developing a real midget set—smaller even than existing types—to work with an external loud speaker. Such a plan overcomes all the more serious objections, and has its own special advantages. It is interesting to hear that at least one firm expects to produce a set on these lines.

Versatile Receivers

It so happens that midget sets are almost invariably of the "universal" type, working either on A.C. or D.C. mains. But none of the objections which have been urged against the midget set are of necessity applicable to a receiver merely because of its versatility in the matter of supply current. At the present time, when electrical undertakings are changing, or are expected to change, their system of supply, many possible buyers of sets are deterred by the possibility of finding themselves with a receiver which will be unsuitable for altered conditions, and it is certain that the new A.C.-D.C. sets which will appear will have a good reception. There is no technical reason why the standard of reproduction of such sets should not be as high as that of any but the more ambitious A.C. receivers which employ a much higher anode voltage than is obtainable from domestic D.C. mains.

Fears have been expressed that the new valves would be introduced into sets before their use was fully understood; it is reassuring to observe that, more than ever before, manufacturers are refusing to allow novelty, merely for its own sake, to influence their plans, and last-minute improvisations will be very much the exception.

Class "B" Economy is Two-fold

Some Measurements of Efficiency

By M. G. SCROGGIE, B.Sc., A.M.I.E.E.

IT is now well known that the quiescent output systems, to which Class "B" amplification belongs, afford a new measure of H.T. battery economy as the current consumed is proportional to the signal strength. It is probably not so well known, however, that these quiescent methods are in themselves much more efficient than the ordinary push-pull scheme with mid-point bias. The accompanying article sets forth some interesting results of efficiency measurements.

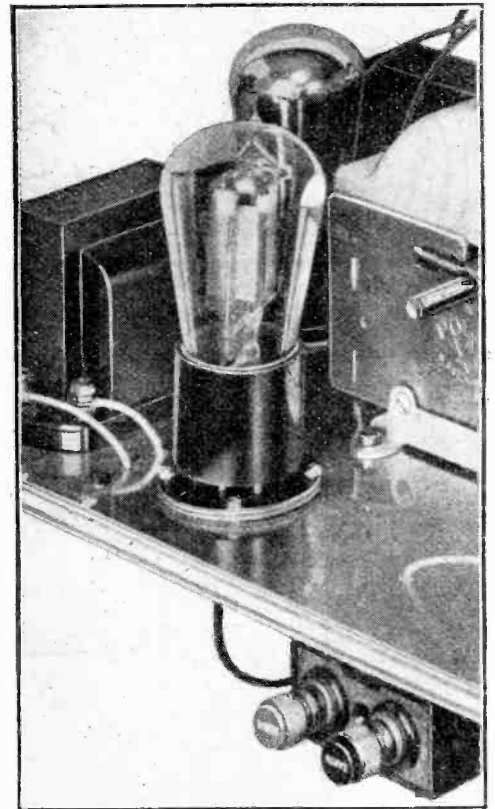
THE merits of the quiescent output stage (Q.P.P. or Class "B") have been widely expounded of late. But so far attention has been concentrated on only one of two respects in which it economises in battery power. It is now generally understood that a power valve worked in the ordinary manner might be compared to a car that consumes petrol just as fast when pottering along—or even standing still—as when going all out, whereas in the quiescent system the consumption is in proportion to the output at any instant. As in normal circumstances a receiver is "all out" for only fractions of a second, or at most seconds, at a time, and on the average is working at something like a tenth of full power, one contribution of quiescence to economical running is easy to apprehend.

Where the Waste Occurs

The impression has been gained, however, that when a quiescent stage is fully extended it is no more thrifty than other systems. This is incorrect. It confers a substantial benefit over and above that with which it is commonly credited.

The true measure of economy is efficiency in the engineering sense of the word, that is to say, the ratio between the useful power given out and the power

fed in. It can be shown mathematically that the greatest theoretical efficiency of the ordinary system is 50 per cent. So that however much valves are improved and sources of loss eliminated, at least another 50 per cent. of the power put into them from the H.T. battery (for it is battery users who are chiefly interested) is wasted. In actual practice 70 per cent. or 80 per cent. is usually wasted even when working at full power, and, of course, a much larger proportion when volume is reduced. But the theoretical efficiency of a perfect quiescent stage is π or 78.6 per cent. So the absolutely unavoidable waste is only a little over 20 per cent.



Showing the output circuit of "The Wireless World" Class "B" Ferrocarr receiver, which delivers about 2 watts speech.

TABLES SHOWING EFFICIENCY TESTS RESULTS

	A.						B.					
	6,400	10,200	12,800	15,400	20,500	28,400	15,400	20,500	24,600	30,600	38,400	
Load resistance, ohms	6,400	10,200	12,800	15,400	20,500	28,400	15,400	20,500	24,600	30,600	38,400	
Output, voltage	107	154	180	194	197	203	195	206	216	221	211	
Output, watts	1.74	2.36	2.53	2.44	1.90	1.47	2.48	2.08	1.83	1.59	1.16	
Anode voltage	193	192	192	192	191	191	196	196	196	196	196	
Anode milliamps	49.0	47.5	45.5	44.5	43.0	42.0	21.4	17.9	15.8	13.8	11.2	
Anode input, watts	9.45	9.10	8.75	8.55	8.25	8.05	4.20	3.50	3.10	2.70	2.20	
Anode circuit efficiency, per cent.	18.4	25.9	28.9	28.5	23.0	18.3	59.0	59.5	59.0	59.0	53.0	
Aux. grid, milliamps	11.0	12.0	11.5	12.5	11.3	10.5	6.0	5.0	4.4	3.8	2.6	
Total input, watts	11.6	11.4	11.0	10.9	10.4	10.0	5.37	4.50	3.96	3.45	2.7	
Total efficiency, per cent.	15.0	20.7	23.0	23.4	18.4	14.7	46.2	46.2	46.2	46.2	43.0	

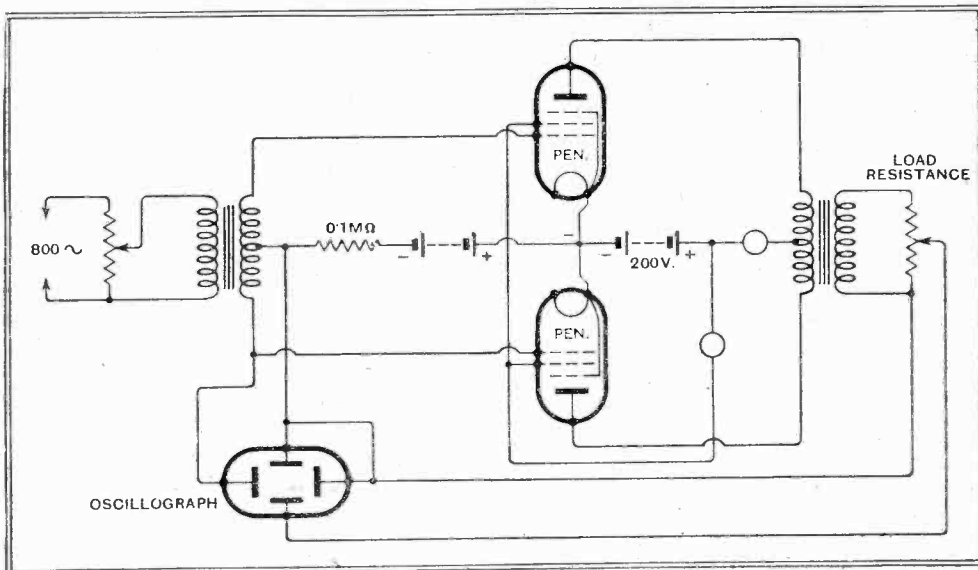


Fig. 1.—The circuit used for the measurement of efficiency of two pentodes in Q.P.P.

Good though modern valves are, they fall short of the ideal assumed in these calculations, and the practical man is not greatly interested in something which cannot be put into effect. But the results of measurements on actual amplifiers confirm that quiescent operation is very substantially more efficient. The tests to be described were for convenience carried out on a pair of standard, separately heated, pentodes, but the general conclusions apply to other types, such, for example, as Class "B" valves, which resemble pentodes in characteristics rather than triodes.

An Interesting Experiment

The valves were connected up in the usual push-pull formation with suitable input and output transformers, and supplied with about 200 volts H.T. (Fig. 1). The grid bias for the first series of tests was 12 volts, giving true push-pull, here-

Class "B" Economy is Two-fold—inafter called TPP, and for the second series 27 volts, giving quiescent operation. The anode current before applying a signal was 40 milliamps and 6 milliamps for TPP and QPP respectively. Instead of a loud speaker a pure resistance

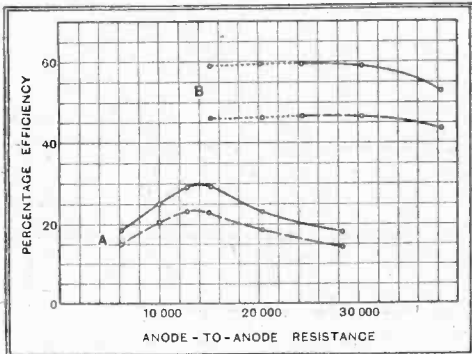


Fig. 2.— Efficiency plotted against load resistance. The solid lines represent anode circuit efficiency and the broken lines take into account power expended in the auxiliary grids.

was used, which could be varied. The signal came from an 800-cycle oscillator of pure waveform, connected to the input transformer. The output and input were visually compared by a cathode-ray oscillograph, and the current was increased until the distortion of the output was just clearly noticeable. Readings were then taken of the alternating voltage across the load resistance, the anode and screen currents, and the exact anode voltage. These data are sufficient for both input and output power in watts to be calculated, and hence the percentage efficiency. The particulars are shown in Table A for TPP and in Table B for QPP.

Advantages of Class "B"

The load resistances specified are the equivalents of those actually used when referred to a 1:1 transformer, and so are what is known as "anode-to-anode load." The figures given include the losses in the output transformer, but as a high grade component was used these would not amount to very much.

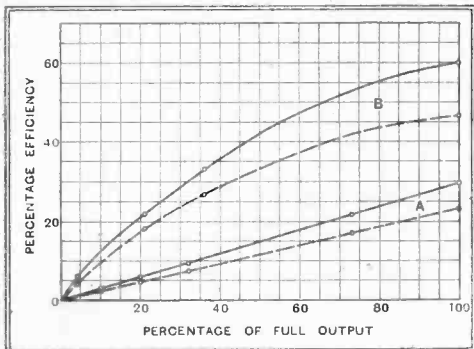


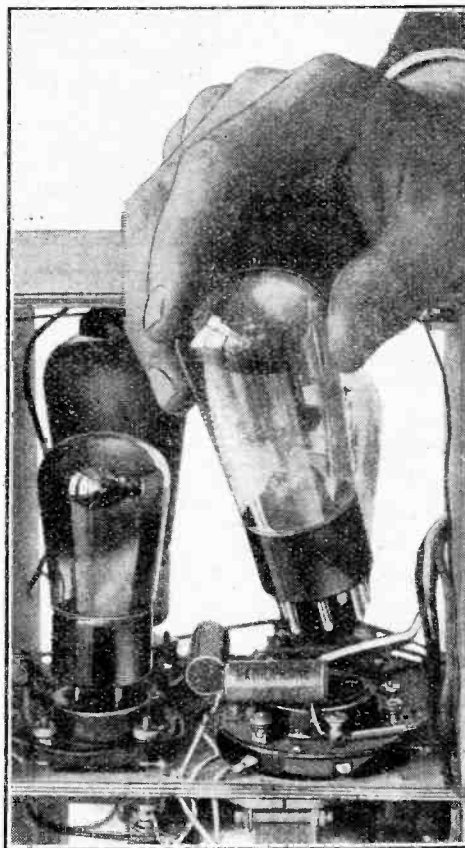
Fig. 3.—The relative efficiency of TPP(A) and QPP(B) can clearly be seen from these curves.

It will be noticed that two figures are given for efficiency in each case. The first takes no account of the power lost in the auxiliary grids of the valves, and is the figure generally quoted when valves are being discussed. It is the efficiency

of the anode circuit exclusively. From a practical point of view the other figure, which might be called the H.T. supply efficiency, is a fairer comparison with other types of valve which require no auxiliary current, because it is right that pentodes should be debited with this particular piece of wastefulness on their part. This is one respect in which Class "B" is superior to the older method, which requires pentodes to achieve the best results.

The results are shown more vividly in Fig. 2, where efficiency is plotted against load resistance. The solid lines represent the anode circuit efficiency, and the broken lines take into account the power expended in the auxiliary grids.

The most important fact to be derived is that the quiescent system has double the efficiency of the other. Remember, the results shown are for maximum "undistorted" output. If the output were



The Class "B" and driver stages of a recent "Wireless World" receiver—the Two-unit Portable.

to be reduced the QPP efficiency would drop slowly, but the TPP would rapidly have taken away from it even the small efficiency that it had. This effect is shown by the curves of Fig. 3, which bring home the two-fold economy conferred by quiescent operation. No special precautions were taken to match the valves or to reduce the quiescent current to a minimum, and better curves than those shown might be obtained with a little care.

Some interesting features of Fig. 2 remain to be pointed out. One is that TPP yields even its mediocre performance only when the load resistance is correctly

chosen. On each side the efficiency falls away rapidly. QPP gives a remarkably level curve over a wide range of load resistance. It is only fair, however, to call attention to the dotted portion, which is marked thus as a warning that over this part of the curve an appreciable amount of distortion was observable at quite small output levels, and that therefore it is better to err on the high side in load resistance.

The Optimum Load

Theory predicts that the optimum load resistance for QPP is just double that for TPP, and is confirmed by the results given, which point to a well-defined best choice of 14,000 ohms (7,000 ohms per valve) for TPP, and a less well-defined 28,000 for QPP. Very terrible distortion results from neglect of this principle.

As a matter of interest it may be noted that in the particular experimental conditions described, TPP was able to achieve 58 per cent. of the theoretical anode current efficiency open to its class, while QPP attained 76 per cent. of its much higher theoretical efficiency.

It is again emphasised that although the abbreviation QPP has been used for convenience, the results apply broadly to any system in which one valve amplifies the positive half waves and the other valve the negative half waves, by starting from the base line. Thus "Class B amplification" is not excluded from the meed of praise due to QPP. On the contrary, it may be expected to put up an even better show, other things being equal. There is, first, no auxiliary grid to side-track the precious milliamps. Another reason is that hitherto available Class B characteristics have suggested a closer approach to the theoretical ideal than is possible even with pentodes. There are, of course, other practical advantages which do not directly affect the efficiency in the strict sense of the word, such as absence of grid bias and need for matching. Class B is, therefore, the form of quiescent operation that finds most favour.

BLUE PRINTS

For the convenience of constructors full-sized blue prints are available of the following popular *Wireless World* sets that have been recently described, price 1s. 6d., post free.

- Monodial A.C. Super. (Booklet, price 1s. 8d. post free.)
- Modern Straight Five. (June 22nd and 29th, 1932.)
- Short Wave Two. (November 4th and December 23rd, 1932.)
- Monodial D.C. Super. (December 2nd and 9th, 1932.)
- Straight Three. (December 16th, 1932.)
- Modern D.C. Threa. (December 30th, 1932, and January 6th, 1933.)
- All-wave Monodial Super. (January 27th and February 10th, 1933.)
- Modern A.C. Quality Amplifier. (February 17th, 1933.)
- Ferrocart III. (February 24th and March 3rd, 1933.)
- * A.V.C. Monodial Super. (March 17th and 24th, 1933.) With 2.5 watt or 5 watt amplifier. State which is required when ordering.
- The Class "B" Ferrocart Receiver. (April 17th, 1933.)
- Universal A.C. Short-wave Converter. (April 25th, 1933.)

* Price of this blue print is 2/-.

These can be obtained from the Publishers, Iliffe & Sons Ltd., Dorset House, Stamford Street, London, S.E.1.

AVOIDABLE INTERFERENCE

The Causes of Unwanted Radiation—and Its Cure

By ANDRÉ L. J. BERNAERT

AN informative article on "man-made static"—a topic very much in the limelight at present. The part played by electrical wiring in disseminating interference to points remote from its source may be proved by an interesting experiment which is described.

As the amount of electrical machinery in use has increased considerably during the last few years, interference with radio reception is becoming more troublesome; a contributory cause is the greater average sensitivity of wireless receivers. Most of those who are responsible for the radiation of interference are still unaware of the existence of remedies which prevent radiation from their apparatus.

Almost every wireless user has observed that, when a lamp is switched on or off near a working wireless set, a click is heard in the speaker. What is the cause of it?

In switching the lamp on or off a spark occurs between the contacts of the switch. That spark causes vibrations in the ether; hence waves are radiated. The switch acts, in fact, as a small spark transmitter,

and, as represented in diagram *a*, radiates waves of different lengths in all directions. That explains why we can hear the noise in the speaker irrespective of the wavelength to which the set is tuned. The amplitude of these waves diminishes with the distance from the switch; they are heavily damped. Very little power is expended, and, theoretically, disturbances do not extend beyond a small area, of which the switch is the centre (diagram *b*).

But the impulses are propagated easily along the mains leads over much greater distances. Supposing we have an electric fan which is connected to the mains and causes interference in a nearby wireless set. If we operate the same fan from an accumulator battery little or no interference will be heard. Thus it is proved that the mains leads acted as an aerial for radiating the electrical disturbances.



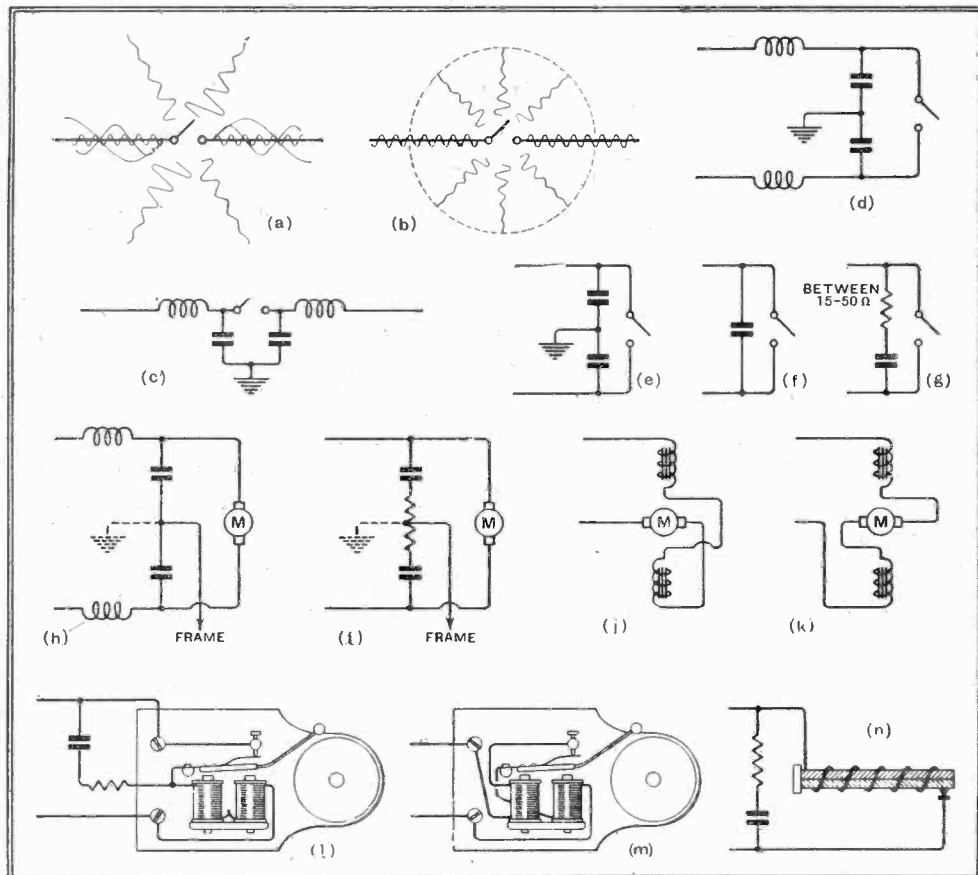
Chokes, condensers and resistances can be brought into use to minimise interference from electric signs.

It is obvious that the cure consists in preventing the waves from being conveyed by the mains leads, and at the same time in reducing the size of the spark and consequently the intensity of radiation.

For that purpose we can use coils and condensers connected as shown in diagram *c*. The coils and condensers must be placed as close as possible to the point at which the spark occurs. By adding the condensers we reduce the size of the spark, therefore the interference is diminished, and as the condensers offer an easy path, they deflect the objectionable waves to earth. The coils to be used on A.C. mains have to be so designed that they do not impede to an appreciable extent the passage of A.C. of low frequency. For instance, a coil wound on a former of about 12 inches long and 6 inches diameter, having 150 turns of No. 18 D.C.C. copper wire, will be efficient on 50-cycle mains if the current through the windings does not exceed 6 amps. On A.C. the value of the condensers will be between 0.1 mfd. and 1 mfd. For D.C. supplies condensers of 1 or 2 mfd. are suitable.

Alternative Suppressor Circuits

There are numerous cases which will be dealt with satisfactorily if only condensers are used. Sometimes even one condenser without earth connection may be sufficient. The different methods are shown in diagrams *d*, *e*, *f*, and *g*. It may be observed that diagram *f* forms an oscillating circuit, and so, if the resonant frequency falls within the tuning range of the receiver, very strong interference will be heard. In this case a resistance of about 20 ohms



The nature of interfering radiation, and the appropriate remedies to apply under different conditions.

Avoidable Interference—

in series with the condenser (diagram *g*) will solve the problem. The four circuits are basically similar, but their efficiency in eliminating interference is different.

But not only the mains leads convey interference. The metal pipes or conduits through which they run do just the same thing. Earthing of the sheathing will stop this trouble. Sometimes, more especially if tubular metal conduit be used, there is a bad contact between successive lengths, and a wire bonding to connect them together will be advisable. Gaspipes also convey their share of disturbances; here again a good connection to earth should be made, and, if necessary, electrical bonding of the joints may be added.

Look to Your Aerial

Very strong interference is often caused by induction between the aerial or lead-in and conductors such as metal roofs, gutters, spouts, gaspipes, central-heating pipes, and so on. The aerial and lead-in should accordingly be kept as far as possible from them. As a further precaution the use of screened aerial down leads is coming into use. Special care must be taken to ensure high insulation between the lead-in and the earthed metal shield, and at the same time to keep the capacity between the two as low as possible. In addition, an alternative earth connection, which may be less affected by the interference, should be tried.

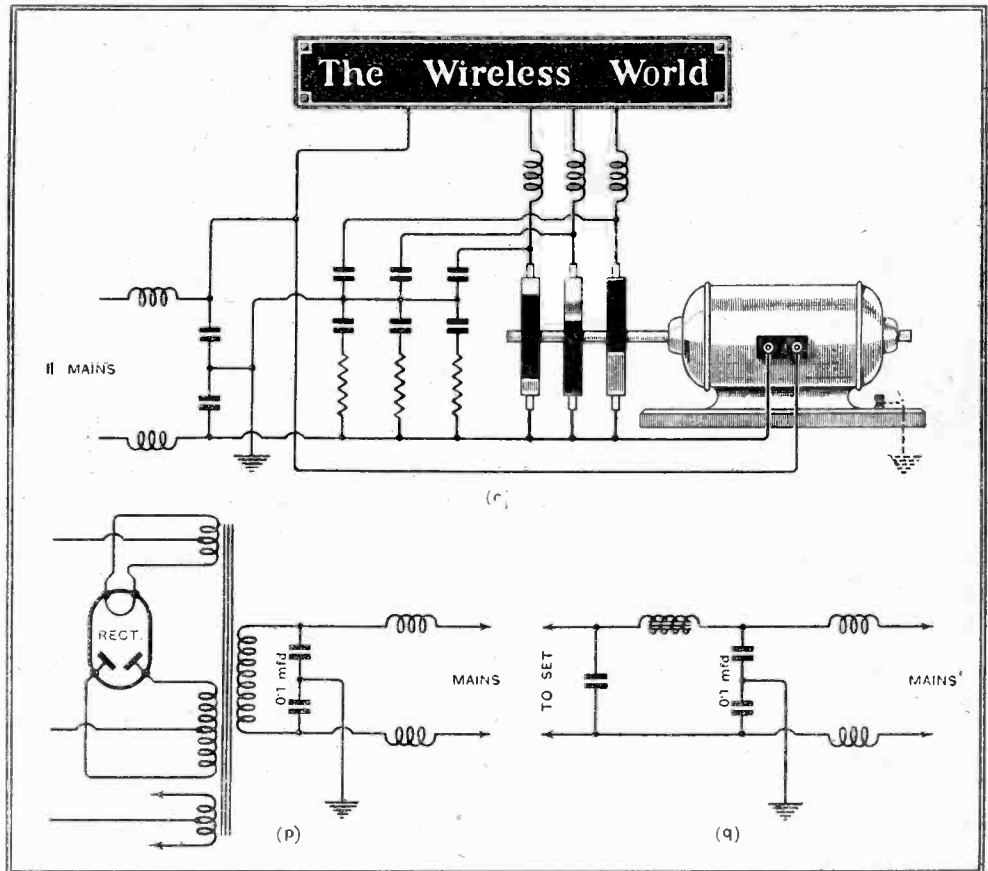
Small motors of all description are notorious offenders. The first thing to look for is excessive sparking. Brushes should be adjusted, and the commutators freed of dirt and metal particles. In most cases this alone will reduce the interference considerably. The metal motor frame should be earthed. If interference still persists the circuit given in diagram *h* should be adopted; the coils and condensers may be as already described. Sometimes either the coils or the condensers only will be sufficient, but where condensers only are used it is advisable to include a damping resistance of about 20 ohms, as otherwise very strong oscillations may be set up in the oscillating circuit formed by the coils inside the motor and the external condensers (see diagram *i*). By fitting two condensers of suitable value across the brushes of the motor of a domestic vacuum cleaner and connecting the centre point to the frame of the machine it will be electrically silent. Anti-interference coils and condensers, if properly designed to withstand the current and voltage used, do not affect the working of the motor and have no influence on the current consumption.

When an electric bell is the offending appliance a condenser of 2 mfd. in series with a resistance of 20 ohms, as shown in diagram *l*, will generally be sufficient. It is, however, interesting to try to use the magnet coils themselves as chokes by connecting one at each side of the interruptor as shown in diagram *m*. An analogous arrangement can be tried on a motor by rearranging the field coils (see *j* and *k*).

Most electric hot-plates are fitted with

an automatic device (diagram *n*) which prevents overheating by switching the mains off and on. A condenser in series with a resistance will, here again, reduce the interference.

with 26 S.W.G. D.C.C. wire to an inductance value of about 6,000 microhenrys. By using a mains transformer with an earthed screen between the primary and the other windings the same result will



If *The Wireless World* used a flashing sign, it would certainly be "silenced": diagram (o) indicates the position of suppressor condensers, chokes and resistances. Below are shown input filter circuits for A.C. and D.C. mains sets.

In diagram *o* is represented an electric sign, in which use is made of coils, condensers and resistances which effectively reduce the background to bare audibility, even when the receiver is in close proximity to the apparatus. In general, all electric disturbances caused by switching mechanisms can be satisfactorily dealt with by including suitable coils in the mains leads and bridging the switch contacts with condensers and resistances.

To sum up, it should be remembered that:—

The anti-interference device should be placed as close as possible to the radiating apparatus. Care should be taken, however, that the condensers used in conjunction with apparatus developing considerable heat are placed at a safe distance, as they are likely to be affected by abnormally high temperatures.

If possible, the centre tap of the condenser block should be connected to the metal screen or frame. But it should be ascertained by trial whether earthing of the screen or frame has an adverse influence on the elimination of interference.

In mains-operated receivers it is useful in some cases to include, between the set and the mains, two H.F. chokes and a centre-tapped condenser block to constitute a barrier to mains interference that may be introduced directly through this channel. Suitable coils may be wound

be obtained, or sometimes even a better one if the earth is rather long.

FOREIGN BROADCAST GUIDE

POSTE PARISIEN

(Paris, France).

Geographical position: 48° 53' N.; 2° 20' E.

Approximate air line from London: 220 miles.

Wavelength: 328.2 m. Frequency: 914 kc/s. Power 60 kW.

Standard time: Greenwich Mean Time (France adopts B.S.T.).

Standard Daily Transmissions

07.15 B.S.T., gramophone records, news, weather; 08.45; daily menus; 09.15, gramophone records (Sun.); 09.45, Bible reading (Sun.); 10.0, variety (Sun.); 12.10, concert; continuous broadcast until 14.00; 18.45, news, gramophone records, plays, talks; 21.20, main evening entertainment; 22.15, final news bulletin and details of following day's programme.

Opens with the playing of a fanfare of trumpets followed by *Marche Lorraine* or *Entre Sambre et Meuse* (gramophone record).

Announcer: Man.

Call: *Ici Poste Parisien*.

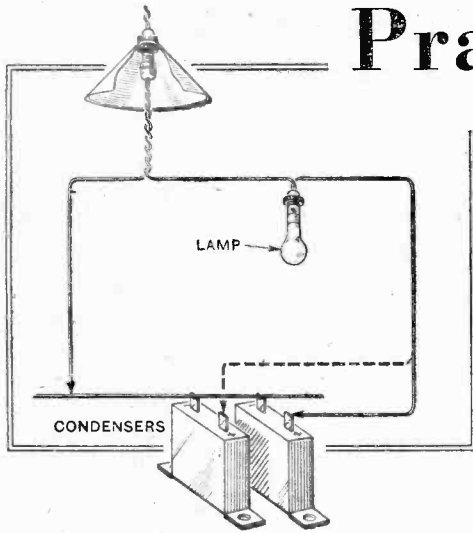
Interval Signal: Trumpet call (first six notes of a melody from Charpentier's Opera, *Leucise*), as under:—



Closes down with conventional French good-night greetings followed by *La Marseillaise*.

Practical Hints and Tips

Simplified Aids to Better Reception



For testing condensers on A.C. mains.

VARIOUS methods of making exceptionally light fuses, "blowing" at a very few milliamperes, have recently been devised. These fuses are generally employed as a safeguard in the anode circuits of battery-operated sets, where they afford protection to the valve filaments, and, of even more importance, to the H.T. battery, in the event of a short-circuit.

When choosing a safety fuse for a Class "B" set, it should be remembered that, although the average current drawn by the output stage will be low, there will always be occasional heavy surges, corresponding to deep modulation at the transmitting end, and current may momentarily reach a value of from 40 to 60 milliamps. This peak or maximum value should be taken into account, rather than the "quiescent" current; otherwise it will be found that the fuses will need constant replacement.

WHEN dealing with a receiver or amplifier having a large number of high-capacity fixed condensers, it is anything but a simple matter to detect a faulty unit (or, in the case of a bank of condensers, the faulty section).

The following method allows a rapid and certain tracing of faulty condensers to be made *in situ*, without the necessity of disconnecting particular sections, and has the advantage of using apparatus which is certain to be at hand. The materials required are a low candle-power electric lamp, 15 watts preferably, of normal mains voltage, with holder and a length of twin flex, fitted with an adaptor at one end. As shown in the accompanying sketch, the tester connections are effected by wiring the lamp-holder in series with one lead of an adaptor flex; two free ends are left, one coming direct from the adaptor and another from the lamp-holder.

A word of caution at this point: remove earth, aerial, and mains leads from the set before starting to test. Now proceed to

attach, by means of a crocodile clip or in some other convenient way, one of the leads to H.T. negative or to the metal chassis. On applying the second lead from the lamp-holder to the "positive" terminals of each of the condensers in turn, the lamp will glow with varying degrees of brilliancy, depending upon the condenser capacity. Normal full light will indicate a short-circuited condenser which requires replacement, while total absence of glow will show an internal disconnection. This method will be found to be extremely rapid and certain, and will save considerable time.

IT may be welcome news to many of those readers who are without an A.C. mains supply to learn that the two-valve short-wave converter described in *The Wireless World* of April 28th is adaptable to battery operation. Although battery-operated valves are never quite as efficient as their "mains" counterparts, the behaviour of the converter, modified in this way, leaves little to be desired.

A complete circuit diagram, showing the necessary alterations for battery work, is

already fully loaded, there would be no objection to feeding the adaptor unit from separate sources.

With regard to components, the types specified for the original converter may be used, but, due to the somewhat lower efficiency of a battery type detector-oscillator valve, it may be necessary to tighten reaction coupling in order to maintain self-oscillation over the whole of the wavebands covered. This point is easily determined by trial, and if necessary a larger reaction winding or a larger fixed reaction condenser may be used. Alternatively, a variable reaction condenser may be substituted.

ALTHOUGH it may seem to be a terribly inefficient and extravagant procedure, often the best way of keeping down the output of a rectifier valve to the desired voltage is to shunt it with an absorbing resistance. This plan is generally adopted when the current to be drawn from the rectifier is considerably below its maximum rating. If no additional load were imposed a rise of voltage would take place, and the smoothing condensers might

Too Many Volts

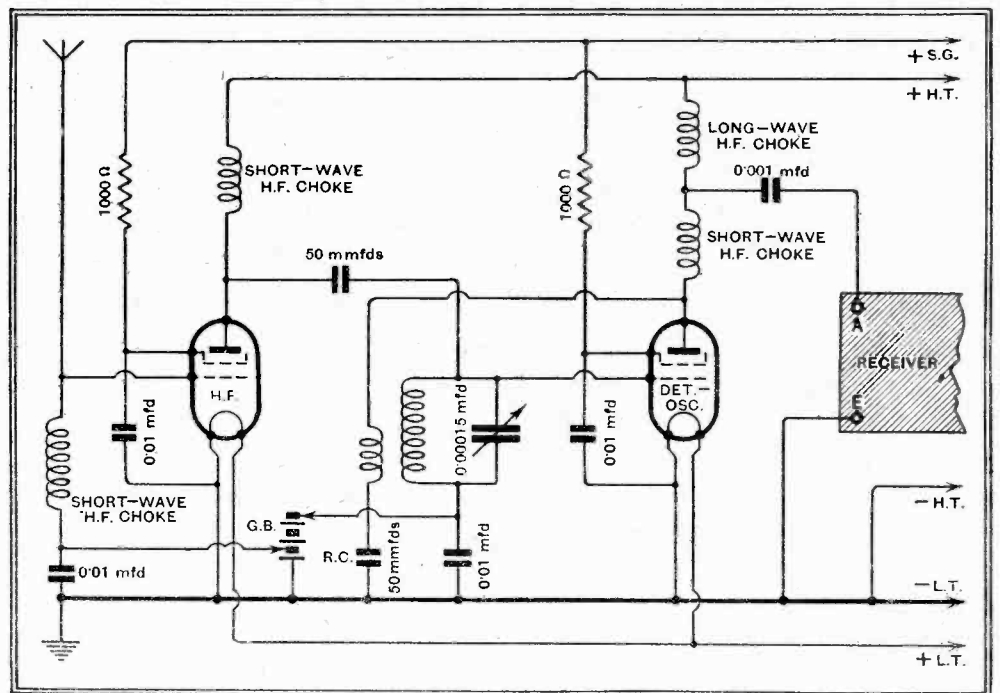


Fig. 1.—The "Universal A.C. Short-wave Converter," as recently described, may be modified for battery working.

given in Fig. 1, from which it will be observed that the unit is basically unchanged, but, instead of obtaining its H.T. and L.T. energy from a self-contained power unit, it is primarily intended for connection to the batteries which normally feed the set. Of course, where these batteries are

suffer; herein lies the real advantage, as the use of high-voltage condensers may be avoided by adopting this scheme. Further, the value of the parallel absorbing resistance may in most cases be estimated in a very simple way.

Take a case that is likely to arise in

Practical Hints and Tips—

practice—that of an "A" type rectifying valve designed to give about 250 volts at 60 mA., but to be used, in conjunction with a standard "A" transformer, to feed a set requiring only 20 mA. at 250 volts. At this relatively light loading voltage might rise to some 300 volts; this rise can be prevented only by ensuring that the total load will amount to 60 mA. What we need to know, therefore, is the value of shunt resistance which will absorb the surplus current—in this example, 40 mA.

The necessary resistance (in ohms) is here ascertained by dividing "voltage" by "surplus current," the latter expressed as a fraction of an ampere. In this case we get $250 \div 0.04$, equal to 6,250 ohms.

The voltage figure used in these calculations is not necessarily the maximum rated output, nor is the system of voltage regulation applicable only to a simple rectifier; an H.T. eliminator may be treated in the same way. Knowing the voltage output for a given consumption, it is easy to estimate the right value of absorbing resistance to maintain that voltage at any lesser consumption.

CERTAIN types of wire-wound potentiometer are prone to develop noisiness in operation, due to movement of adjacent turns of the resistance element as it is traversed by the rotating contact arm. It has been found that a potentiometer which gives trouble in this way can generally be put right by varnishing the windings with two or three coatings of celluloid cement. A clear day should be allowed for each coat to dry before the next is applied, and, of course, the actual contact surface should be kept free of varnish.

**Wire-wound
Potentiometers**

Celluloid cement is widely used for repairing accumulators, etc., and is obtainable fairly easily. It can be made by dissolving scrap celluloid in equal parts of acetone and amyl-acetate.

ALUMINIUM is in many respects a highly satisfactory metal for wireless work, and for many purposes it is almost irreplaceable. But, when using it, more than usual care must be taken to ensure good electrical contact.

**Contact
Resistance**

Metallurgists tell us that almost as soon as the tool leaves the surface of a piece of aluminium that is being worked, an invisible film of oxide is formed. The film is of high electrical resistance, and this is the reason why a wire to be joined to an aluminium chassis, condenser frame, etc., should always be forced into close and intimate contact with the metal.

The need for taking a certain amount of care in making electrical connections to aluminium is particularly likely to be noticed when carrying out experimental or testing work, when rough, temporary joins are usually made.

THE "VOLKSEMPFÄNGER"

More Details of the Hitler Set

GERMANY'S "Volksempfänger" — or national receiving set—is now an accomplished fact. It has been designed by Professor Leithäuser to the requirements of the German Ministry of Propaganda with the object of obtaining as big an audience as possible for the State talks and other ministerial propaganda.

In an interview with a correspondent of *The Wireless World*, Professor Leithäuser explained some of the problems set by the demand for a receiver of very high quality and very low price. It was necessary, he explained, that the set should be selective and powerful enough to guarantee loud speaker reception of the Königswusterhausen station and at least one German regional at all times of the day. At the same time, the receiver must not be "too good," otherwise the listener might hesitate to buy a more expensive receiver even if he had the money for it!



Professor Leithäuser

A two-valve all-mains set combined with loud speaker was found to be the best solution. Professor Leithäuser took one of the first trial models on a grand tour of Germany, in ten days he carried out reception tests in Central Germany, in Bavaria, in the Black Forest, in North Germany, and on the Rhine. Tests were also carried out in Eastern Prussia. Some curious effects were noticed in the Black Forest. In one village the long wave of the Königswusterhausen station seemed to come round a mountain on both sides, the two branches of the deflected ray causing mutual interference. At Castle Niedeggen, in the Eiffel district, it was possible to receive practically all European stations on a four-metre aerial.

The "Volksempfänger" is being manufactured on a generous scale; the first order is for 75,000 A.C. mains sets, 15,000 D.C. mains sets, and 10,000 battery sets, all of these to be ready by the time the German radio exhibition opens. Selectivity is secured by the use of a litz-wound coil and a special low-loss valve socket. The use of capacity reaction on the aerial will imply some tuition to the uninitiated, who would otherwise cause considerable interference.

Both A.C. and D.C. models employ two indirectly heated valves. In the A.C. model the popular RE 904 is used. This valve has a mutual conductance of 3.5 mA. per volt. The equally well-known RES 164d is a directly heated pentode with about three watts output. The two valves used in the D.C. mains set are both of the 20 volts indirectly heated type. The first, a RENS 1820 is a screened-grid detector valve. The second, REN 1823d, is a 20-volt pentode. The battery set has three valves, two RE 034's and one RE 174d.

The battery firms have decided to cooperate, and are producing special 2.5 amp. hour anode batteries at 6.90 marks. The loud speaker is selected from about forty

different types by different committees, which, curiously enough, were unanimous. It is a well-known moving-iron type.

Our correspondent asked Professor Leithäuser how it was possible for all the twenty-eight firms concerned to co-operate in the production of a uniform set. Professor Leithäuser replied that all drawings were supplied by the Central Office of the Manufacturers' Association, while each firm would furnish him at Heinrich Herz Institute with a test receiver which would have to be approved before going into production.

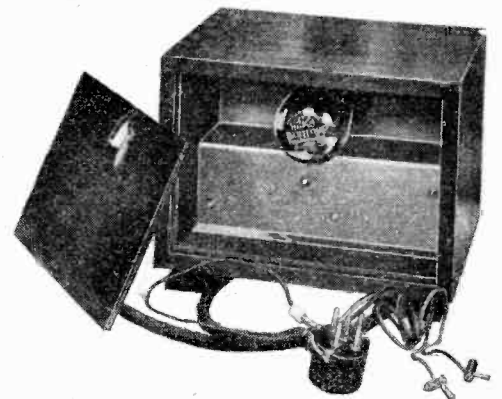
The price of 76 marks (approximately £3 16s.) has only been possible by mass production and the consent of the traders and manufacturers to large profit cuts.

MULTITONE CLASS "B" CONVERTER

CLASS "B" amplification offers such important advantages over other forms of output stage for battery sets that it is likely to find almost universal application in future. Not the least attractive feature of the new system is the ease with which an existing set can be changed to Class "B" by converting the normal output valve into the driver.

With the Multitone Class "B" Converter, which is illustrated herewith, not a single connection in the set or between the set and speaker need be interfered with, since the necessary change of connections is brought about by the use of a valve holder adaptor with a "split" anode. To put the converter into operation it is only necessary to remove the output valve from the set, insert into the adaptor and plug the whole back into the valve holder. This applies to either pentode or triode. The converter contains a driver transformer, a Class "B" valve holder, and an auto-transformer which was found to match any high-resistance speaker. There is no separate switch for the L.T. supply.

When tested the unit gave a good account of itself. The volume was far in excess of that obtainable from the ordinary single triode or pentode, and the quality of reproduction well balanced—there being a fixed tone correction circuit across the secondary of the driver transformer to prevent undue shrillness with a pentode driver.



The Multitone Class "B" converter. No alteration to the wiring of the set is needed when using this unit.

The converter sells at 37s. 6d. without valve, and certainly represents good value for money; furthermore, it affords an extremely easy means of obtaining mains volume from a simple battery set.

How the Superhet Works. 7.

Single-Dial Tuning

The Alignment of the Oscillator Circuit

By W. T. COCKING

WHILE the superheterodyne is one of the most efficient types of receiver extant, certain adjustments are invariably necessary before it can yield its best. This article is of vital importance to the listener who desires that his superhet shall be tuned to give the highest performance. Most important among adjustments are those relating to the single-control tuning system.

IT has already been pointed out that the success of a superheterodyne depends upon two things—the soundness of the original design and the accuracy with which the various circuits are adjusted. From the point of view of the constructor the latter is more important, since it is he who must carry out the adjustments. All that he need do as regards the design is to satisfy himself that the receiver he chooses comes up to the required standard.

The most important adjustments are those connected with the single-control tuning system, for we have already seen that if the ganging is not accurate the advantages of the pre-selector in removing second-channel and kindred forms of interference are lost. It is as well, therefore, to examine the question in some detail, for there is no doubt that the adjustments necessary are rather more complex than those for a straight set.

In a set of this type, we assume that each section of the gang condenser has exactly the same capacity at every dial setting. Each circuit is required to be tuned to the same frequency, and this will be obtained if each coil has the same inductance, and the stray capacities on all the circuits are identical. This last requirement is achieved in practice by connecting small-capacity condensers across each circuit, so that the stray capacities may be artificially equalised. Ganging, therefore, is carried out by the simple process of tuning-in a low wavelength station and adjusting each trimmer in turn for maximum signal strength. Provided that the final setting is such that an increase or decrease in the capacity of any trimmer reduces signal strength, the actual trimmer capacity does not matter at all, as far as ganging is concerned. If too much capacity be used, of course, the tuning range will be restricted, and it will no longer be possible to tune-in stations

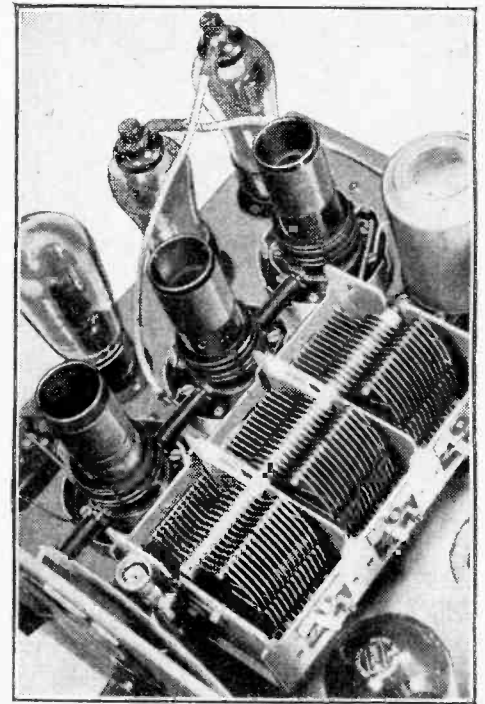
on wavelengths as low as 200 metres; the ganging, however, will be quite accurate.

Now, in the superheterodyne it is only the pre-selector circuits which can be ganged in this simple manner, for the oscillator must not be tuned to the signal frequency, but to a frequency 110 kc. higher. In general, there are two practical methods by which this may be achieved. The first is the padding circuit, and it is almost universally employed in America and in many British commercial receivers; the second is the shaped-plate tracking system; it is quite rare in America, but fairly common in this country.

Let us first consider the padding circuit. With this the gang condenser can be of any ordinary type, with identical sections; in addition to the usual parallel trimmer, however, a padding condenser is connected in series with the oscillator section. The arrangement may be seen from Fig. 1; the circuit LC represents one of the pre-selector circuits, L being the tuning coil, C the variable condenser, and Ct the trimmer. The more complex network is the arrangement adopted for the oscillator,

and L1 is the coil, C1 a section of the gang condenser identical with C, Ct1 the parallel trimmer, and C2 the padding condenser. At low dial settings the capacity of C2 is large compared with that of Ct1, so that the total capacity is nearly equal to that of Ct1 and Ct1 together. The oscillator circuit capacity, therefore, at this end of the tuning range will be roughly the same as the capacity of one of the signal frequency circuits. The necessary frequency displacement between the circuits is thus obtained by choosing a lower value of inductance for L1 than for L.

Even with this lower inductance, however, the oscillator circuit would be tuned to too low a frequency at high dial settings if the padding condenser were not used. At this end of the range, therefore, this



If the superhet is to give of its best, the alignment of the ganged circuits must be carried out with care.

condenser is adjusted to such a value that the oscillator circuit capacity is appreciably less than that of the other circuits. In theory, completely accurate ganging over the whole tuning range is impossible, and perfection can only be obtained at three points in the waveband; the maximum error, however, need be no more than 2 or 3 kc.

The Padding Condenser

In practice, the designer fixes the values of the coil inductances, the padding condenser capacity, and the minimum circuit capacities, and, for the ganging to hold, these must all be reproduced exactly in the receiver. A set of matched coils will usually be obtained, but the correct capacity values must normally be obtained by a system of trial and error. At the start, probable settings are assumed for C2 and Ct1, a low wavelength station tuned in, and the pre-selector trimmers adjusted for maximum response. A station at the top of the medium waveband must then be found, and C2 adjusted while rocking the tuning dial backwards and forwards over a few degrees until the optimum combination of settings is found. This rocking of the tuning dial is necessary because an adjustment is being made to the oscillator circuit, and it is always this circuit which controls the dial settings in a superheterodyne.

Now the adjustment of the padding condenser throws out slightly the previous setting of the oscillator trimmer Ct1, so that a return to the low wavelength station is necessary for the readjustment, not of this, but of the pre-selector trimmers. A further adjustment of the padding condenser may then be needed, and so on. After alternating several times between the different adjustments, correct ganging will be obtained at the two ends of the wave-

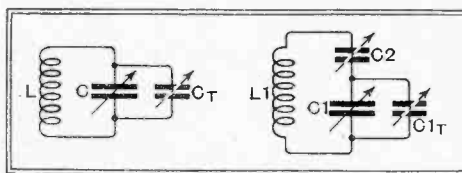


Fig. 1.—The tuning system when the padding circuit is used necessitates the insertion of an adjustable condenser C2 in the oscillator circuit.

How the Superhet Works—

band. The ganging at the middle of the range, however, will not be correct unless the pre-selector and oscillator stray capacities have their correct relative values.

It is therefore necessary to check the ganging at the middle of the range, and if it be found inaccurate, the capacity of C_{IT} must be appropriately altered; the amount of the alteration needed will be largely based on guess-work. The whole process described above must then be gone through again and a further check made at the middle of the tuning range. If the ganging here is still inaccurate, C_{IT} must be changed again and the circuits re-ganged at each end of the range, and still another check made at the middle.

It will be seen, therefore, that the process is quite complicated, and likely to take some time, particularly if one is without previous experience. It is not so difficult as it sounds, however, and the arrangement is perfectly feasible. In the case of a commercial receiver, of course, where suitable calibrated instruments are available, the process is much easier.

A Simplified System

With the shaped-plate ganging system, however, the adjustments are much simpler, and the arrangement is much more suitable for amateur use; furthermore, it can give more accurate ganging. With this system a special gang condenser is used in which the sections used for tuning the pre-selector circuits are of ordinary type, and identical in every respect, but in which the oscillator section has specially shaped plates to obviate the need for a padding condenser. The arrangement is illustrated in Fig. 2, where L , C , and C_T represent, as before, the inductance, tuning condenser, and trimmer, respectively, of the pre-selector circuit, and L_1 , C_1 , and C_{IT} are similar components in the oscillator.

As with the padding circuit, the frequency displacement at low dial settings is obtained by making L_1 smaller than L , but at high dial settings it is maintained by the special shape of the condenser vanes, and not by the introduction of an extra series condenser. It is merely necessary, therefore, that the coils should have their correct inductances, and the stray capacities be given their correct relative values. A matched set of coils will usually

be obtained, and the adjustments, therefore, are limited to the trimmers.

At the start a value is assumed for C_{IT} , a low wavelength station is tuned in, and the pre-selector trimmers adjusted for maximum response. A station at the other end of the waveband is then found, and C_{IT} is adjusted while rocking the tuning dial backwards and forwards until the optimum combination of settings is determined. A return is made to the low wavelength station and the pre-selector trimmers are re-adjusted. Usually this will complete the ganging for the medium waveband, but if the original choice of capacity for C_{IT} was very widely out, it may be necessary to repeat the process.

It will be seen, therefore, that with this method of ganging not only is the adjustment to the padding condenser avoided, but the necessity for checking the ganging at the middle of the tuning range is obviated. The system thus represents a considerable simplification, and even the inexperienced need have no hesitation in tackling the adjustments; with a little practice the whole process can be carried out in less than five minutes.

Although the oscillator condenser vanes are specially shaped to avoid the necessity for a padding condenser, this can only apply to a single waveband. Even if we use this type of condenser, therefore, a padding condenser will still be necessary on the long waveband. This need occasion no difficulty, however, since the medium waveband adjustments determine the correct values for the stray capacities. On the long waveband, therefore, only the padding condenser needs adjustment. The complete arrangement is shown in Fig. 3, with the waveband switching.

In the pre-selector, an additional coil is thrown into circuit on the long waveband, but there are no further adjustments. In the oscillator circuit an additional coil, L_2 , and a padding condenser, C_2 , are inserted, and the correct capacity for C_2 is found by the simple process of tuning in a station on the upper end of the waveband and adjusting C_2 while rocking the tuning dial until the optimum combination of settings is found.

It will be seen, therefore, that the ganging is in no way difficult. It should be pointed out, however, that correct ganging is dependent upon the attainment of the proper relative stray circuit capacities, and if this cannot be obtained the ganging will be inaccurate. When building a

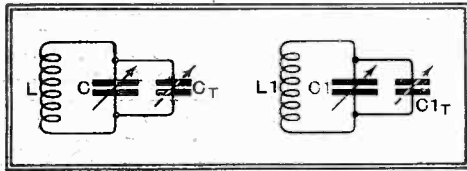
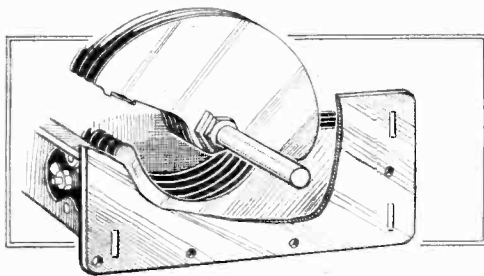


Fig. 2.—When the shaped-plate ganging system is employed, the oscillator circuit differs only in the value of components from the others.



The oscillator section of a shaped-plate gang condenser, showing how the fixed vanes are cut away to maintain the ganging.

Previous articles of this series have dealt with the following stages of the superheterodyne receiver; (1) The signal frequency stage; (2) the H.F. stage and the oscillator; (3) the frequency changer and the I.F. amplifier; (4) the second detector; (5) the first detector; (6) whistle interference.

receiver, therefore, it is important to keep the stray capacities, excluding the trimmer capacities, as nearly as possible to the values allowed for by the designer. The use of a different type of screened wire or valve-holder, for instance, may so increase the stray capacities that correct ganging is impossible. This would not occur in a straight set, for correct ganging would still be obtainable in spite of a general increase in capacity, and the only effect would then be to restrict the wavelength range.

The importance of correct ganging cannot be too highly stressed, for it is chiefly upon this that the designer relies for freedom from second-channel interference and whistles generally. In the removal of the latter much may be done by the correct adjustment of the operating conditions of the first detector, and by taking pains to avoid overloading the valves, but correct ganging is undoubtedly the chief safeguard.

We have now travelled through the superheterodyne, touching upon every portion of the apparatus peculiar to it, and going in some detail into the more important sections. Owing to limitations of space it has not been possible to deal exhaustively with any single portion of the receiver; a complete account of the operation of frequency-changing alone, for

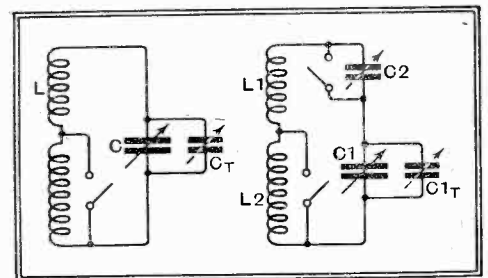


Fig. 3.—The shaped-plate circuit showing switching for two wavebands; a padding condenser C_2 is necessary for the long waveband, but its adjustment is easy.

instance, would occupy many more pages than have been devoted to the whole of this series of articles. It is hoped, therefore, to deal with certain of the more important questions which have been left untouched here, or only cursorily treated, in the future.

Radio International. A glossary of about 900 technical terms in 5 languages:—German, English, French, Spanish and Italian. In addition to the general list in which the various equivalent terms are arranged in parallel columns in the alphabetical order of the German words, each of the other languages has a separate alphabetical list of terms with reference numbers corresponding to those in the general list.

Compiled by Ernst. A. Pariser and published by Union Deutsche Verlagsgesellschaft, Berlin. Price R.M. 3.50.

McMICHAEL Duplex Super Five



FEATURES

Type.—Frame aerial self-contained battery receiver with Class "B" output valve. Moving-coil loud speaker. Provision for external aerial, loud speaker and gramophone pick-up. **Circuit.**—Screen-grid H.F. with tuned grid coupling; grid detector with magnetic reaction; first L.F. stage; driver valve; Class "B" push-pull output valve. **Controls.**—(1) Tuning with "Duplex" dial calibrated in wavelengths. (2) Trimmer. (3) Volume control and on-off switch. (4) Reaction. (5) Waverange. **Price.**—19 guineas. **Makers.**—McMichael Radio, Ltd., Slough, Bucks.

An Economical Self-contained Battery Receiver

THE design of this table-model self-contained receiver is based on portable set practice of which this firm has an unrivalled experience. A frame aerial is fitted inside the cabinet, which stands on a ball-bearing turntable, and can be rotated to make use of the directional properties of the frame. The reproducer is of the moving coil type, and is fed by a Class "B" push-pull output valve which gives excellent volume and quality with a long battery life.

The early stages of the receiver do not differ greatly from those of the "Duplex Four" described in the issue of this journal for April 14th, 1933. The signals from the frame aerial pass through a screen-grid H.F. stage, in which volume is controlled by a filament resistance, to a leaky grid detector, and thence through parallel-fed transformers to an intermediate L.F. amplifier before reaching the special push-pull valve and its preceding driver valve. Cells incorporated in the H.T. battery supply the bias for the driver valve, and also for the H.F. and first L.F. stages through a potential divider which is automatically disconnected when the set is switched off.

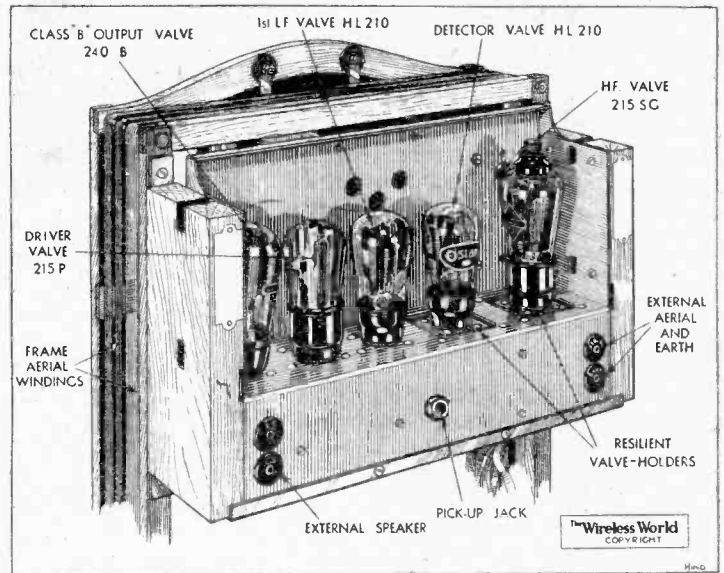
The controls of the set are not difficult to operate, and the beginner should at once be able to obtain good results from his local stations. At the same time, the set is one which responds to skilful handling, and when the interdependence of the reaction and balancing controls are properly understood and full use is made of the directional properties of the frame aerial, a wide choice of foreign programmes is available. Sockets are provided for the addition of an external aerial and earth, but these should

be necessary only in districts where pronounced screening or absorption is evident.

The Duplex tuning dial, in which the pointer moves to the appropriate scale when the waverange switch is operated, is already a well-known feature of McMichael sets. Volume is controlled by reaction or, alternatively, by the filament resistance incorporated in the on-off switch at the right of the control panel. As the filament volume control is rather sluggish in action it is preferable to reserve its use for cases where the local station is too loud with reaction at minimum, and where it is inconvenient to turn the frame aerial in order to reduce volume.

The quality of reproduction is good, and considerably more volume is available without distortion than in the average battery receiver with a normal output stage. We were particularly impressed by the bass reproduction which goes down well below 100 cycles and is not coloured by any obvious resonance. From this point of view the performance is better than many mains receivers in which economy in the power supply is not a matter of importance.

In the "Super Five" the standing H.T. current when no signals are passing was found to be only 3.8 mA, and sustained loud passages drew about 25 mA. The average consumption at the maximum permissible volume may, therefore, be estimated at 8 to 10 mA., which is no more than that of a



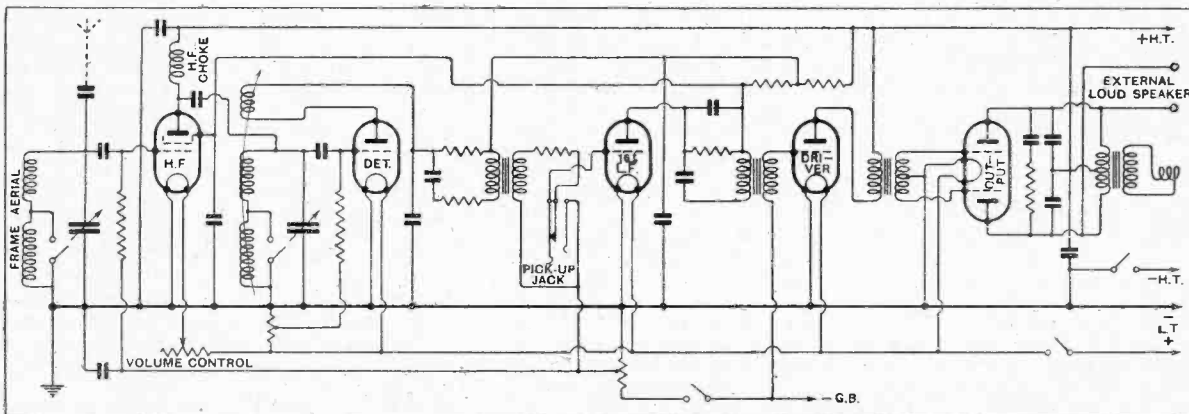
The chassis is mounted on the frame aerial unit above the battery compartment

portable with a normal output stage. For this expenditure of current a much greater volume with improved tone quality is obtained, while a much longer battery life is assured by the fact that the current is automatically reduced during intervals in the programme and when volume is low.

TRADE NOTES

F. C. Heayberd and Co., 10, Finsbury Street, London, E.C.2, have issued a leaflet dealing with Heayberd battery eliminators of constant voltage regulation for Class "B" and Q.P.P. receivers.

S. Smith and Sons (Motor Accessories), Ltd., Cricklewood Works, Cricklewood, London, N.W.2, have introduced a double-capacity 120-volt dry battery tapped at 10-volt intervals for use with Class "B" amplifiers. The price is 17s. 6d.



Circuit diagram showing connections of driver valve and Class "B" output stage.

News of the Week

Events of the Week in Brief Review

Lucerne: The Non-Signatories

IT now appears that to the seven countries which abstained from signing the Lucerne Plan must be added Hungary, bringing the total of intransigents to eight. And what (writes a correspondent) was the reason for their objections? Poland, Finland, Holland, Sweden and Lithuania all objected to the treatment they received on the long-wave band; this, also, was the reason for the refusal of Luxembourg to sign. Greece may sign without delay. Hungary is probably sore at the fact of not getting a 700-800-metre wave for Budapest No. 2.

Whatever the objections, the Plan de Lucerne without all signatures is no Plan at all, and some powerful diplomacy on the part of the International Broadcasting Union will be necessary between now and January 15th, 1934, when the "Plan" is scheduled to come into effect. If the differences are not smoothed out by

then, it is difficult to see how long-wave listening, at least, will be possible. Probably the International Broadcasting Union, at its meeting in Holland this autumn, will effect certain compromises or "glissements," to use a diplomatic term.

Fortunately, certain of the stations in the Lucerne Plan are not yet constructed, and pending their completion, it may be possible to lend their wavelengths to more insistent transmitters.

Luxembourg

"IS Luxembourg free to do what she likes?" is the question arising out of the fact that while Luxembourg signed the Washington Radio Convention and ratified the Plan de Prague, she has signed and ratified neither the Madrid Convention nor the Lucerne Plan.

So disgusted were the Luxembourg representatives at losing their long-wave channel, that they left the Conference hall five days before the end.

FIVE-METRE 'PLANE TESTS

London-Liverpool-Hull Flight on Sunday

THE postponed five-metre 'plane tests are to take place, weather permitting, on Sunday next, July 9th, when, at 10 a.m., Mr. S. G. Morgan (G6SM) will begin his flight in a Gypsy Moth from Croydon and proceed to Liverpool, transmitting speech on 50 m.c. practically throughout the journey. At intervals the call sign G6SM and the 'plane's registration letters G-ACCY will be radiated in morse.

The approximate time-table will be as follows:—

London ..	.. 10.0 a.m.
Aylesbury ..	.. 10.30 a.m.
Daventry ..	.. 11.0 a.m.
Birmingham ..	.. 11.20 a.m.
Stafford ..	.. 11.40 a.m.
Stoke ..	.. 11.50 a.m.
Liverpool ..	.. 12.15 p.m.

On the return journey the approximate localities and times should be as follows:—

Liverpool ..	.. 3.0 p.m.
Manchester ..	.. 3.30 p.m.
Leeds ..	.. 3.50 p.m.
Hull ..	.. 4.30 p.m.
Lincoln ..	.. 4.55 p.m.
Stamford ..	.. 5.30 p.m.
Bedford ..	.. 6.0 p.m.
London ..	.. 6.30 p.m.

Reports, which will be warmly welcomed from any district, should be in log form, mentioning time and nature of reception, signal strength, quality, presence or absence of fading, etc., etc. All communications should be addressed either to Mr. S. G. Morgan (G6SM), 3, High Street, Croydon, Surrey, or to the Editor, *The Wireless World*, Stamford Street, London, S.E.1.

Amateurs in the London area were given an opportunity to calibrate their five-metre receivers on Sunday last, July 2nd, when Mr. A. D. Gay (G6NF) transmitted almost continuous tests (speech

and I.C.W.) from 11 a.m. to 7 p.m. from the roof of *The Wireless World* offices in Stamford Street, S.E.1.

A number of reports were received from districts so far apart as New Southgate, Maida Vale, Victoria Park, Blackdown, Oxstead and Tatsfield. Once during the afternoon five-metre reception was picked up from a moving car "somewhere in Kent."

To enable listeners to the 'plane tests to calibrate their sets the following gentlemen have kindly undertaken to radiate 56 m.c. tests to-day and to-morrow (July 7th and 8th):—

G2IO.—J. Lees, 17, Trevoze Gardens, Sherwood, Nottingham: July 7th, 10.30 to 11 p.m.

G5TN.—, 87, Shaftesbury Road, Hammersmith, W.6, working duplex with

G5NR.—E. G. Nurse, 1, Cambridge Road, Hammersmith, W.6: July 7th and 8th, 11.20 to 11.30 p.m., 11.40 to 11.50 p.m.

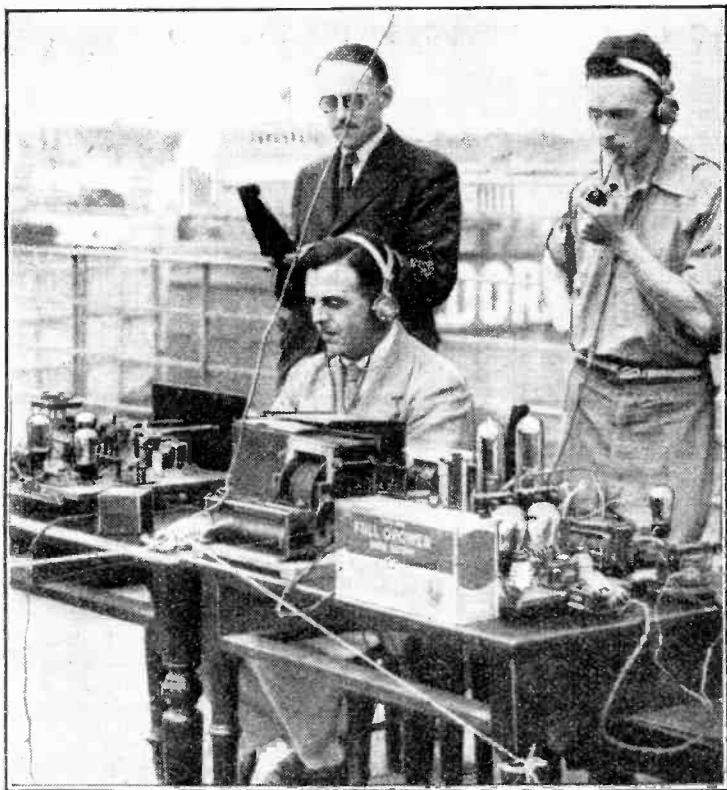
G6WJ.—V. Parker, 83, Mount Crescent, Thornes Road, Wakefield, Yorks: July 7th, 9 to 9.45 p.m. ('phone); July 8th, 10 to 10.30 p.m. ('phone), 11.30 to 12 midnight (I.C.W. and 'phone).

G2WD.—G. McLean Wilford, 33, Bibury Road, Hall Green, Birmingham ('phone: Springfield 2434): July 7th and 8th, 9 to 10 p.m. ('phone).

G5LS.—R. Bloxam, 12, St. Michael's Avenue, South Shields: July 7th, at 6, 7, 10 and 11 p.m.; July 8th, at 2, 3, 4, 5 and 11 p.m.

G6TW.—J. Noden, Coppice Road, Willaston, Nantwich, Cheshire: July 7th, 9.30 to 9.45 p.m.; July 8th, 4.15 to 4.30 p.m.; 9.30 to 9.45 p.m.

G2NH.—E. A. Dedman, 63a, Kingston Road, New Malden, Surrey: July 7th, 11 to 12 p.m.



CALLING LONDON ON FIVE METRES. Mr. A. D. Gay (G6NF) transmitting test signals on 57 m.c. from the roof of *The Wireless World* offices on Sunday last. Many reports were received.

New Belgrade Station

A 40-kW Marconi broadcasting station is to be erected at Belgrade. This is the biggest item in the reorganisation of Yugo-Slavian broadcasting, which follows a redistribution of listeners' fees between the broadcasting organisations and the Post Office.

Demonstration Licences

THE Radio Traders' Federation and the Post Office in New Zealand are negotiating for the establishment of a system of free monthly demonstration licences, enabling prospective purchasers to test receivers without having to take out a licence for the whole year.

The R.N.W.A.R.

GOOD progress is being made with the Royal Naval Wireless Auxiliary Reserve, which was formed at the end of 1932 to provide a reserve of operators for service in the Navy in the event of a national emergency. The membership on January 1st last was one hundred, and has now risen to 175, seventy-five of whom are transmitters.

Instructional classes are held on Mondays and Thursdays at the Admiralty. A special short-wave transmitter has been designed by Mr. G. A. Exeter, and the sketches and drawings will shortly be ready for issue to members.

Those wishing for information regarding the Royal Naval Wireless Auxiliary Reserve should apply to: The Admiral Commanding Reserves, Queen Anne's Chambers, Tothill Street, London, S.W.1.

A Royal Visit

PRINCE GEORGE paid a visit to the works of the British General Manufacturing Co., Brockley, on Friday, June 23rd. He was shown over the factory where electrical and radio accessories are manufactured.

His Royal Highness displayed a sound knowledge of radio technique.

A Queen's Station

THE Queen of Bulgaria, the daughter of the King of Italy, has received a novel present in the shape of a 3-kW broadcasting station, given her by the City of Rome. It is understood that the Queen's own station will shortly be testing.

Sofia, the capital of Bulgaria, at present owns a station of only ½ kW. When sufficient capital can be found a powerful 100-kW transmitter is to be erected near the city.

Broadcasting for All

UNION RADIO, Madrid, is inaugurating a new feature. In future anyone is to be given access to the microphone who has something of interest to say or to play. The studio is to be opened to musicians, authors, artists, writers, dramatists, and scientists. One fly in the ointment may stem the rush of applicants; everyone must consent to a reasonable preliminary process of selection, and they must give satisfactory evidence of the possession of the necessary talent.

This seems to be the usual requirement of broadcasting organisations.

LABORATORY TESTS

New Radio Products Reviewed



Fluxite complete soldering outfit.

FLUXITE SOLDERING SET

MANY who are quite skilled in constructional work eschew soldering because of a mistaken idea that it is difficult to master. On the contrary, soldering is particularly easy provided a suitable equipment is employed; furthermore, having once acquired the art, considerable time can be saved in constructing a wireless receiver.

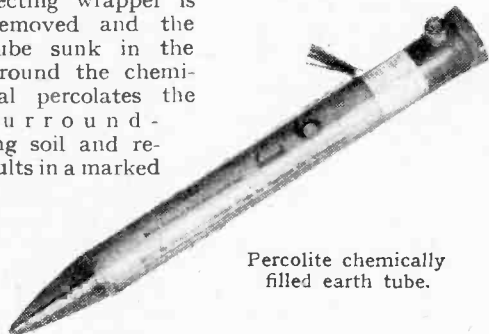
The Fluxite Soldering Kit provides all the necessary equipment, and enables anyone to tackle ordinary repair or constructional work entailing soldering. It is very compact and consists of a soldering iron, a tin of Fluxite soldering paste, several sticks of soft solder, and a small spirit lamp. This gives an intense flame which is thrown out horizontally, and is about four inches long. Its principal use is for heating the work to be soldered, but if other means of heating the iron are not available, it could be employed for this purpose.

The outfit includes, also, a small handbook giving a full description of how to solder, and much other useful information on soldering in general.

The makers are Fluxite, Ltd., West Lane Works, West Lane, Rotherhithe, London, S.E.16, and the price of the complete outfit is 7s. 6d.

PERCOLITE EARTH TUBE

MADE by Aerialite, Ltd., 10, Amber Street, Manchester 4, the Percolite earthing device consists of perforated copper tube 10½ in. long and one inch in diameter and filled with a special salt. When the protecting wrapper is removed and the tube sunk in the ground the chemical percolates the surrounding soil and results in a marked



Percolite chemically filled earth tube.

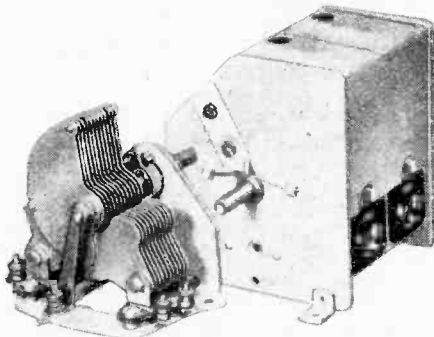
reduction in its resistance over a wide area. The chemical does not appear to be of a hygroscopic nature and it would seem that it relies for its effect on the presence of moisture in the earth. Its action will, therefore, be accelerated if after the tube is in position the ground is thoroughly wetted in

the vicinity of the earth tube. A terminal is provided for connecting the earth lead and the price is 2s. 6d.

NEW RADIOPHONE CONDENSERS

TO the range of condensers made by the British Radiophone, Ltd., Aldwych House, Aldwych, London, W.C.2, has now been added two new models. One is a small two-gang unit totally enclosed and having the trimmers placed on the top. The style of construction adopted is similar to that of the condenser assembly embodied in their "Radiopak," and has the advantage that it requires the minimum baseboard space. Each section has a nominal capacity of 0.0005 mfd., and the price is 15s.

The two sections in the specimen tested were quite well matched throughout, but as this is the first sample of the new style we have examined, criticism on the accuracy of alignment of the two capacities will be deferred until production models become



British Radiophone new model two-gang condenser and single unit embodying two small fixed condensers.

available for test. The style of construction, however, allows for very accurate adjustment, since each condenser is fitted with segmented end-vanes in the rotor sections.

The trimmers have a total capacity of 90 m-mfds. of which 64 m-mfds. represents the variable portion. The total change in capacity of each condenser is 482 m-mfds. (0.000482 mfd.) It is understood that for the present this new style will be made in the two-gang type only.

The other new model is a single 0.0005 mfd. condenser assembled on a stout bent metal frame and fitted with a single bearing for the rotor. It is fitted with a single hole fixing bush, and includes, also, two small fixed condensers, one plate of which is the supporting frame for the stator section. These condensers have mica dielectric and could be used one as a grid condenser and the other as an aerial series condenser in a single-tuned circuit receiver. There are, however, several other uses to which they could be put.

The measured minimum and maximum capacities are 17 m-mfds. and 492 m-mfds. (0.000492 mfd.). Each small fixed condenser was found to have a value of 102 m-mfds. (0.00012 mfd.). An enclosed pigtail is fitted for the electrical connection to the moving vanes, and the price is 8s.

RADIOLAB VALVE AND SET TESTER

THIS test set has been designed to enable the service engineer, the radio dealer, and the experimenter to undertake practically every test, whether this be of a complete wireless receiver, valves, or components, in a simple, straightforward manner. Each stage in a set can be checked separately by the simple process of removing each valve in turn, mounting it in the socket provided on the test set, and inserting a special adaptor in the vacant valve-holder in the receiver. All the voltages and currents can then be measured under working conditions, so enabling a faulty valve or a breakdown in any part of the receiver to be located in a few minutes.

Provision is made for dealing with three-electrode valves, screen-grid valves, and pentodes, either battery or mains-operated, the necessary alterations in the test set being effected by means of switches.

When checking the voltages and currents in certain types of mains receivers we were unable at first to obtain a true reading of grid bias voltages, since it was found that the presence of a grid leak or a grid decoupling resistance affected the reading. If the bias is derived from a resistance in the cathode lead, and these other resistances are included in the circuit, it will be necessary to join the grid of the valve to the earth line before taking a reading of grid bias.

Another precaution that should be observed in this case when checking the anode currents of H.F. or I.F. circuits, is to guard against H.F. instability when the valve is transferred to the test set. Should this take place, the anode current reading will not be a true one, and it will be necessary to short-circuit the grid circuit to suppress oscillation.

In addition to the applications mentioned above, the test set can be employed for measuring A.C. and D.C. voltages up to 1,000 volts, resistances up to 250,000 ohms, and it can be employed, also, as a signal generator for finally checking the working of the set.



Radiolab complete valve and set tester in portable carrying case.

The Radiolab Complete Valve and Set Tester is one of the most versatile instruments of this type we have examined; furthermore, it is particularly well made. The price is £12 12s., and the makers are the Radiolab Manufacturing Co., Sandridge Works, St. Albans, Herts.

Broadcast

The Belfast Mystery

SINCE the exclusive report in these columns that a site has been definitely chosen for the new B.B.C. high-power station in Northern Ireland, the air has been thick with the usual refutations. I can only repeat, possibly with a little more emphasis, the information previously given. The site has been selected, and although I must not name the exact locality, it is a few miles from the city in the centre of one of the most fertile potato-growing districts in Northern Ireland.

An announcement will shortly be made.

The New Organ : Strange Time-table

DESPITE the introduction of the new organ at Broadcasting House, it does not appear that we are to have a glut of organ music; indeed, it looks as if the ordinary evening listener will have few opportunities of hearing the new organ in the next few weeks.

A Quiet Hour

I hear that there will be a series of recitals from the Concert Hall on August 4th, 11th, 18th, and 25th, but these are to be given at the extraordinary hour of noon to 1 p.m., when probably 95 per cent. of listeners have their thoughts far removed from organ music. From 1 to 2 p.m. would be a more reasonable time, for then the jaded worker could at least steal a few moments from his lunch hour to pick up the strains outside a cut-price radio shop.

Small Audience

I am surprised that so eminent an organist as Sir W. G. Alcock should be engaged to play at a time when so few can listen.

Successful B.B.C. Test

CONGRATULATIONS to the B.B.C. engineers on the success so far achieved in synchronising West National and London National transmitters. I hear that "car radio" has been employed after midnight by some of the engineers who have roamed the Wiltshire countryside in the wee sma' hours trying to pick up the heterodyne that never came.

It seems that the two stations are synchronised in very fact. So far the B.B.C. has not dared to experiment before midnight, but I have no doubt that, judging by these results, listeners will have little to complain of when tests begin during programme hours.

Broadcasting Hall at Olympia

IT is good to have confirmation of the rumour, to which I was able to give first exclusive publication, that this year's Olympia Wireless Show will be notable for a huge Hall of Broadcasting, from which four or five concerts will be broadcast.

Listeners will not only be able to see how broadcasting is carried out in the studio, but they will be given an insight into the technical side; the Balance and Control Section will be present in force.

Twice Daily

In addition to the broadcast concerts, there will be other performances twice daily during the period of the Show.



DUKE ELLINGTON. The famous American jazz leader addressing one of the new condenser microphones during his recent broadcast from London.

By Our Special Correspondent

A Hot Place

THE comedy of the blinds promises to arouse considerable interest at Broadcasting House in the next three or four months.

Those who have surveyed that noble west façade will remember that no blinds or shutters mar its chaste whiteness. This spectacle is quite satisfying to one standing in the shadow of the Langham Hotel, but to the workers inside the building, half-blinded and half-roasted by the afternoon sun, other thoughts occur.

The other day green blinds were fitted inside the windows, and when it was discovered that these brought no relief (the glass conducting the heat just as much as ever), the more favoured officials were able to install grey silken curtains.

Not even these, however, helped "the green thought in the green shade," and now there is a campaign afoot to provide the whole of that western front with external green shutters.

Green Shutters

What Colonel Val Myer, the architect, says (or thinks, which may be worse) I do not know. Whatever is done must be uniform. Probably the staff will get their way, and the green shutters will be ordered and installed just before the November fogs begin.

U.I.R. and Interference

HOW fortunate it is that the International Broadcasting Union is not one of those bodies with a single idea, like the flat earth cranks or early-morning swimmers in the Serpentine. Although it has been up to its neck in wavelength problems, the Union has spared the time to consider the problem of interference, with the result that it is represented at the Electrotechnical Commission now meeting in Paris to consider man-made static from the international point of view.

Brevities

Selfishness

The Union realises only too well that the finest of wavelength schemes can be wrecked by the selfish thoughtlessness of the local static-maker.

New Gear at Brussels

Among other subjects which have occupied the attention of the International Broadcasting Union is the policing of Europe's wavelengths. New tuning-fork control as a secondary standard frequency has been obtained for Brussels, and other new equipment includes a thermostat for the tuning forks, and a heterodyne for obtaining beat notes.

There is also new short-wave measurement gear and apparatus for field-strength measurement.

Television from the Crystal Palace

IT has long been hoped that the B.B.C. would provide facilities for television transmission on the ultra-short waves from Broadcasting House. Just now, however, the B.B.C.'s ultra-short-wave transmitter is deserted, and possibly forgotten, in the excitement attaching to the Lucerne wavelength scheme.

In the meantime, I hear that the Baird Television Company is taking time by the forelock by installing ultra-short-wave gear on the top of one of the Crystal Palace towers.

Chance for 5-Metre Workers

It is understood that a contract has been signed which will involve experimentation over a number of weeks, and those readers of *The Wireless World* who have constructed the "Ultra-Short-Wave Two" may soon feel encouraged to construct simple television gear for operation therewith.

The New Scottish Director

NOT a few of the B.B.C.'s most successful henchmen have come from Aberdeen, and the Reverend Melville Dinwiddie, the new Scottish Regional Director, is in the same worthy tradition.

Mr. Dinwiddie, who was born in 1893, took his M.A. degree at Edinburgh in 1914, and served with distinction in the Gordon Highlanders throughout the war, being awarded the D.S.O., O.B.E., and M.C. He has been associated with St. Machar's Cathedral, Aberdeen, since 1924.

Payment in Kind

I HAVE just been regaled with another strong argument against sponsored programmes. Apparently, owing to the economic crisis, a number of French firms which had signed publicity contracts with broadcasting stations have been unable to pay the piper after the programmes have been broadcast. The stations have had no alternative but to accept payment in kind, with the result that the managerial offices of some studios are now replete with magnificent carpets, tablecloths, and other trimmings.

One station received a letter from a defaulter in these terms: "The state of my treasury compels me to ask you to accept 200 Yo-Yos and a number of dolls, each of which says 'Mamma' simply on being squeezed."

Correspondence

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

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

Location of the Speaker

I WAS very pleased indeed to read, under your "Editorial Comment" in the May 19th issue, the article on "Location of the Speaker," and hope to see this matter referred to again.

Rarely, if ever, is the best position for the speaker also the best position for the set, and for best results the speaker should not be built into the receiver.

Wireless World designers have offended in this matter in the past, and I am pleased to see that the "Ferrocart 3" was laid out with the idea of using the speaker apart from the set.

It is to be hoped that this practice will be continued in all future designs.

G. L. CANTRILL.

St. Helens, Lancs.

"Increasing Bass Response"

BOTH Mr. Willans and Mr. Pohu decry the practice of boosting the bass by means of mechanical resonance of the pick-up, and in this I concur generally.

I think that, as with many other things, it is a case for moderation. A pick-up with excessive resonant mechanical compensation is surely a bad pick-up, and I think this point was brought to light in the article, the purpose of which was to show that with a good pick-up having a *moderately* rising bass characteristic the output of the amplifier might yet be "down" on the lower frequencies, but that this defect might be made good to some extent by the careful application of the simple electrical resonance method described.

Precise application necessitates a study of the pick-up response, so that the electrical resonant frequency may be placed to the best advantage for the particular pick-up in use.

This point would obviously be where a pronounced "dip" occurred in the response curve above, say, 40 cycles. As pointed out in the article, very little compensation is obtainable below this region.

South Shields.

R. BLOXAM.

Components

IN the issue of the *Wireless World* for May 26, 1933, I noticed in the Correspondence columns a letter from Mr. E. J. B. Curtis, of Bournemouth, the subject being "Prices." While not necessarily disagreeing with Mr. Curtis as regards the basic principles of his arguments, I should like to point out the inaccuracy of one or two of his remarks.

First, regarding the bakelite shrouding of modern intervalve transformers. Without having given the matter much thought I can immediately think of the following advantages to be gained from this shrouding, apart from the matter of appearance. Here are a few.

1. Exclusion of dust and damp. Dampness causes rusting of laminations and possibly corrosion of windings, with consequent electrical breakdowns.

2. Mechanical protection for transformer.

3. Cheapness of construction. This is the

very point Mr. Curtis has been aiming for. The bakelite moulding enables us to dispense with all terminal strips, clamps for the laminations, feet for mounting on base-board, etc. Also the transformer can be assembled rapidly owing to the absence of bolts and nuts, because in many cases the bakelite is shaped internally so as to form a clamp for the core. Assembly costs are then very low.

4. Better electrical efficiency in some cases due to the fact that no holes for clamping need be punched in the laminations. Admittedly, some non-shrouded transformers can also claim this advantage.

Later in his letter Mr. Curtis states "It is . . . fashion to cellulose with a nice grey 'paint.'" The use of the word "paint" when referring to "cellulose enamel" is hardly accurate and is certainly not complimentary to our manufacturers, especially in view of the splendid finish obtained by this means on many components. Might I point out the very, very obvious reason for using this finish, beyond adding to price? It is simply to prevent the steel chassis and covers, now commonly employed, from rusting under atmospheric action. Surely manufacturers can hardly be blamed for having this object in view.

In point of fact Mr. Curtis has little sense of proportion, and at the outset should realise that, of the total cost of a component, possibly as much as 50 per cent. is absorbed by advertising, retail and wholesale profits and research work, not to mention overhead expenses. There are many cases where the bare cost of production is only 10 per cent. of the selling price, so it is a poor policy to base all cost-cutting on that alone.

G. M. MEW.

Canterbury.

Automatic Volume Control

IN spite of the experiments quoted by Mr. Haynes in the *Wireless World* of June 9th, I am unwilling to believe that the signal of a weak transmission is partially demodulated before it reaches the second detector of a superheterodyne.

With a linear first detector, both E. B. Moullin (*Wireless Engineer*, Vol. 9, p. 378) and Aiken (*Proc. I.R.E.*, April, 1933, pp. 624-5) have shown that any such effect is negligible; and it is improbable that a square law detector would give a greater demodulation effect than a linear one. Moreover, since the local oscillator must provide an output appropriate to the strongest signal to be received, one would expect the demodulation effect to be noticeable over a fairly wide range of signal strength.

If the experimental result (a), "that very little signal voltage is developed at the second detector until a certain initial value of signal voltage is applied at the aerial terminal," refers to carrier voltage at the second detector, I must admit that I can offer no explanation; but neither can the demodulation hypothesis explain a reduction in carrier strength. It is difficult to judge without numerical data, but I would suggest that the lack of proportionality be-

tween the voltage across the output load and the second detector input on weak signals may be due to the behaviour of this detector. The signals may be so weak that the diode is no longer linear, or, alternatively, a small bias would give a delay effect, reducing the sensitivity to signals below a critical value.

D. A. BELL.

Oxford.

Volume and Tone Controls

WHATEVER the technical advantages of A.V.C., from the listener's point of view, if there is to be a choice of one of the two I should say that *variable* tone control is of far greater importance.

In every set there is usually a manual volume control for use, but often and often one has to put up with uncomfortable and ear-rending reproduction because of the lack of a variable tone control. A few makes have a "fixed" tone control which enables one to go from one extreme to the other by means of a switch, but generally some intermediate point is most suitable, according to the type of matter broadcast.

Therefore, if manufacturers have to choose between the two, the variable tone control would be more useful, while the A.V.C. may be more "fashionable" next year. A set having both incorporated would naturally be more completely equipped.

A. A.

Liverpool.

DISTANT RECEPTION NOTES.

QUITE apart from the new wavelength plan to which it has given birth, the Lucerne Conference has been marked by several achievements of the highest importance to the listener. All of the countries whose representatives signed the Convention have agreed that none of their stations may make any change in its wavelength or its power except by common agreement. This in itself is one of the biggest steps yet made towards international co-operation in policing the ether. Of great importance, too, is the agreement to limit the power of stations working between 272.7 and 549.4 metres to 100 kilowatts, with a few exceptions; that of stations between 240 and 272.7 metres to 60 kilowatts and that of stations on lower wavelengths to 30 kilowatts. Then there is the undertaking to enforce "ten cycle exactitude" on most of the international common waves—at the present moment the inexactitude of these waves is often much nearer ten kilocycles!

I am afraid, though, that long-distance enthusiasts must wait a little before flinging up their hats to celebrate the coming of a wireless Utopia. There are still seven countries which have not yet signed the Convention and, though it is expected that they will fall into line, there is no guarantee that they will do so. Since the seven in-

Distant Reception Notes—

clude Holland, Sweden, Poland and Luxembourg, all of which own high-powered stations, it is obvious that if they do not agree the whole of the carefully worked out plan may be wrecked. Luxembourg is perhaps the biggest problem of all. She owns only one station, but this is a 200-kilowatt giant designed to work on a wavelength in the neighbourhood of 1,200 metres. Under the Lucerne Plan Luxembourg is assigned a wavelength of 240.2 metres and thus scrapes by 20 centimetres into the 60-kilowatt class. But to bring the power down to 60 kilowatts and to reduce the wavelength to 240.2 metres would entail something very like a complete reconstruction of the transmitting plant.

To the long-distance man the new plan may seem disappointing in some ways, for not a few of the stations that we now hear well are put down to share wavelengths and will therefore probably not be receivable after the middle of next January completely free from interference. To enable stations to cover their own service areas must always be the primary consideration of any well-thought out plan and this is the underlying idea of the Lucerne scheme. It seems to me, though, that the long-distance man is not too badly treated for he will still have a very large number of stations to provide him with genuine alternative programmes and with the increases in power that many of these will undergo during the next few months a wide choice of stations should be available for him all the year round.

Possibility of Improved Reception

As I write we are still going through a period of thundery weather which has already lasted for a fortnight without intermission. Atmospherics have therefore been a great nuisance at most times. The all-round field strength of stations, however, continues to be excellent and as soon as more stable weather conditions arrive first-rate reception should prevail once more.

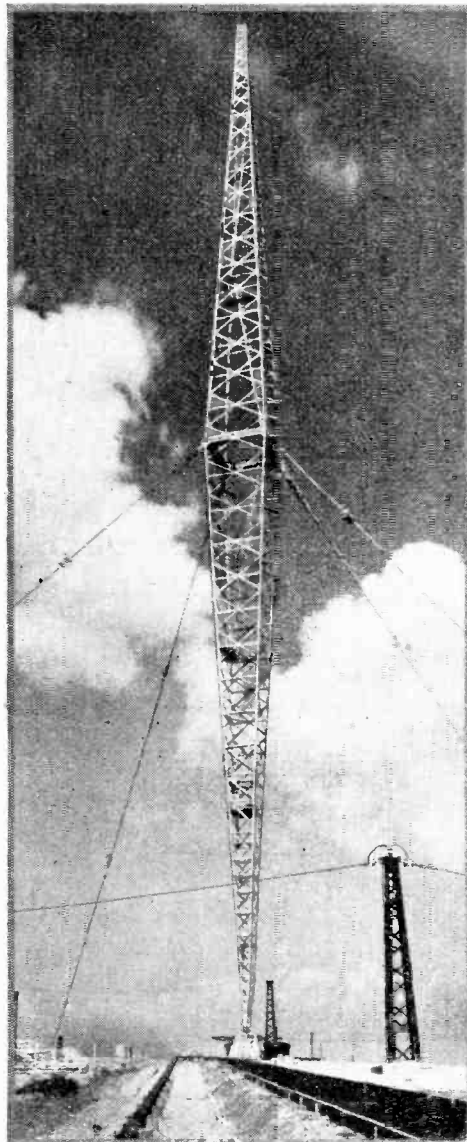
On the long waves Radio-Paris, Zeesen, Warsaw and Luxembourg are still worthy of note, and on the medium band stations which show a consistently good record are Brussels No. 1 and No. 2, Prague, Langenberg, Lyons Doua, Berömunster, Paris Ecole Supérieure, Rome, Katowice, Leipzig, Hamburg, Strasbourg, Milan, the Poste Parisien, Breslau, Hilversum, Heilsberg, Turin and Trieste. Stations frequently well heard are Florence, Söttens, Brno, Göteborg, Gleiwitz and Fécamp.

D. EXER.

VIENNA VISITED

Inspecting the New 100 kW. Transmitter at Bisamberg

By DR. ADOLF ERDÖS



(Above) The 400-foot mast which actually forms the aerial. A portion of the counterpoise and one of its supports is seen in the foreground.

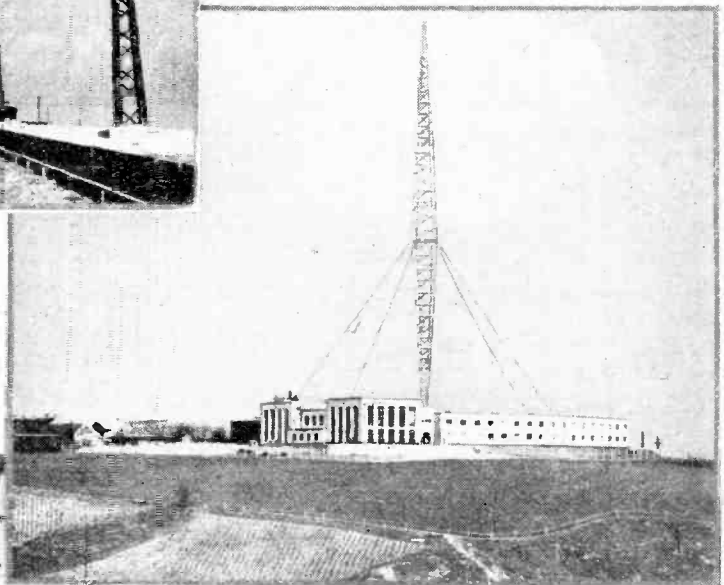
(Below) The control desk, from which the entire station can be operated. Safety switches permit of instant stoppage in cases of emergency.

IN outward appearance the new 100 kW. broadcasting station at Bisamberg, near Vienna, resembles no other station in Europe. The transmitter building is the last word in modernity, while the 400ft. mast, which actually forms the aerial, gives the station a compact, self-contained look.

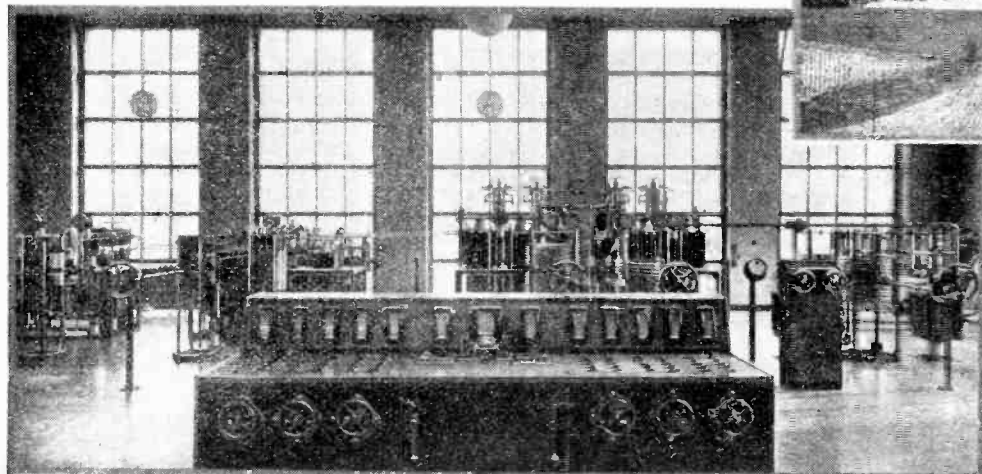
When the 100 kW. transmitter began its radiations on May 28th reports of good reception were received from all parts of the Continent, though the transmission during daylight, so the reports reveal, does not greatly exceed that of the old transmitter at Rosenhügel.

An engineer conducted me over the station. The Telefunken transmitter is served by three groups of Diesel engines supplying 1,400 h.p., and generating 3,308 volts at 50 cycles. The various voltages required are obtained from transformers and mercury arc rectifiers, and the total anode supply is 650 kW. In the final stage two 300 kW. valves are used. Each of these is 6ft. high, and requires a heating current of 1,800 amperes at 15 volts. The entire station can be operated from a central point, pressure on a single button being sufficient to start up the generators and radiate the carrier wave.

The weight of the aerial tower approaches sixty tons, and the whole is supported on a porcelain insulator, tested to take a strain of a hundred tons. At the earlier station trouble was experienced with the earthing



This general view of the station reveals its modern and efficient layout.



arrangements; consequently, Bisamberg dispenses with an earth, using a counterpoise mounted on a number of posts some 40ft. high and consisting of about ten miles of wire.

Two huge rotating light beams function after dark for the guidance of planes. For the safety of aircraft in daytime the aerial tower is painted alternately red and white, making it easily visible at a very great distance.

READERS' PROBLEMS

Erratic Reception

THE so-called mains aerial should be regarded rather as a makeshift device, likely to be uncertain in its action, and only to be used where nothing better is practicable. The behaviour of a mains aerial can never be foretold with confidence, as its efficiency as a collector is likely to be affected by circumstances beyond the control of the user.

A correspondent, who is using one of these aerials, complains of serious changes in signal strength which occur even during the day time; he therefore concludes, quite rightly, that true fading is not responsible. It has been confirmed by the use of a detector anode meter that the changes are real, and not imaginary. The set behaves quite normally when operated in another house with an outside aerial.

There can be little doubt that this variation in signal strength is caused by the switching on or off of various electrical appliances connected to the supply system

densers joined between each anode of the output valve and H.T.+) should be applied.

The "Sunbeam" Circuit

IN the circuit diagram of the "Sunbeam" Model U35 receiver, reviewed in our issue of June 23rd, there was a regrettable error in the connections of the valve heaters and H.T. supply. To those who are familiar with "Universal" A.C.-D.C. sets the correct connections will be obvious, but many readers who do not understand how a receiver, without any alteration, can work on either A.C. or D.C. supplies, were naturally puzzled. We tender to them our apologies, and reproduce in Fig. 2 a simplified diagram showing the correct arrangement of the feed circuits for both H.T. and heater current.

The rectifier is of course essential when the set is operated on A.C., but becomes a "passenger" on D.C. supplies, and offers

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

can only recommend that provision should be made for reducing the input to the receiver from the exceptionally large aerial which is in use.

A Class "B" Conversion

THE "All-Wave Monodial" was, of course, designed long before the days of Class "B" amplification, but there is no reason why it should not be altered to include this modern refinement.

Several readers have written to us for advice on this subject, and, as is usual when the question arises of modifying an existing receiver, it is recommended that the present output valve be converted into the driver, which in turn is linked to the added Class "B" valve by a special transformer.

The receiver in question includes an output pentode; in the interests of simplicity it may be preferred to replace this by a low-power three-electrode valve, but, provided suitable precautions are taken, the pentode may be retained as a driver. These precautions consist in using a Class "B" transformer of rather higher ratio than would otherwise be needed, and in taking extra measures against over-accentuation of high notes.

A Compensating Resistance

A CORRESPONDENT proposes to adopt for his new A.C. receiver a published design for an H.F.-det.-L.F. circuit, but, for the time being, wishes to omit the H.F. stage. It is realised that the omission of this valve will bring about a rise in H.T. voltage, and we are asked to say how this may be prevented.

The easiest, and generally the most satisfactory, way of maintaining the H.T. voltages intended by the designer is to connect, in place of the H.F. valve, a loading resistance across the source of H.T. supply.

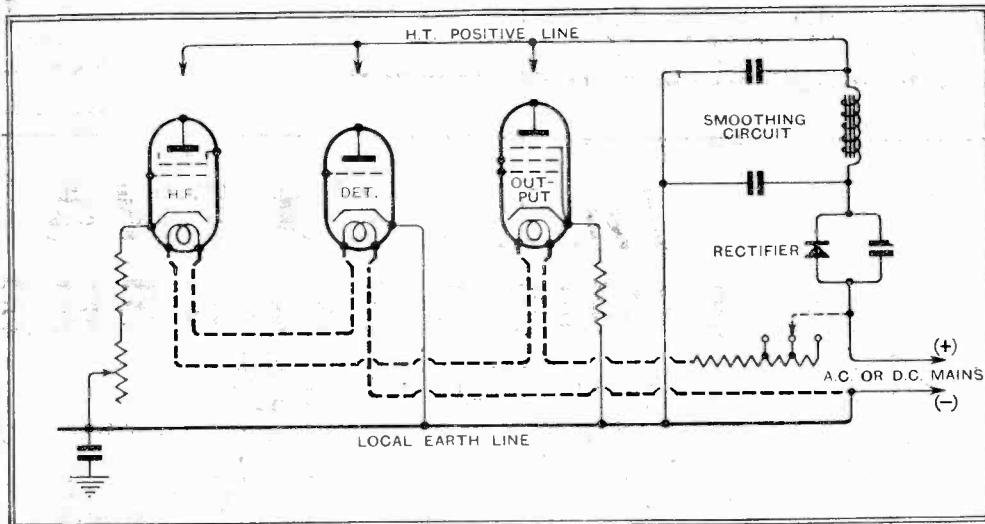
To calculate the value of this resistance it will first be necessary to estimate the sum of the currents normally consumed in the H.F. valve anode circuit, the screening grid circuit, and by the associated S.G. potentiometer, if any. The necessary value of loading resistance (in ohms) is then found by dividing "H.T. voltage" by "total current," the latter being expressed as the fraction of an ampere.

The Wireless World

INFORMATION BUREAU

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

Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.



Power supply circuits of the "Sunbeam" "universal" receiver, which functions on either A.C. or D.C. supplies. This simplified diagram will help to explain the underlying principle of most A.C.-D.C. sets.

which our querist is using. The efficiency of a mains aerial often depends to a great extent on the nature of the devices connected to the wiring in the immediate vicinity of the set.

Spurious Oscillations

IT is not always easy to recognise the symptoms of parasitic oscillation in an output stage, but this trouble should always be suspected when, for no obvious reason, reproduction is not up to the standard expected.

A querist, who has added Class "B" amplification to his receiver, suspects that this form of oscillation may be present; he states that quality is poor, and that volume is disappointing.

We agree that self-oscillation may be taking place. If, in addition, measurement shows that anode current in the output stage is unduly high, this opinion will be confirmed almost beyond doubt. The usual remedy (a pair of 0.005 mfd. con-

an almost negligible resistance to the passage of anode current to the valves.

Overloaded First Detector

MOST users of superheterodynes know by now that, if the design be a good one, an excessive number of whistles can generally be attributed to incorrect "ganging" of the signal-frequency and oscillator circuits; another type of heterodyne whistle is caused by adjusting the I.F. amplifier in such a way that it embraces an unduly wide band of frequencies.

Still another possible cause of this trouble is an overloaded first detector; this trouble may occur over a relatively wide band of wavelengths when the set is operated in the immediate vicinity of a power station. From a description of operating conditions submitted by a correspondent, we are inclined to think that this is the cause of his own particular trouble. As the number of "pre-selector" tuned circuits already in use cannot, practically speaking, be increased, we

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

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EDITORIAL COMMENT

Electricity and Wireless

Need for a Better Understanding

WE learn on good authority that the electricity interests are about to embark upon a publicity campaign on a big scale to bring home the advantages of electricity for domestic purposes.

The development of the Grid Scheme has brought electricity within the reach of vast areas of the country where formerly electricity was only available if generated on the premises.

We think it is an opportune moment to draw the attention of those who will be responsible for this publicity campaign to the many irksome and unnecessary restrictions which have been placed on the use of electricity for operating wireless receivers by many distributors of electricity throughout the country.

Surely it is time that valves ceased to be confused with lamps for illumination purposes, and that insistence on the current for wireless sets being charged for on the same basis as lamps for illumination was discontinued.

We have, on several occasions in the past, drawn attention to the irritating and inexcusable attitude adopted by certain suppliers of electricity on this point, yet again and again the question crops up and leads to publicity for electricity of a kind likely to do considerable damage to the cause of extended popularity, and calculated to neutralise any collective efforts which may be made.

It has been clearly laid down that the special charge known as the "lighting rate" is to apply only where electricity is used for purposes of illumination, yet once more an electricity supply authority, this time in Surrey, is at present exasperating consumers by attempting to insist

upon current for wireless sets being taken through the lighting meter.

It is all very ridiculous, and it is high time that the Central Electricity Board recommended a uniform policy to distributors of electricity.

One of the first considerations in endeavouring to popularise the use of electricity should, in our view, be to emphasise the simplicity and convenience of this source of energy and even if we cannot, for the moment, expect uniform charges for electricity throughout the country, at least we may expect the abolition of petty restrictions to the use of wireless receivers now that they are sufficiently commonplace to be regarded as ordinary articles of domestic equipment.

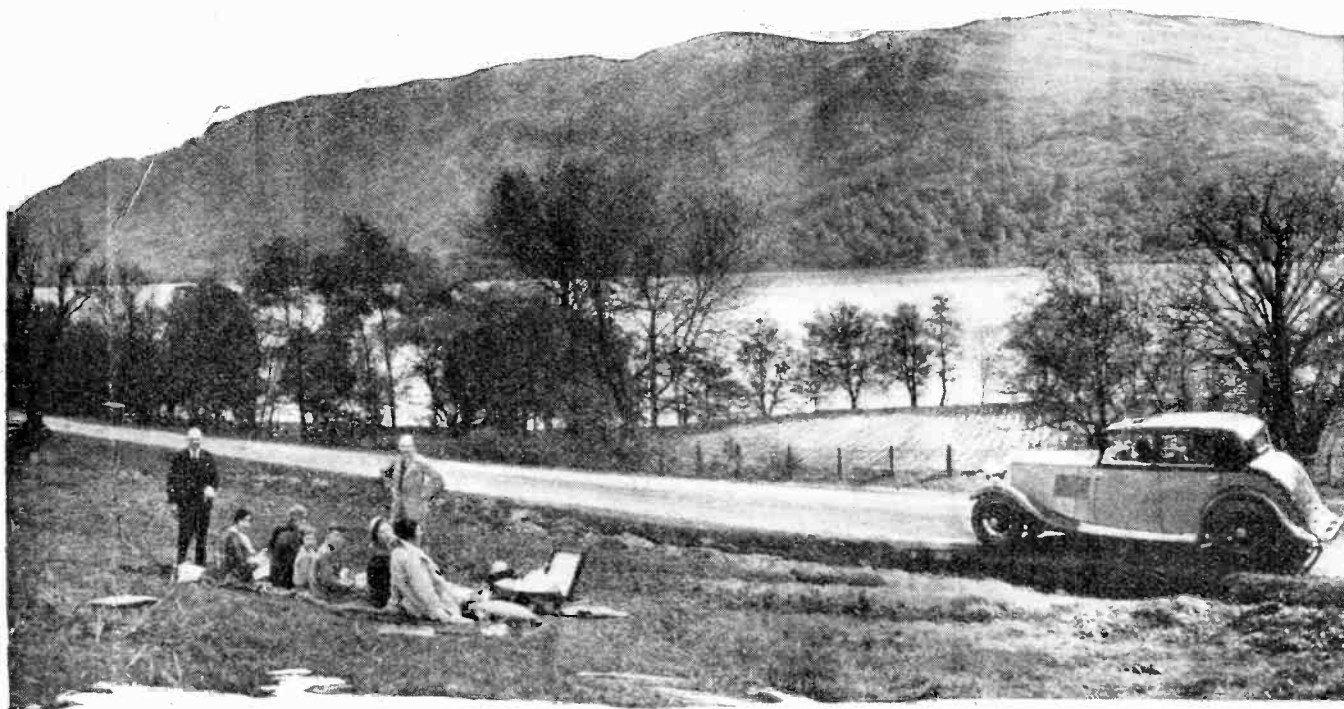
The "New Monodial"

A Receiver of Outstanding Performance

IN this issue we announce the introduction of a new constructional set.

The original "Monodial Super," as our readers are well aware, has earned for itself an incomparable reputation, and has been very generally described as a set having the finest performance of any receiver which has yet appeared in this country.

We now have the opportunity of presenting to our readers, with the "New Monodial," a design which, although based upon the original receiver, surpasses it in performance in every way. Every new development in receiver technique which could be put to a useful purpose in superheterodyne design has been incorporated in this set. A list of parts employed and a preliminary reference to the set appears in this issue, whilst the full description with details of construction will be included in our issues of July 21st and 28th.



A wireless-equipped car beside Loch Chon.

Wireless Under Way

Suppressing Radiation from Car Electrical Systems

IF a wireless set is to be operated successfully in a car while the vehicle is in motion, or even while the engine is running, it is essential that the electrical equipment should be "silenced"; in other words, anti-interference devices must be fitted in much the same way as when dealing with other apparatus of similar type. It has been proved that the

***E**VEN an ordinary portable set may be operated satisfactorily in a stationary car, but the electrical equipment of the vehicle must receive special attention if signals are to be received, on any set, without serious interference while the engine is running. This article describes, in the simplest possible terms, the fitting of anti-interference devices, and the electrical system of a typical modern car is taken as an example.*

suppression of interference is seldom a particularly difficult matter, in spite of the fact that the ignition system, with its sparking plugs and high voltages, is obviously akin to a spark transmitter, which, if unchecked, will radiate strongly. The radiation is bound to affect adversely a sensitive receiver mounted only a few feet away, unless effective means are found to stop it.

Interference with reception is not confined entirely to the high-tension side of the ignition system. Heavy surges are produced by arcing at the low-tension make-and-break contacts, and the dynamo also produces interference by

sparkling at the brushes. Auxiliary apparatus, such as electrical screen-wipers and petrol gauges, all contribute their share, and finally we have to contend with the fact that almost all forms of interference are propagated along the car wiring, some of which is certain to run in close proximity to the set and aerial.

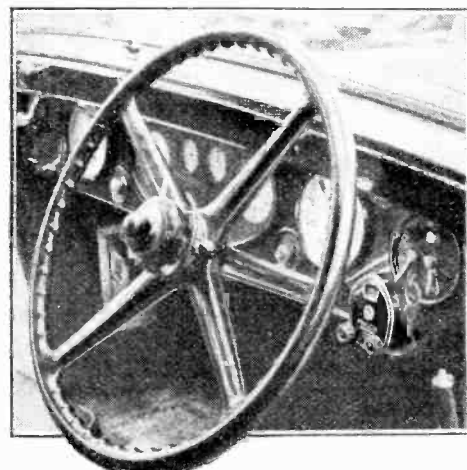
High-tension ignition interference, although it is so strong, is fortunately the easiest to prevent, and, by fitting suitable "stoppers," it is almost always possible to obtain virtually complete immunity from its effects. In practice, radiation is prevented by inserting a resistor of about 25,000 ohms in series with each sparking plug, and another of the same value in series with the common high-tension lead from the coil secondary to the distributor. The position of these various resistors is clearly shown in the accompanying circuit diagram, which relates to the ignition system of a typical modern four-cylinder car with coil ignition.

Heavy-duty Resistors

All this sounds simple enough, but the design of a resistor to stand up to the work is not entirely straightforward. It will be subjected to extremes of heat and cold, humidity and dryness, and is likely to become coated with oil. Although the steady current passing will amount only to a few milliamperes, heavy surges take place, and—perhaps most important of all—the high-frequency resistance of the suppressors, as opposed to their D.C. resistance, must be well maintained. This postulates a low self-capacity, and so composition-type resistors are usually

employed. It is claimed by some manufacturers that, by taking special precautions in design, it is possible to use a considerably lower value of resistance than that stated above, with consequently less chance of impairing the electrical efficiency of the ignition system.

In any case, it cannot be guaranteed that any resistor will last indefinitely, and few makers claim that their products will last longer than for 50,000 miles of driving. From this it will be gathered that specially made resistors are almost essential; amongst the firms making or distributing suitable types in this country may be mentioned the Dubilier, Erie, Rothermel, and Varley concerns. In all cases suitable precautions are taken to protect the



Almost all motor-car sets are remotely controlled on the "Bowden wire" principle. This photograph shows the control-box of a Philco "Transitone" mounted on the dash, to the right of the steering wheel.

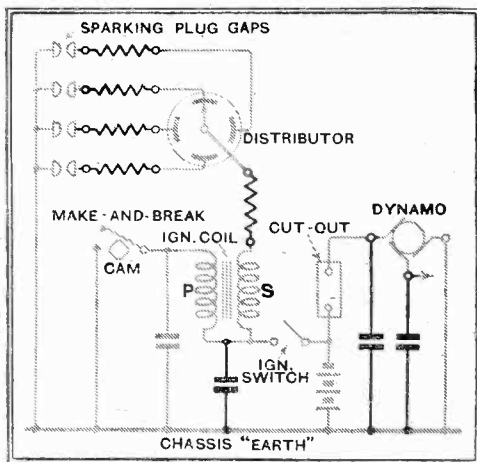
Wireless Under Way—

resistance elements by enclosing them in a cover of vitreous or similar material.

It should be emphasised that the suppressor resistances should always be mounted as closely as possible to the source of interference. Sparking plug suppressors are so made that they may be connected directly to the plugs, while the distributor resistance is usually of such a type that it may be easily inserted in the high-tension cable.

Care of the Sparking Plugs

In order that these measures may be entirely effective, it is worth while to clean the plugs and to adjust the spark gaps to the length recommended by the manufacturers with rather more care than usual.



A simplified circuit diagram, drawn "wireless fashion," to show the addition of suppressor resistances and by-pass condensers. Additions are shown in full lines.

As a general rule, wide gaps tend to provoke interference, and so minimum clearances should be employed. But at least one manufacturer of car radio sets recommends that, if the idling of the engine is adversely affected by the fitting of suppressors, the sparking plug gap should be increased by a few thousandths of an inch.

Turning to the low-tension equipment, several condensers are bound to be required for the complete suppression of interference. These condensers, for which a capacity of about one mfd. will generally be right, should preferably be made specially for car use, as, like the resistances, they have to work under much more trying conditions than in a wireless receiver. A specially designed condenser, enclosed in a copper case, and with a heavy fixing bracket which also acts as the earthing connection, is illustrated in an accompanying photograph. Electrically speaking, the demands made on a car "suppressor" condenser are not heavy, but heat and dampness are the principal enemies. It has been found that, where an ordinary wireless condenser can be mounted in a position where it will be fairly cool, it stands up to its work quite well, but the position cannot always be chosen from this point of view, as the connecting leads should be short.

With regard to interference from the

make-and-break, the usual preventive measure is the connection of a condenser between the primary of the coil and earth, as shown in the diagram. It has been found that in a few instances a residue of interference may be minimised, without noticeably impairing engine performance, by adding to the capacity of the existing built-in condenser (shown in faded lines), which is normally shunted across the make-and-break contacts, and which is usually built into the lower part of the casing which encloses the mechanism. In one case where interference from this source was particularly troublesome, the connection of a 20-ohm resistance in series with the shunt condenser proved to be entirely effective.

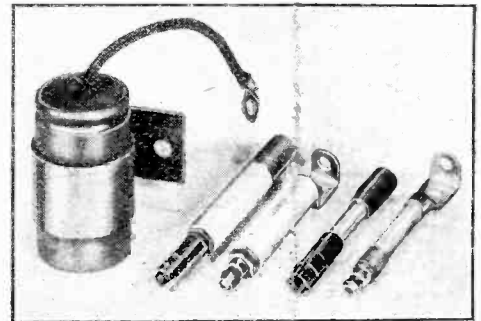
Interference from the Generator

Radiation produced by sparking at the dynamo brushes may always be recognised, as it is heard in the loud speaker as a whining sound, of which the pitch depends upon engine speed. Except in particularly difficult cases, or where an exceptionally silent background is needed, it will be sufficient to connect a condenser between the positive dynamo terminal and earth. As a refinement, or where it seems to be especially necessary, an extra condenser may be connected between the third brush (the so-called control brush) and earth in the manner shown.

For obvious reasons, it is hardly necessary to trouble about the starter motor; it usually produces heavy radiation, but as it is used so intermittently it does not cause annoyance.

Auxiliary apparatus is generally silenced quite easily by connecting a shunt con-

one of the electrodes. This casing should be directly earthed, or at any rate joined to the "earth" terminal of the device, while the insulated connection is, of course, joined to the positive or "live" terminal.



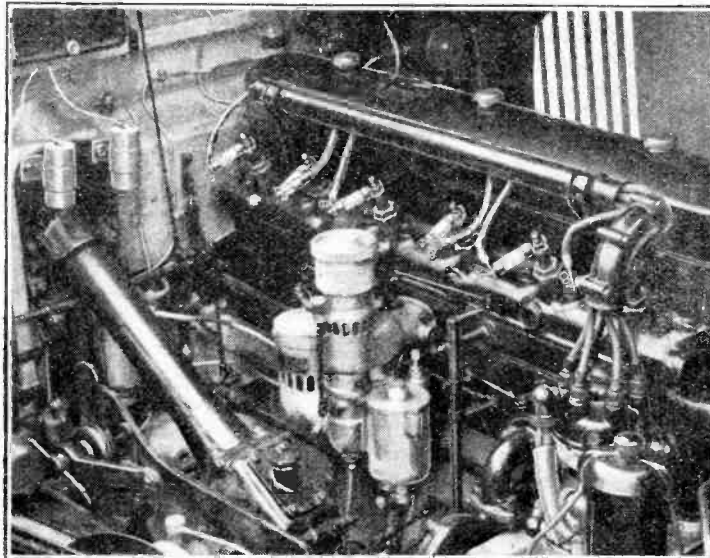
A special T.C.C. condenser, and suppressor resistances made by Erie and Centralab (Rothermel).

It should also be mentioned that when the addition of a shunt condenser fails to have the expected results the expedient of connecting a 20-ohm resistance in series with it, as already mentioned, should always be tried. By making this addition, H.F. oscillations in an "accidental" circuit will be damped out.

Although this article deals with the suppression of interference rather than with the installation of car sets, it should be mentioned that the car aerial is, more often than not, installed in the roof, and so is particularly likely to be affected by H.F. impulses propagated along the wiring of the roof-light. The aerial should accordingly be spaced as far as is practicable from this light; its leads should be also kept clear, and, if possible, screened in metal-braided coverings. The roof-light wiring may also be by-passed to

earth by a condenser, and the wiring of the ignition switch may be screened.

In order to minimise the pick-up of interference by the aerial down-lead, which is usually run to the set down one of the front pillars, it is as well to enclose it in a low-capacity metal shield, which should extend all the way to the aerial terminal of the receiver. The latter, of course, should be totally enclosed in a metal case, carefully earthed to the chassis; similar remarks apply to



Under the bonnet of a Rolls-Royce. Suppressor resistances mounted directly on the plugs, and two by-pass condensers are shown; the distributor resistance is enclosed in a length of rubber tubing.

denser. Most cars are wired on the earth-return system, and so it is necessary to take certain precautions when connecting condensers, especially if these be of the special "car" type, of which the external metal casing is joined internally to

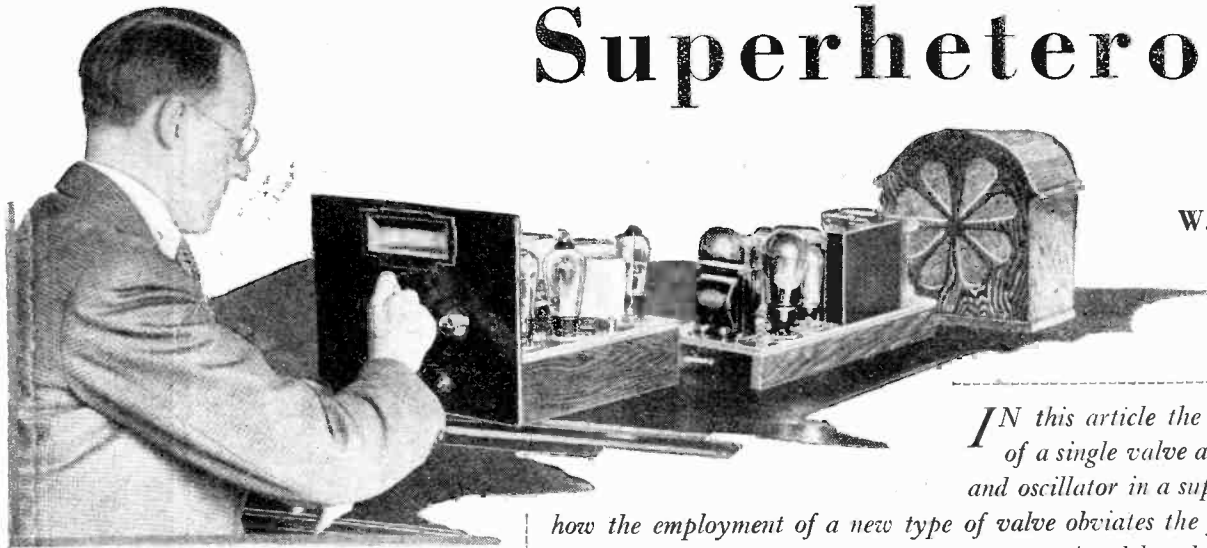
the H.T. generator, and all external connections to the loud speaker, etc., should be made with metal-braided wire.

Finally, it should be remembered that clean contacts and good insulation will help to ensure a silent back-ground.

New Ideas for the Superheterodyne

By

W. T. COCKING



IN this article the author discusses the use of a single valve as combined first detector and oscillator in a superheterodyne and shows how the employment of a new type of valve obviates the former disadvantages of a single valve and at the same time permits delayed A.V.C. to be used on the first detector. Other new features in superhet design are also discussed.

MANY attempts have been made in the past to carry out the functions of the first detector and oscillator of the superheterodyne with a single valve, but none has proved to be entirely free from drawbacks. Until recently the self-neutralised pentode, which was introduced by *The Wireless World*, was one of the few satisfactory single-valve frequency changers, but even this suffered on the grounds of low efficiency and critical operation when compared with the conventional two-valve circuit.

It seems that the two functions of rectification and oscillation cannot be carried out with complete satisfaction when the same electrodes of a valve are used for both purposes. A valve with more electrodes than usual would appear to be necessary. Even the two-valve frequency changer is not without its defects, however, and these are of two kinds—a tendency to the formation of whistles and difficulties connected with the coupling of the oscillator to the first detector.

Why Whistles Occur

Whistles are produced in the frequency changer if the first detector is not effectively linear, and theory indicates that a square law valve with a long grid-base is desirable. Such a valve, however, is likely to prove inefficient, and in practice a particular type of variable-mu valve is the most satisfactory. Practical tests show the importance of the grid volts-anode current curve being of smooth shape without any sudden change of slope, and this usually means a valve with a maximum mutual conductance of about 1 mA/V. and a grid-base of some 50 volts. Unfortunately, there are now few such valves available.

The coupling between oscillator and first detector may result in interaction between the oscillator and signal frequency tuning controls, and hence to ganging difficulties. Moreover, the oscillator potential

developed on the first detector grid will usually change considerably with frequency unless special precautions are taken, and the overall efficiency of the frequency changer will consequently vary over the waveband. If the oscillator coupling is not so tight that overloading of the first detector occurs at low wavelengths, the efficiency may be low at low

The Latest Tendencies in Design

wavelengths, and background hiss become prominent. Conversely, if the coupling be made tight enough at a low wavelength, the first detector may overload at a high wavelength, and then whistles will occur.

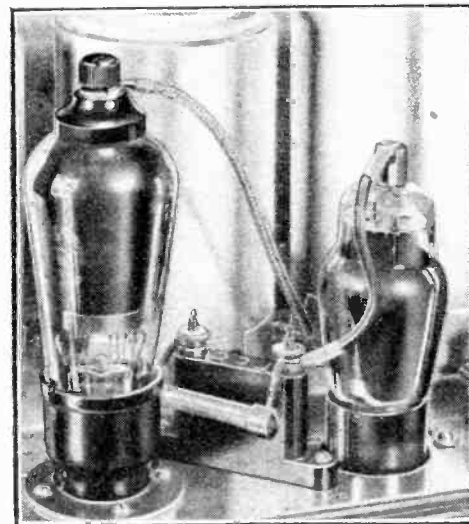
A new valve has recently been developed in America which overcomes these defects. The Pentagrid is really two valves in one, for it contains the electrodes of a variable-mu valve and of a triode. The latter are used for the oscillator, and are screened from the tetrode electrodes which form the first detector. The characteristics of the latter are of the type which we have already seen to be desirable, so that on this score there is no difficulty.

Advantages of the Pentagrid

As the two sets of electrodes are screened from one another, and no external coupling between the oscillator and first detector circuits is used, there is no interaction between the controls. The necessary coupling is neither capacitive, inductive, nor resistive, but electronic. The tetrode has no proper cathode, and its place is taken by a cloud of electrons sur-

rounding the screen placed between the triode and tetrode. The density of this electron cloud varies with the instantaneous oscillator potentials, with the result that the electron stream through the tetrode is modulated by the oscillator. Provided that the oscillation is sufficiently vigorous, the efficiency of this frequency changer is independent of the actual oscillation strength, so that full efficiency can be maintained without special circuits.

As a result, we have not merely a single-valve frequency changer which is as satisfactory as the two-valve circuit, but one which is definitely better, and which would merit use on this score alone. As compared with the conventional arrangement, the efficiency is considerably higher, back-



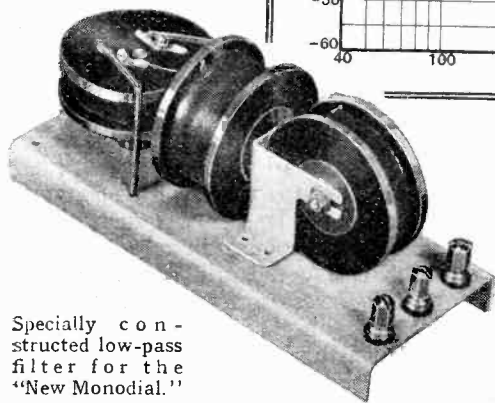
The Pentagrid valve incorporated in the design of the "New Monodial Super" to be described next week.

ground hiss is less, the efficiency is more evenly maintained over the waveband, and whistles are absent.

Development has not proceeded only in

New Ideas for the Superheterodyne—

the frequency changer, however, and no part of the superheterodyne is completely free from change. The use of critically-coupled I.F. circuits has resulted in increased simplicity of adjustment with improved selectivity and efficiency, but has necessitated an increase in the amount of tone correction necessary for high-quality reproduction. High audible frequencies must be amplified some thirty times as much as low notes, and it has proved difficult to obtain the requisite performance with a triode tone-corrector valve. A screen-grid type of valve or, better, a screened pentode, has thus become necessary in the L.F. circuits, for its high internal resistance does not have the effect of



Specially constructed low-pass filter for the "New Monodial."

greatly damping a tuned correction circuit.

The introduction of duo-diode triode and duo-diode pentode valves has rendered the use of separate valve A.V.C. systems unnecessary, and has greatly added to the number of methods of obtaining automatic volume control. The choice of method depends largely upon the receiver design, and not upon the merits of the system in itself, the amount of L.F. amplification employed being one of the chief factors. The simple delayed diode control is hardly possible when only a small detector output is needed, since it can give good control only when the detector input is large. If the control be arranged to operate on the first L.F. stage as well as the early stages, however, this system becomes possible with a moderate detector input, and it has the supreme merit of simplicity.

Choice of First L.F. Valve

A variable-mu valve is then necessary for the first L.F. stage, and as we already require this valve to be of the pentode type for tone correction purposes, the Cossor duo-diode pentode becomes ideal. A single valve of this kind will provide diode second detection, delayed diode A.V.C. on the H.F., first detector, I.F., and first L.F. stages, and act as the first L.F. valve giving tone correction. It thus takes the place of two ordinary valves,

By suitably designing the tone-corrector an overall frequency response substantially flat up to some 7,000/8,000 cycles can be obtained, with a noticeable improvement in the resulting quality of reproduction, which becomes very close to that given by a purely local station receiver. As a result of the improved frequency response, however, sideband splash is apt to become more noticeable when listening to weak distant stations. Such interference can only be removed by restricting the high-frequency response,

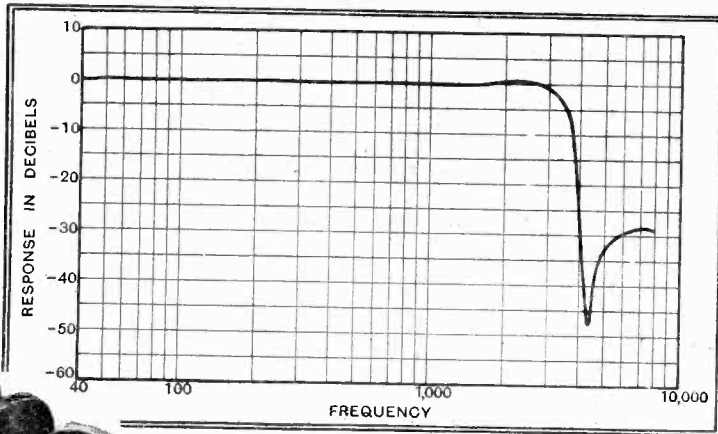


Fig. 1.—The measured response curve of a low-pass filter designed to eliminate sideband splash. The attenuation does not exceed 4.5 db. below 3,500 cycles, but reaches the high figure of 50 db. at 4,500 cycles. At higher frequencies the attenuation is less, but it is still sufficient.

but the usual methods of tone control are likely to prove unsatisfactory owing to their gradual cut-off. A properly designed low-pass filter is necessary to prevent sideband splash with a minimum of deterioration in quality.

Importance of the New Features

A suitable filter would have a cut-off frequency of 3,500 cycles, and would attenuate very greatly all frequencies higher than that without affecting lower frequencies. The measured curve of an experimental filter is shown in Fig. 1, and practical tests showed that it would entirely remove sideband splash under normal conditions. Since the stations upon which the filter need be used are usually weak and accompanied by a background of atmospherics and local interference, the deterioration in quality is not very noticeable. Indeed, the lower standard of quality with complete freedom from sideband splash is definitely more pleasing than perfect quality accompanied by interference. When conditions are suitable, of course, the filter can be thrown out of circuit by a switch and the full benefit of the upper register obtained.

It will thus be seen that considerable development has recently taken place in superheterodyne design and that an up-to-date set would employ two fewer valves, be more sensitive and selective, give better quality, less background hiss, and fewer whistles than an A.V.C. receiver of only a few months ago. In addition, the inclusion of a low-pass filter enables sideband splash to be eliminated

at will. The reduction of valves, of course, lies in the receiver proper, and it is particularly important in that it permits the use of an additional output valve without the total number of valves becoming excessive. The use of a push-pull output stage, with its attendant advantages of reduced amplitude distortion and feed-back effects, thus becomes permissible.

BOOK REVIEW

The Cult of Invention

Dr. Hatfield treats his subject in wide perspective, as might perhaps be expected from the son of a former Chief Examiner in the Patent Office. He is concerned not so much with the prosaic details and formalities of patent law and practice as with the peculiar qualities that go to distinguish the inventor—and his activities—from the rest of *homo sapiens*.

Special consideration is given to the practice of invention as a profession, to the art of directing the creative urge in the most promising direction, and to the still more difficult task of financing the invention when made. There is also an interesting and detailed survey of the mechanical, chemical, electrical, and biological aspects of the inventive faculty.

In a final chapter on patent law the author tackles some of the admitted weaknesses of the present system with considerable point, and goes on to develop an alternative scheme designed to give the inventor a financial return based definitely on his practical value to the industry of the country.

"The Inventor and his World," by H. Stafford Hatfield, Ph.D. Kegan Paul, pp. 269, price 6s.

FOREIGN BROADCAST GUIDE

BRESLAU

(Germany).

Geographical position : 51° 5' N. ; 17° E.

Approximate air line from London : 745 miles.

Wavelength : 325 m. Frequency, 923 kc/s. Power : 60 kW.

Standard time : Central European (coincides with B.S.T.).

Standard Daily Transmissions.

06.15 B.S.T. Physical exercises and concert; 07.00, military band (Sun.); 07.30, news, weather; then continuous broadcast until 11.15, weather, news, concert; 16.20, concert, talks; 19.00, National programme; 20.00, main evening entertainment; 22.00, weather, news, etc.; light concert.

Announcer : Man.

Call : *Achtung! Achtung! Hier die Schlesische Rundfunksender Breslau und Gleiwitz.*

Interval signal : Metronome (200 beats per minute), and when of long duration, first bars of *Hohenfriedberger March* as under.



Closes down as other German stations with a patriotic song or, alternately, with the *Horst Wessel* lied (Nazi Hymn) and National Anthem (*Deutschland ueber Alles*). Relay : Gleiwitz, 253 m. (1,184 kc/s), 5 kW.

Practical HINTS and TIPS

ONE of the greatest advantages conferred by the variable-mu H.F. valve is that volume may be controlled in an extremely satisfactory manner by variation of its grid bias voltage. In order that signal strength may be reduced to a sufficient extent, arrangements are usually made for varying the bias progressively from the optimum value of

a volt or so to anything up to some 30 volts negative.

But even when the maximum available bias is high it is not always possible to reduce signals from a powerful nearby station to inaudibility, or even to a comfortable strength. Insufficient control is particularly likely to manifest itself in sets with only one controlled stage, and also in battery receivers where it may be inconvenient to use a sufficiently large bias battery.

Out of Control

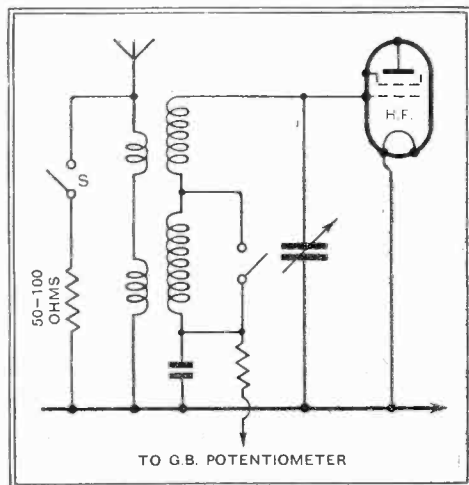


Fig. 1.—By closing the "local-distance" switch S the aerial input is almost completely short-circuited by a resistance of low value.

As a supplementary control, to be used only when receiving a local station for which grid bias adjustment may be inadequate, it is a good plan to fit some form of desensitising device which may be thrown into operation at will. Such a device is generally known as a "local-distance switch," and, of course, must be capable of bringing about a drastic reduction in overall sensitivity.

Of all the methods that have been suggested for the purpose it is doubtful if any are greatly superior for all-round use to the simple expedient of shunting the aerial-earth circuit by a resistance of 50 to 100 ohms. This resistance, of course, is connected across the circuit at will by means of a switch, as shown in Fig. 1.

The only disadvantage of a local-distance switch is that one is apt to forget its existence, and to attempt to tune in distant stations when the switch is closed!

AIDS TO BETTER RECEPTION

THERE is no royal road to real selectivity, and the only way to obtain exceptional freedom from interference from unwanted stations is to use plenty of tuned circuits, which, unfortunately, add to cost and complexity. Of course, the superheterodyne principle in itself helps towards the attainment of this ideal, but its success is largely

Tuned Circuits for Selectivity

due to the fact that the number of circuits actually employed may be increased very simply and cheaply by putting some of them into the I.F. amplifier, where they do not need retuning for each station.

From a practical point of view the selectivity obtainable from a set in which the modern iron-powder-cored coils are used is high, but a small number of exceptionally good circuits is not a complete substitute for a larger number of less ambitious ones.

To give a quantitative idea of the true position, it may be stated that two of the best circuits that it is practicable to include in a receiver at the present time would not provide as much real overall selectivity as three circuits in which coils of average efficiency were employed.

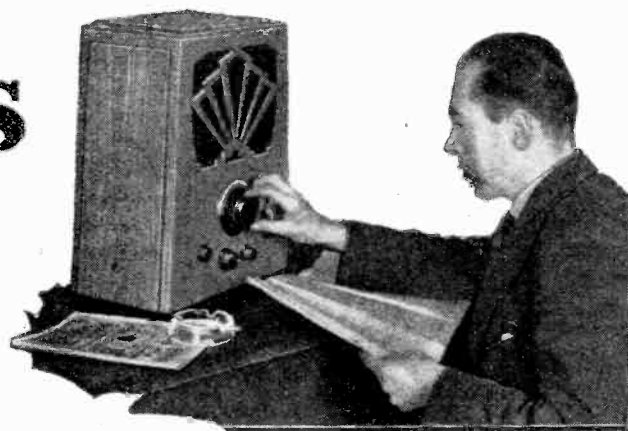
WHEN the usual remedies for hum in an A.C. set have been tried and found to be ineffective it may be remembered that a misplaced centre-tap on one of the L.T. windings of a power transformer is not unknown, and may be

An Artificial Centre-tap

largely responsible for the trouble. To unwind the transformer, and then to experiment with another position for the tapping, is a laborious task, not to be recommended to the amateur, but, fortunately, the use of an adjustable potentiometer, whereby an artificial centre point may be located accurately, provides a solution of the difficulty.

The connection of a potentiometer in place of the existing centre-tapping is quite simple, and, indeed, is only the work of a moment. The ends of the resistance winding are joined across the transformer winding, and the wire which was originally connected to the centre point is transferred to the potentiometer slider terminal.

A suitable value of resistance is about 20 ohms, and is by no means critical. Ready-made potentiometers, specially in-



tended for this purpose, and which occupy very little space, are available commercially.

ALTHOUGH the components associated with a Class "B" output stage do not take up very much space, it is not always possible to find room for them in an existing set of fairly compact design. In such circumstances the obvious

A Class "B" Unit

thing to do is to mount the extra components in a separate container, which will be treated as an external adjunct to the receiver. As a rule the original output valve will be converted into a driver valve; it will generally be possible to economise in anode currents by over-biasing the grid of this valve.

As will be seen from Fig. 2, which shows such an "add-on" unit, the internal wiring and also the interconnections to the existing receiver are quite simple. Little or no alterations to the set itself will be required, although some form of tone control must be provided in order to prevent over-accentuation of high notes. This control could be embodied in the Class "B" unit, but it is perhaps more usual to include it in an earlier stage. As a rule, the simple plan of shunting the primary of the existing L.F. transformer with a condenser of 0.01 mfd. in series with a variable resistance of 20,000 ohms or so will be found satisfactory.

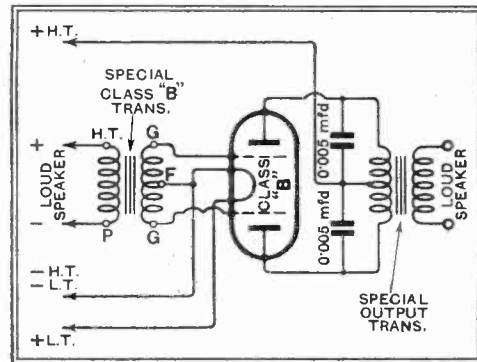


Fig. 2.—An "add-on" unit for converting an existing set to Class "B" amplification. Connections to the receiver terminals are indicated.

In addition, if there are any signs of instability, or if quality is poor, it may be necessary to provide extra decoupling in the set. Occasionally this decoupling will be desirable in the driver circuit.

News of the Week

Current Events in Brief Review

2RN Testing

THE Irish Free State Minister of Posts and Telegraphs states that the Dublin station (2RN) is now broadcasting the Dublin studio programmes for test purposes. The wavelength has been altered from 413 to 217 metres.

Sir Ambrose Fleming

THE gold medal of honour of the Institute of Radio Engineers of New York has been awarded to Sir Ambrose Fleming, the well-known radio research worker and inventor of the first thermionic valve.

One-way Traffic at Olympia ?

TO relieve the tremendous crush at the Olympia Radio Show this year, it is suggested that visitors should be marshalled along gangways in one direction only. "Test walks" made last year proved that it was impossible to cover all the Show in less than three hours.

Safeguarding the Buyer

ACCORDING to new regulations in Germany, the sale of wireless sets and installation of aerials is restricted to firms who are registered as wireless dealers. Licences are granted only if the owners and employees of the firm have passed a test in radio theory and practice.

Two-way Police 'Phone

LORD TRENCHARD, Commissioner of the Metropolitan Police, hopes that secret daily changes of wavelength will enable him to obtain privacy with the new two-way wireless telephone installation in his house near Barnet. This apparatus is to be used to maintain direct communication with Scotland Yard.

Soldiers as Set Builders

THE Chilean army is now fighting—the foreign radio manufacturer. With the restoration of peace in Chile, the army is concentrating on the manufacture of multi-valve sets which, the Government hopes, will reduce the present outflowing of more than £80,000 annually spent on foreign receivers.

Respite for French Listeners

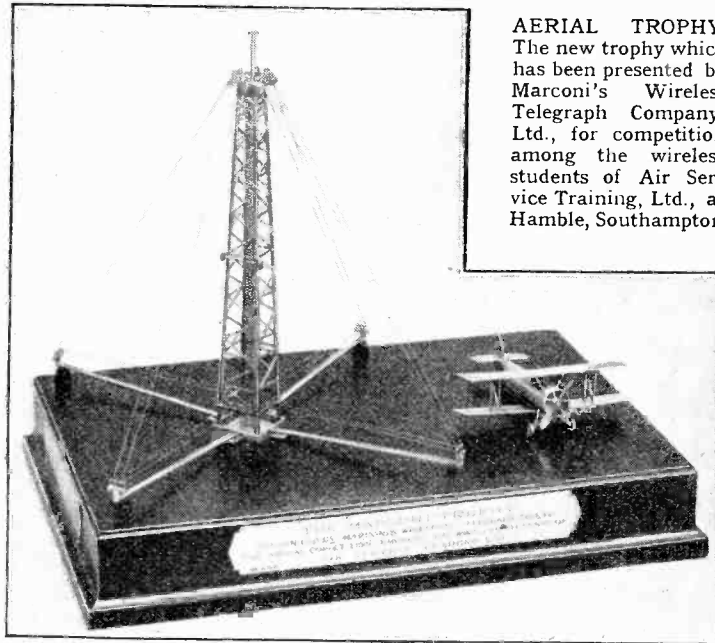
THE order to all French possessors of sets to have these licensed by June 30th caused a lot of worry and embarrassment, not only to the "pigs of payers" (*cochons de payants*), as the tax-paying public calls itself, but also to postal officials, who had not been supplied with the necessary instructions. The result, according to our Paris correspondent, was that many people had to copy out in detail the forms displayed in their local Post Offices. This entailed queues, delays, bad temper, and universal grumbling. In the end the permissible registration time has been indefinitely extended.

Athlone Nearly Paid For

LAST year the Irish Free State spent £87,945 on the broadcasting service, this including £46,100 for the high-power station. Mr. Boland, Minister of Posts and Telegraphs, secured a

Human Wavelength Scheme ?

IT is predicted in Paris that the forthcoming "Who's Who" will take the form of a wireless annual containing the individual wavelengths of everybody who is



AERIAL TROPHY. The new trophy which has been presented by Marconi's Wireless Telegraph Company, Ltd., for competition among the wireless students of Air Service Training, Ltd., at Hamble, Southampton.

vote of £43,530 for the broadcasting service for the current year, as compared with £60,310 for last year. The decrease was due to the fact that the cost of the high-power station had almost been cleared.

Last year the revenue from wireless receiving licences was £17,296. The total number of licences last year was 33,083, an increase of 4,438.

New Interval Signals

AS a new interval signal, Bavarian stations are now using the famous tune from the opera "Parsifal," portraying the bells of the Holy Grail, the notes being C—G—A—E.

An automatic vibraphone is used, operated by small hammers driven by an electric motor, and striking steel plates fixed to tubes of varying lengths.

Nürnberg, when transmitting from its own studio, employs a similar signal, but consisting of a few bars from the "Meistersingers."

How The Money Goes

GERMAN listeners' licence fees, which are to be reapportioned during the budget year 1933-34, will be distributed between the Post Office and the Ministry of Propaganda in the proportion of 55 per cent. and 45 per cent. respectively. The Post Office proportion covers the cost of the new high-power stations and their operation, together with the cost of collection. The Ministry of Propaganda retains ten millions of marks, or about 9 per cent., passing on the remainder to the Reichs Rundfunk Gesellschaft.

anybody. It seems that personal wavelengths are now being taken very seriously by the psychotherapists, hypnotists, and psychologists who met in Paris last week under the chairmanship of Professor d'Arsonval.

The greater part of the proceed-

ings was devoted to human radiations. Dr. Vachet, a prominent Paris psychologist, stated that the "animal organism plunged in a magnetic field acts exactly as any other object," and he traced an analogy between the "electric wave" and the "nervous wave."

If there is any truth in this, many unpleasantnesses might be avoided with the creation of a kind of human Lucerne Plan to prevent individual "jamming."

The Lucerne Plan

IT is regretted that in the necessary haste to secure publication of the Lucerne Wavelength Plan before any other journal in Britain or abroad, we allowed two or three slight errors to creep in. The wavelength of 274 metres is allocated to Vinnitsa, not Venice. The 309.9 metre wavelength applies to Odessa, not Vinnitsa.

A Whisper from Spain

THE magnificent project of a 500 kW. broadcasting station in Madrid seems to have collapsed, but we learn that it has been decided to build a "provisional" station with the comparatively modest power of 100 kW., according to a communication of the Spanish Home Office.

The Sound Film

IN the caption to an illustration of a Vinten tracking camera on page 427 of our issue of June 16th it was erroneously stated that the truck was designed to transport the microphone boom, whereas, as explained in Mr. Dallas Bower's article, the illustration is of the machine on which the camera is placed for moving-camera shots.

A Chequered Journey

First Reports on the Five-metre Tests

DESPITE a chequered journey, interrupted by severe storms and temporary breakdowns of his apparatus, Mr. S. G. Morgan (G6SM) secured a number of reports on his transmissions during his flights between London and Liverpool on Sunday last.

At the time of going to press reports are still being received from Liverpool, Southgate, Sidcup, and other points, and it is evident that the range of reception was only limited by the fact that the 'plane was unable, owing to unfavourable weather conditions, to rise above a maximum height of 4,000 feet. Clear signals were heard at Firlie Beacon on the South Downs, near Lewes, by Mr. H. L. O'Heffernan (G5BY), when the 'plane was eighty miles away.

After a delayed start at 10.30 a.m. the 'plane flew over London at a height of 3,000 feet. A slight mechanical breakdown necessitated a landing at Heston, but after ten minutes the 'plane got away and test signals were transmitted continuously until the oscillator valve broke down when G6SM was over Halton Aerodrome, North Bucks. A quick landing was made to effect

an adjustment, and the 'plane took off for the North at noon.

The weather broke up after leaving Halton, and terrific rainstorms and "bumps" threatened to incapacitate the apparatus. However, all went well until the modulator failed to function near Birmingham, but the necessary adjustment was made in the air. Liverpool was reached at 4 p.m.

The return journey from Liverpool was begun at 5.15 p.m., and the city was encircled before the 'plane started off for Manchester, which was reached at 6 p.m. The Pennines were crossed at 4,000 feet, and the course then followed Sheffield, Derby, Northampton, Leicester, St. Albans, and London. It was found necessary to descend for petrol near Leicester and also near St. Albans. Croydon Aerodrome was reached at 9.11 p.m.

On the southward journey the wireless apparatus functioned perfectly. At the time of going to press it is too early to have received reports from the various districts in the North.

Next week we hope to collate reports and to publish Mr. Morgan's own story of the test.

Simplified "Science Museum" Receiver

A Reader's Experience with Resistance-coupled Push-pull

INSPIRED by the description of the Science Museum receiver in *The Wireless World* of July 30 and August 6, 1930, the writer decided to build a local-station receiver and gramophone amplifier, the L.F. side being designed on the same lines. The following notes may be of interest to anyone attempting this form of amplification without previous experience.

The accompanying diagram shows the general arrangement of the set; it is not proposed to deal with the eliminator, as this unit follows convention and gives an output of 350 volts smoothed D.C.

The detector arrangements are also quite normal, and the radio side is designed to receive only the two local stations; a single-circuit tuner was used, this being desirable because the receiver was designed for fixed tuning, switching from one station to the other being accomplished by relays which switch in fixed condensers (see later remarks).

Switching from "gramophone" to "radio" is done by a relay which changes over the grid of the first amplifying MH4 valve to the pick-up. A resistance, R11, is fitted to prevent the grid circuit of this

IT is often thought that the resistance-coupled push-pull amplifier, as used in the famous Science Museum demonstration receiver, is too complex for amateur use. Many of our readers have expressed disagreement with this view, and here one of them describes a successful "paraphase" amplifier of his own construction.

By C. C. INGLIS

valve from being "opened" during switching operations.

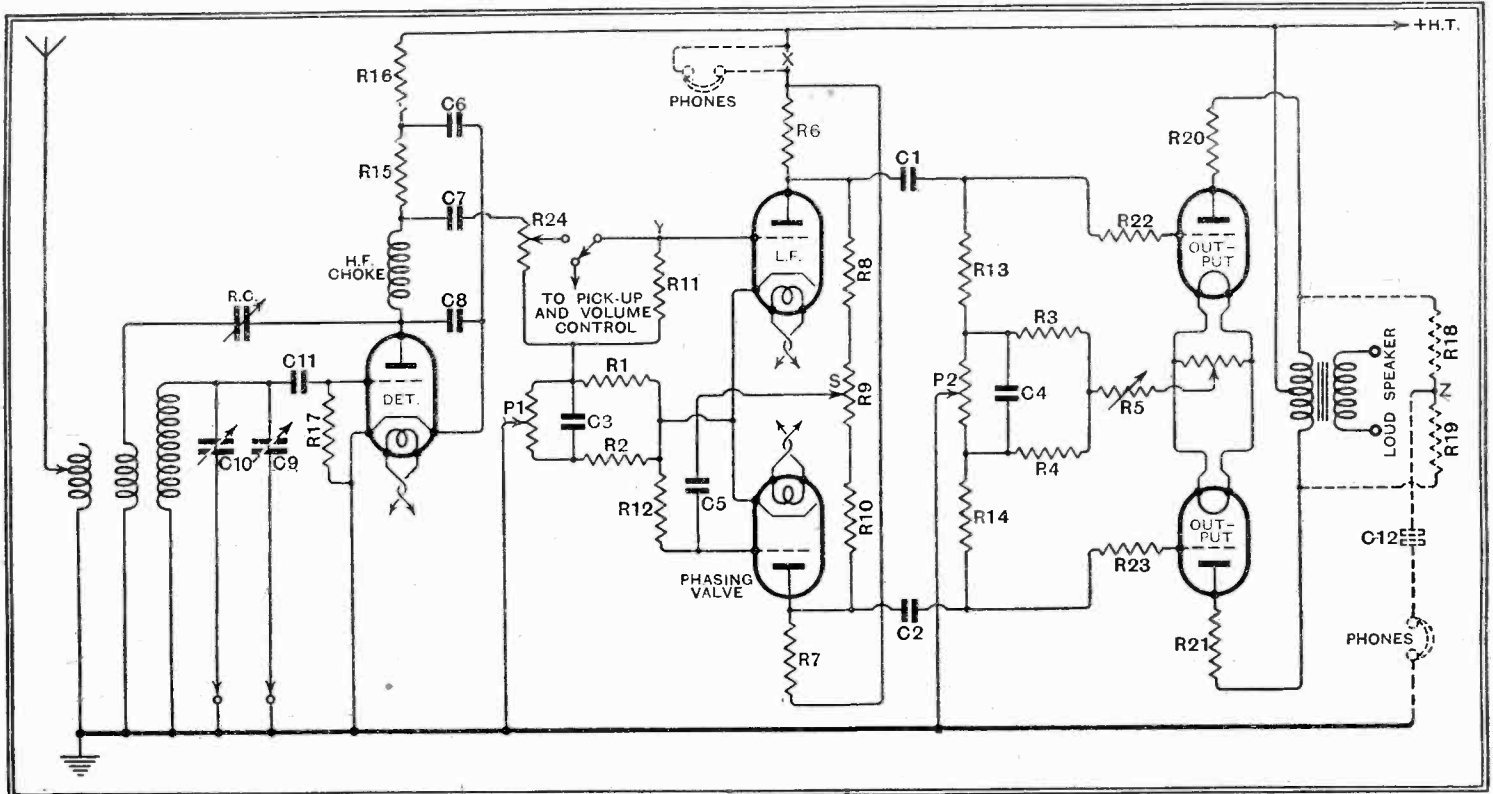
In order to obtain push-pull working from a pair of output valves, it is necessary to introduce an opposition in phase between their grid voltages. With the usual transformer coupling, this is easily obtained by using a centre-tapped transformer, but, where resistance coupling is used, this can be effected by taking advantage of the principle that the A.C. voltage component on the plate of an am-

plifying valve is 180° out of phase with that on the grid.

The input voltage is applied, therefore, to the grid of one valve, say, to point Y in the diagram, and a portion (in this case about 4 per cent.) of the amplified voltage, which is now 180° out of phase, is injected into the grid of the second chain of amplifying valves. This is done by tapping off a portion of the voltage difference between the anodes of the first stage by means of the potentiometer S.

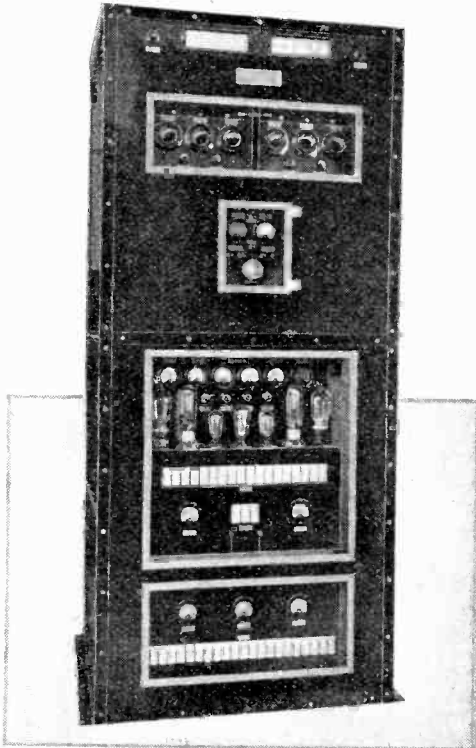
The success of the operation of the amplifier depends on the correct balancing of the circuits—that is to say, considering the first stage, the L.F. voltage on the grid of one MH4 must be equal and opposite to the L.F. grid voltage on the other MH4. If this is done, the L.F. voltages on the plates of these valves will be equal and opposite in phase, provided that the amplification of each MH4 with its associated resistances and condensers is the same.

Similar remarks, of course, apply to the output valves. If this correct balance is attained, there should be no audio-frequency currents in the common positive feed to any stage or in the common nega-



Short-range radio-gramophone set with resistance-capacity-coupled push-pull amplification. Valves: MH4's in early stages, with PX4 output valves. Values of components: P1, P2, 50-ohm potentiometers; R1, R2, 600 ohms; R3, 250 ohms; R4, 300 ohms; R5, 400 ohms; R6, R7, 30,000 ohms; R8, R10, 0.25 megohm; R9, 50,000 ohms; R11, 2 megohms; R12, R13, R14, 0.25 megohm; R15, 30,000 ohms; R16, 20,000 ohms; R17, 0.25 megohm; R18, R19, 10,000 ohms; R20, R21, 100 ohms; R22, R23, 10,000 ohms; R24, 0.25 megohm; C1, C2, 0.012 mfd.; C3, C4, C6, 2 mfd.; C5, 0.01 mfd.; C7, 0.05 mfd.; C8, 0.0003 mfd.; C9, C10, 0.0005 mfd.; C11, 0.0001 mfd.; C12, 0.01 mfd.

Simplified "Science Museum" Receiver.— five feed from the stage. This is easily tested in the first stage by the insertion of a pair of phones, at the point X, and the potentiometer S is moved so that a minimum signal is heard in the phones, the PX4's having been temporarily removed from their holders. If, now, the PX4's be replaced, and if each PX4 and its associated components amplify the signal to the same extent, there should be



Courtesy Science Museum.

Quality at all costs! The mammoth demonstration receiver installed at the South Kensington Science Museum.

no signals heard in a pair of phones connected (as shown in dotted lines) across the output transformer. This arrangement is virtually the same as that for the first stage, except that the heavy anode current of the output stage is prevented from flowing through the phones, the point Z being at the same L.F. potential (if any) as the centre tap of the primary of the output transformer.

Balancing the Amplifier

In practice it has been found that, in order to obtain a minimum signal in the phones when connected in the latter manner, the setting of S is slightly different when compared with the setting when the first stage was balanced; and this can only be due to slightly different conductances of the PX4's and other circuit differences. The difference of the settings of S in the two cases is small, however, and the final setting is that which gives a balance when the phones are connected to the output transformer.

The balancing of the first stage is done only as a check on the correct functioning of the first stage, and to prove that, while the value of amplification of each chain was the same, such amplification was properly divided between each valve in each stage

It is interesting to note that if S is varied, so that an out-of-balance of, say, 20 per cent. is produced (a guess), instability is noticed in its effect on the quality of reproduction, and if this value is considerably exceeded motor-boating will set in, especially when the amplifier is working as a local-station receiver. Decoupling is unnecessary in the amplifier, as each stage is self-contained as regards L.F. energy, there being at most only a trace in the common positive feed to each pair of valves, and in the negative feed from the cathodes. This absence of decoupling enables a lower H.T. voltage to be used, with a consequent saving in cost of condensers and resistances, mains transformers, etc., this saving more than compensating for the cost of the extra phase-reversing valve where push-pull output is required.

Matching Anode Currents

The 2-mfd. condensers C3 and C4 might be regarded as a form of grid decoupling, but as they shunt a 50-ohm potentiometer, they obviously do not play any useful part except as convenient terminal points—which actually was the reason for their inclusion.

The grid-bias arrangements look unusual, but they only serve to enable the

valves to be matched, as regards anode current. The arrangement used can vary the anode currents of the PX4's by 4 mA. each, so that valves with anode currents differing by 8 mA. can be matched by a turn of the potentiometer P2.

In practice it was found that the PX4's differed by more than 8 mA., so that the greater portion of the out-of-balance was catered for by the unequal values of the two main bias resistances (300 and 250 ohms).

Similar arrangements were made for the first stage, but the out-of-balance was not so severe, and could be allowed for by the potentiometer P1.

Hum is negligible, and the smoothing is simplified by reason of the balanced nature of the stages. It is possible to apply unsmoothed D.C. to the output stage with very little resultant hum, and when this is applied to the first stage as well, the consequent hum is not so great as one would expect.

The PX4's require about 300 volts, including grid bias and drop in the output transformer, and the surplus 50 volts is absorbed by relays in series, which switch in fixed tuning condensers for remote control of tuning.

These relays are operated by the anode current of the last stage, but details of these are outside the scope of this article.

ELECTRONIC MUSIC IN LONDON

Theremin Principle in a New Instrument

WE understand that a series of concerts will be given in London in the near future to enable the public to judge the standard now reached in what is generally known as "electrical music." At a recent demonstration of an improved Theremin instrument at the Connaught Rooms by the Electronic Music Development Co., Ltd., of Purley, Surrey, it was evident that this electronic music instrument must be accepted as a serious effort towards the creation of a new musical art.

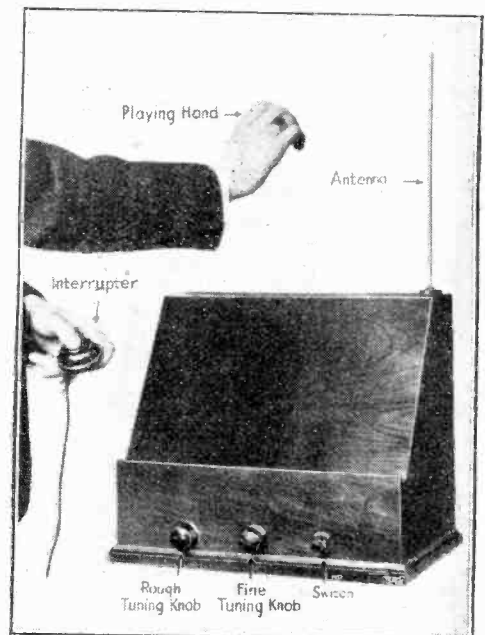
The principle of the Theremin is familiar to the majority of readers of *The Wireless World*. Briefly, the unit consists of two valve-driven, high-frequency tuned circuits. The frequency of the one circuit is fixed and that of the other is varied by the player. The combination of the two generated frequencies produces a heterodyne or beat note which, after rectification and low-frequency amplification, operates the loud speaker in the usual manner. A compass of about nine octaves can be covered.

Avoiding Glissando Effect

The instrument is essentially an adjunct for use with any existing radio receiver, mains or battery operated, but preferably employing a high-frequency stage or stages before the detector valve. The normal aerial lead is removed from the set, being replaced by the screened cable from the control gear of the instrument. The receiver is then tuned to about 1,100 metres, the wavelength upon which the new instrument operates.

The instrument is played usually by bringing the right hand nearer or farther from the brass rod, thus creating a capacity effect

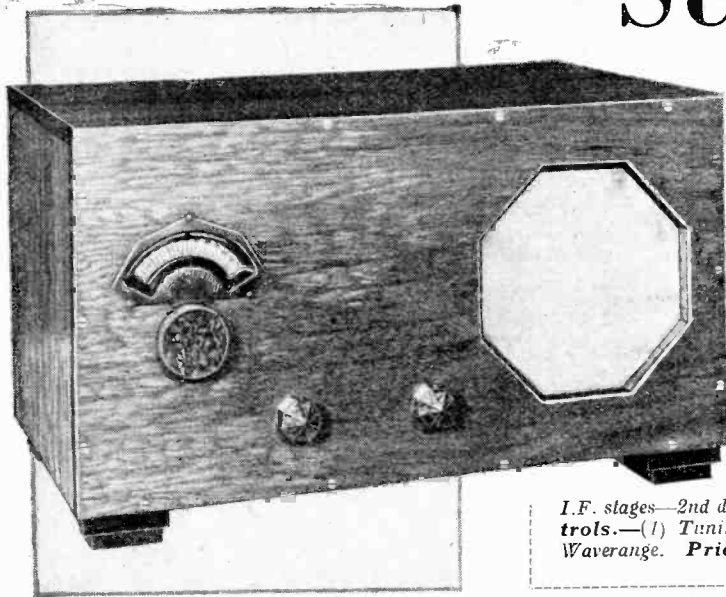
which varies the note. Perhaps the most important feature of this model is the device for permitting interruption of the notes by a contact held in the left hand. The player is thus able, if desired, to avoid the *glissando* effect in passing from one note to another. The volume of sound can be controlled by means of a pedal.



ELECTRONIC MUSIC. The new musical instrument, based on the Theremin principle, which has been developed by the Electronic Music Development Co., Ltd. Public concerts are shortly to be given in London.

Scott Sessions "Equator-Super"

A Short- and Medium-wave Battery Superheterodyne with Automatic Volume Control



FEATURES

Type.—Short- and medium-wave battery superheterodyne for tropical use. Automatic volume control, Class "B" output and moving-coil loud speaker.
Circuit.—Signal-frequency variable-mu H.F.—1st detector (autodyne on short waves)—separate oscillator (medium waves only)—two variable-mu I.F. stages—2nd detector (metal oxide "Westector")—driver valve—Class "B" output valve. **Controls.**—(1) Tuning, with illuminated dial. (2) Manual volume control and on-off switch. (3) Waverange. **Price.**—£33. **Makers.**—G. Scott Sessions and Co., Muswell Hill, London, N.10.

IN view of the fact that short-wave receivers are in great demand in tropical countries where supply mains are not always available and where climatic conditions are severe, the makers have designed this set for battery operation, and housed it in a dust- and insect-proof cabinet.

The circuit is thoroughly up to date, and contains many features of special interest from a technical point of view. There are, in all, eight stages, with a "Westector" metal oxide rectifier taking the place of a valve in the second detector stage. The set covers the medium broadcast band, in addition to three short-wave ranges, and the wavelengths covered are approximately as follows: *Medium-wave*, 220-550 metres. *Short-wave* Range (1) 80-55 metres. Range (2) 60-28 metres. Range (3) 30-12 metres. All four ranges are controlled by a single switch, and the user is not called upon to interchange coils on the short-wave ranges. The control switch, in addition to altering the wave range, also modifies the circuit in the earlier stages in the following manner:—

On the medium-wave broadcast band the aerial circuit includes a tuned input trans-

former, and the signals after amplification at radio frequency by the first screen grid variable-mu valve are heterodyned in the first detector stage by a separate oscillator before passing to the intermediate frequency stages. On the short-wave ranges the detector, which is the second valve from the left in the circuit diagram, functions on the autodyne principle and is self-oscillating, while the third valve—the medium-wave separate oscillator—is put out of action by short-circuiting the reaction coil and opening the filament circuit. At the same time the tuned aerial circuit is replaced by a high resistance, and the tuned grid circuit preceding the detector is changed over to the short-wave coils and the special short-wave condenser coupled to the spindle of the medium-wave triple gang condenser. Only two sets of coils are used on short waves, and the three ranges are covered by short-circuiting or paralleling sections.

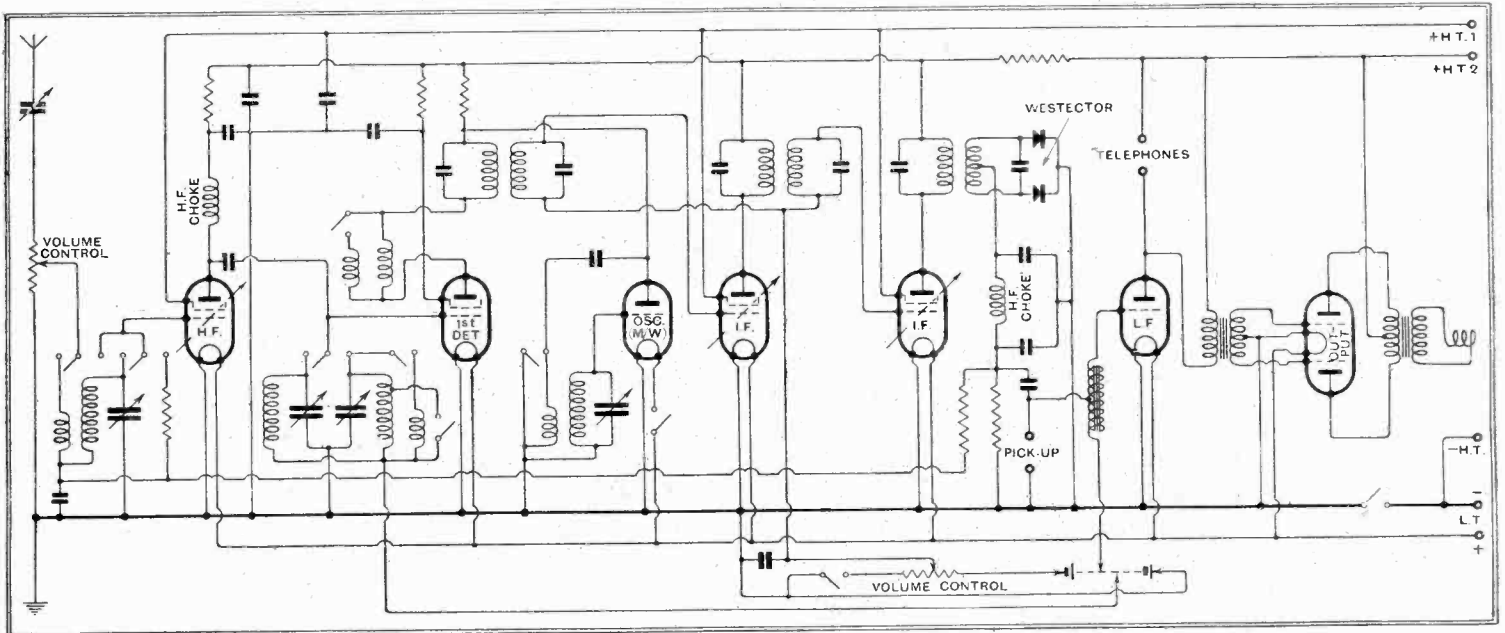
Westector and A.V.C.

The two intermediate frequency stages employ variable-mu screen-grid valves, and are

tuned to 110 kc/s. The full-wave metal oxide rectifier which performs the function of second detector is shunted across the tuned secondary of the second I.F. stage. This type of rectifier is well suited to deal with the comparatively high output from the I.F. stages, and also provides a convenient means of obtaining automatic volume control. In the Scott Sessions set the D.C. component of the rectifier output is used to bias back the variable-mu radio frequency amplifier. A measure of automatic volume control is thus obtained which appreciably reduces fading effects on short waves.

The automatic volume control is supplemented by a manual control, which performs the dual function of reducing the aerial input and biasing back the I.F. valves. The two potentiometers are ganged, and when the set is switched off the potentiometer across the grid bias battery is disconnected.

The remaining two valves deal with the low-frequency component of the "Westector," and comprise the driver and push-pull valve of a Class "B" amplifier feeding into the permanent magnet moving-coil loud speaker. This arrangement ensures



Complete circuit diagram. The two volume-control potentiometers are ganged, and in the latest models a tone compensation circuit is incorporated in the output stage.

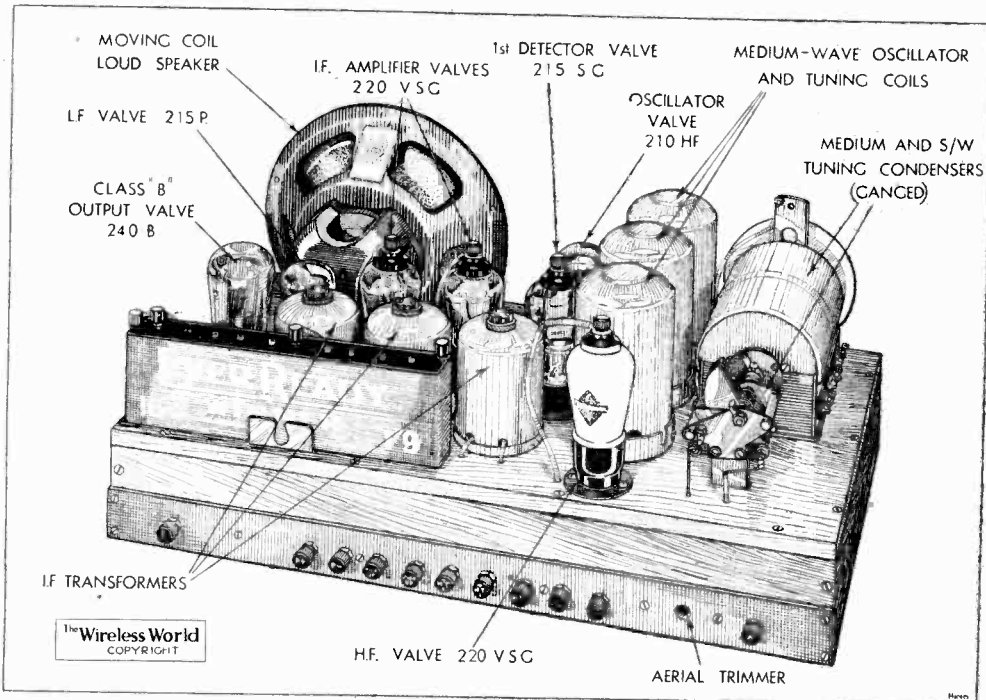
Scott Sessions "Equator Super"

efficient utilisation of the battery current expended in the output stage—an important consideration to users who may be many miles from a source of supplies.

The construction of the chassis is well suited to tropical conditions, and careful consideration has been given to insulation resistance. Ample spacing is provided between the contact springs of the waverange switch, and paxolin insulation is used

of the latest models in which a tone-control circuit is associated with the Class "B" output transformer. In this case the quality was well balanced, and a power output estimated at 600 to 750 milliwatts was obtained without overloading. Four Continental short-wave transmissions were received at this level, and an opera from one of the Italian S/W stations was enjoyed without once having to touch the controls, a slight rise and fall in the background noise being

louse problem by the list of wavelengths under the Lucerne Plan. Examine it carefully and you will find no channel assigned to Toulouse Midi, though on 386.6 metres (776 kc/s) you will find Toulouse PTT. This wavelength is very close to that at present used by the Midi station, and it would seem that what I suggested some months ago as likely to happen will actually take place with regard to the St. Agnan station. It will most likely be taken over by the French Government lock, stock and barrel, and when it does start to give a regular broadcasting service it will do so as Toulouse PTT. The Government want a high-powered station at Toulouse; Toulouse Midi has one. But the station cannot be used until the Government gives permission, and this permission is being withheld. The choice for the owners thus lies between handing over the station at a reasonable valuation, or reserving it as the only silent transmitter in the world!



A teak baseboard forms the foundation of the chassis, which is designed to withstand tropical climates.

wherever possible. The frame of the set is made of teak, the underside of the baseboard being covered by an earthed metal screen.

The Manual Volume Control

To get the best results from the set, careful attention must be given to the adjustment of the manual volume control. Just above the half-way mark the I.F. stages go into oscillation, and there is an appreciable angle of zero near the lower end, so that the range is rather restricted. The efficiency of the I.F. stages is rather dependent on the correct adjustment of this control, which must therefore be handled as a reaction control.

The range of automatic volume control is sufficiently wide to be effective in cutting down background noise on strong signals, and the levelling effect on the relative strength of medium-wave broadcasting stations is at once noticeable. At first the set gives the impression of being insensitive in relation to the number of valves used, but further acquaintance soon reveals that the number of distant stations received is in keeping with the advanced character of the circuit. While the automatic volume control is helpful, its range is not sufficient entirely to cope with short-wave fading, and for those who prefer the crispness and "punch" of a normal sensitive receiver, and do not object to frequent manipulation of the manual volume control, the makers are willing to supply the set without automatic volume control.

In the original set tested the quality was somewhat high-pitched, but we have subsequently had the opportunity of hearing one

the only evidence that fading was present.

The standing H.T. current is of the order of 12 mA., and on loud passages the average current was estimated at 18 to 20 mA. Large-capacity dry batteries are recommended, and the H.T. voltage required is 120, with provision for a tapping at 45 volts. We understand that a special rotary converter will shortly be available in order that the power for the H.T. circuits may be derived from the L.T. accumulator.

Provision is made for the reproduction of gramophone records, and telephones may be connected in the driver valve stage for very weak signals.

Distant Reception Notes

What Lucerne Really Means

WHAT exactly did Luxembourg do or omit to do at Lucerne? In his broadcast talk on the Conference transmitted from the B.B.C. National stations, Mr. F. W. Phillips, Assistant Secretary of the G.P.O., stated that eight countries had not signed the Convention, namely, Holland, Sweden, Poland, Finland, Hungary, Greece, Lithuania, and Luxembourg. Yet a pronouncement by the B.B.C. says that only seven countries failed to sign, and does not mention the name of Luxembourg. Since manuscripts of all talks have to be sent in for scrutiny before they are passed for broadcasting, this one presumably received official approval for the correctness of its statements. But the B.B.C.'s own pronouncement must also have received that approval.

Light appears to be thrown upon the Tou-

Posers for Set Designers

Have you noticed how small is the separation between channels on the band provided under the new plan on the long waves? Radio-Paris is only 7 kc/s above Brasov and 8 kc/s below the 500-kilowatt Moscow I. The latter station is separated by 8 kc/s again from a wavelength shared by four stations, and there is another 8 kc/s separation between this group and Zeesen. Daventry is 9 kc/s above Zeesen, and 8 kc/s above is Minsk. Kalundborg, besides having to share a wavelength with Portugal, is 8 kc/s from Warsaw on the one side and only 7 kc/s from Leningrad on the other. Designers of receiving sets will have some pretty little problems to deal with so far as the long waves are concerned in the matter of providing adequate selectivity combined with reasonably good quality. Radio-Paris is at present about the easiest of all foreign stations to receive clear of interference; after January next it may well be one of the most difficult.

Reception conditions continue to be extraordinarily good, and now that a welcome change has occurred in the weather, atmospheric are almost if not entirely absent. We had a bad spell of them during June as a result of seventeen days of thundery weather on end.

With the exception of Kalundborg, Oslo and Motala, the long-wave stations can be relied upon for good reception at any time. Motala has been below par for some weeks now, while both Kalundborg and Oslo have almost disappeared.

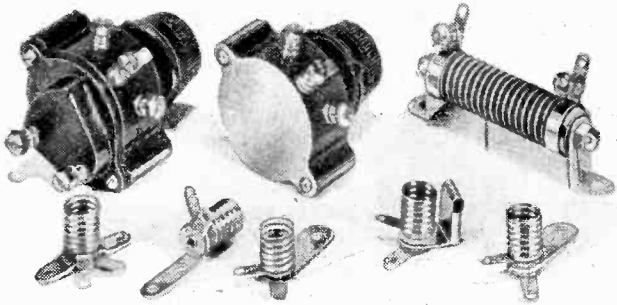
Brussels No. 1, though usually wonderfully good and generally receivable in the daytime, has had occasional rather poor days of late. Possibly this station is coming under the influence of the adverse seasonal effects which manifest themselves on transmissions near the top of the medium waveband. Florence, Prague, and Langenberg have all been excellent. The Lucerne list shows that the present power of Lyons Doua is actually 15 kilowatts, and not 1.5 as most lists show it. Readers may remember that I suggested some time ago that the indications were that the decimal point had been moved one place to the right.

Stockholm is temporarily on the weak side, but Rome is first-rate. Katowice, Sötiens, Leipzig, Hamburg and Strasbourg are all quite reliable. Other stations always to be found when required are Brussels No. 2, Milan, the Poste Parisien, Breslau, Göteborg, Bordeaux-Lafayette, Hilversum, Heilsberg, Turin, Gleiwitz and Nürnberg.

D. EXER.

LABORATORY TESTS

NEW RADIO PRODUCTS REVIEWED

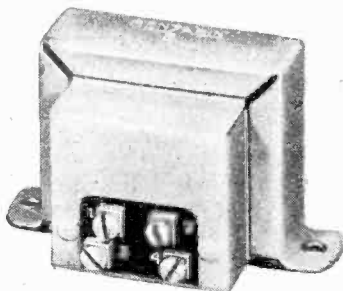


Selection of new Bulgin components consisting of Compact volume control with switch, power resistances and M.E.S. lamp holders.

BENJAMIN CLASS "B" OUTPUT CHOKE

A TAPPED output choke giving the choice of seven different ratios, and developed especially for use with Class "B" valves, has been introduced by the Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17. Known as the Class "B" Universal Output Choke, its function is to provide the medium for matching the valve to the loud speaker, but it does not replace the transformer fitted to present-day loud speakers, nor is it suitable for use with low impedance models. The ratios provided are 1/1.2, 1/1.6, 1/1.9, 1/1, 1.2/1, 1.6/1, and 1.9/1. It has a total resistance of 400 ohms, and with no D.C. flowing shows a total inductance of the order of 60 henrys. The core is of ample size to ensure that a satisfactory power output at the lower audible frequencies is obtained when one-half of the winding is carrying the normal working current of one valve.

The winding is completely screened, and the overall dimensions are 3½ in. x 2½ in. x 1 in. The price is 11s.



Benjamin Class "B" Universal output choke.

NEW BULGIN COMPONENTS

THE new Compact volume controls, which have a maximum rated dissipation of 3 watts, contain a resistance element wound with special nickel chrome alloy resistance wire totally enclosed in a moulded bakelite case finished in mottled green, a colour scheme that is adopted for many of this firm's products. A single hole fixing bush is fitted, and as this is electrically "live" to the moving arm, insulating washers can be obtained for mounting the component on a metal panel.

Contact between the centre terminal and the resistance is made by a small squash plate, a system which is both silent in operation and imposes the minimum of mechanical strain on the wire. These new resistances are made in all the usual values from 500 ohms to 100,000 ohms, the prices of the volume controls range from 3s. 6d. to 4s. 6d.,

and fitted with a built-in mains switch rated to handle 3 amps. at 250 volts, from 5s. to 6s.

We have tested some specimen volume controls, and find them perfectly silent and smooth in operation, and the measured resistances agree very well indeed with

the marked values.

Recent improvements effected in the manufacture of Bulgin 20-watt power resistances have resulted in a higher degree of accuracy and reliability than hitherto. The nickel chrome resistance wire employed is spirally wound on a heat-resisting core, and this, in turn, is wound on a spirally grooved porcelain former. The tapping bands, which carry the terminal, are not employed to anchor the wire, so that they can be loosened and readjusted if a non-standard resistance value is required. Alternatively, extra tapping clips are available at an additional charge of 6d. each.

These resistances will dissipate their rated watts, but naturally a certain amount of heat is generated so that care should be taken to mount them in well-ventilated positions and not too close to other components. Resistances up to 5,000 ohms in value cost 3s. 6d. each; from 7,500 ohms to 40,000 ohms the price is 3s. 9d. Between 50,000 ohms and 100,000 ohms the prices range from 4s. to 6s. Among other new items is a series of small M.E.S. lamp-holders for illuminating condenser scales, etc. They are fitted with fixing lugs and soldering tags, and the prices range from 2d. to 3d.

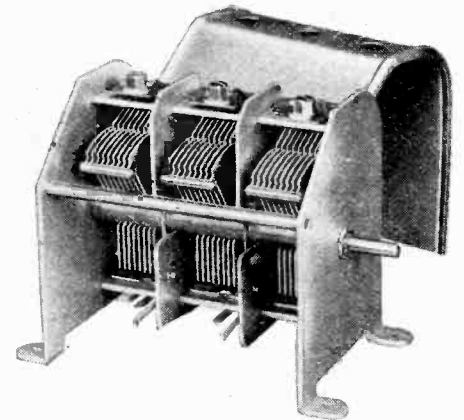
The makers are A. F. Bulgin and Co., Ltd., Abbey Road, Barking.

ORMOND THREE-GANG CONDENSER

KNOWN as the No. 7 Screened Gang Condenser, this latest Ormond product incorporates the most up-to-date features and principles of condenser construction, for it is assembled on a stout steel frame rigidly supported and well braced. The rotors are mounted on a hollow shaft carried in two large bearings, which preclude any form of end-play. The spindle is positioned by small grub screws, it is adjustable for length, and can be inserted at either end for clockwise or counter-clockwise drive. Constancy of initial adjustment is ensured, first, by employing stout gauge aluminium for the vanes, and, secondly, by securely bonding the free ends of the rotor vanes in each section.

Contact is made with the rotors at two points, in addition to that afforded by the end-bearing, thereby enabling the wiring to be arranged so as to avoid connections common to two or more circuits. Each section is fitted with a small trimmer, the adjusting screws for which will be at the top when the condenser is secured to the baseboard by the fixing lugs provided. Provision is made, also, for mounting the condenser on its side, but this entails removing the dust cover.

Matching of the three sections in the specimen tested was very satisfactory, the largest discrepancy in the capacities was of the order of one per cent. only, while over the major part of the scale the average deviation was considerably less. The trimmers gave a variation of approximately 74 micro-mfds., and the minimum capacities of the three sections were 25, 26, and 25



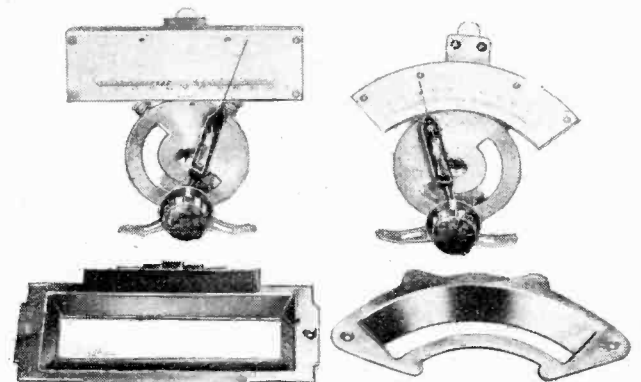
Ormond No. 7 screened gang condenser.

micro-mfds. respectively. The maximum change in capacity of a section was found to be 480 micro-mfds. (0.00048 mfd.), and the full capacity, with the trimmer set to minimum, was 0.000505 mfd.

To sum up, this latest Ormond gang condenser is a thoroughly sound component, both mechanically and electrically, and at the price of 21s. represents good value for money. The makers are the Ormond Engineering Co., Ltd., Ormond House, Rosebery Avenue, London, E.C.1.

NEW BRITISH RADIOPHONE DIALS

BRITISH RADIOPHONE, Ltd., Aldwych House, Aldwych, London, W.C.2, have introduced two new condenser dials of the type usually described as full-vision scales. Known as the models 582A and 583A respectively, they incorporate the same mechanical principles, and the only difference is in the shape of the scales employed. The slow-motion drive gives a ten-to-one reduction, and will drive a large gang



British Radiophone new type full-vision scales.

condenser without the slightest trace of slip or backlash.

Easily detachable dual-lampholders are fitted at the back of the translucent scale so as to give even illumination. The dial

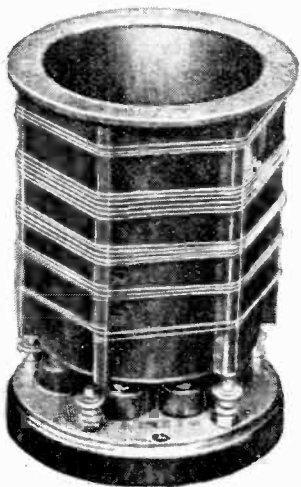
is particularly robust, and will withstand very hard wear, being made almost entirely of steel. It is secured by screwing to the baseboard, for which purpose feet made of a pliable material are fitted, so that they can be easily bent to raise the dial to the height desired.

The model 582A has a straight horizontal scale divided into one hundred divisions, but on the companion model this is replaced by one having a slight curve, arranged so that the engravings are on the arc swept by the pointer. Either style will greatly enhance the appearance of the set, and, furthermore, they offer a welcome change to the orthodox semi-circular type.

These new dials fit condensers having 1/4 in. shafts, and the drive spindle is left sufficiently long to pass through the wood front of a cabinet and protrude sufficiently to take a standard knob with a 1/4 in. hole. Model 582A costs 8s. 6d., and the companion style (model 583A) 8s., including a bronzed-finished escutcheon of appropriate design.

EEXLEX DUPLEX COIL

UNLESS particular care is taken, switching in short-wave circuits may introduce quite serious losses, yet so far as practical considerations allow, the duplication of coil formers should be avoided, since coils not in use may be mislaid or suffer damage. In order to comply with both these conditions J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, London, E.C.1, have developed a short-wave coil covering a range of 15 to 60 metres nominal without the need for switching or using a tuning condenser of abnormal size. Known as the Duplex coil, it is wound with two separate sets of windings, and the required wave-band is selected by the simple expedient of reversing the coil



Eelex Duplex short-wave coil and base. Wave-change is effected by reversing the coil.

in its holder. A special base with sockets arranged to facilitate this is supplied. Tests made with a specimen coil proved entirely satisfactory. Used either in a straight det.-L.F. receiver or in a superheterodyne adaptor reaction was perfectly smooth and easily controllable over the whole range covered. No "blind spots" were encountered. We found it advisable, however, to include a small condenser in series with the aerial coil, since without it the effect of aerial damping was very marked at some parts of the wave band.

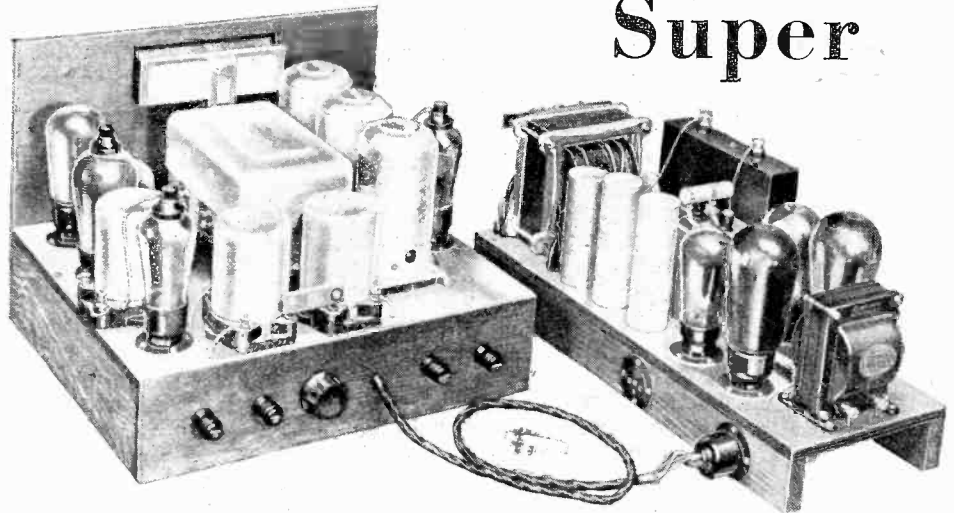
The top of the coil former is marked to indicate the short and long positions, their respective wave ranges being 15.25 to 31.7 metres and 27.6 to 55 metres using a 0.00015 mfd. tuning condenser and a 0.0003 mfd. reaction condenser.

To cover the 60-metre wavelength a 0.0002 mfd. tuning condenser is required.

The price of the Duplex short-wave coil is 7s. 6d., and this includes the special base.

In Next Week's Issue:—

The New Monodial Super



A successor to the original *Wireless World* Monodial, this receiver incorporates every practical new development in superheterodyne technique

THE New Monodial Super is designed on similar lines to the original Monodial, but incorporates those refinements and improvements which eighteen months of research have made possible. Among the features of the new receiver are a Pentagrid single valve frequency-changer, which reduces the possibility of whistle production, a duo-diode-pentode second detector giving delayed A.V.C. for eliminating fading, and a 6-watt push-pull output stage. The set is A.C. operated.

The performance is exceptional in every way. The sensitivity is sufficiently high to permit consistent distant listening even under poor conditions, and background hiss is very low. The selectivity prevents interference of the intelligible type from all stations spaced by 9 kc/s, and a filter permits sideband splash to be cut out at will. The quality of reproduction is better than that given by many local station "quality" receivers, and the volume is adequate for a small hall, but is under complete control. The A.V.C. system eliminates most of the effects of fading and also keeps the volume level constant on all stations.

LIST OF PARTS

After the particular make of component used in the author's model, suitable alternative products are given in some instances.

Receiver Unit.

- 1 3-gang Superhet. condenser with right-hand trimmers (Polar.) British Radiophone No. 582A
- 1 Set Superhet. coils Varley BP19
- 3 I.F. transformers, 110 kc. Telsen (Colvern.)
- 3 5-pin Valve holders Clix chassis mounting type
- 1 7-pin Valve holder Clix chassis mounting type (Goltone, W.B.)
- 1 7-pin Valve holder for 2A7 valve Claude Lyons
- 1 5-pin Plug Eutgin P3 (Keystone.)
- 1 5-way Battery cable with twin 70/36 leads Harbros
- 1 Tapered volume control, 250,000 ohms Centralab (Claude Lyons.)
- 2 Toggle switches Bulgin S.98
- 1 Toggle switch, make and break Bulgin S.80 (British Radiophone, Claude Lyons.)
- 1 Potentiometer, 5,000 ohms, wire wound Watmel No. 1 (Haynes Radio, Claude Lyons.)
- 1 Fixed condenser, 12 mfd. Edllystone No. 929
- 4 Terminals, A. E. Pickup (2) Belling-Lee Type "B"
- 1 Compression condenser, 0.002 mfd. R.I.
- 1 Heterodyne filter, 3,500 cycles Wearite W.M.3
- 2 Screened H.F. chokes Wearite Type H.F.P.
- 2 Fixed condensers, 2 mfd., 400 v. D.C. test T.C.C. Type 50

- 1 Fixed condenser, 1 mfd. 400 v. D.C. test T.C.C. Type 50
- 5 Fixed condensers, 0.1 mfd. 400 v. D.C. test T.C.C. Type 50
- 1 Fixed condenser, 0.02 mfd. mica, 500 v. D.C. test T.C.C. Type 25A
- 1 Fixed condenser, 0.001 mfd. T.C.C. Type 34
- 1 Fixed condenser, 0.01 mfd. T.C.C. Type 34
- 5 Fixed condensers, 0.001 mfd. T.C.C. Type "M"
- 1 Fixed condenser, 0.002 mfd. T.C.C. Type "M"
- (Dubilier, Peak, Telsen.)
- 1 Electrolytic condenser, 50 mfd. T.C.C. Type 501
- 2 Dial lamps, 6 volts Bulgin Type O.B.
- 2 Metallised resistances, 10,000 ohms 2 watts
- 1 Metallised resistance, 1,000 ohms 1 watt Dubilier
- 1 Metallised resistance, 2,000 ohms 1 watt Dubilier
- 3 Metallised resistances, 20,000 ohms 1 watt Dubilier
- 3 Metallised resistances, 100 ohms 1 watt Dubilier
- 3 Metallised resistances, 2 megohms Dubilier
- 2 Metallised resistances, 0.1 megohm Dubilier
- 2 Metallised resistances, 0.25 megohm Dubilier
- 1 Metallised resistance, 0.5 megohm Dubilier (Erie, Claude Lyons, Seradex.)
- 1 Resistance, 2 ohms Claude Lyons
- 1 5-way Connector Wilburn
- 2 lengths Screened sleeving Harbros (Goltone, Lewcos.)
- 10 lengths Systollex, 2 ozs. No. 20 Tinned Copper Wire, Wood, etc.
- Plymax Baseboard, 14in. x 12in. x 1/2in. Peto-Scott
- Wood Panel, 14in. x 10in. 3-ply
- Screws: 12 1/2in. No. 4 R/hd.; 30 1/2in. No. 1 R/hd.; 16 1/2in. No. 4 R/hd.; 2 1/2in. No. 4 R/hd.
- Valves: 2 Marconi or Osram VMS4 (plain, metallised, or Catkin); 1 Osram or Marconi PH14; 1 Cossor D1/Pen; 1 Claude Lyons 2A7 with grid clip.

Power Unit.

- 1 Fixed condenser, 4 mfd. 1,500 v. D.C. test T.C.C. type 101 (Dubilier.)
- 1 Dry Electrolytic condenser, 8 mfd. 500 v. D.C. working T.C.C. Type 502 (Dubilier.)
- 2 Dry Electrolytic condensers, 50 mfd. T.C.C. Type 521
- 2 Wet Electrolytic condensers, 8 mfd. 40 v. D.C. working T.C.C. Type 802
- 2 Metallised resistances, 1,000 ohms 2 watts Dubilier
- 2 Metallised resistances, 100 ohms 1 watt Dubilier
- 1 Metallised resistance, 10,000 ohms 1 watt Dubilier
- 1 Metallised resistance, 30,000 ohms 1 watt Dubilier (Erie, Claude Lyons, Seradex.)
- 1 Resistance, 2,500 ohms, tapped at 1,400 ohms, 5 watts Dubilier "Spitchni" (Electrad.)
- 1 10 henry choke Sound Sales No. 10 D.C.
- 1 20 henry choke Bulgin LF14
- 1 L.F. Transformer, push-pull Ferranti A.F.5c
- 1 Mains transformer, Primary 200/250 volts 50 cycles, Secondaries, 425-0-425 v. 120 mA., 4v.C.T.3A., 4v.C.T.1A., 4v.C.T.1A., 4v.C.T.6A., Screened Primary Claude Lyons
- 6 5-pin Valve holders Clix Chassis Mounting Type (Goltone, W.B.)
- 1 5-pin Plug Bulgin F3 (Keystone.)
- Plymax Baseboard, 18in. x 6 1/2in. with 2 runners Peto-Scott
- 18in. x 1 1/2in.
- 2 lengths Systollex, etc.
- Screws: 36 1/2in. No. 4 R/hd.; 8 1/2in. No. 6 R/hd.
- Valves: 2 Osram or Marconi PX4 or Mullard AC044 or Mazda PP3/250; 1 Osram or Marconi U14, or Mullard DW4, or Mazda U120 500, or Cossor 460BU; 1 Ediswan DLS1 (Delay Switch).

UNBIASED

BY FREE GRID

They Trust Me

I HAVE been extremely gratified by the very considerable amount of correspondence received apropos of my recent note re automatic record changers for gramophones. Some of the missives from the silent sufferers who write to thank me for once more championing the cause of the under-dog are sufficiently poignant to make even a gramophone manufacturer cry like a human being.

Apart from these, however, I have had considerable correspondence from inventors who write and complain of the scurvy treatment which they have received at the hands of manufacturers. One man who possesses a record-changer with many invaluable features, including the ability to play either side of some twenty records, states that it has been hawked round all the various companies without a sale of the patent being effected.

Specially do I desire to thank all the many trusting inventors who have sent in for my inspection full details and all necessary working drawings of their brain-children without even observing the precaution of taking out a provisional patent.



Implicit trust in my integrity.

Their implicit trust in my integrity is very moving, and has done much to restore my fast waning faith in the inherent goodness and guilelessness of human nature.

This Must Stop

I HAVE had a pathetic appeal from a Novocastrian concerning the adoption of A.V.C. on the pleasure steamers which ply up and down the Tyne. According to my Tyneside correspondent, the B.B.C. programme received and fed to the various loud speakers on board is often completely ruined by a complete fade-out every time the ship passes under the high level bridge at Newcastle. "Often," writes my Northern friend, "I have been the unwilling spectator of the heartrending disappointment of a little child who has missed its birthday greeting owing to the wretched bridge intervening at the critical moment.

Now, personally, I have no sympathy with the bridge in question, having been mulcted of a halfpenny when passing over it some years ago, but, to give it its due, I am afraid that if it causes a complete blot-out, no ordinary system of A.V.C. will do, and a special one will have to be devised in its honour.

The only thing I can think of for the moment is that the steamer should rig up a spare aerial on a small boat, which should be towed behind it at a suitable distance, so that when the ship's aerial is momentarily screened the cessation of aerial current will release a delicate relay, which will bring the spare aerial into circuit. If any of you can think of anything better pray bear in mind the pathetic spectacle of little Tyneside children being robbed of their birthright, and communicate with me accordingly.

The Choir Boy Problem

A NOVEL experiment which is being tried in a church in one of the northern countries of Europe interested me so much that I paid a special visit there last week. Briefly, the customary choir-boys have been displaced by loud speakers, and in a chat with the local priest, aided by an interpreter, I learnt exactly why this course had been adopted.

Choir boys in that Northern latitude, it appears, are no better behaved than their cousins over here, and complaints from the congregation finally decided him upon this drastic step.

Into each choir stall had been built a cunningly concealed loud speaker, and these were all connected up to an amplifier fed by a gramophone pick-up and turntable under the control of the organist. Records had been obtained of the singing of most of the well-known hymns and psalms by choirs of world renown. The organist, therefore, had merely to keep in time with the singing. The whole thing had proved remarkably successful in leading the congregation in their choral efforts, except in the case of those newcomers who were put off their note in their efforts to probe the secret of the "ghost choir."

Although interested, I pointed out through the interpreter that the priest had undertaken needless expense in having a loud speaker built into every choir stall when two would have done the job much better, and more cheaply.

Furthermore, I stressed the fact that instead of taking pains to obtain records of unaccompanied singing it would have been better to have got hold of records with an organ accompaniment. He could then have dispensed with his organ and organist. He could also dispense with church bells, as the amplifier leads could

be switched through to a speaker in the belfry.

He was, I could see, quite fired by my idea, but wished to extend it further by having microphones fitted in the large cathedrals of his country, thus enabling



Hastily recanted.

him to obtain the whole service *en bloc*. I pointed out to him, however, that by so doing he would abolish himself, and he hastily recanted.

A Falling Commentary

THE B.B.C. are always seeking novel broadcasts to titillate the jaded palates of their listeners, but almost everything seems to have been done, ranging from broadcasts in the air to those from the bottom of the sea. I have just heard, however, of a new surprise item with which they are proposing to edify us, and, as the stunt does seem to me to possess the merit of real novelty, I tender them my warmest congratulations.

Briefly, the stunt is to broadcast the impressions of a parachutist descending from a height of between three and four miles. It is intended that he shall give a few preliminary observations from the aeroplane, and, as he leaps and trails his aerial after him, he is to give us a running, or perhaps I should say a falling, commentary on his impressions.

The transmitter will be a special low-power short-wave instrument strapped on his back, the whole apparatus having been developed by a well-known commercial wireless company for the purpose. Its signals will be picked up by a short-wave ground station, and the whole relay carried out after the manner of the usual boat-race broadcast. Well-known aeronautical experts tell me that the broadcast should last for about a minute and a half.

I cannot help thinking that this idea is worthy of further development, and the B.B.C. could with advantages arrange a similar broadcast by Professor Piccard the next time he ascends into the stratosphere.

Broadcast Brevities

By Our Special Correspondent

Hot Ideas

THE hot weather does not stem the flow of ideas in Broadcasting House, and I was amazed last week, when visiting that noble pile, to note the cascade of suggestions for brightening the programmes during the "dog days."

Ideas emanating from the staff rarely reach fruition, but this fact does not detract from the intrinsic value of the ideas themselves.

Sunday Evening "Proms" ?

"Why not give the public Sunday evening 'Proms'?" demanded one zealous creature. "And what," cried another, "is the objection to talks in public in the Concert Hall—talks that would have a snap about them which is totally lacking in the refrigerated stuff from the Talks Studio?"—or words to that effect.

Argument Against

The former suggestion has definitely been turned down by those in authority, who hate the thought of public audiences (other than church congregations) on a Sunday. It is no use to argue that the "Proms" need not start till 9 p.m. Presumably the trouble then would be that the audience would not get home in time to hear the Epilogue.

All-day Transmissions on Sunday

The Board of Governors met on Wednesday last, July 12th, to decide whether Sunday broadcasting should be continuous from mid-day till 10.30 p.m. By the time these lines are read an announcement may have been made. It seems pretty evident that the 6.30 to 8 p.m. period will be filled, possibly with alternative programmes.

Charity Appeals in the Studio

THE financial depression is having its effect on the "Week's Good Cause" appeals. There has been a considerable falling-off in contributions of late, though charitable bodies still recognise the microphone as the finest possible medium for appealing to the public purse.

Song Plugging to be Stopped

And, while on the subject of appealing to the public purse via the "mike," I have some interesting news apropos of song plugging. Dance-band leaders, not less than hospital secretaries, know the potency of the microphone, and anyone with any aural discernment must be aware that certain tunes are played more often than others. Why?

A Drastic Move

Well, it seems the B.B.C. is at last beginning to smell a rat, and I am able to state that a drastic move towards the suppression of this evil of "song plugging" will be made before the trees turn brown.

Even if additional expenditure is involved, the Corporation is determined to stop the subsidising of band leaders by the music publishers. At present the B.B.C. does not pay hotels and restaurants from which dance music is broadcast, but, remembering that "he who pays the piper calls the tune," the Corporation may shortly change its policy.

Henry Hall on Saturday Nights

ON his return from his American holiday Henry Hall will be faced with a slightly different régime. The B.B.C. Dance Band is to be heard on Saturday nights instead of Thursdays, as at present. This arrangement is no doubt due in some measure to the departure of Ambrose from the May Fair Hotel.

In the meantime, although big changes are imminent in the broadcasting of outside dance bands, the B.B.C. is definitely not appointing an outside band leader as "Controller-in-Charge" of broadcast dance music.

Scrapping the Nationals

BY the time these lines are read, West National should be testing during programme hours.

The synchronisation experiment has proved remarkably satisfactory, but, lest it should have failed, the engineers were previously comforting themselves with the reflection that the measure was only a temporary one. It is common knowledge that West National, in common with London National and North National, will be scrapped or at least suspended from service when the 100 kW. long-wave station at Droitwich is opened towards the end of next year. Scotland will probably retain its National transmitter, but the whole of England, it seems, will obtain its National programmes from the new high-power station.

Regrettable

In many ways this drastic step will be regrettable, for no one would pretend that a long-wave station, however powerful, can give such good modulation and be consis-

tently good over long ranges as a medium-wave transmitter covering a reasonably small service area.

National Programme as Standby ?

It certainly looks as if the National programmes will have to consist of talks and scraps, the Regional wavelength being reserved for serious musical efforts.

Wasted Transmitters

There is another aspect of the case. The London, Northern and West Nationals have not long been completed; indeed, West National was not on the air before sentence of death was passed upon it. How can the B.B.C. square up this with its ideals of economy and efficiency?

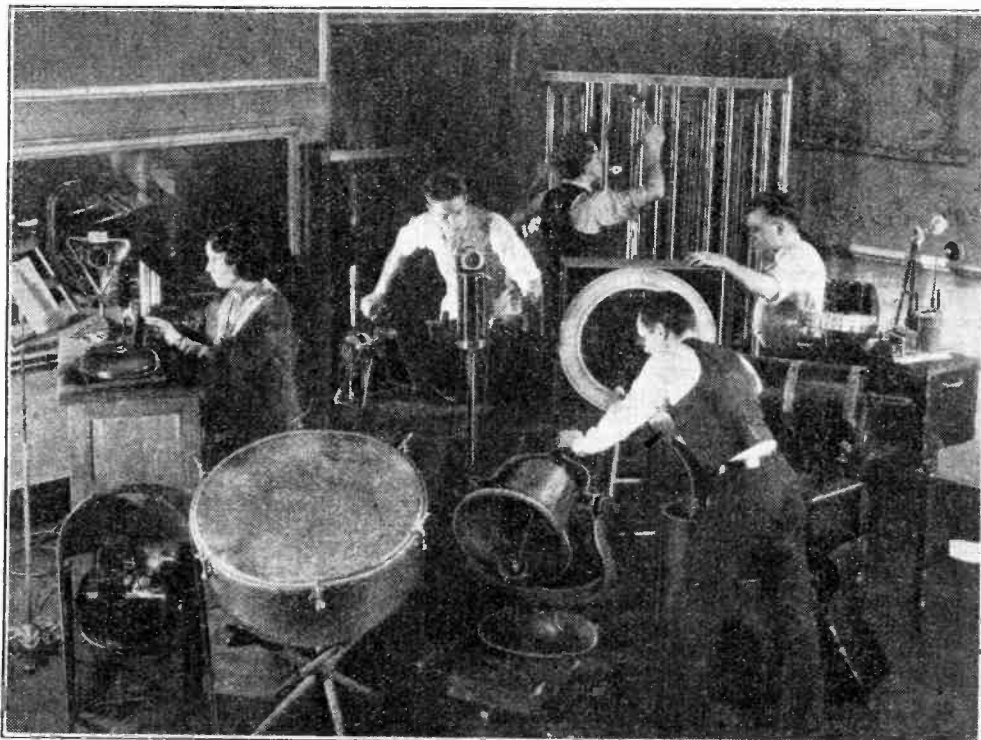
The answer, if any, will be given next week.

From the Crystal Palace

A CHOIR of four thousand voices, drawn from two hundred and twenty choirs of cathedrals, town and village churches affiliated to the School of English Church Music, will be heard by London Regional listeners on July 21st, when they take part in the Festival of English Church Music at the Crystal Palace. Organ accompaniments will be played by Dr. Ernest Bullock, and organ solos by Dr. Stanley Marchant. The conductor is Dr. Sydney H. Nicholson.

Re-arranging the Acoustics

The Crystal Palace holds no terrors for the B.B.C. engineers from the acoustical point of view, although admittedly only two previous relays have been given from this vast glass house on Sydenham heights. For the relay on July 21st, draperies will be fixed behind the organ, and the whole of the centre transept will be enclosed by movable draperies from roof to floor. In addition to the singing of the magnificent choir, an address by the Archbishop of Canterbury will be broadcast.



COATS OFF IN THE "EFFECTS" ROOM. A tense scene during the transmission of a play over the Columbia Broadcasting System of America. Radio drama in the U.S. is usually linked up with the products of the firm sponsoring the programme.

READERS' PROBLEMS

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

The "A.V.C. Monodial" Control Valve

IT is quite impossible by ordinary means to make an accurate measurement of the voltage applied to the control valve of the "A.V.C. Monodial" receiver. This is because the valve includes in its anode circuit a resistance of 1 megohm, and even when the best of meters is used for measuring the loss of voltage in this resistance is so great that the reading will be altogether misleading. Several querists who are apparently using low-resistance meters have found hardly any indication of voltage on the anode.

The published figure with regard to voltage relates to the measured difference of potential between the receiver chassis and the power chassis; this, in effect, is the true voltage applied to the A.V.C. valve under "no-signal" conditions, when no current is flowing through the valve.

Gramophone Volume Control

A QUERIST, who is about to convert his A.C. mains receiver for gramophone reproduction, asks whether it is better to fit the volume control potentiometer in the receiver itself, or at the end of the extension leads by means of which the pick-up will be connected.

Although this is often a matter of indifference, it is safest to install the potentiometer in the set, as indicated in

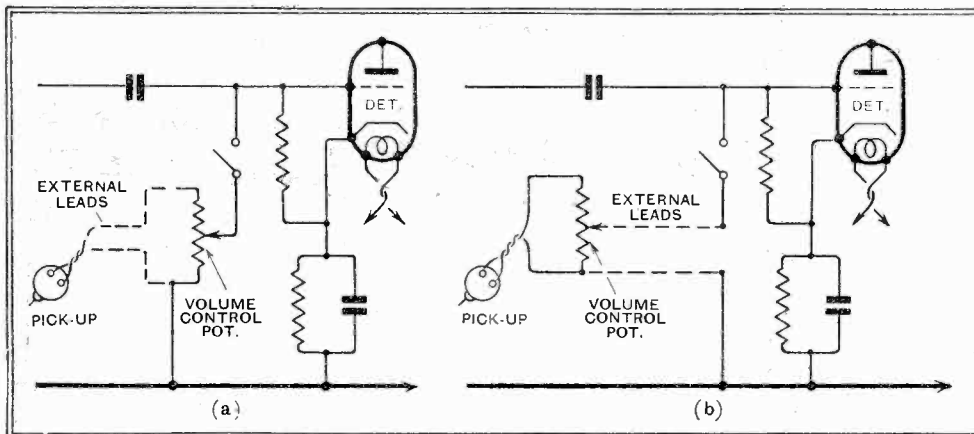


Fig. 1.—It is safer to install a gramophone volume control potentiometer at the receiver end of the pick-up leads (a) than at the remote end (b).

Fig. 1 (a). The alternative arrangement is illustrated in diagram (b).

Incidentally, it is worth while pointing out that when hum, instability, or any other untoward effect is produced by adding a pick-up to a receiver which originally worked satisfactorily without it, this detail should be borne in mind, and, if possible, the effect of changing the position of the potentiometer should be tried.

A.C. to D.C.

A READER, who has recently moved to a locality where the electrical supply is D.C., asks us to explain, as simply as possible, how his A.C. eliminator may be converted for operating on the new supply.

Full-wave valve rectification is employed, and the eliminator is of conventional design.

Theoretically, it should be a very easy matter to make the necessary changes. The two leads originally joined to the centre tapings of the filament-heating and H.T. windings of the power transformer should be disconnected from these points, and then connected, respectively, to the positive and negative mains leads, preferably through safety fuses.

Most eliminators are intended to give, on normal load, a voltage in the order of 150 volts, but the voltage of the ordinary domestic D.C. supply is considerably greater than the output of the rectifier normally included in commercial eliminators. It may therefore be necessary to add a resistance for absorbing the surplus voltage.

It is as well to remember that the amount of smoothing included in the average A.C. eliminator may be insufficient to cope with exceptionally "rough" D.C. mains.

Bias Volts for Nothing

AS the supply voltage of a correspondent who writes on the subject of a three-valve D.C. mains set is 200 volts only, it is realised that, in order to obtain the best possible performance, it will be necessary

the slider of a potentiometer which is connected across the choke.

By adopting this plan, the additional loss

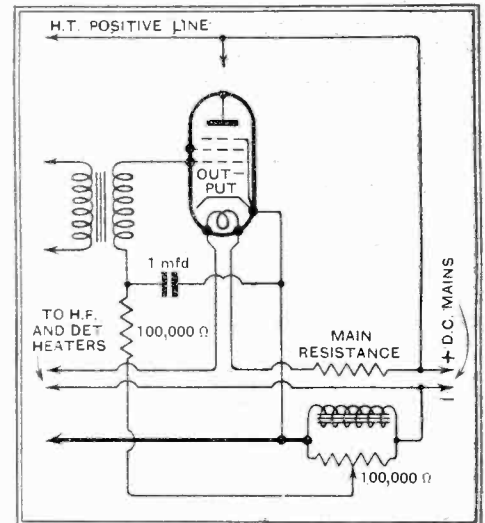


Fig. 2.—How to save ten volts: Grid bias scheme applicable to a D.C. mains set.

of H.T. voltage that would normally occur is entirely avoided. As the positive side of our correspondent's mains is earthed, the connection of the choke in the negative H.T. lead is quite permissible.

Impaired Smoothing Properties

ANOTHER question on a topic similar to that treated in the preceding reply deals with the ohmic value of a potentiometer which is to be shunted across a smoothing choke. To quote from the letter: "Would it not be permissible to use almost any resistance value, provided that it is several times greater than the D.C. resistance of the choke?"

In this connection, the D.C. resistance of a choke is of minor importance; what we are mainly concerned with is its reactance at the ripple frequency with which it will have to deal. By shunting the choke with a resistance of 1,000 ohms, as our correspondent proposes to do, its smoothing efficiency would be greatly impaired. A value of at least 50,000 ohms, and preferably higher, is to be recommended.

The Wireless World INFORMATION BUREAU

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

Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.

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

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EDITORIAL COMMENT

Olympia 1933

Intriguing Probabilities

THE annual Radio Show is now very near at hand; the actual date of opening at Olympia is Tuesday, August 15th, and it would be well to make a special note of this date to ensure that a day is reserved for a visit. Each annual Radio Show has been of interest, largely for the reason that it provides a unique opportunity for examining and comparing the new products of the manufacturers, but Olympia 1933 promises to be of quite outstanding importance to those who are interested in something beyond the cabinet of the wireless set.

There never has been before a season when so many intriguing new ideas have cropped up for the attention of designers, and early information which we are obtaining regarding the exhibits at the Show already indicates that designers have made full use of the new ideas and valves which have become available to them.

As in previous years, *The Wireless World* will be dealing with the Show in three special numbers, to be dated August 11th, 18th and 25th. The first of these special numbers will provide a guide to the reader to ensure that he does not miss those items which are of special novelty or technical interest. The second number will deal in considerable detail with products which are definitely new and are typical examples indicating the progress which has been achieved since last season. Every section of radio progress represented at Olympia will receive attention, and in the case of new valves, components and accessories, the aim will be to show the reader how these can be utilised to the best advantage. The third Show number will describe features of the exhibits after personal

visits to every stand by the technical staff of *The Wireless World*, and this report will be fully illustrated with photographs of apparatus taken by our photographers at Olympia.

Wireless Exchanges

Attempt to Involve the Ratepayer

CONSIDERABLE discussion took place in the House of Commons recently on the question of whether or not a municipal authority should be permitted to maintain a wireless exchange and redistribute broadcast programmes.

It is well that such a proposition met with opposition, for it would indeed be unfortunate if a precedent were created and municipal authorities, backed by the ratepayers' money, were permitted to trade as distributors of broadcasting.

If there were no objections to municipal trading and ratepayers in a district were unanimous in their desire to subscribe to such a service the position might then be different, but it is manifestly unreasonable to expect ratepayers, the vast majority of whom would prefer a wireless receiver with a choice of programmes, to subsidise for a few a restricted service which they would themselves have no occasion to require.

The New Monodial

Instructions for Building

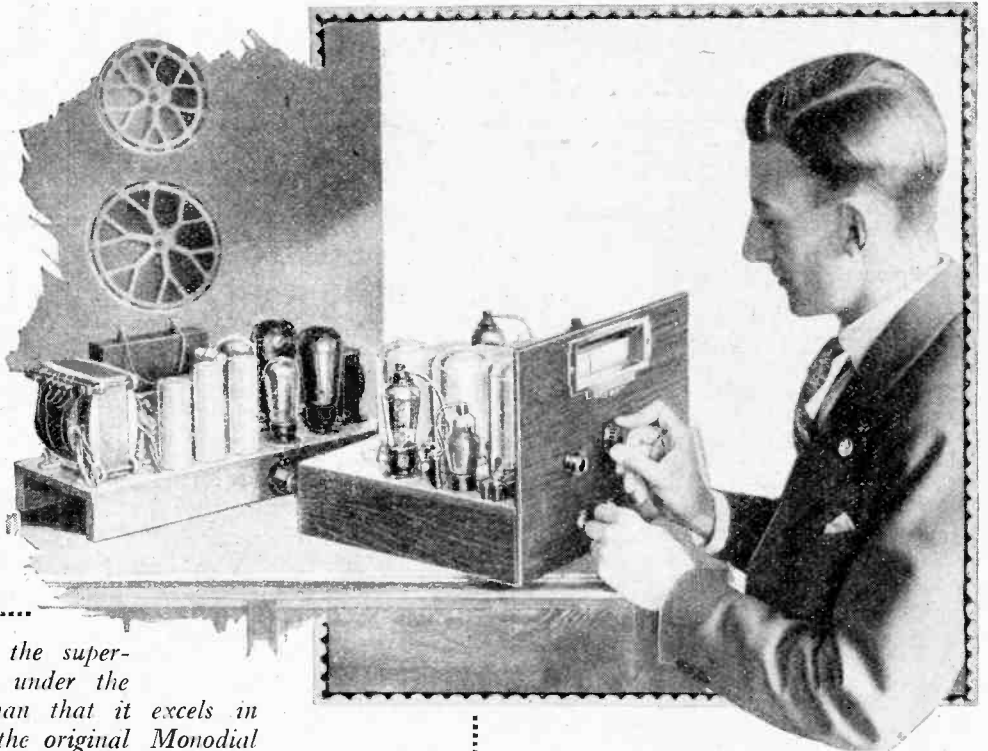
IN this and in next week's issue articles appear describing in detail the construction of the "New Monodial Super" announced last week. This receiver has already aroused much interest amongst our readers, and we confidently recommend it as an excellent introduction to *The Wireless World* for those who may start to take the paper at this time.

The New Monodial Super

An A.C. Superheterodyne
Embodying the
Latest Developments

By W. T. COCKING

THE problem of obtaining both high selectivity and realistic reproduction is by no means easy of practical solution. The use of highly selective circuits in conjunction with tone-correction enables intelligible interference to be reduced to a negligible amount without detriment to the quality of reproduction, but this cannot be said of



NO higher praise can be given to the superheterodyne receiver here described under the name of the New Monodial Super than that it excels in performance in almost every direction the original Monodial described in "The Wireless World." The original Monodial is still regarded by the thousands of constructors who have built it as the finest receiver which has appeared in this country, yet now "The Wireless World" beats its own record by the production of a new design which, whilst based on the original set, incorporates every new idea of practical value in superheterodyne technique.

sideband heterodyning. There is, indeed, no known way of avoiding this form of interference which does not at the same time restrict the high-frequency response of the receiver.

In the past the difficulty has been overcome by fixing a definite upper limit to the frequency response at about 5,000 cycles. With this limit really good quality can be obtained and sideband splash is reduced to modest proportions. The quality, however, is not the best obtainable and the remaining interference is all too noticeable. Fortunately, sideband splash does not occur on all stations, and on the stronger transmissions it is often absent. Obviously, therefore, the solution to the problem lies in providing alternative receiver characteristics.

The Latest Technique

Fundamentally, the receiver should be designed to provide a level frequency response up to some 7,000 or 8,000 cycles, for this is sufficient to provide the best quality with the vast majority of present-day loud speakers, and further extension of the response would result in needless expense. Means should be provided for restricting the response to about 3,500 cycles, however, when it is desired to listen

to stations suffering from sideband heterodyning.

A modern superheterodyne, therefore, must be fitted with an adjustable frequency response, but development does not stop here, and no part of the receiver is completely free from change. Automatic volume control has now become a necessity, and one of the simplest means of achieving it lies in the use of a valve of the duo-diode-pentode type for the second detector. With such a valve, not only are the initial stages controlled, but the first L.F. stage also, with the result that the system can become practically perfect.

The I.F. circuits, too, are changed, although this is not apparent from the circuit diagram. The alteration lies in the degree of coupling adopted in the transformers, for now no attempt is made to obtain a double-humped resonance curve, and tone-correction is relied upon entirely for the preservation of the upper musical frequencies. This change results in an increase in selectivity, but has been made primarily with a view to the simplification of the initial adjustments, since without elaborate apparatus it has been found difficult to adjust true band-pass circuits in such a way as to avoid obtaining an asymmetrical resonance curve.

The most striking modification, how-

ever, lies in the frequency changer, for the introduction of the special Pentagrid converter has enabled an improved performance to be obtained with one valve less than in other arrangements. The use of this valve enables interaction between the signal frequency and oscillator circuits to be avoided, with a consequent simplification of the ganging, it reduces the cost, it leads to greater efficiency, and, most important, it greatly reduces the possibility of whistle production.

Pre-Selector Circuits

The application of the latest developments to the superheterodyne have thus resulted in striking changes, and the circuit diagram of the receiver unit will be seen in Fig. 1. The H.F. valve is preceded by a single tuned circuit, and its grid bias is applied through the 2-megohm resistance R1, the 0.0001-mfd. condenser C5 serving to couple the grid to the tuned circuit. The coupling between the H.F. valve and the frequency changer is by means of an H.F. transformer, and the control grid of the Pentagrid is again biased through a 2-megohm resistance R2, the signal being fed through the 0.0001-mfd. condenser C6. The two signal-frequency tuned circuits are tuned by two similar sections, C1, C2, of the three-gang condenser.

The inner grid of the Pentagrid is joined to the oscillator tuned circuit through the 0.0001-mfd. condenser C9, and its bias is derived by the flow of grid current through the 0.25-megohm resistance R4. The

The New Monodial Super—

tuned circuit is of the conventional type and is tuned by the shaped-plate section C3 of the gang condenser. The 0.002-mfd. padding condenser C4 is inserted on the long waveband for the maintenance of ganging. The reaction coil is shunt fed by the 0.1-mfd. condenser C10 and the 20,000 ohms resistance R5.

The primary of the first I.F. transformer is included in the Pentagrid anode circuit, and its secondary is coupled to the primary of the second transformer by a 12-mmfd. condenser C11, this loose coupling being necessary in order to avoid a double-humped resonance curve. The secondary of this transformer feeds the variable-mu I.F. valve, in the anode circuit of which the third transformer is connected.

The A.V.C. System

The secondary of this transformer feeds the two diode anodes of the duo-diode-pentode which serves as the second detector, the A.V.C. valve, and as the tone-corrector. One anode is fed directly from the tuned circuit, and it provides the rectified L.F. output and the bias for the pentode portion of the valve through the I.F. filter Ch1, C13 and C14, the potentiometer R14 of 0.25 megohm serving as the manual volume control and also as the diode load. The other diode provides delayed A.V.C. for the H.F., frequency changer, and I.F. stages; it is fed through the 0.0001 mfd. condenser C19, and its load is the 0.5 megohm resistance R11, and the A.V.C. voltage developed across this resistance is applied through the filter comprising R10 and C15 to the grids of the controlled valves. The necessary delay voltage is provided by the voltage drop across the 100 ohms resistance R12, which is shunted by a 2 mfd. condenser C16.

The D.C. voltage due to the rectification of the signal is fully applied to the pentode control grid through the 2 megohm resistance R15, and any desired proportion of the L.F. voltages through the 0.01 mfd. condenser C18. On gramophone the connections are changed, and the pick-up is connected between the upper end of the volume control and the earth line. The fixed negative grid bias is then nearly equal to the potential across the delay resistance R12.

L.F. Circuits

The tone-corrector is fitted as the intervalve coupling, and on radio it consists of the 0.25H. choke Ch2 in series with a 2,000 ohms resistance R18, the 0.002 mfd. condenser C20 being joined across the combination. It is thus a tuned anode circuit resonating at 7,000 cycles, and giving a flat response curve over the lower and middle frequency ranges. Such a characteristic is quite unsuited to gramophone reproduction, and so the radio-gramophone switch changes over the connections. On gramophone the coupling consists of the 2,000 ohms resistance R18,

THEORETICAL CIRCUIT DIAGRAM OF THE NEW MONODIAL SUPER

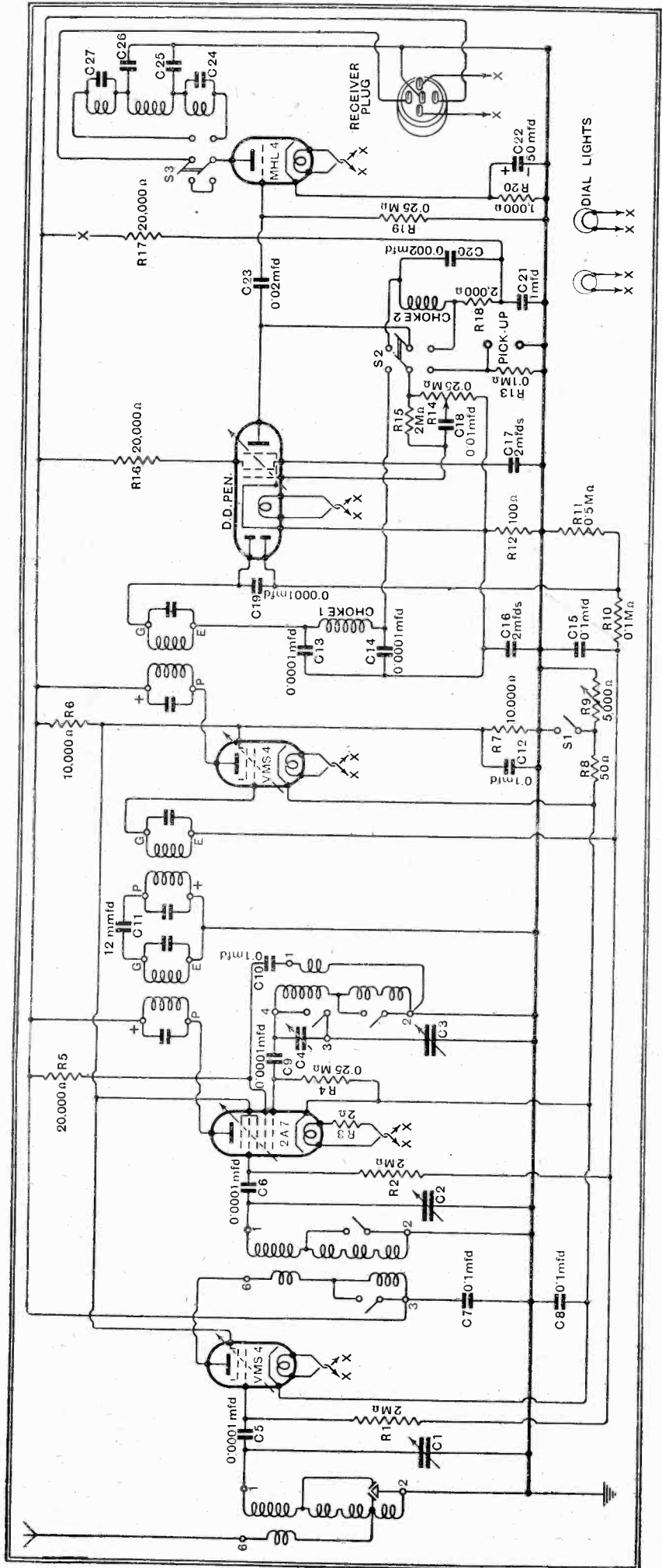


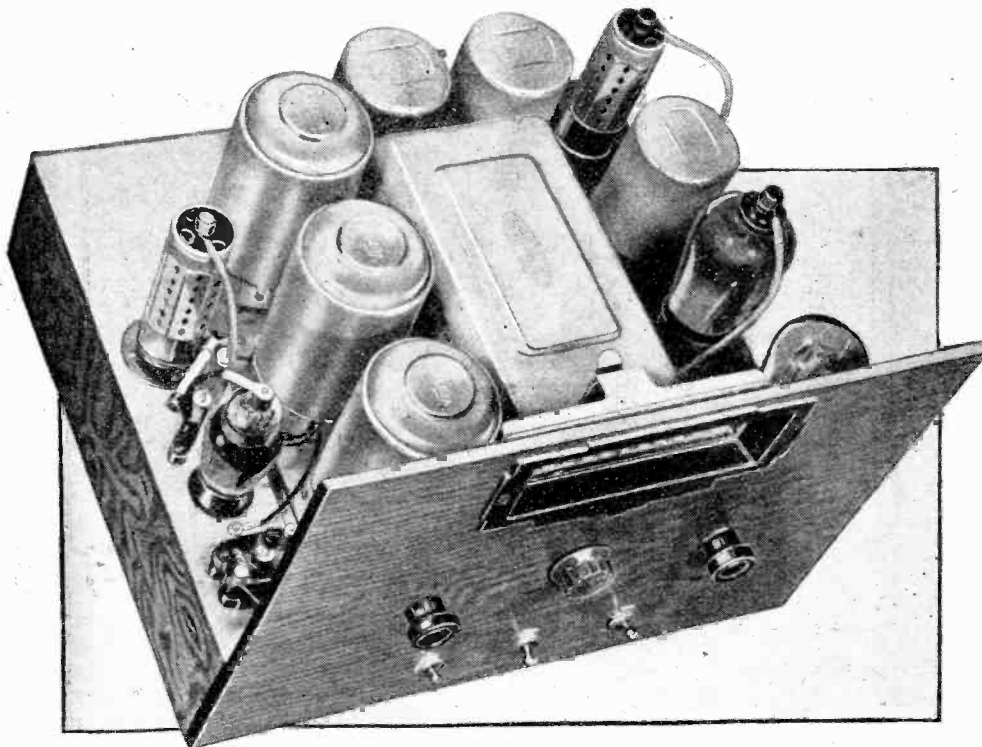
Fig. 1.—The complete circuit diagram of the receiver unit of the New Monodial Super. An American type valve is used for the frequency changer, and as its heater is rated for 2.5 volts only, a 2-ohms resistance R3 is included in circuit. Practically perfect A.V.C. is obtained, together with signal rectification and tone-correction, from a duo-diode-pentode valve. It should be noted that the 50-ohms resistance R8 actually consists of two 100-ohms resistances wired in parallel.

The New Monodial Super—
shunted by Ch2 and C20 in series; these components then act to some extent as a scratch filter.

The pentode screen is fed from the 200 volts line through the 20,000 ohms resistance R16, with a 2 mfd. condenser C17 connected to earth. The anode cir-

cuit is decoupled by another 20,000 ohms resistance and the 1 mfd. condenser C21; this condenser also acts to give a rising characteristic in the extreme bass to compensate for the inevitable slight loss of bass occurring in the R.C. couplings. The intervalve coupling to the MHL4 L.F. valve is completed through the 0.02 mfd. condenser C23 and the 0.25 megohm resistance R19. This valve is biased by the 1,000 ohms resistance R20, shunted by a 50 mfd. electrolytic condenser C22. With the switch S3 in the upper position,

the primary of the L.F. transformer which feeds the push-pull output stage, Fig. 2, is connected directly in its anode circuit. When the switch is placed in the lower position, however, the special low-pass filter is connected in circuit, and the overall frequency response of the receiver is then limited to 3,500 cycles for the the anodes of the H.F., frequency changer, and I.F. valves. The screens of the variable- μ type valves, however, are fed from the tapping on the potentiometer, made up from the 10,000 ohms resistances R6 and R7, connected across the H.T. supply, and are by-passed to earth by the 0.1 mfd. condenser C12. The cathodes of these early valves are commoned and, when the switch S1 is closed, are taken to earth through a 50 ohms resistance R8 to provide the initial bias. When S1 is open a 5,000 ohms variable resistance is connected in circuit to limit the maximum sensitivity of the set; this is primarily for reducing background while searching, for the normal condition of the receiver is one of exceptional sensitivity. The secondary purpose of the resistance is to reduce the sensitivity for local reception, since, if the set be used with a good aerial very close to a powerful local, the A.V.C. system may not provide sufficient control.



This view of the receiver unit clearly shows the clean layout and the full-vision tuning dial.

Mains Equipment

The push-pull PX4 valves are slightly over-biased so that they take only 35 mA. apiece (nominal current); as a result, the total current of the receiver falls within the 120 mA. rating of a single rectifier valve. Owing to the push-pull connection, this over-biasing does not introduce distortion, for the harmonics are balanced out. Calculation indicates that some 4 watts output is obtainable with zero second and third harmonic distortion, and in practice some 5 to 6 watts is obtained for the usual 5 per cent. total harmonic. Decoupling of the grid circuits is likely to be ineffective in push-pull, so that the bias resistances are by-passed by 50 mfd. electrolytic condensers in order to maintain the full bass response. The load impedance required by this output stage is 10,000 ohms, so that the output transformer must be of the ratio required to give this with the particular speaker employed.

The five indirectly heated valves and the dial lights are all run from a winding

elimination of sideband heterodyning. This filter is available as a complete unit, including the three chokes and the condensers C24, C25, C26 and C27. It is designed for working between terminal impedances of 10,000 ohms; the input impedance is provided by the internal A.C. resistance of the MHL4 valve, but the output impedance must be obtained by connecting a 10,000 ohms resistance R21 across the primary of the transformer.

The L.F. valve anode is fed directly from the 200 volts line, in common with

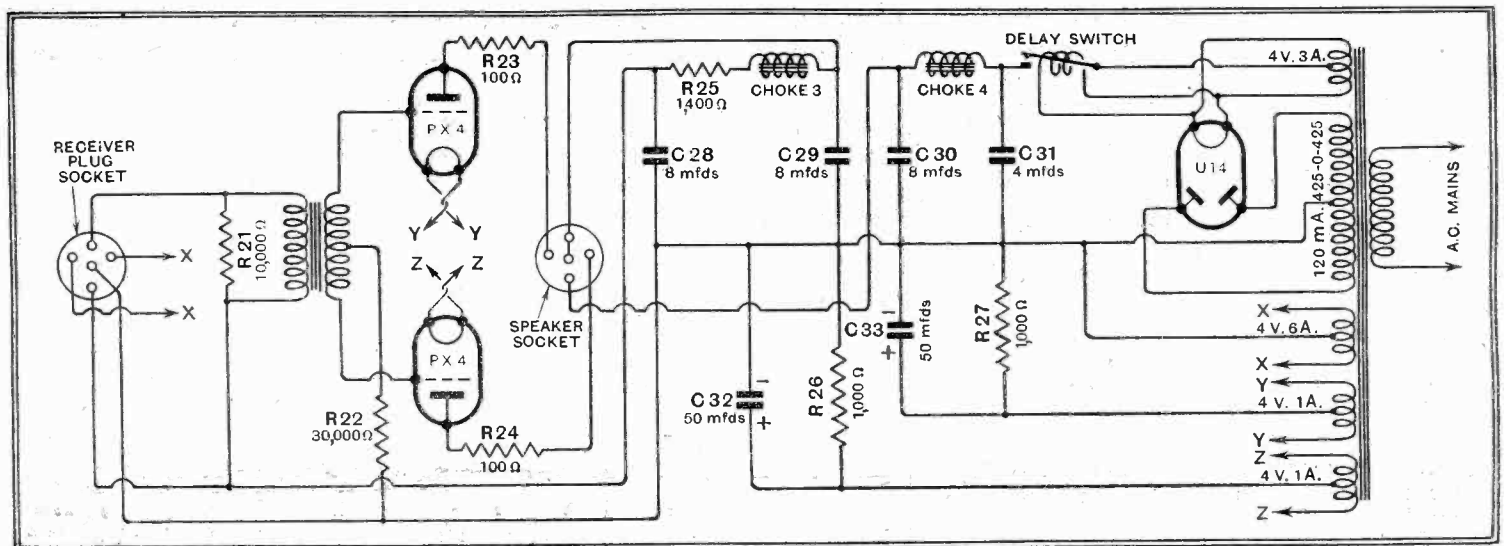


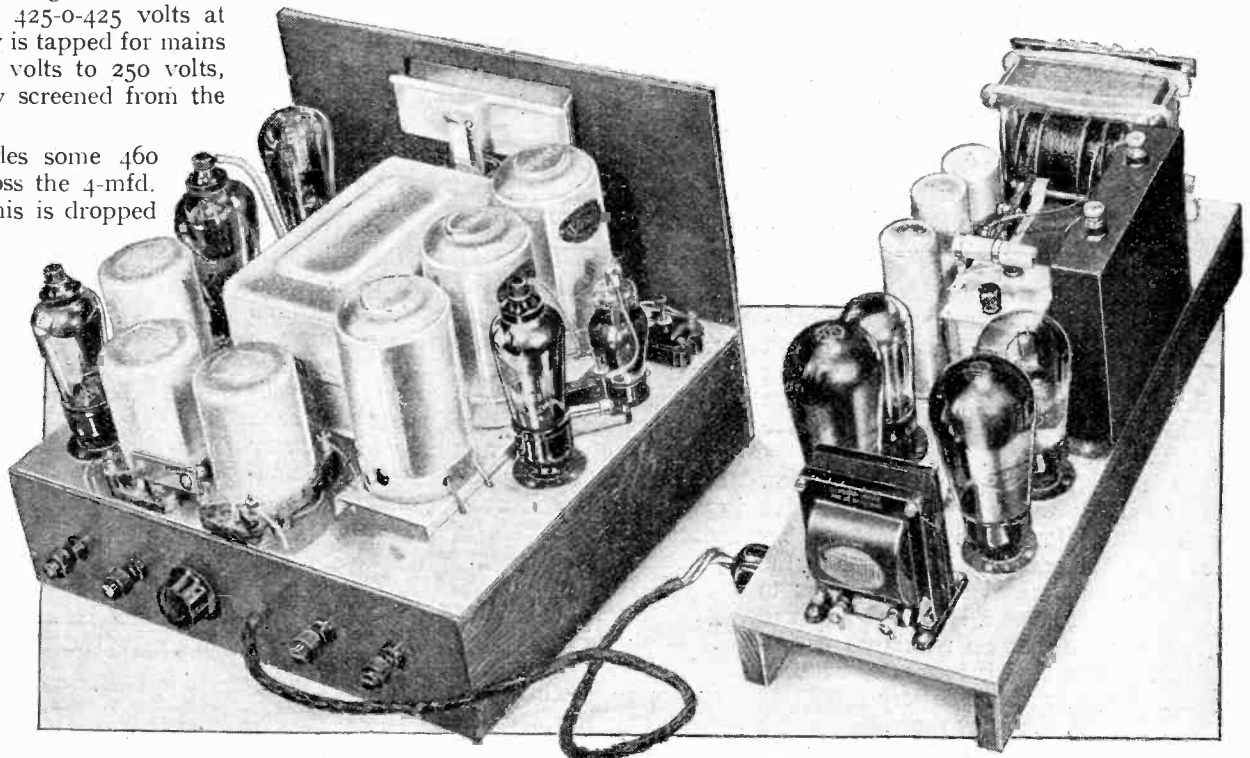
Fig. 2.—The complete circuit of the power unit is shown here; electrolytic condensers are used, not only for smoothing, but for by-passing the bias resistances and care should be taken to connect them with their negative terminals to the chassis.

The New Monodial Super—

on the mains transformer rated at 4 volts 6 amps., and separate 4 volts 1 amp. windings are provided for each of the output valves. The U.14 rectifier and the vacuum-type delay switch are run from the 4 volts 3 amps. winding, and the H.T. secondary is rated at 425-0-425 volts at 120 mA. The primary is tapped for mains voltages of from 200 volts to 250 volts, and is electrostatically screened from the secondaries.

The rectifier provides some 460 volts unsmoothed across the 4-mfd. condenser C31, and this is dropped to 443 volts and initially smoothed by passing through the 10H. choke Ch4. This smoothing stage is completed by the 8-mfd. dry-electrolytic condenser

The Pentagrid frequency-changer valve may be seen on the right-hand side of the receiver chassis and it should be noted that its holder is mounted on the under side of the base.



- 3 5-pin Valve holders Clix chassis mounting type
- 1 7-pin Valve holder Clix chassis mounting type (Goltone, W.B.)
- 1 7-pin Valve holder for 2A7 valve Claude Lyons
- 1 5-pin Plug (Keystone.) Euglin P3
- 1 5-way Battery cable with twin 70/36 leads Harbros
- 1 Tapered volume control, 250,000 ohms R14 Centralab 372-097 Rothermel (Claude Lyons.)

- 2 Metallised resistances, 1,000 ohms 2 watts R26, R27 Dubilier
- 2 Metallised resistances, 100 ohms 1 watt R23, R24 Dubilier
- 1 Metallised resistance, 10,000 ohms 1 watt R21 Dubilier
- 1 Metallised resistance, 30,000 ohms 1 watt R22 Dubilier (Eric, Claude Lyons, Seradex.)
- 1 Resistance, 2,500 ohms, tapped at 1,400 ohms, 5 watts R25 Dubilier "Spirohm" (Electrad.)

C30. The current then passes through speaker fields, or their equivalent, having a total resistance of 1,250 ohms, and is still further smoothed in conjunction with the 8 mfd. condenser C29. The potential across this condenser is about 280 volts, and the supply for the output stage is tapped off; the current for the early stages passes through the choke Ch3 in series with a 1,400 ohms resistance R25, which, with the 8 mfd. condenser C28, completes the smoothing and drops the voltage to the requisite 200 volts.

In this way a very high degree of smoothing is obtained so that reception is completely hum-free, and yet the whole receiver can be operated from, and the fields of dual speakers energised by, a single class C rectifier valve. A maximum of economy is thus combined with a first-class performance.

The precise arrangement adopted in the new superheterodyne will now be apparent, and it remains to describe those details of the construction which are not readily apparent from the drawings and to give details of those adjustments which are essential for the attainment of the optimum performance. The concluding article, therefore, will appear in next week's issue.

LIST OF PARTS

After the particular make of component used in the author's model, suitable alternative products are given in some instances.

- Receiver Unit.**
- 1 3-gang Superhet. condenser with right-hand trimmers British Radiophone
 - (Polar.)
 - 1 Slow motion dial British Radiophone No. 582A
 - 1 Set Superhet. coils Varley BP19
 - 3 I.F. transformers, 110 kc. Telsen (Colvern.)

- 2 Toggle switches S2, S3 Bulglin S.98
- 1 Toggle switch, make and break S1 Bulglin S.80 (British Radiophone, Claude Lyons.)
- 1 Potentiometer, 5,000 ohms, wire wound R9 Watmel No. 1 (Haynes Radio, Claude Lyons.)
- 1 Fixed condenser, 12 mfd. C11 Eddystone No. 329
- 4 Terminals, A. E. Pickup (2) Belling-Lee Type "B" R.1
- 1 Compression condenser, 0.002 mfd. C4 R.1
- 1 Heterodyne filter, 3,500 cycles Wearite W.M.3
- 2 Screened H.F. chokes Ch1, Ch2 Wearite Type H.F.P.
- 2 Fixed condensers, 2 mfd., 400 v. D.C. test T.C.C. Type 50 C16, C17
- 1 Fixed condenser, 1 mfd. 400 v. D.C. test T.C.C. Type 50 C21
- 5 Fixed condensers, 0.1 mfd. 400 v. D.C. test T.C.C. Type 50 C7, C8, C10, C12, C15
- 1 Fixed condenser, 0.02 mfd. mica, 500 v. D.C. test T.C.C. Type 25A C23
- 1 Fixed condenser, 0.0001 mfd. C6 T.C.C. Type 34
- 1 Fixed condenser, 0.01 mfd. C18 T.C.C. Type 34
- 5 Fixed condensers, 0.0001 mfd. C5, C9, C13, C14, C19 T.C.C. Type "M"
- 1 Fixed condenser, 0.002 mfd. C20 T.C.C. Type "M" (Dubilier, Peak, Telsen.)
- 1 Electrolytic condenser, 50 mfd. T.C.C. Type 501
- 2 Dial lamps, 6 volts Bulglin Type O.B.
- 2 Metallised resistances, 10,000 ohms 2 watts R6, R7 Dubilier
- 1 Metallised resistance, 1,000 ohms 1 watt R20 Dubilier
- 1 Metallised resistance, 2,000 ohms 1 watt R18 Dubilier
- 3 Metallised resistances, 20,000 ohms 1 watt R5, R16, R17 Dubilier
- 3 Metallised resistances, 100 ohms 1 watt R8, R12 Dubilier
- 3 Metallised resistances, 2 megohms R1, R2, R15 Dubilier
- 2 Metallised resistances, 0.1 megohm R10, R13 Dubilier
- 2 Metallised resistances, 0.25 megohm R4, R19 Dubilier
- 1 Metallised resistance, 0.5 megohm R11 Dubilier (Eric, Claude Lyons, Seradex.)
- 1 Resistance, 2 ohms R3 Claude Lyons
- 1 5-way Connector Wilburn
- 2 lengths Screened sleeving Harbros (Goltone, Lewcos.)
- 10 lengths Systoflex, 2 ozs. No. 20 Tinned Copper Wire, Wood, etc.
- Plymax Baseboard, 14in. x 12in. x 3/8in. Peto-Scott
- Wood Panel, 14in. x 10in. 3-ply
- Screws: 12 1/2in. No. 4 R/hd.; 30 1/2in. No. 4 R/hd.; 16 1/2in. No. 4 R/hd.; 2 1/2in. No. 4 R/hd.
- Valves: 2 Marconi or Osram VMS4 (plain, metallised, or Catkin); 1 Osram or Marconi MHL4; 1 Cossor D1/Peu; 1 Claude Lyons 2A7 with grid clip.

Power Unit.

- 1 Fixed condenser, 4 mfd. 1,500 v. D.C. test C31 T.C.C. Type 101 (Dubilier.)
- 1 Dry Electrolytic condenser, 8 mfd. 500 v. D.C. working C30 T.C.C. Type 902 (Dubilier.)
- 2 Dry Electrolytic condensers, 50 mfd. C32, C33 T.C.C. Type 521
- 2 Wet Electrolytic condensers, 8 mfd. 450 v. D.C. working C28, C29 T.C.C. Type 802

- 1 10 henry choke Ch4 Sound Sales No. 10 D.C.
- 1 20 henry choke Ch3 Bulglin LF14
- 1 L.F. Transformer, push pull Ferranti A.F.5c
- 1 Mains transformer, Primary 200/250 volts 50 cycles, Secondaries, 425-0-425 v., 120 mA., 4v.C.T.3A., 4v.C.T.1A., 4v.C.T.1A., 4v.C.T.6A., Screened Primary Claude Lyons
- 6 5-pin Valve holders Clix Chassis Mounting Type (Goltone, W.B.)
- 1 5-pin Plug Euglin F3 (Keystone.)
- Plymax Baseboard, 18in. x 6 1/2in. with 2 runners 18in. x 1 1/2in. Peto-Scott
- 2 lengths Systoflex, etc.
- Screws: 36 1/2in. No. 4 R/hd.; 8 1/2in. No. 6 R/hd.
- Valves: 2 Osram or Marconi PX4 or Mullard AC044 or Mazda PP3/250; 1 Osram or Marconi U14, or Mullard DW4, or Mazda UU120 500, or Cossor 460BU; 1 Ediswan DLS1 (Delay Switch).

OLYMPIA RADIO SHOW

Tuesday, Aug. 15th to Thursday, Aug. 24th

Three Special Numbers of The

Wireless World

AUG. 11th. GUIDE TO THE SHOW

What to look for at Olympia. A helpful forecast, arranged conveniently under suitable headings, with a full list of exhibitors and a pictorial plan.

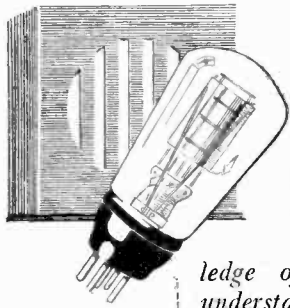
AUG. 18th. TREND OF DESIGN

A series of well-illustrated articles describing the year's progress in the design of sets, components and accessories.

AUG. 25th. COMPLETE SHOW REPORT

A full description, prepared by the Wireless World Technical Staff, of new apparatus shown by each exhibitor

The Load Line



HERE is an explanation of the load line, from which so many important valve calculations can be made. Without a knowledge of its meaning it is difficult to understand how to match the output valve to the loud speaker or to determine the undistorted power which can be derived from the last stage of the receiver.

How Undistorted Output is Computed

By
A. L. M. SOWERBY,
M.Sc.

voltage at this last value and changing the bias to -9 volts shifts us to the next curve, which shows an anode current of $15\frac{1}{2}$ milliamps.

We will suppose that our high-tension battery gives 150 volts; the grid bias recommended by the makers of this particular valve at this anode voltage is -14 volts. Point A on Fig. 1, at which the curve for $E_g = -14$ cuts the vertical line indicating $E_a = 150$, will therefore represent the condition of the valve as it

IN the bald form in which they are presented in the valve-maker's catalogue, valve curves are rather dull and unenlightening, and they seem at first sight to have but little connection with the practical behaviour of the valve as it is used in the set.

The main reason why valve-curves, considered by themselves, do not give much direct information is that they represent the response of the valve to the application of various steady voltages to grid and anode, and it is always assumed in taking them that no resistance or impedance of any kind is connected between anode, or grid, and the battery supplying it with voltage. In a set the voltages with which we are chiefly concerned are not steady, but alternating, while every valve has to have a component in its anode circuit to enable it to provide useful amplification. The official valve curves are therefore only the raw material from which the performance that the valve will give in the set can be deduced.

In practice, the voltage and current changes caused by the reception of a signal do not interest us very greatly except in the case of the output valve, from

an example of the relationship between conventional and operating curves, while at the same time we shall see how the correct loud speaker load for any valve is found, and how the volume of available sound can be estimated for each case. Incidentally, we shall derive a very clear understanding of the rather complicated voltage and current changes taking place at the anode of a valve during the process of amplifying.

Curves for Measurements

In Fig. 1 are reproduced a series of curves connecting the anode voltage E_a of an output valve with its anode current I_a . These curves are obtained from a series of measurements made with a circuit like that of Fig. 2, in which the three meters read anode and grid voltages, and anode current. For any one curve the grid bias, as indicated on the meter E_g , is held constant; the anode voltage read on the meter E_a is raised from zero in a series of small steps, the anode current shown by the meter I_a being noted for each voltage. The resulting figures, when plotted on squared paper, give one the curves of Fig. 1, while the whole process has to be repeated, each time with a different value of grid bias E_g , for each of the curves shown on the diagram.

The completed family of curves gives fairly full information as to the anode current resulting from any combination of grid and anode voltages that may be chosen. All values of anode current that can be obtained with a bias of -6 volts, for example, appear on the

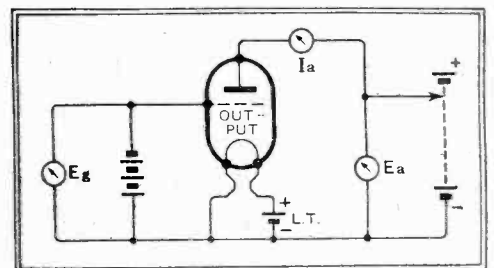


Fig. 2.—Measuring circuit for plotting curves of Fig. 1. For each value of E_g , E_a is varied over a wide range and the corresponding values of I_a are noted.

is used in the set. The anode current, as the diagram shows, will set itself at $15\frac{1}{2}$ milliamps.

To begin with, we will suppose that there is no loud speaker or other component connected between the anode of the valve and the battery, so that the circuit will be that of Fig. 3. The steady state of the valve is already defined by the point A of Fig. 1, but we still have to trace the course of events when a signal is applied to the grid. The voltage of the latter will begin to swing up and down on either side of the fixed bias value, the magnitude of the swing depending upon the amplitude of the signal. What will the anode current do?

Since the anode voltage is fixed at 150 by a direct and presumably resistanceless connection to the battery, the anode cannot depart from that portion of Fig. 1 which gives its possible currents for that voltage. All these values are to be found on the vertical line BC running upwards from 150 on the anode voltage scale; as the signal swings the grid through various momentary voltages the corresponding currents will be shown by the intersection of the appropriate curves with BC. If, for example, the signal has a maximum value of 5 volts, the grid will

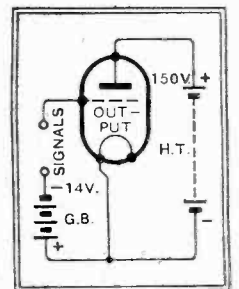


Fig. 3.—Output valve without anode-circuit load. The application of the signal swings anode current only, along the load line AB of Fig. 1.

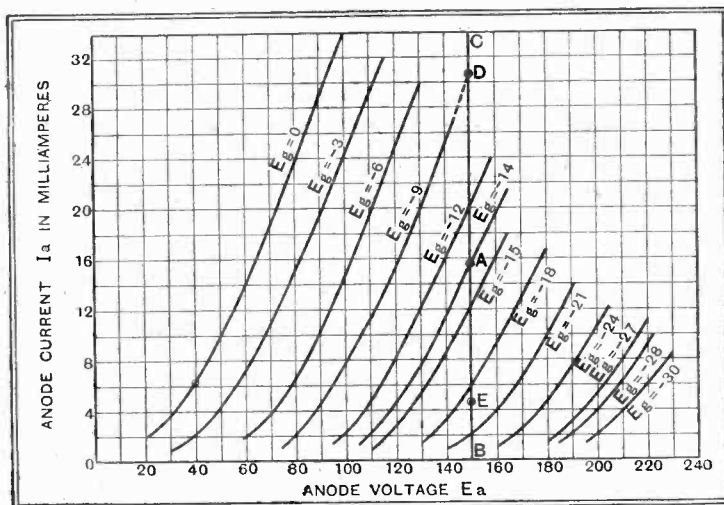


Fig. 1.—Anode volts—anode current curves of typical two-volt power valve. Each curve refers to the grid voltage indicated against it.

which we nearly always need to obtain the maximum volume that can be had before overloading and consequent distortion begin to be manifest. We will therefore restrict our scope to the examination and analysis of the curves of output valves, which will serve as well as any others as

third curve, each value being indicated by the point at which the curve crosses the vertical line representing the value of anode voltage chosen. For this grid voltage the anode current is 7 mA. at $E_a = 80$, $14\frac{1}{2}$ mA. at $E_a = 100$, and $24\frac{1}{2}$ mA. at $E_a = 120$. Keeping the anode

The Load Line—

swing up and down between -9 and -19 volts; the anode current, as the curves show, will swing in sympathy between the values represented by points D and E. A weaker signal, of amplitude only three volts, will swing the grid from -11 to -17 volts, and the anode current will now vary less widely, swinging as before between the points where the curves for these two bias values, if drawn, would cut the vertical line BC.

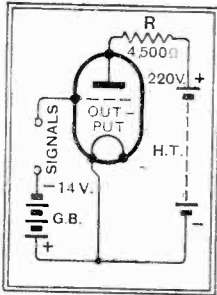


Fig. 4.—Output valve with 4,500-ohm load R, and battery voltage adjusted to correspond. The application of the signal swings both anode current and anode voltage along the load line PQ of Fig. 5.

Having seen the uses of the curves of Fig. 1 by considering this very simple case, we will progress a stage farther and imagine that a resistance is connected in the anode circuit of the valve in place of the loud speaker that would normally be used. The justification for the choice of a resistance is found in the fact that it offers the same impedance to direct as to alternating currents, and so allows us to trace out at our leisure from a D.C. diagram effects which, in reality, are taking place by virtue of the impedance of the speaker to rapidly changing voltages.

At the operating voltages taken, the correct load for the particular valve whose curves are shown will be assumed to be 4,500 ohms.

This, then, must be the value of the resistance inserted as in Fig. 4 in the anode circuit. If we insert this resistance there will be a voltage drop across it, the magnitude of the drop depending, as Ohm's law describes, upon that of the steady anode current; to maintain the correct operating conditions for the valve we shall have to increase the battery voltage to compensate for this drop. At $15\frac{1}{2}$ mA. the voltage drop in R will be 4.5×15.5 , or 70 volts; adding this to the 150 volts that we require at the anode of the valve shows that the battery must now be one of 220 volts, as indicated in Fig. 4.

The main difference between this new arrangement and the last is that now any change in anode current will be accompanied by a corresponding variation in the voltage drop across R, and hence by a variation of the voltage on the anode itself. If the anode current drops the anode voltage will rise, approaching a

maximum of 220 (the battery voltage) as the current approaches zero. Zero current at 220 volts is shown by point P of Fig. 5, on which the valve curves are repeated from Fig. 1.

Starting from this point, we can find the voltage on the anode of the valve at various anode currents. At 10 mA., for example, 45 volts will be dropped in R, leaving 175 volts out of the total of 220 for the valve itself. At 20 mA. 90 volts will be lost in R, so that the anode will have a voltage of 130. Similarly, the anode voltage will drop to 85 volts at 30 mA. Plotting on Fig. 5 the points corresponding to these calculated voltages and currents, we find that they mark out the straight line PQ, and from the way in which the points were worked out we know that with the battery voltage held at 220, and the value of R fixed at 4,500 ohms, the valve can only take up voltage current combinations shown by points on this line.

The "Load Line"

The fact that PQ, which is called the "load line," passes through the operating point A is not an accident, but is an inevitable result of so choosing the battery voltage that the voltage at the anode of the valve should be 150 while passing its normal current of $15\frac{1}{2}$ milliamps.

With the load line drawn across the valve curves, we are in a position to follow the course of events when the grid voltage of the valve in the circuit of Fig. 4 is altered. If we set it at -9 volts the voltage current condition must necessarily

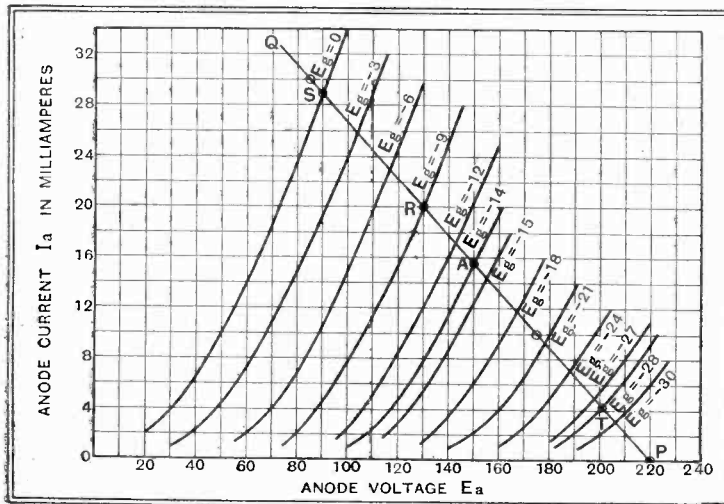


Fig. 5.—The line PQ, drawn across the valve curves repeated from Fig. 1, gives the combinations of anode-voltage and anode-current possible with a load of 4,500 ohms with A as the operating point.

lie on some point of the curve representing a 9-volt bias. But equally it must lie, as we have seen, somewhere along the load line PQ. The only possible values for which both conditions can be simultaneously fulfilled are those given by the point where the curve cuts PQ—at R, where the current is 20 milliamps., and there are 130 volts on the anode.

We can now extend this argument to see what happens if a signal, the peak voltage of which we will take as 14, is applied to the grid. Such a signal will swing the

grid backwards and forwards over the voltage range 0 to -28 , and the anode current and anode voltage will swing in sympathy along the line PQ between the points where the curves for these limiting voltages cut the load line; that is, between S and T.

In the simpler case already discussed in connection with Fig. 3, we saw that the anode current swung through the series of values marked out by the vertical line AB of Fig. 1, the anode voltage remaining constant. In the more complex case of Fig. 4 anode voltage and

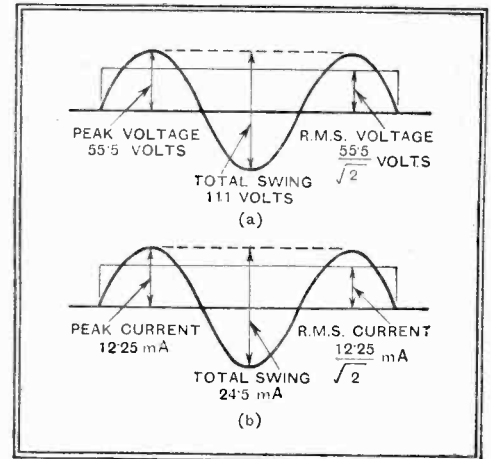


Fig. 6.—(a) Showing relationship between total voltage swing, peak voltage and R.M.S. voltage. (b) The same relationships for current. With a resistance load, power is product of R.M.S. voltage by R.M.S. current.

anode current swing together through the series of values marked out by the load line PQ. In both cases the extent of the swing is controlled by the amplitude of the signal applied to the grid, and extends along AB or PQ as far as the points where the curves for the extreme limits of the grid voltage swing cut the line in question.

Slope of the Load Line

Comparison of the two cases brings another point into prominence. A vertical load line, such as AB, indicates a zero load, while a diagonal line like PQ represents a load of a fair number of ohms. Clearly a lower load than 4,500 ohms would produce a load line more nearly vertical, and a higher load one more nearly horizontal than PQ. The slope of the load line, expressed in voltage change for each change of one milliampere of current, gives the resistance, in thousands of ohms, of the load it represents. The choice of the correct numerical value of load for any particular output valve is necessary to enable the greatest amount of undistorted power to be extracted from the valve.

Reverting to the case of Fig. 5, we see from the diagram that the total swing of anode current is from 28.7 to 4.2 milliamps (at S and T respectively), this making a total variation of $24\frac{1}{2}$ mA. Similarly, the voltages taken up by the anode lie between 201 and 90, a range of 111 volts.

There is therefore present at the anode

The Load Line—

an alternating signal voltage of total sweep III volts, and hence of peak value $55\frac{1}{2}$ volts (see Fig. 6), and this drives through the resistance an alternating current of maximum sweep $24\frac{1}{2}$ mA., and of peak value $12\frac{1}{4}$ mA. On this information the power dissipated in the resistance can be computed; it is half the product of peak current by peak voltage. In the present case this is $\frac{1}{2} (12\frac{1}{4} \times 55\frac{1}{2}) = 340$ milliwatts. This power, of course, is that due to the signals; the power used up in R by the passage of the steady current has not been taken into consideration. The 340 milliwatts are, in fact, available for operating the loud speaker for which R is standing, and causing it to deliver audible signals.

Undistorted Output

The question of distortion has not been entered into at all in this discussion, but it is not difficult to see that if each separate volt of the total swing applied to the grid evokes the same change in anode current as every other, there will be no distortion. In terms of Fig. 5, this implies that if curves were drawn for each volt of grid bias, they should divide PQ into a number of exactly equal lengths. It is evident from an inspection of the figure that this is not the case, for the curves are more closely crowded together at the bottom right-hand corner of the diagram, where the grid voltages are higher.

Since distortion cannot be eliminated altogether, it becomes necessary to fix some allowable limit on the basis of which to compare the output available from

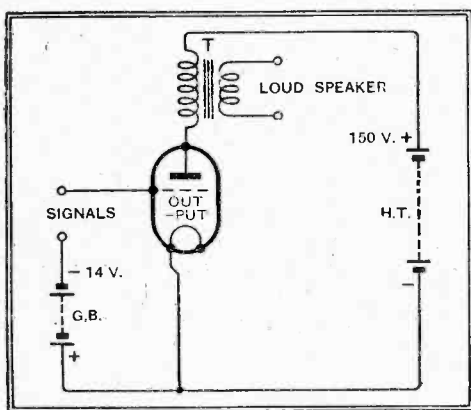
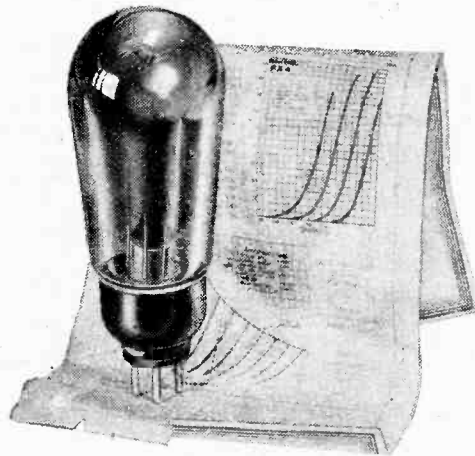


Fig. 7.—Although the output transformer T may have negligible D.C. resistance, the anode voltage will swing, at signal frequency, far above and below the 150 volts of the battery.

different valves. For the case of the triode output valve which we have been considering quite a simple convention is usually adopted. It is laid down that distortion due to the distance AS, taken as a whole, being greater than AT shall be limited, no attention being paid to the equal spacing of points lying between A and S or A and T. Experience shows that a discrepancy in these two lengths just barely begins to make itself manifest by slightly impaired quality of reproduction when AS exceeds AT in the ratio of 11 to 9. This ratio is therefore taken

as that to be satisfied when specifying the load to be connected in the output circuit, and when quoting the "undistorted output" of a valve.

When working out the correct load and



A typical output valve with the data supplied by the makers. From this sheet of details the load line is derived.

the undistorted output from any valve it is almost always assumed that the load will be a pure resistance, and that the voltage of the anode current supply will be augmented sufficiently to keep the anode of the valve at its normal working potential in spite of the introduction of this resistance. In practice, however, this is never done; the anode supply voltage is not raised above the normal value, and a loud speaker or output transformer of negligible D.C. resistance is connected in the anode circuit as in Fig. 7. It would seem at first sight that the anode voltage can now never rise above the normal working value, since there are no extra battery volts.

It is true that if in Fig. 7 the grid-bias battery is augmented from 14 to 28 volts, the anode voltage will not rise, any more than it did in the almost equivalent circuit of Fig. 3. The cases, indeed, are exactly parallel in that neither anode circuit contains any resistance to speak of to direct current. But there is a distinction, and a very big one, when rapidly alternating grid voltages, such as those due to the signal, are applied. Towards the rapidly changing anode currents called forth by the signal the transformer primary offers a very appreciable impedance; the natural result of this is that as the alternating currents flow through it a voltage is set up across it. Since the zero point round which this voltage is built up is the steady anode voltage of the valve, there are instants when the voltage at the anode is considerably in excess of that of the battery.

If we consider that to the grid of the valve of Fig. 7 there is applied an alternating voltage, at first very slow, but gradually increasing in its rate of alteration, rather a curious point comes to light. For the slowest alternations the transformer has no appreciable impedance, so that the load line corresponding to it is vertical. As the rate of alternation increases the load begins to be effective, and the load line swings over to the left and

takes up a position similar to that of PQ. There is thus the possibility that for full description of the behaviour of the output valve it might be necessary to draw a separate load line for every frequency, each line passing through the operating point of the valve, and having an angle expressing the impedance of the speaker to the particular frequency.

In practice no one ever bothers with such a family of load lines, but instead one assumes that the impedance of the speaker is roughly constant. The value that it should have, as an average over the audible scale, is found by examination of the curves of the valve it is to follow.

In finding the best load for a newly developed valve the maker of it will lay a rule on the working point A and try, by swinging the rule round about that point, to find a load line such that the 11 to 9 ratio already mentioned is exactly satisfied when the maximum permissible grid swing is applied. From this can be worked out in the manner already detailed the power available with this working point, for which the load has already been adjusted to be that giving greatest output at the predetermined level of distortion. Then a new working point is tried, taking it a little higher or lower than A on the vertical line AB of Fig. 1; keeping, that is to say, the anode voltage at its full rated value but trying different values of bias. For each of these the output available at the maximum distortion permitted is found as for the first point. Comparing the outputs for each of these tentative working points, the one for which the output is greatest can be found. The value of bias which gives it and the load that fits it best are then included in the instruction leaflet.

FIVE-METRE 'PLANE TESTS.

THE following is a list of the observers who sent in the most useful reports of 6GSM's signals on Sunday, July 9th.

On the Outward Journey (covering period 10.38 to 12.10).—E. J. Armstrong, G2RM, Burgess Hill, Sussex; Harry E. Smith, G6UH, Limpsfield Common, Surrey; R. C. Richards, Seven Kings, Essex; R. E. Waters, Peckham Rye, S.E.15; R. J. Denny, G6NK, Weybridge; C. A. Reid, BRS9ro, Finchley; A. L. Beedle, Balham, S.W.12; E. H. Robinson, G2VW, Slough, Bucks; J. Paine, BRS1132, Slough, Bucks; E. W. Rawlings, G5RS, Guildford, Surrey; E. J. Pearcey, G2JU, Harrow; R. C. Neale, G6GZ, Farnborough, Hants; W. A. Duncun, Sidcup; H. L. O'Heffernan, G5BY, at Firle Beacon, Surrey.

Liverpool, Manchester and Birmingham Districts (5.08 to 7.40 p.m.).—W. W. Kenyon, Liverpool, 15; I. D. Auchterlonie, G6OM, Heswall, Cheshire; J. Davies, G2OA-G5MT, Liverpool; W. Lucas, G2OI, Winton, Manchester; B. Webster, Eccles, Manchester; A. R. Land, G2ASF, Bradford; J. H. Bateman, G6BX, Bradford; R. E. Summerfield, G6RK, Yardley, Birmingham; J. S. Owner, G6XQ, Birmingham; G. A. Swinnerton, G2BJR, Smethwick, Staffs.

London District: Inward Journey (8.50 to 9.10 p.m.).—R. C. Richards, Seven Kings; A. L. Beedle, Balham, S.W.12; E. H. Robinson, G2VW, Slough, Bucks.

PRACTICAL HINTS AND TIPS



SRJ

EVEN though the usual precautions have been taken, it is not uncommon to find that a certain amount of H.F. energy reaches a mains-operated receiver from the power supply circuits, and is responsible for an excessively noisy background. This is particularly likely to be troublesome when the set is fed from D.C.; it is to users of this type

Mains Filters

of supply that these remarks are mainly addressed.

Comparatively elaborate H.F. filters for interposition between the set and the supply mains have been suggested in these pages, and it is true that in certain cases a pair of high-inductance coils are necessary. Due to the fact that a D.C. set consumes a good deal of current, the resistance of these chokes must be kept low if an appreciable loss of voltage is to be avoided.

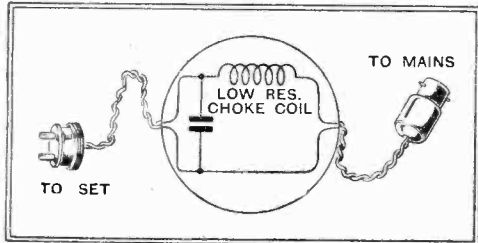


Fig. 1.—A simple anti-interference filter for inserting in the mains supply leads.

Experimental work that has been recently conducted proves conclusively that certain forms of interference may be eliminated completely by means of the simple and inexpensive filter shown diagrammatically in Fig. 1. The point about this filter is that it includes a single choking coil, by means of which the disturbing impulses are prevented from gaining access to the receiver circuits. A device of this sort is quite valueless unless the choke be connected in the right lead, and this is a matter that can be determined only by trial and error. Fortunately it only takes a moment or two to change over the choke to the other lead if, in its original position, it fails to reduce the interference.

In many cases a coil of about 100 turns of No. 22 wire on a former of roughly 2 in. or 2½ in. in diameter will meet the case. In the absence of anything better, an obsolete tuning coil may be tried, but it should be remembered that the D.C. resistance should not amount to many ohms, or the behaviour of the set may be impaired. Where a number of coils are available, it is worth while trying the effect of different inductance values.

Simplified Aids to Better Reception

The capacity of the by-pass condenser is not critical; anything from 0.1 mfd. upwards may be expected to prove satisfactory, and as low a value as 0.002 mfd. will sometimes be effective.

Although there is always an element of uncertainty with regard to the cure of interference in D.C. mains receivers, the device described is so simple and inexpensive that it is always worth a trial even if the interference is but slight. As often as not it will work, as the patent medicine advertisements used to say, "like a charm."

THERE is a tendency nowadays to "shorten the grid base" of variable-mu H.F. valves. In other words, for a given reduction in sensitivity the increased negative grid bias applied to a modern valve will be less than that necessary for its older counterpart.

The Volume Control Position

As a result of this change, the substitution of a modern valve often gives the erroneous impression that the set has become less sensitive. This is due to the fact that, to maintain the original average sensitivity, the volume control pointer must be set nearer the "maximum" end of its travel. In any case, the position of the volume control pointer is not a good indication of sensitivity, and a set should really be judged from this standpoint only when the control is at maximum.

FROM the point of view of stability, it is often possible to add a push-pull output stage to an existing receiver without making any internal alterations. The addition of a "straight" L.F. stage in this way will usually involve such a great increase of overall magnification that stray inter-circuit couplings will produce motor-boating, but push-pull tends to prevent this trouble.

But in another direction there is a possibility of introducing distortion by adding an L.F. stage—even push-pull—at random and without due consideration. Most modern detectors are arranged to give best results with a fairly large input; with considerably smaller inputs than those legislated for by the designer, rectification will no longer be linear, and serious harmonic distortion will take place.

Without making sweeping alterations the only practical way of overcoming this difficulty, and at the same time retaining full amplification for use when it is needed, is to fit a post-detector volume control at some convenient point in the L.F. amplifier. Where resistance coupling is used a grid potentiometer or an anode potentiometer may be employed without risk of impairing the amplifier characteristics; with transformer coupling it is not so easy to devise a perfect control, but usually the connection of a variable resistance across the transformer primary will prove satisfactory. For reproduction of strong signals, where the best possible quality will be required, overall L.F. amplification may, with the help of this control, be reduced to such a value that the detector is working under the best possible conditions for the avoidance of harmonic distortion.

WHERE an insulated wire is passed through a metal base-plate or screen especial care should be taken to preclude the possibility of a short-circuit. In some cases it is as well to supplement the normal insulation by a tubular sleeve, or, better still, by a rubber bush if the wire is likely to be subjected to strains.

Avoiding Short-circuits

Insulation is particularly likely to fail if a wire is bent sharply at the point where it emerges from the hole (see Fig. 2, A). When metal-covered plywood is used as a baseboard,

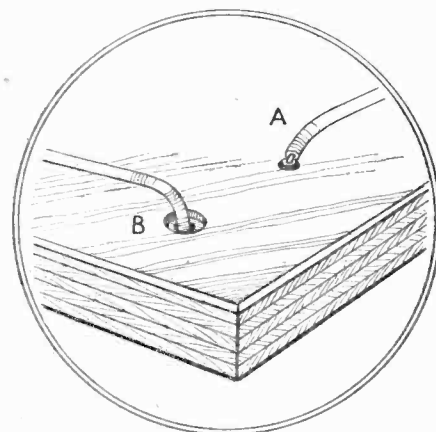


Fig. 2.—Metal-covered plywood; counter-boring wiring holes.

the possibility of this trouble is greatly reduced by drilling a small hole for the wire and then, with a larger drill, cutting away the metal surrounding the hole, as in Fig. 2, B.



Divorced

To and Fro

FROM a preliminary private view which I have had of a representative collection of new receivers intended for exhibition at Olympia, I am disquieted to note that the type of receiver in which the loud speaker is incorporated will be decidedly in the ascendant.

I don't know about you, but, speaking personally, I don't like a loud speaker blaring away right by my ear, nor do I like having to keep jumping up like a jack-in-the-box every time I wish to tune in another station; yet, with this type of set, you have to choose between one of these two evils. Either you have got to have the receiver by your armchair and risk injury to the ear drums, or you have got to stick it at the other side of the room where the controls are out of reach.

There is, of course, a way out of this trouble other than my suggested one of having the loud speaker divorced from the receiver, and that is to have a remote tuning control unit fixed to the old armchair; but somehow or other these things have never taken on in this country, and, in any case, there is another reason for having a separate loud speaker, and that is you can sling it up on the wall in a position where it is found to give the most pleasing reproduction according to your own particular tastes and the acoustic properties of the room.

Tea at the N.P.L.

WHEN attending the annual "Tea Party" at the National Physical Laboratory the other week I was interested in the method adopted for producing a million volt spark; it was none other than a modification of the old method of deriving H.T. from the L.T. battery which certain of my correspondents "invent" with unflinching regularity week after week. The method of H.T. production to which I refer, of course, is to charge a large number of fat condensers in parallel across the L.T. battery and then to stick 'em all in series and so get a high voltage discharge.

The various methods brought forward by my readers for connecting up vibratory multi-contact switches so that the condensers are in parallel across the L.T. battery at one instant and in series across the H.T. terminals the next have always shown remarkable evidence of misplaced

UNBIASED

By FREE GRID

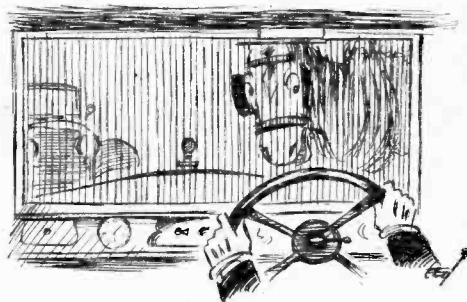
genius. The arrangements at the N.P.L. showed definite evidence of genius, but it was not misplaced, and the results were truly impressive.

For the edification of visitors, the million-volt high-tension apparatus was hard at work disrupting wooden rods into slivers in a most spectacular fashion. The demonstrator offered to try the effect of the discharge on my precious umbrella, but I indignantly refused.

Television on the Car

AS I prophesied somewhat earlier in the year, the development of car radio is proceeding apace. Already experiments are being conducted with a view to the use of television apparatus, and it would not surprise me if a special company were formed for the development of the scheme. It is not intended, however, that the television apparatus be used for amusement purposes. On the contrary, it is hoped to develop it so that it becomes of real assistance in navigating the car during foggy weather.

The idea is that in a dense fog the front of the car should be fitted with a powerful "lamp" radiating infra-red rays. This, by itself, would not, of course, assist the motorist in the slightest degree to see what lies in front of him. It is quite different with television apparatus, which, as is well known, will quite cheerfully deal

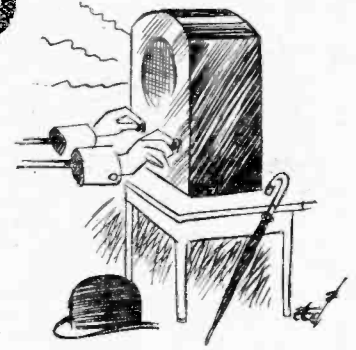


Steering by television.

with any subject "illuminated" solely by infra-red rays. The infra-red ray lamp will pierce the fog and the combined television transmitter-receiver on the car will do the rest, and pictures of approaching traffic will be flung on to the windscreen.

Tests are at present being carried out, using ordinary daylight, and some truly extraordinary results have been obtained. The windscreen and indeed all the windows of the experimental car are blocked up so that the driver has to rely solely on what he sees on the television screen.

I am sworn to secrecy regarding a privileged trial run, and can only say that the whole experience was uncanny in the extreme, and I am wondering whether the police officials will look on the scheme



. . . . from the receiver.

with favour or not. It is hoped to make the real trials during the usual November fogs, and I hope to arrange to secure for "W.W." the exclusive right of publishing technical details when they are "released."

Patentable ?

AS a result of my mentioning the other day that I was plagued with would-be inventors who wished me to perfect their half-baked ideas I have been bombarded by letters from more of the fraternity, who have wrongly interpreted my remarks as encouragement. Among the bunch there are some really excellent ideas which are obviously patentable, and it is, I think, strange that their originators should not perceive this fact.

The gem of the bunch is an idea for cutting out mutual interference with tuning which sometimes occurs when two aerials run parallel and very close to each other in adjacent suburban gardens. The plan is ingeniously simple; the originator of it suggests that the two neighbours should use each other's aerial poles so that their respective aerials are no longer parallel to each other. The chances are about a million to one against any two aerials being exactly the same height, and so they would not make contact at the cross-over. The only trouble is that my correspondent thinks he can patent the idea. What are your views on the subject?

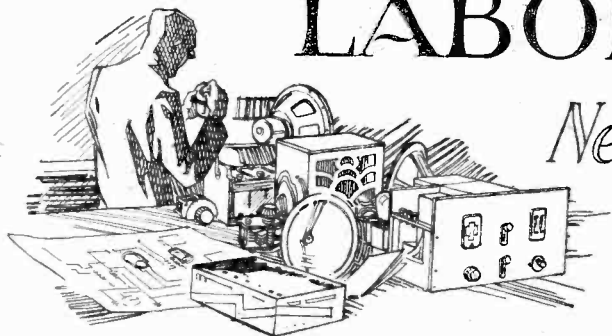
Acoustics in the Courts

I AM rather surprised at the statement made by a well-known Sunday newspaper to the effect that certain police courts are being fitted with a microphone and headphone installations for the benefit of "deaf magistrates and other officials." If this be so it points to a strange state of affairs, for one must infer that, prior to this installation, magistrates have been following their cases by lip reading or some similar method. I have heard of justice being blind, or reputedly so, but never deaf.

The most charitable view that I can take is that the installation required is simply to combat the poor acoustic properties of certain courts which, as I can assure you from personal experience, are really deplorable in this respect.

LABORATORY TESTS

New Radio Products Reviewed

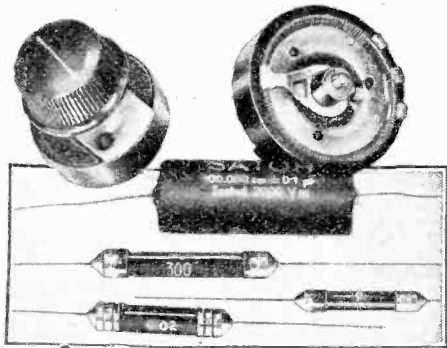


SATOR COMPONENTS

SEVERAL different styles of resistances, both fixed and variable, also a range of tubular fixed condensers with wire ends, are marketed by Orion Lamps, Ltd., 72, Oxford Street, London, W.1, under the name of Sator components. The small fixed resistances are available in 0.75-watt, 1.5-watt, and 4-watt types, the prices being 4d., 5d., and 6d. each respectively. The first two mentioned are of the composition type, and consist of a porcelain rod coated with the resistance compound and then lacquered. Metal end-caps are fitted, and either type can be obtained with or without wire ends.

A few specimen 1.5-watt resistances of 10,000 ohms nominal value were measured, their actual resistances being 9,900 ohms, 10,500 ohms, and 10,020 ohms. These show a good agreement with the marked values, being well within the usual tolerance of plus or minus 10 per cent. When dissipating the maximum watts the temperature of the resistor did not rise above normal, the lacquer coating showed no signs of softening, and on completion by the test the measured resistance was the same as before.

Of the several different types of wire-wound volume controls made, the linear models R.K. (1.2 watts) and R.K.G. (2.5 watts) and the graded types L.R.K., Mu L.R.K. (0.7 watt), L.R.K.G. and Mu L.R.K.G. (1.75 watts) are of greatest interest to the home constructor. The types preceded by the word "mu" are fitted with a wire element graded especially for use with variable-mu valves. Ninety per cent. of the resistance is contained in the first half and ten per cent. in the second, this division of values having been found very suitable for this style of volume control.



Selection of Sator components, including fixed resistances, tubular condenser, and wire-wound volume control.

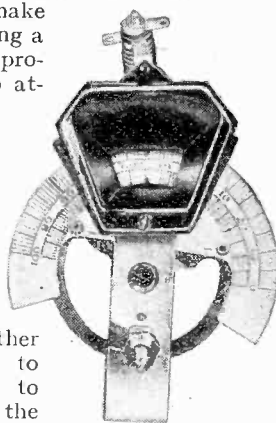
They are made in all the used values, and the prices are very reasonable. A 50,000-ohm type R.K. costs 4s. 6d., a 25,000-ohm type L.R.K. or Mu L.R.K. 4s. 9d., while a 50,000-ohm Mu L.R.K.G. (1.75-watt) costs 5s. 3d. For a single H.F. valve the 0.7-watt model is suitable. Some specimens have been tested and found perfectly satis-

factory. The resistances are in close agreement with the marked values, and they are perfectly silent in operation.

Sator fixed condensers are made in values extending from 0.0001 mfd. to 0.1 mfd., and the prices range from 6d. to 1s. 4d., according to size. They are tested at 2,000 volts D.C.

MAGNUM SLOW-MOTION DIAL

MADE by Burne Jones and Co., Ltd., Magnum House, 296, Borough High Street, London, S.E.1, this slow-motion dial gives a drive reduction ratio of six to one. It will fit any make of condenser having a 1/4 in. spindle, and provision is made to at-



Magnum slow-motion dial.

tach the dial either to the condenser, to the baseboard, or to the front panel, the fixing being equally secure whichever form of mounting is adopted.

The scale is engraved on a translucent disc illuminated from the back, and is obtainable with a 0-100 division scale or with one marked in wavelengths, the latter being calibrated to suit the Magnum screened coils.

The dial is assembled on a cadmium-plated bent steel frame, and the price is 3s. complete.

ELECTRO DYNAMIC H.T. CONVERTER TYPE D.

THIS is a compact self-contained unit designed especially for use with battery-operated receivers, and enables the high-tension supply to be taken from the L.T. accumulator, models being available for use with two-, four-, or six-volt batteries. The type D is rated to give 150 volts at a maximum current of 30 mA., and thus the output is quite sufficient to meet the requirements of practically every type of battery-operated set. In many cases there will be a sufficient surplus to justify fitting a slightly larger power valve in the output stage.

The unit is assembled on a stout steel baseplate, and consists of a small rotary converter, H.T. smoothing equipment, and an L.T. filter, the latter being included to prevent the commutator ripple reaching the filaments of the valves.

The converter has a double-wound armature with a commutator at each end. It runs in ball bearings which are self-lubricating and require no attention, and in order to minimise vibration and mechanical noise is mounted on Sorbo rubber pads. This type of mounting is so effective that the machine is inaudible a few feet away. Carbon brushes of the box type are fitted, and these are

claimed to give 4,000 hours' working before renewal becomes necessary. They are self-adjusting.

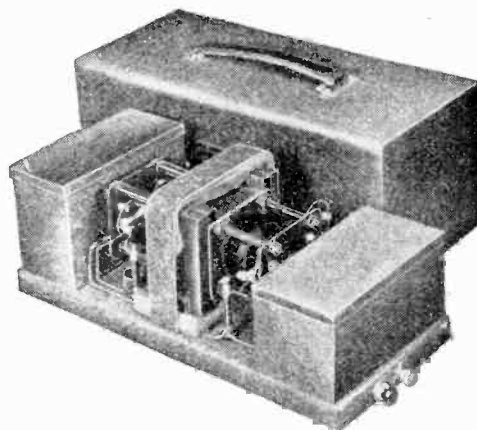
The specimen sent to us operates on four volts, but provision is made for using it in conjunction with two-volt valves.

On test the following results were obtained:—

Input.			Output.			Efficiency per cent.
Volts.	Current in Amps.	Watts.	Volts.	Current in mA.	Watts.	
4.0	1.04	4.16	199	1	0.190	4.8
4.0	1.24	4.97	189	5	0.945	19
4.0	1.46	5.94	175	10	1.75	30
4.0	1.72	6.88	164	15	2.40	35.8
4.0	1.96	7.84	152	20	3.04	38.8
4.0	2.24	8.96	140	25	3.5	39.1
4.0	2.47	9.88	129	30	3.87	39.2
4.0	2.68	10.73	119	35	4.04	37.7

Although we did not obtain quite so good an efficiency as the makers claim, we yet regard the performance as exceptionally good in view of its small size.

The converter was used with a sensitive superheterodyne receiver, and the results obtained were perfectly satisfactory. The almost entire absence of background noise was very marked, and, apart from a faint ripple when listening close to the loud speaker, there was nothing to indicate that the set was not working from batteries in the usual way. The only precaution that need be observed is to be sure that the L.T. accumulator is of sufficiently large capacity to stand a continuous drain of 2.5 amps. in addition to the requirements of the valves.



Electro Dynamic H.T. converter type D with cover removed showing the machine and filter units.

The makers are Electro Dynamic Construction Co., Ltd., Devonshire Grove, London, S.E.15, and the price is £7 10s.

TRADE NOTE

Mr. P. G. A. Voigt, for some time chief research engineer of Edison Bell, Ltd., has acquired the stocks of Edison-Bell-Voigt moving coil loud speakers and electrostatic microphones and has formed a company to carry on the manufacture of high-grade electro-acoustic devices. The address of the new concern is Voigt Patents, Ltd., The Courts, Silverdale, Sydenham, London, S.E.26, and deliveries of loud speakers and microphones can be made from stock.

"Ultra-Shorts" from the Air



The Gypsy Moth ready for the start. The aerial can be seen slung between the left rear strut and the tail plane.

ON Saturday evening, July the 8th, a short test flight was made around Croydon, during which signals from the 'plane were received at great strength on the ground, but with a good deal of interference from the engine and rush of air in the slipstream from the propeller.

On the previous Wednesday, H. L. O'Heffernan (G5BY) and I had taken our gear to a well-tryed spot on the South Downs, Firle Beacon, where we carried out tests with G6UH who had located himself on the North Downs at Leith Hill. Good signals were obtained at each end and we had the satisfaction of knowing that everything was ready for the big test. The morning of July the 9th was rather overcast, with bright intervals.

Signals Held by Listeners

We took off, my pilot, R. Lindsay Neale, and I, at 10.38 a.m., and straightway realised that the trip would be a bumpy one with a strong headwind. Almost from the take-off many people heard our signals. They were followed right across London and beyond until about midday by listeners in Peckham, Seven Kings, Weybridge, Finchley, Balham, Slough, Guildford, Harrow, Sidcup and Farnborough, and by G5BY at Firle Beacon and G2RM at Burgess Hill, Sussex. These two stations may be credited with the best reception of the day, as they were able to follow our signals until 11.40, when we were about 80 miles away from them. Although reports were received from these widely scattered districts, not one authentic report was received from the centre of London. This is rather a bewildering fact as it is known that there were some receivers active in Central London. The International Short Wave Club Station on the "Daily Telegraph" building reports hearing signals at 11.30 which

were believed to emanate from the 'plane "when it was near Aylesbury" and which is in agreement with the log.

We crossed London at about 3,000 feet and called in at Heston to collect a map, while I took the opportunity of changing one of the oscillator valves which showed signs of losing its emission. (Heston, 10.55 to 11.10.) After leaving Heston we climbed again to the cloud base, about 2,500 to 3,000 feet.

All the time the wind had been increasing in force and the bumps became worse, until we were finally receiving a very bad buffeting. Another of the oscillator valves then gave up owing to its filament being jarred to bits. We were just near Halton R.A.F. Aerodrome so a call was made there and the valve replaced. The weather soon became worse. The head wind seemed to have increased—the pilot estimated it at times at 50 m.p.h. From Halton we immediately shaped our course for Birmingham, where we flew around the University Tower, giving a few calls to the people who were listening. It was then realised that all was not well with the modulator. The oscillators were behaving normally, as could be seen from the anode feed, but the normal slight variations in anode feed due to modulation could not be detected in the oscillations that the needle of the milliammeter was making, due to the severe vibration. We were so much behind schedule that I decided to push on and to trust that the trouble would cure itself (11.20 p.m.).

Overcoming Engine Noise

I was, by the way, giving a running commentary on our progress during the whole of the flight. The engine and "flying" noises had been reported as obtruding so much into the transmission that the rough and ready expedient of turning down the gain control at the input

G6SM's Own Story: Listeners' Reports

By S. G. MORGAN

end of the modulator and shouting more loudly into the microphone had to be adopted—to the great detriment of one's vocal apparatus!

We made a landing in a field near Aldford, five miles from Chester at 2.15 p.m., in order definitely to ascertain how much fuel we had left. The bottom of the tank was only just covered. We had been using a great deal of petrol in our struggle against the headwind.

After sundry difficulties we got into the air again at 3.31 and eventually arrived at our destination, Hooton Park, Liverpool, at 3.40 p.m.

The transmitter was unslashed and the cause of the trouble was traced to a fracture, inside its insulating covering, of a 16 S.W.G. copper wire supplying the driver valve with filament current. Another lead was substituted and everything was working beautifully again. No further trouble was experienced during the rest of the day.

We took off again at 5.08 p.m. It was manifestly impossible for us to adhere to our schedule in order to be back at Croydon by sunset at 9.10, as we were without navigation lights for night flying. It was therefore much to my regret that we had to miss Leeds, Bradford and Hull on our return journey. The best possible compromise was, however, effected. We flew in a northerly direction along the South side of the Mersey, and then proceeded to Manchester, via Warrington.

The sky was overcast and the "ceiling" was still fairly low. It was while we were over the Manchester Ship Canal and while

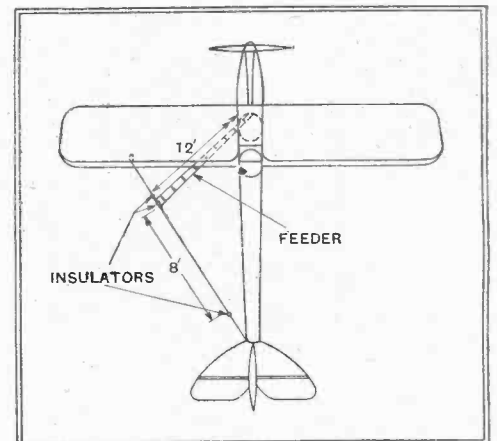


Diagram of the aerial arrangement. The 12ft. feeder wires (three-quarter wave) were separated by ebonite strips.

subsequently crossing the Pennines that we attained our greatest possible height, about 3,500 feet.

Reports on our signals have been very

"Ultra-Shorts" from the Air—
 numerous from the Liverpool, Manchester, Leeds, Bradford and Birmingham districts. Our speech was picked up in Manchester and district whilst we were over Liverpool and was followed and reported from Liverpool and Bradford whilst we were over Manchester and the Pennines. A great

No signals were reported from soon after the time at which we ran into heavy weather. This suggests the possibility that thick banks of cloud or rain cast "shadows" or act as effective blankets to ultra-short waves. Several reports mention the fact that signals fluctuated wildly soon after this weather was encountered, which

consisted of a standard G.P.O. solid back microphone coupled through a suitable transformer to a Marconi LP2 valve driving, through a standard "Multitone" 1:1 Class "B" transformer, two Mazda PD220 valves in parallel. The conditions of operation for two Mazda PD220's in parallel are as follows:—

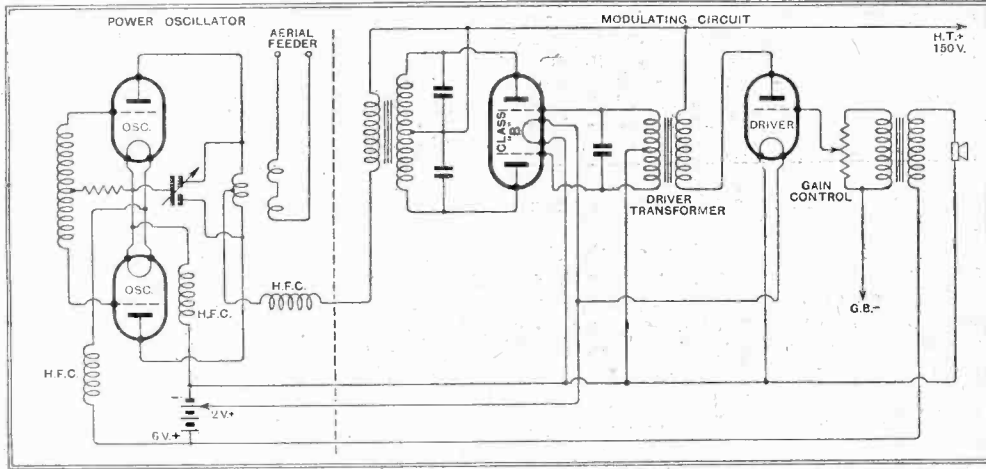
Anode volts	150
Quiescent current per pair of anodes	2.5 m.a.
Anode to Anode load	6,500 ohms.
Min. Grid Input Resistance ..	1,700 ohms.
Power Output	5.1 watts.
Power required from Driver (80% efficient transformer)	165 mW.

A larger power output may be obtained by increasing the driver power output.

The oscillators drew a current of 50 ma. at 150 volts and a special output transformer for the Class "B" stage was built by Messrs. Varley to conform with the above-mentioned characteristics. The oscillator valves were some of the old Ediswan type PV625A, which have been found to be ideal low power oscillators.

The oscillator unit is normally quite separate from the modulator and can be mounted, if desired, in the middle of the antenna system and fed with current through a three-way cable, which terminates on the small sub-panel carrying the Belling-Lee terminals and mounted on the output transformer. The antenna on G-ACCY consisted of a half-wave radiating portion fed through a three-quarter wave double feeder wire, mounted as shown in the drawing.

The receiver uses almost the same cir-



The circuit diagram of G6SM's transmitter. The push-pull oscillator unit is on the left. On the right is the Class "B" modulator.

many were able to follow us until we were 40 to 60 miles distant, but no greater ranges were, as far as we know, achieved in the north, owing to our comparatively low altitude.

From Manchester (5.42) we flew via Stockport (5.45) and Glossop (5.53) over the Pennines, thence to Chesterfield (6.13) Derby (6.29) and on to Loughborough and Ratcliffe Aerodrome (6.41), where we landed to stretch our legs.

Do Clouds Cause "Shadows" ?

While still some way from Derby we had been picked up by two or three amateurs in Birmingham, over forty miles away. G6RK, in fact, heard us when we were nearly 60 miles distant.

Our signals were held by these listeners for some time after leaving Ratcliffe, past Leicester (7.25) to Market Harborough (7.29).

Time was getting on, so we dropped down to about 1,200 feet so as to increase our speed, and we proceeded towards Northampton, and thence over Fenny Stratford, Leighton Buzzard, Tring and Berkhamsted to St. Albans, where we made a short stay of ten minutes to take on a few more gallons of petrol (8.35-8.45). We crossed the Thames again at Hammer-smith at 3,000 feet, and landed at Croydon at 9.11 p.m.

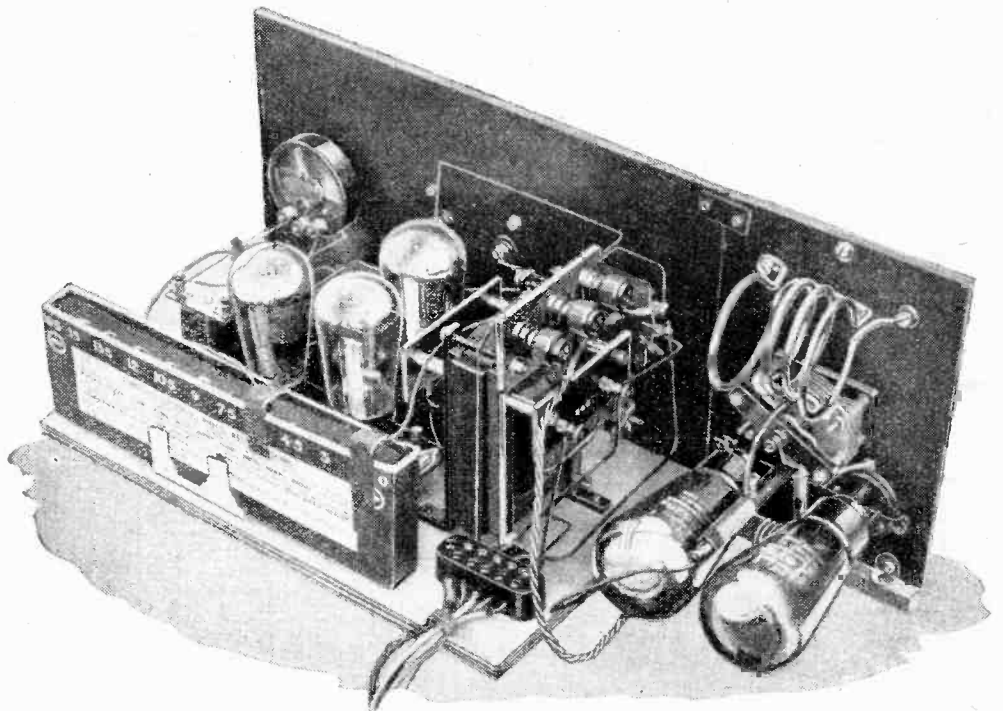
Our signals had been picked up while approaching London from the North and were followed almost up to the time when we landed.

To summarise the results of the test: Many listeners were able to hold signals up to a distance of 50 miles or so, and this, taking into account our comparatively modest height owing to weather conditions and the low power input to the oscillators (about 7 watts at the start, falling to 5 watts at the conclusion of the tests) is very encouraging.

again lends force to this theory. These effects may, however, have been due to the failure of the modulator at this critical period.

It is most certainly hoped that it will be possible to use these to the full in a further flight at some future date, when, perhaps, the anticipated results will be obtained.

If it is only for the amount of enthusiasm which they have aroused, the tests have



The complete transmitter showing the oscillators in push-pull on the right.

been extremely valuable. This keenness is especially apparent in the North and Midlands, and it is safe to prophesy that with so many ardent experimenters co-operating in ultra-short wave work, these "useless" frequencies will be put to great account in the near future.

The modulating unit on the 'plane set

cuit as that employed for the "Wireless World Ultra Short Wave Two." The main difference lies in the fact that the aerial is coupled to the grid of the detector through a J.B. 0.0001 trimming condenser.

A list of observers who sent in the most useful reports will be found on another page.

Burrell 3-valve A.C. Receiver

An Inexpensive Set Giving Outstanding Volume and Quality



FEATURES
Type.—Straight three-valve receiver for A.C. mains. Moving coil loud speaker. Provision for pick-up and external loud speaker. **Circuit.**—Variable- μ pentode H.F. stage—power grid detector—pentode output valve. Full-wave valve rectifier. **Controls.**—(1) Tuning, with illuminated dial calibrated in wavelengths. (2) Input volume control. (3) Reaction. (4) Wave-range and on-off switch. **Price.**—12 guineas. **Makers.**—Burrell Radio Ltd., 45, High Road, Willesden, London, N.W.10.

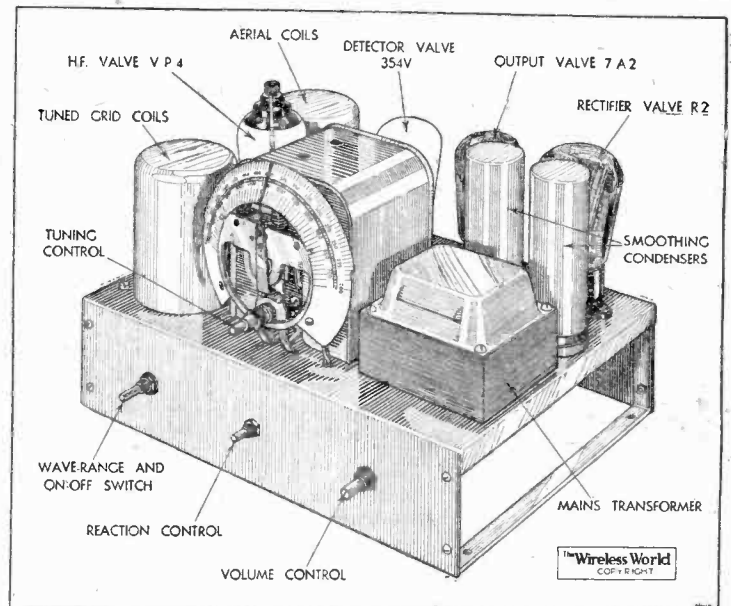
WHILE the majority of prospective purchasers of receiving sets demand a reasonably high performance in the matter of range and selectivity, there can be little doubt that the final choice rests upon the quality of reproduction of the local station. From this point of view the Burrell A.C. set is outstandingly good, the more so since the price is by no means high. It is obvious, from the moment of first switching on, that the power-handling capacity of the output valve is much above the average, and it is reasonable to conclude that a fairly high anode voltage is used. As a result there is no apparent distortion of modulation peaks when the average output is of the order of 1 watt, which is more than sufficient for a large living-room. The reproduction is exceptionally clear and has that elusive two-dimensional quality which makes the individual instruments of the orchestra stand out clear of one another. In view of the small diameter of the loud-speaker diaphragm, it is unreasonable to expect a truly proportional bass response, but the makers have wisely refrained from spoiling the good effect produced in the middle and upper registers by introducing a false resonance in the bass. It was found possible, however, to considerably improve the balance by increasing reaction and correspondingly reducing the volume control. This has the effect of appreciably increasing the bass

response provided the set is accurately tuned to the station.

High-quality reproduction of the local station does not by any means exhaust the possibilities of the set, for its range and selectivity are well up to the standard of performance we are accustomed to expect from a three-valve circuit with a single H.F. stage. On medium waves Langenberg comes in at moderate strength in Central London during daylight, and upwards of fifteen or twenty stations, depending on conditions, can be relied upon after dark. With the reaction and volume controls set for normal distant reception, the London National transmitter spreads from 245 to 270 metres, and the Regional from 320 to 325 metres. On long waves the range is all that one could wish. As regards selectivity, there is no difficulty in separating Daventry and Radio Paris, but Zeesen cannot be quite extricated from the background of Daventry.

The set owes its efficiency to careful choice of valves and attention to detail in the design rather than to any novelty or elaboration in the circuit. A wave trap is included in the aerial lead on long waves to prevent break through of the medium-

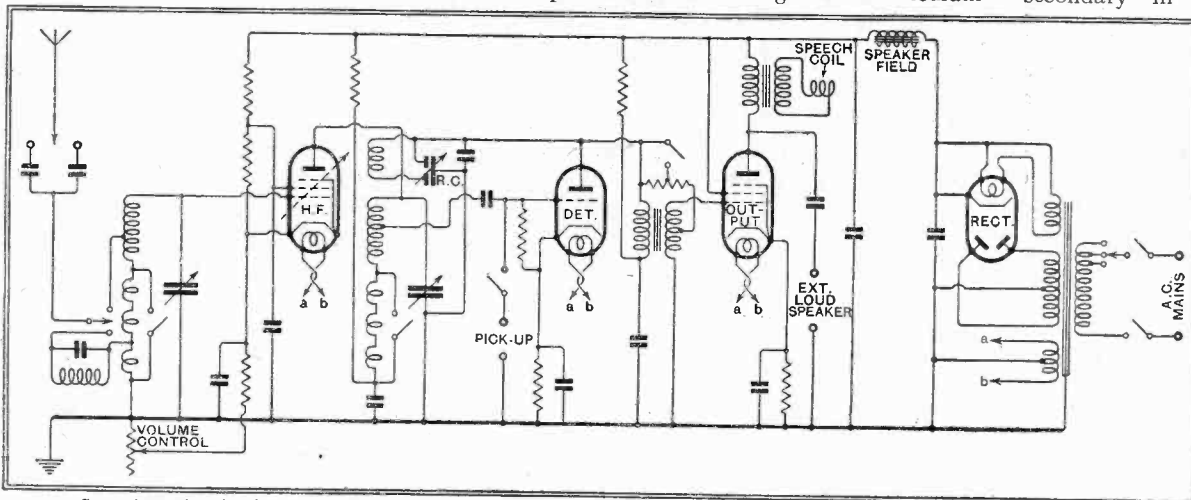
wave stations. Volume is controlled in the H.F. valve, which is of the variable- μ pentode type, by varying the cathode biasing resistance. The range of this control is well distributed in relation to the movement of the control knob, and gives a good minimum. Reaction is capacity controlled



The Burrell three-valve chassis in which the gang-condenser unit is suspended on rubber.

and is smooth and free from backlash. The connections of the L.F. intervalve transformer are interesting and have been designed to improve bass response. To neutralise the polarisation of the core by the D.C. current in the primary, a reverse current is passed through a section of the secondary in the opposite sense, with the result that the primary inductance is raised. The increase in the primary D.C. current when the detector is biased to zero for radio reception is met by short-circuiting a part of the resistance feeding the current to the secondary winding.

The set is housed in an attractive walnut cabinet. It is in every way a sound and workmanlike job, and the performance offered—particularly as regards quality of reproduction—is remarkably good value for money.



Complete circuit diagram. Note the method of balancing out the polarising current in the L.F. transformer.

News of the Week

Current Events in Brief Review

Will Olympia Go Feminine ?

MORE than half the visitors at last year's Olympia Radio Show were women. Yet in 1929 it could not truthfully be said that women visitors numbered more than about 15 per cent.

"Broadcasting House" for Brussels

NO fewer than thirty architects have submitted plans for the new building for the National Institute of Broadcasting to be erected in Brussels. The winning design will be announced within the next few days.

Eight Simultaneous Programmes

BY November next "Broadcasting House" in Berlin will have one of the most imposing control rooms in Europe, capable of handling eight programmes simultaneously in addition to rehearsals. It will also be possible to record as many as six programmes at one time.

Mr. W. I. G. Page

AFTER a number of years' association with *The Wireless World*, Mr. W. I. G. Page, B.Sc., designer of many well-known receivers, is now leaving the staff to take up general wireless consultancy, and also the commercial development of car radio. His many friends in the radio world will wish him continued success in his new sphere of activity.

Ban on Loud-speaker Parts

CONCERN is felt among German amateurs over the announcement that, from September 1st, next, no loud speaker parts will be available. This measure is designed to help the loud speaker trade, which has made special sacrifices in connection with the new "popular" receiver (described in *The Wireless World* of July 7th). German home constructors must henceforth buy their loud speakers ready made.

Eight Super Stations for Germany

THE German Post Office announces that, in accordance with the provisions of the Lucerne Plan, the stations at Mühlacker, Langenberg, Munich, Breslau, and Hamburg will increase their unmodulated carrier wave power to the maximum of 100 kW. In most cases the increase will take effect in December next.

Königswusterhausen is to be rebuilt and the power increased to 150 kW., thus overshadowing the B.B.C. Droitwich transmitter by 50 kW. Should it be necessary, the power of Heilsburg and Breslau will also be increased to 100 kW. next year, so that, by the end of 1934, Germany may have seven 100-kW. stations and one of 150 kW., all equipped with the new anti-fading aerials of the type now used at Breslau.

Toulouse Returns, but . . .

ALTHOUGH it is cheering to learn that Radio Toulouse is about to "come on the air" again, listeners who have hoped for an increased power output will be disappointed. According to our Paris correspondent, the official permit lays down that the power must not exceed that employed by the original transmitter at the Villa Schmidt, which, as all the world knows, was 8 kW.

French Women to Forgo Radio

A NEW grievance is being aired by the multitudes of French listeners who are now called upon for the first time to take out a wireless licence. In the form of application the prospective licensee

Does Radio Pep Up Brain Cells ?

THE remarkable discovery has been made by Dr. Frank N. Freeman, Professor of Educational Psychology to the University of Chicago, that the general intelligence of the radio audience is well above that of the average adult.

Answers to three questionnaires were submitted by more than 2,500 listeners, and Dr. Freeman found that the average score of listeners responding to the test was thirty-two, as compared with the average adult intelligence designated by the numeral twenty-four.

Obviously, contact with the ether stimulates the mental faculties, and "the man on the air" is mentally superior to "the man in the street."

Not Enough Listeners

THE Cracow station, in Poland, has ceased its educational transmissions because it has been found that "very few schools are equipped with receivers."

Papal Set is Silent

THE Vatican City station apparently cannot make itself heard in Washington, according to the sad tale of an apostolic delegate there, who recently received one of the short-wave sets distributed by His Holiness the Pope, for the benefit of Vatican embassies abroad. The delegate at Washington states that he has never been able to get the set in working order, possibly because the American capital is a "dead spot."

Britain's Youngest ?

ALTHOUGH this country cannot boast of any infant prodigy amateur transmitters such as those eight- and nine-year-old operators recently mentioned in *The Wireless World*, many British "hams" have several years to live before they attain their majority.

Until recently it was believed that Mr. R. Miller (G6ND), the Stirlingshire transmitter, held the record, being eighteen years of age, but a subsequent claim comes from Mr. R. D. L. Dutton, whose call-sign, G6QQ, emanates from Oxford. Mr. Dutton is sixteen. Both these amateurs are exceptionally efficient operators, and are widely respected among the "hams." They have both figured prominently in recent R.S.G.B. transmitting tests.

What Man-made Static Costs

DURING the twelve months ended March 31st, 1933, the Postmaster-General received 20,624 complaints of electrical interference with broadcast reception, according to a statement by Sir Kingsley Wood, Postmaster-General, in the House of Commons last week.

The Postmaster-General was also asked how much had been spent during the past five years by his Department upon research into remedial measures against interference with broadcast reception. Sir Kingsley Wood replied that the total cost to the Post Office of engineering work in connection with broadcasting during the last five financial years was as follows:—

Year	£
1928-29	12,245
1929-30	16,498
1930-31	23,103
1931-32	33,441
1932-33	51,000 (approx.)

It was not practicable to subdivide this amount but the expenditure was mainly incurred in the treatment of complaints of electrical interference with broadcast reception, including the research work which had been necessary to find remedies.

THE RADIO SHOWS

The National Radio Shows of 1933 are to be held on the following dates:

LONDON (Olympia)	- - -	AUGUST 15th - 24th.
GLASGOW	- - -	SEPT. 2nd - 9th.
MANCHESTER	- - -	SEPT. 27th - OCT. 7th.

must give the place and date of birth—a piece of information which most Frenchwomen resolutely decline to vouchsafe. It would seem, therefore, that the majority of France's feminine population must forgo the delights of wireless.

The Propaganda War

THE plot to blow up Radio Strasbourg last week seems to have been anticipated by the French Secret Service. Recent broadcasts by the German stations under the direction of Dr. Goebbels, Minister of Propaganda, have referred in no uncertain terms to foreign propaganda. Dr. Goebbels has officially announced that the German stations will in future effectively counteract "poisonous news broadcasts"

A "Royal Signals" Quarterly

A DISTINCT need should be filled by the "Royal Signals Quarterly Journal," the first number of which has just made its appearance, dated July, 1933. This bright and informative review is issued by the Publications Branch of the Signals Association, which has responded to a demand for a journal dealing with subjects of a technical and military nature connected with the Corps. The articles cover the more highly technical side of signal communications, various military subjects, the work of "signals" in past campaigns; and there are also articles on various branches of sport with which Signals officers are familiar.

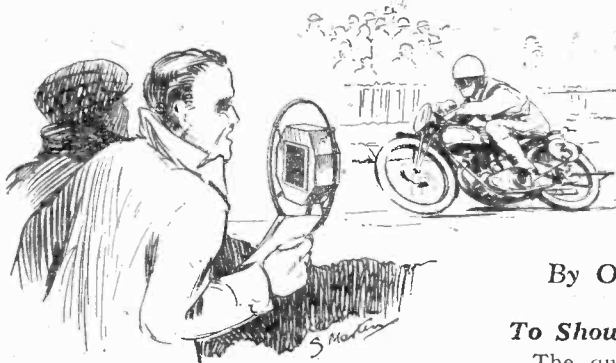


THE FIVE-METRE VIGIL. Members of the International Short-wave Club, London Chapter, photographed on the roof of the *Daily Telegraph* building in Fleet Street, on July 9th, while listening for signals from G6SM. Morse was picked up when the 'plane was at Aylesbury.

and "provocative propaganda" of certain foreign stations.

On July 8th all German stations broadcast an item referring to a certain statement broadcast by "a well-known station in Eastern France," which, it is felt, can have been none other than Strasbourg.

Contributions in the first number touch upon carrier telephony in military signals, the training of territorial (Royal Signals) recruits, the Signal Service in the Palestine Campaign, and other pertinent topics. The journal is obtainable, price 2s. 6d., at 95, Belgrave Road, London, S.W.1.



Broadcast Brevities

By Our Special Correspondent

Synchronisation Freaks

NOW that West National is actually working in synchronisation with London National during programme hours—the transmitter is now functioning daily between 8 and 10.50 p.m.—listeners are probably noticing some unexpected variations in signal strength.

During the early morning tests the B.B.C. engineers discovered that while the two transmitters were in synchrony there was a noticeable diminution of signal strength in London's western suburbs and even towards the east.

Phase Differences

This is not the page for a discussion of the mathematical aspect of the question, but the plain truth seems to be that phase differences are at work. Far from giving increased strength with a double transmission, the two waves actually tend in some districts to cancel each other.

Western National will enter into full service or on about Saturday, August 12th.

Problem for Balance and Control

LAST week the Balance and Control Section were eagerly discussing whether they would be required to make a public appearance at the Olympia Wireless Show in connection with the broadcasts from the great B.B.C. Concert Studio in the National Hall.

There is no doubt that a large percentage of visitors will know little and care less about Balance and Control, and are likely to think that the polished panels and gleaming knobs form a sort of soda fountain for hot artistes.

To Show or Not to Show ?

The question is whether the discerning few should be initiated into the rites of Balance and Control. If so, the engineers must, they feel, be spick and span, as likewise their apparatus. On the other hand, the Balance and Control can hide itself as in an ordinary O.B., the usual impromptu lash-up being used.

For my part I would prefer to see the engineers doing the job in the ordinary way. It is the curse of most exhibitions that everything is too sacredly clean and polished "for human nature's daily food."

R.M.A. Theatre

Apart from the theatre, which, incidentally, is being constructed by the R.M.A., the B.B.C. will not feature very much on their own account at Olympia, though there will be a small stand to represent the multifarious activities of the Corporation, ranging from the sale of portraiture to home cookery hints.

A Special Revue

Eric Maschwitz is arranging for an Olympic Revue, which will be given each night and broadcast twice during the period of the Show.

There will also be a vaudeville, which will be broadcast four times in all. The theatre will hold 1,500 people.

Dramatising the News

NEXT winter the News Studios at Broadcasting House may, it seems, be fitted up with an "effects" panel to enable the announcers to "hot-up" the bulletins.

The other day the method was tried very effectively; to each of the more important news items was appended a talk or gramophone record in keeping with the topic under review. So successful was the ven-

ture that H.R.H. the Prince of Wales, who happened to be listening, 'phoned the B.B.C. to express his appreciation of the new system.

A New Appointment ?

Now the B.B.C. is looking round for a news editor—a man combining the eagle eye and discrimination of a Fleet Street sleuth with the dramatic perceptions of a West End play producer.

Among the names which I have heard mentioned in connection with the new post is that of Cecil Lewis, who, despite his allegiance to the films, is still burning with enthusiasm for broadcasting, and teems with ideas for new methods of presentation.

When Good News is Bad

Bad news, of course, will always offer better opportunities to the Effects Department, who will only be able to express themselves adequately when the bulletins tell of war, revolutions, accidents and sudden death. However, a new technique will probably be devised to give flavour to the more hum-drum events. Here music would be of inestimable help in tiding over the dull days of peace and plenty—when pastoral symphonies would form a background to the announcer's voice—until the next outbreak of human passions would set the big drum banging.

A New Music Committee ?

THE rumour that Mr. Arthur Bliss, the composer of "Rout" and "Morning Heroes," has been appointed to a position in the B.B.C. is untrue.

Nevertheless, the idea is being explored of appointing a small committee of first-class musicians to assist Dr. Adrian Boult.

A Big Job

The B.B.C.'s Director of Music has a tremendous responsibility, for he caters for one of the biggest audiences in the world, and, as anyone knows who has ever prepared a concert programme, the difficulty of entirely pleasing even a fraction of an audience is formidable. The wonder is that Dr. Boult has interpreted public opinion so cleverly in the past. Even a small committee should be of immense help.

Promenade Concerts, 1933

NO one looks for any outstanding change in the general arrangement of the Promenade Concerts, and it is satisfactory to note that the 1933 season, which opens on August 12th next, will follow the old and tried tradition.

New Artistes

Saturday nights will, as usual, be "popular." Bach and Brahms evenings will be given on alternate Wednesdays, while, as of old, Mondays will be devoted to Wagner and Fridays to Beethoven. Tuesdays and Thursdays are left open for miscellaneous programmes, and it will be on these nights that British music will be included. There will be no exclusively "British nights."

No fewer than fourteen artistes, new to these concerts, will appear in the course of the season. They will include Elsie Board-



A FLOURISH FROM RABAT. Even the mace-bearer made his appearance before the Radio-Maroc microphone when the Sultan's Black Guard (Garde Noire) turned out to give listeners an evening of military music.

man, Samuel Dushkin, Mary Jarred, who sang in "The Ring" at Covent Garden; Kendall Taylor (in the first Beethoven piano concerto) and Samuel Worthington (bass).

A "Prom." a Night

Every "Prom." concert will be broadcast from one or other of the B.B.C. stations, so that from August 12th to October 7th no listener will be able to complain of the lack of serious music.

A Guessing Game

A MEMORY test will be imposed upon listeners to the National programme tomorrow evening (Saturday), when "Sound Pictures" is presented. In this programme the gramophone combines with the Blattnerphone to present five groups of sound pictures, which will include well-known dance refrains, sounds, musical compositions, voices and plays. Listeners are invited to identify each picture, and the solutions will be given at the end.

Song Plugging

THERE is a mistaken notion that, if the B.B.C. pays dance-band leaders, it will be able to compile the programmes. This is not so, for it is one of the functions of

DISTANT RECEPTION NOTES

Over-Modulation: 500 kW. from U.S.

FELLOW listeners may have noticed that Toulouse has returned, temporarily at any rate, but, I hope, permanently, to the ranks of the broadcasters. I came upon the transmission quite unexpectedly when tuning upwards in the neighbourhood of 380 metres a few evenings ago. There was no doubt about it, for the call-sign was given at the end of the item then in progress.

I have a report that Kalundborg has been conducting tests with a new transmitter late in the evenings, but I cannot claim to have heard the station myself, mainly because interference has been so severe of late. The gigantic 200-kilowatt Luxembourg is working with a frequency separation of only 8 kilocycles and interference is also experienced on occasion from a Russian station working on a wavelength between the two.

Monte Ceneri, the Italian-Swiss station, has been adding to the already sufficient troubles of Kalundborg by "jumping" a wave-length only a few metres below that of the Danish station. There seems to be no excuse for this, since Switzerland is not

to be heard on favourable nights? The best time is round about two o'clock in the morning. I cannot claim to have "sat up for America," but I made the discovery that stations were to be received on my coming down for a cigarette during a night when insomnia had me in its horrid grip. There is a good deal of fading now on these transmissions, but it is surprising to find how many can be picked up from both the United States and South America. WPG and WCAU are almost all-the-year-round stations nowadays.

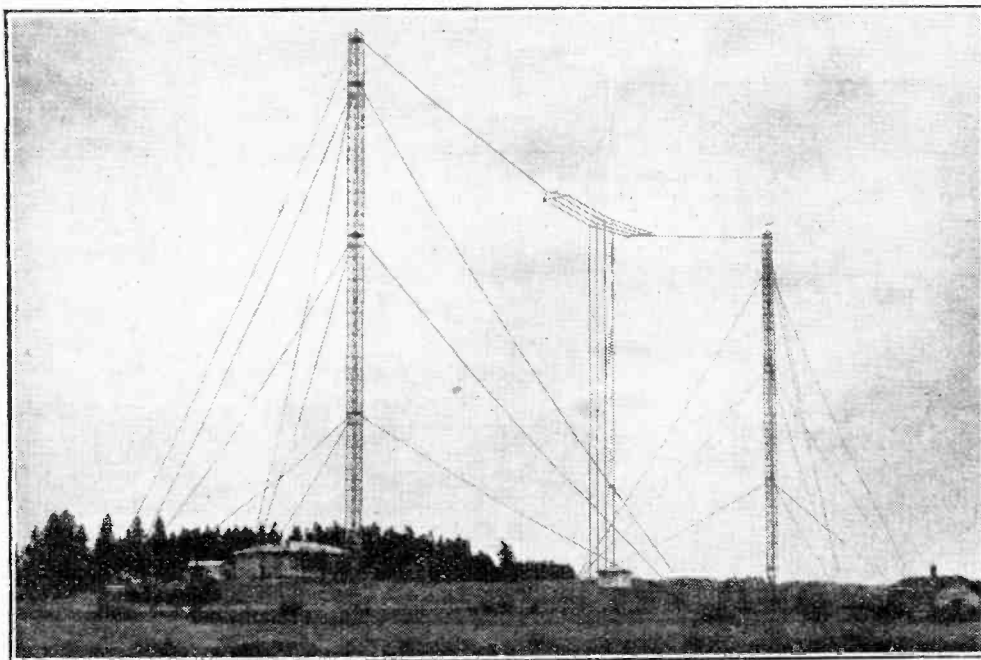
Will U.S. Jam Europe?

If conditions continue to be as good as they are now you may require to use the volume control rather than the reaction knob when the 500-kilowatt WLW comes into action. Nor should I be surprised if this station caused fairly serious interference with certain European transmitters from an hour quite early in the evening in winter time. If America builds any more of these giants the next Broadcasting Conference may have to be a World affair instead of confining itself to Europe and parts of Asia and Africa.

Atmospherics continue to be something of a nuisance, though, fortunately, there are evenings when they are absent altogether or so mild that they do not cause much trouble.

The number of stations receivable at full loudspeaker strength shows signs of diminution at the present time. Outstanding transmissions from the Continent are Huizen, Radio-Paris, Zeesen, Warsaw, Luxembourg, Brussels No. 1, Prague, Lyons Doua, Rome, Katowice, Breslau, Hilversum, Turin, Trieste and Fécamp. There are many other fine stations, but these are the pick.

D. EXER.



THE MODERN TOUCH IN FINLAND. A general view of the often-heard broadcasting station at Viipuri, showing the up-to-date aerial system. Copper concentric feeders convey the energy from the transmitter to the four-wire aerial, which is nearly 400ft. high. The 10-kW transmitter was built by the British Marconi Company.

a dance-band leader that he should plan his own entertainment.

Moreover, early experience has shown that it is impossible to draw up dance programmes in advance. When a band is performing in public there are so many requests for various numbers that the leader cannot hope to stick to a prearranged plan.

An Expensive Policy

The real advantage in paying the dance bands would be that the bands themselves would be under a much greater obligation to the Corporation, and would, presumably, be less financially susceptible to the wiles of the music publishers.

The cost to the B.B.C. of subsidising the various dance bands is estimated at £15,000 per annum.

allotted a channel on the long waves under either the Prague or the Lucerne Plans.

One point of great interest about the Lucerne Agreement is the clause whereby administrations bind themselves to avoid all over-modulation likely to cause interference with other stations. It is very much to be hoped that this will be faithfully applied to transmissions of speech, for there is no question that sideband splash, now amongst the worst forms of interference on the wave-band allotted to broadcasting, is due to the use of too great a depth of modulation when speech is being sent out. Myself, I hope that at the next Conference the percentage of modulation permissible for speech transmissions will be strictly regulated.

Have any readers noticed that many of the medium-wave American stations are still

FOREIGN BROADCAST GUIDE

BELGRADE

(Jugo Slavia).

Geographical position: 44° 49' N.; 20° 27' E.

Approximate air line from London: 1,005 miles.

Wavelength: 430.4 m. Frequency: 697 kc/s.
*Power: 2.8 kW.

Standard time: Central European (tallies with B.S.T.).

Standard Daily Transmissions.

09.30 B.S.T., physical exercises (Sun.); 10.00, sacred service (Sun.); 11.00, gramophone records; 11.57, time signal, carillon concert; 15.00, concert, children's hour; 20.00, main evening entertainment; 22.00, news, gipsy music.

Announcer: Woman.

Call: *Hallo, Radio Beograd!*

Interval signal: Musical box melody (Serbian Folk song) as under:—



Closes down with good-night greetings: *Radio Beograd zeli svima svojim slusacima; laku noc* (Belgrad wishes all her listeners good-night); *ne zaboravite da spojite antenu sa zemljom* (do not forget to earth your aerial), followed by National Anthem.

Associated Transmitters: Zagreb, 307 m. (977 kc/s.), 0.7 kW.; Ljubljana 574.7 m. (522 kc/s.), 7.0 kW.; Skopje, Split, Subotica (in course of construction).

* A new high-power transmitter is nearing completion.

Correspondence

The Editor does not hold himself responsible for the opinions of his correspondents. Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Stamford Street, S.E.1, and must be accompanied by the writer's name and address.

A New Symbol ?

THE standardisation of all symbols used for circuit representation is undoubtedly highly desirable, and I would express myself in complete agreement with Mr. Tyers in his letter published in your June 30th issue, for the adoption of a broken line "core" figure to distinguish iron dust transformers.

I would also suggest the adoption of a standard symbol for the indication of an intermediate-frequency transformer. It will be found that the distinctive symbol most generally used both in American and European laboratories is a "core" consisting of three large dots. This figure particularly simplifies the identification of the first I.F. transformer in a superheterodyne circuit, a factor which is not always immediately apparent in modern mixer circuits.

Finally, might I commend to your notice a symbol for a trimming condenser in almost universal use outside this country which, I

Television

PROPOS your editorial on television. What is this television?

Has it anything to do with those very queer noises we hear on the wavelength of London National when it should be shut down, and the other sounds of people enjoying themselves to alleged comic songs and piano music in the region of Midland Regional?

I have had a wide experience in wireless circles, and know many of the leaders in this part of the world, but I have never yet seen a television set, never seen anyone who has one, or, what is more strange, never seen or spoken to anyone who has seen or spoken to anyone who knows anyone who has a television set or knows anyone who knows anyone who has, or has had, or intends to get, a chance to look at a television set!

Possibly, if the transmissions were done in the North (where the intelligent people

can City (50.26) can be tuned in equally as easily at full loud speaker strength.

I make a point of listening to the Empire News at 11.10 p.m. each night, and often also at 1.40 a.m. What is specially remarkable—my set is installed in a basement.

The set is a superheterodyne, and I convert it for short-wave reception merely by connecting the aerial leads to a 5-turn plug-in coil, with centre tapping on the first turn. A 20ft. length of insulated aerial wire stretched across the room serves as an aerial.

S. J. NOEL-BROWN.
Portman Square, W.1.

Synchronised Transmitters

NOTICE in "Broadcast Brevities" that the B.B.C. are congratulated on synchronising two of their transmitters.

It seems to me that after sunset listeners within the service area of one transmitter and outside the other will have a fine time with their volume-controlling devices. Stations broadcasting on 260 metres or less receive a hefty push from the Heavyside Layer after dark, and this will result in the steady voltage in the receiving aerial from the "local" being supplemented with sudden reinforcements of power arriving from the "distant" synchronised station. Of course, fading cannot occur, but overloading may; this may be bad enough to force one to turn for relief to Daventry 5XX, in spite of its inferior quality. Anyway, we shall see!

CLEMENT R. MOSCROP.
Aylesbury, Bucks.

The A.V.C. Unit

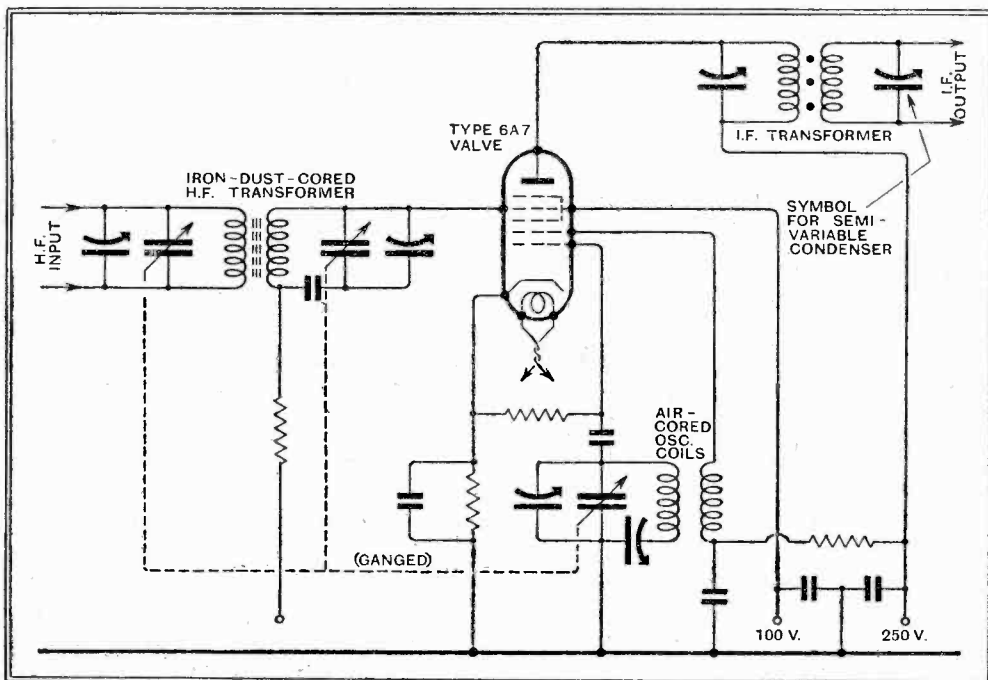
MAY I point out an application of *The Wireless World* A.V.C. unit described in the issue for March 31st which may be of interest to some of your readers?

When trying to gang my set accurately, I found that the deflection of the milliammeter in the anode circuit to indicate resonance was so small that greater accuracy could be obtained by ear. I constructed the A.V.C. unit, and connected it up, omitting the connection to the grid return lead of the controlled valve, and substituted a milliammeter for the biasing resistance R₄.

The set and the unit were switched on, and the meter adjusted to read zero by means of the potentiometer R₅. When the set was tuned through resonance, the meter showed quite a large current reading. By choosing a suitable valve for the A.V.C. unit, an indication of resonance can be obtained from quite a small signal, even if the meter is not very accurate.

Actually, my meter reads up to 10 milliamps., and as the total anode current of the detector valve is only about 1.5 mA, only a very strong signal would cause an appreciable deflection if the meter were connected in the detector anode circuit. By the above method I have succeeded in ganging my set accurately, and the arrangement is also useful for calibrating the set. It can be quickly converted back to an A.V.C. unit.

D. P. C. HEPBURN.
Loscoe, Nr. Derby.



Suggested new symbols are illustrated in this representative circuit.

am sure, could be adopted with advantage. This takes the form of single short heavy lines which indicates either the fixed earthed plate(s) or the plates which are at the lower H.F. potential, while the moving plate(s) are shown as a curved line of similar length, terminating in an arrow head.

The symbol at present used to illustrate this component in circuits appearing in *The Wireless World* admirably fulfils most requirements, but it can quite easily lead to confusion in a less excellently printed paper, either through line-block defects or the use of poor paper.

A portion of a modern mixer circuit using these symbols is given in the accompanying diagram.

G. S. HOLIDAY.
Mill Hill, N.W.7.

are), the television folks may make some progress. What do you think?

LEWIS J. WOOD.
Hon. Sec., Halifax Wireless Club.

London Reception of Daventry Short Waves

AS I understand that the reception of the B.B.C. Empire short-wave programmes in London is unusual, you may be interested to know that I tune in to the African and West African and Canadian Zone programmes nightly—GSA, 49.59 metres, and GSB.

I receive these stations at full loud speaker strength. Tuning is by no means difficult, and Moscow (50 metres) and Vati-

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

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EDITORIAL COMMENT

Wireless Propaganda *The Risk of International Friction*

MANY times in the past we have referred to the risk which is always present that broadcasting may be used for purposes of propaganda unfriendly to a neighbouring State and completely out of harmony with the B.B.C. motto, "Nation Shall Speak Peace Unto Nation."

Just recently unfortunate incidents have occurred in connection with the Strasbourg station, which has been accused of an unfriendly action of this kind.

Under existing conditions it seems certain that broadcasting stations would be put to use as distributors of propaganda matter immediately if any serious incident occurred to upset the comparatively good relations at present existing between the nations of the world. It is hardly to be hoped that broadcasting could fail to be drawn into the general scheme and utilised as a propaganda instrument in the unhappy event of actual hostilities.

But surely some steps might be taken internationally to guarantee that in times of peace broadcasting stations should avoid issuing any matter calculated to be regarded as deliberately offensive to neighbouring countries. It would indeed be a tragedy if broadcasting, which we regard as a magnificent vehicle for friendly intercourse between nations, should itself come to be the cause of international strife. Broadcasting differs from the Press in that in the majority of countries broadcasting stations are directly under the control of the State and, therefore, the State is liable to be regarded as responsible for the nature of the transmissions where these are concerned with political issues. News-

papers, on the other hand, are generally independent of Government control, and the expressions of opinion which they print are not, therefore, regarded as having the endorsement of the Government of the country.

It would be well for an early attempt to be made to obtain some form of international agreement on this question.

Relay Services

Should They Pick and Choose ?

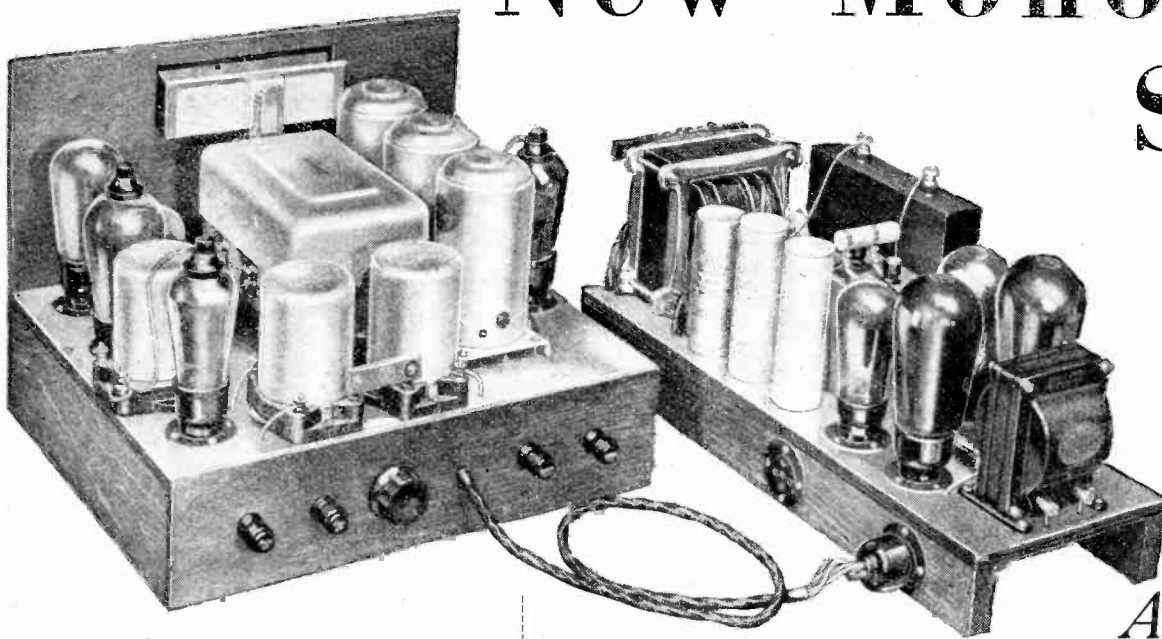
WHILST touching upon the subject of propaganda and the distribution of broadcast matter, we cannot refrain from drawing attention to the peculiar position of the relay services which have been developed in various parts of the country.

Relay services are apparently left free to pick and choose what items they will from the B.B.C. programmes and programmes from abroad. True, they are not permitted to originate matter of their own, but with so wide a choice as is available to them it is almost equivalent to giving them permission to do so. Again, whilst we have recently had an assurance in the House from the Postmaster-General that relay services are not entitled to receive remuneration for relaying particular programmes, yet, nevertheless, it is a fact that they are in the habit of relaying programmes from stations outside the B.B.C. control and sponsored by advertisers.

It is difficult to understand why a policy laid down by the Postmaster-General to be observed by the B.B.C. should not be equally applicable to relay services, and the question of whether or not the relay services receive payment for the retransmission of sponsored programmes seems to us to be only a minor point in a question of general principle.

The New Monodial Super

Constructing
and Operating
the New
Superheterodyne



A FULL account of the theoretical side of the new superheterodyne appeared in last week's issue of "The Wireless World," while constructional details and initial adjustments are dealt with in the present article. In spite of the exceptionally high performance of which the receiver is capable, these operations are essentially simple and need occasion no difficulty even to the inexperienced.

By W. T. COCKING

THE receiver is constructed on a chassis built of aluminium covered plywood, which may be obtained ready built with the large holes drilled. With the exception of the valveholder for the Pentagrid, the valveholders are all mounted with their main bodies on the upper side of the base, and their legs projecting through large diameter holes. No British Pentagrid valve is as yet available, and the valve specified is of American origin, and is fitted with an American type 7-pin base. Consequently, an American valveholder is necessary, and this cannot readily be mounted in the same manner as the others. This valveholder, therefore, is mounted on the underside of the chassis, and the hole in the base is large enough to accommodate the base of the valve.

When wiring up the circuits of this valve it should be remembered that the control grid is mounted on the top of the bulb, not the anode, as in British valves. There is no terminal on the valve, merely a metal boss, and for the connection it is necessary to use the special clip provided. The valve is rated for a heater potential of 2.5 volts at 0.8 ampere, so that it is necessary for a resistance to be included in its heater circuit. This resistance R3 has a value of 2 ohms, and the actual heater potential is slightly under 2.5 volts.

Checking the Operation

Apart from these points, the construction is entirely straightforward, but it should be noted that it is necessary for the base to be cut away slightly to accommodate the volume control. In most places the wiring is carried out with No. 22 tinned copper wire run in small diameter sleeving, and in certain cases screened leads are used. It is important that the screened sleeving be of the type specified or of similar characteristics, and that the internal wire be no heavier than

No. 22 gauge. Thick rubber-covered metal braided wire or motor car type armoured cable must not be used.

The inter-unit cable must have two heavy members for the heater current, and if an excessive voltage drop is to be avoided these must be of at least 70/36 gauge and no longer than 30in. The speaker connections will depend upon the type of loud speaker used, and six alternative arrangements are shown in Fig. 1. The output transformer employed is of importance if the best results are to be obtained; it should have a primary inductance with no D.C. of not less than 60H, and be of such ratio that the average

primary impedance is about 10,000 ohms. With Magnavox dual speakers this calls for a ratio of 112-1, and with Rola dual speakers a ratio of 100-1. A single Magnavox speaker, however, would call for a ratio of 79-1, and a single Rola a ratio of 70-1; the B.T.H. R.K. Senior speaker needs a ratio of 25.8-1, and the Ferranti M.1 a ratio of 25-1.

When the set has been switched on for a quarter of an hour or so the various voltages and currents should be checked over to make sure that they are reasonably in accordance with the figures of the Table given herewith. Any wide discrepancy would indicate a defect in the receiver or a valve,

TABLE.

Valve.	Meter Reading.			True Voltage.			Current.	
	Anode Volts.	Screen Volts.	Grid Volts.	Anode Volts.	Screen Volts.	Grid Volts.	Anode Current. mA.	Screen Current. mA.
H.F. VMS4.....	200	58.5	- 1	200	68	- 1.03	7.3	1.7
Freq. Chan. 2A7:								
Tetrode.....	200	58.5	- 1	200	68	- 1.03	2.25	1.45
Osc.....	87	—	—	168	—	—	1.6	—
I.F. VMS4.....	200	58.5	- 1	200	68	- 1.03	5.2	1.1
2nd Det. DD/Pen.	23.5	83	- 1.9	24	116	- 1.3	8.95	4.2
L.F. MHL4.....	184	—	- 5.5	184	—	- 5.85	6.85	—
Output PX4:								
1.....	270	—	-35	270	—	-38	38	—
2.....	270	—	-36	270	—	-40	40	—

Volts across C31 .. 460 volts.
C30 .. 443 volts.
C29 .. 280 volts.
C28 .. 200 volts.

Total measured current through Ch4 = 118 mA.

All readings taken with Avometer, mains voltage 240 volts connected to 240 volts tapping on transformer, set tuned to no signal. The columns headed True Voltage are corrected for the load imposed by the meter in the measured voltage columns.

The New Monodial Super—

but no notice need be taken of a general rise or drop in voltages by some 10 per cent., since this may be due merely to the mains voltage being different from its rated value. Such a change in voltage, of course, would be accompanied by a similar, although usually smaller, change in current; low voltages accompanied by abnormally high currents or high voltages with low currents would show a defect in the receiver.

Preliminary Adjustments

Having made certain that the operating conditions are in order, it remains to carry out the initial adjustments of trimming and ganging, and here a milliammeter connected in the anode circuit of the DD/Pen. at the point "X" is of great service. The meter should give a full scale deflection for 10 mA. or 12 mA. At first, the I.F. coil couplings should be set fairly close together, and in any location it should be found possible to obtain some signal; this should be tuned in as accurately as possible, and the I.F. adjustments proceeded with.

The I.F. couplings should next be loosened as much as possible without completely losing the signal, retuning if necessary, and the coil cans replaced. Each I.F. trimmer must then be adjusted for maximum response. Some trimmers will be more critical than others, but a definite optimum setting on each should be obtained. If the signal is weak this adjustment must be carried out by ear, for the meter deflection will be too small

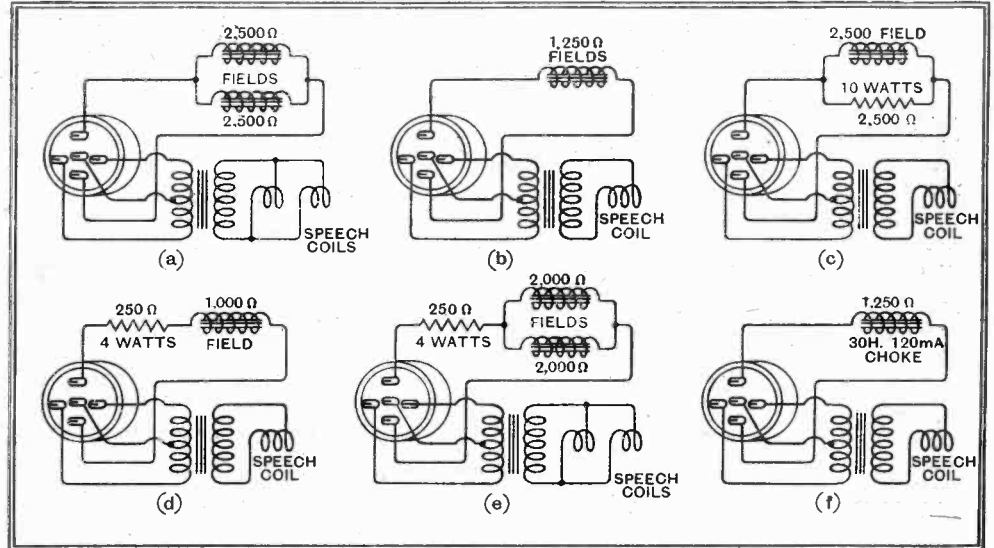


Fig. 1.—The various speaker connections for different cases are illustrated, at (a) for dual speakers with 2,500-ohms fields, at (b) for a single 1,250-ohms speaker, at (c) for a single 2,500-ohms field, at (d) for a single 1,000-ohms field, at (e) for dual 2,000-ohms speakers, and at (f) for a non-energised speaker.

to be observed. With a strong signal, however, the meter is essential, for, owing to the action of A.V.C., the ear is not sufficiently critical. A really accurate adjustment can only be obtained with the aid of the meter and with a strong signal.

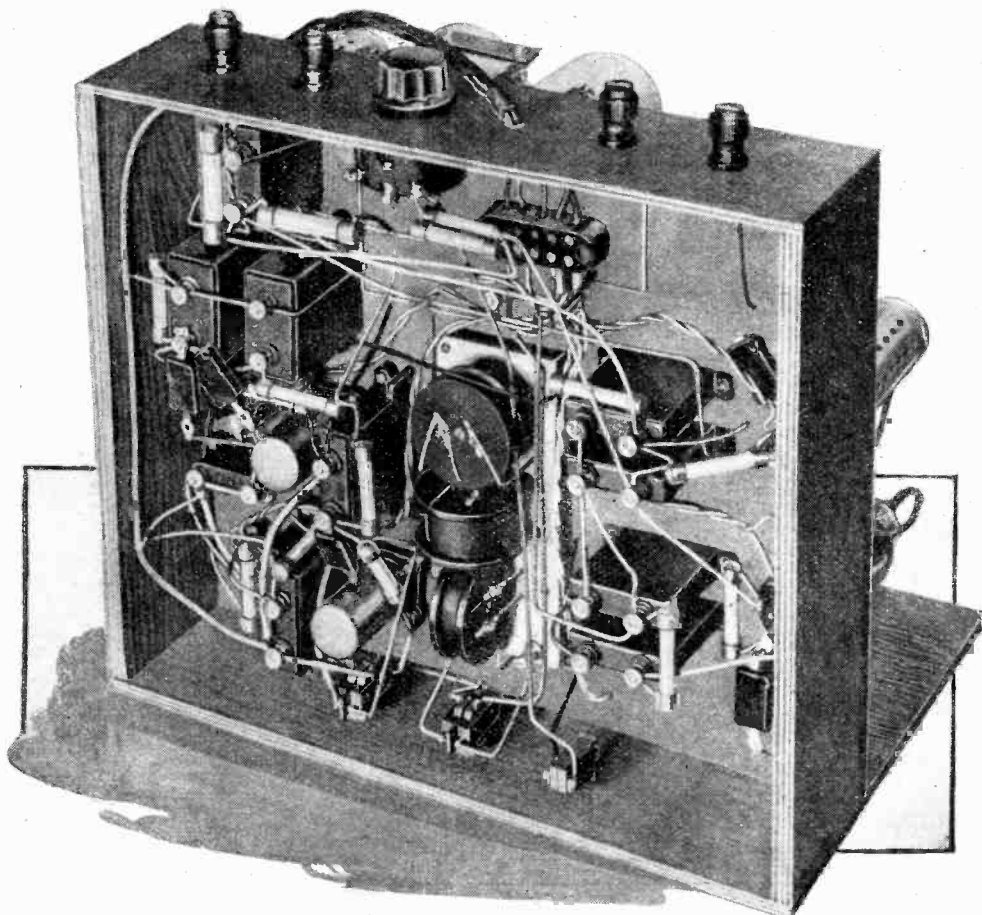
When a rough preliminary adjustment of the I.F. trimmers has been obtained in this way the coil couplings should receive attention. Each coil coupling must be set for maximum signal strength, whether judged audible or by the change of current indicated by the meter. The I.F. cir-

cuits are now roughly adjusted, but, before paying great attention to their precise adjustment, it is as well to make sure that their frequency is correct.

The Final Ganging

The input circuits should, therefore, next be roughly ganged. The oscillator trimmer should be set to about one-half of its capacity and a very low wavelength station tuned in. The two pre-selector trimmers should then be adjusted for maximum response; in general, that on C2 will have to be nearly fully screwed home, and that on C1 nearly fully unscrewed. A station on some 500 metres should next be found, and the oscillator trimmer adjusted while rocking the tuning dial backwards and forwards over a few degrees until the optimum combination of settings be found. A return should then be made to the low wavelength station, and the two pre-selector trimmers readjusted. The I.F. frequency can now be checked. If all is in order, a whistle should be heard when receiving a station on a frequency 220 kc/s lower than that of the local station. Thus, in the London area, a whistle will be found on North Regional due to second channel interference from the London Regional. The frequency of the latter station is 843 kc/s and that of the North Regional is 625 kc/s; the difference is 218 kc/s; consequently, when tuned accurately to North Regional with a 110 kc/s intermediate frequency, the whistle would have a frequency of 2,000 cycles. Its note, however, will vary with the setting of the tuning dial. Another similar whistle will be found between Breslau and Goteborg, due to second channel interference from the London National. Even if other whistles are present at this stage, the particular ones due to second channel interference can readily be picked out owing to their strength.

If the second channel whistle is from 215 to 225 kc/s lower than the frequency of the local station, the I.F. adjustment can be taken as correct, but if it be found



The low-pass filter can be seen in the centre of the chassis, above its controlling switch.

The New Monodial Super—

to occur at some other frequency, all the I.F. trimmers must be appropriately altered. Thus, it is not uncommon to find that the whistle occurs on Brussels No. 1 in the London area. This means that the intermediate frequency is 127 kc/s, and is too high for accurate ganging to be maintained. The frequency must be lowered by increasing the capacity of all I.F. trimmers, and this is accomplished by rotating the adjusting wheels all in an anti-clockwise direction when viewed from above.

Full-size blue print of this receiver, including the power unit, is available from the publishers at 1s. 6d., post free.

When the correct frequency has been obtained, a strong signal should be tuned in so that the meter needle is deflected by several milliamperes and a change in current is easy to detect. Each trimmer can then be accurately adjusted for maximum change in current, and the couplings readjusted for the same condition. The ganging can then be similarly readjusted, using the meter as an indicator, and no difficulty should be experienced with a good aerial in obtaining a large deflection even in daylight from such stations as Fécamp and Brussels No. 1. As before, the adjustment on the low wavelength station is to the pre-selector trimmers, and is for maximum response, as indicated by maximum change of current on the indicating meter. On the high wavelength station the oscillator trimmer is adjusted while rocking the tuning dial for the best combination of settings. After this adjustment it is always necessary to return to the lower wavelength, and retrim the two pre-selector circuits.

Long-wave Ganging

When the medium waveband ganging has been completed, attention can be paid to the long-wave adjustment. This is only to the padding condenser C4; the tuning dial should be set to about 60° and C4 adjusted until Daventry National is heard. Huizen should then be receivable at a higher dial setting, and C4 can be adjusted while rocking the tuning dial backwards and forwards until the optimum combination of settings is found.

The adjustments are now completed, and the receiver can be tested. The manual volume control will be found to give a smooth and gradual change of volume from maximum to minimum; the latter is very low, but does not represent complete extinction of the signal. The A.V.C. system should hold all stations at the same volume as set by the manual control, except those which are too weak to bring the control into action and those which employ a different level of modulation from the usual. These include many French stations, and it will usually be found that Radio Paris in particular is received at greater strength than other

stations, because its average modulation depth is greater. The volume variations of fading should be entirely absent, except when it is so severe as to amount virtually to complete extinction of the signal.

The Switches

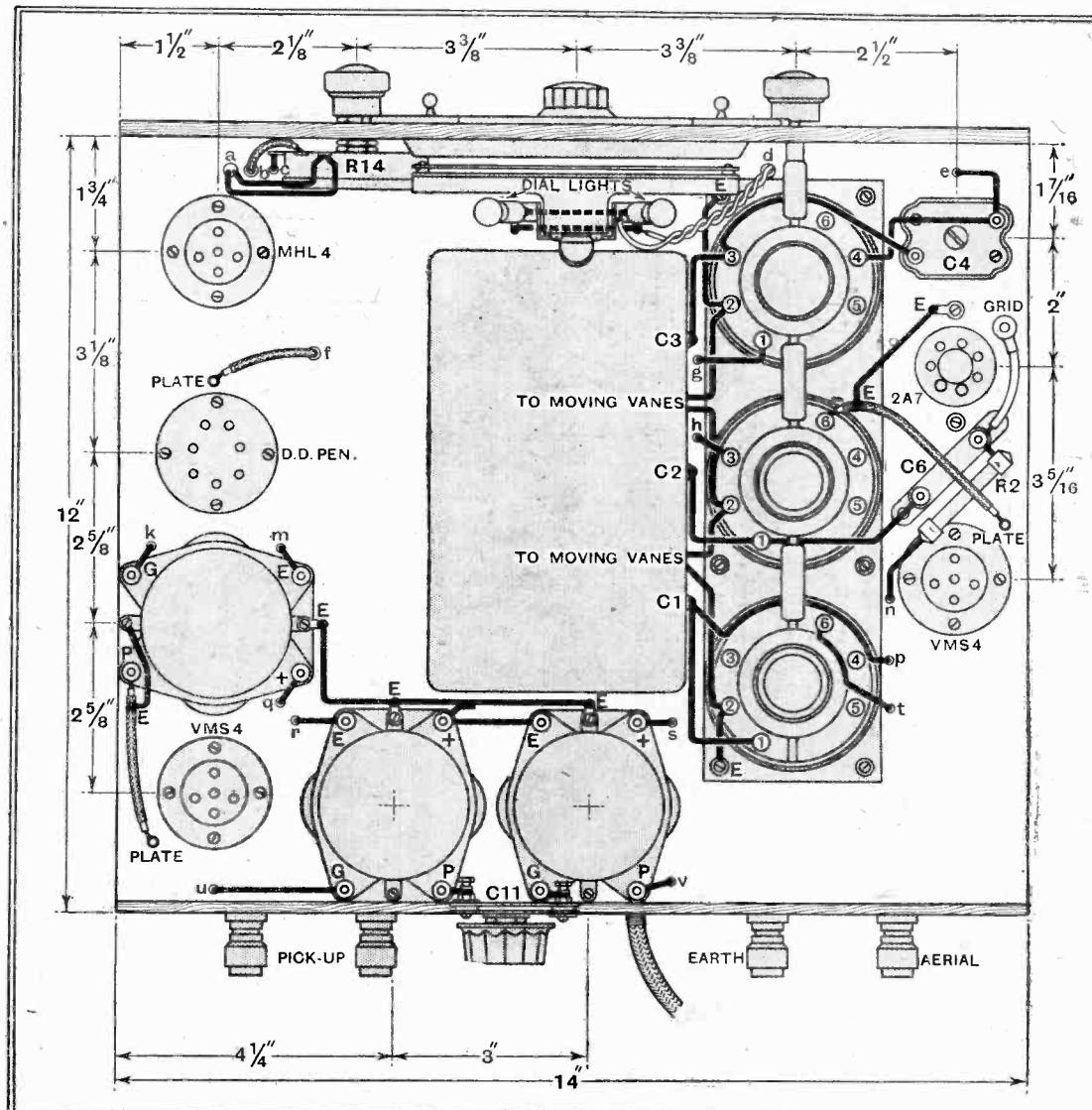
Background hiss should prove negligible on all but the weakest of signals with any reasonably good aerial, and the sensitivity is normally sufficient to provide full loud speaker volume from any station stronger than the generally prevailing mush level. With the switch S3 in the upper position, the quality of reproduction should be really first class, and the lowest and highest frequencies fully represented. With the switch in the lower position the high-frequency response will be restricted to 3,500 cycles, and the quality will deteriorate, although not as much as one might expect. Indeed, on certain transmissions in which there is only a small amount of the upper register, it is difficult to detect any change in quality. True sideband heterodyning will normally be completely absent with the switch in this position.

The maximum volume obtainable on both radio and gramophone is sufficient for all normal requirements, and for ordi-

nary domestic use, where the volume control will be somewhat retarded, there should be a complete absence of overloading effects on even the loudest passages. On gramophone, it should be noted, the low-pass filter can still be used if desired, and here it will serve to remove all traces of needle scratch.

The purpose of the switch S1 and the resistance R9 have yet to be explained. The normal condition of the receiver is with this switch closed, and the sensitivity is then at its maximum. As a result, the process of tuning is apt to be rather noisy; the maximum sensitivity of the set is exceptionally high, and with the switch closed is always present when the set is not tuned to a station. Atmospherics and local interference, therefore, present an annoyingly strong background. As the set is tuned into a station the sensitivity decreases, but it is still abnormally high until exact resonance is obtained. While tuned to the sidebands, therefore, distorted reproduction is found. For correct results it is essential that the tuning be really accurate, and it is a help, therefore, if the meter at "X" be left permanently in circuit to serve as a tuning indicator; it is by no means essential, however, for

PRACTICAL WIRING DIAGRAM OF



The layout of components and wiring in the receiver unit is readily apparent

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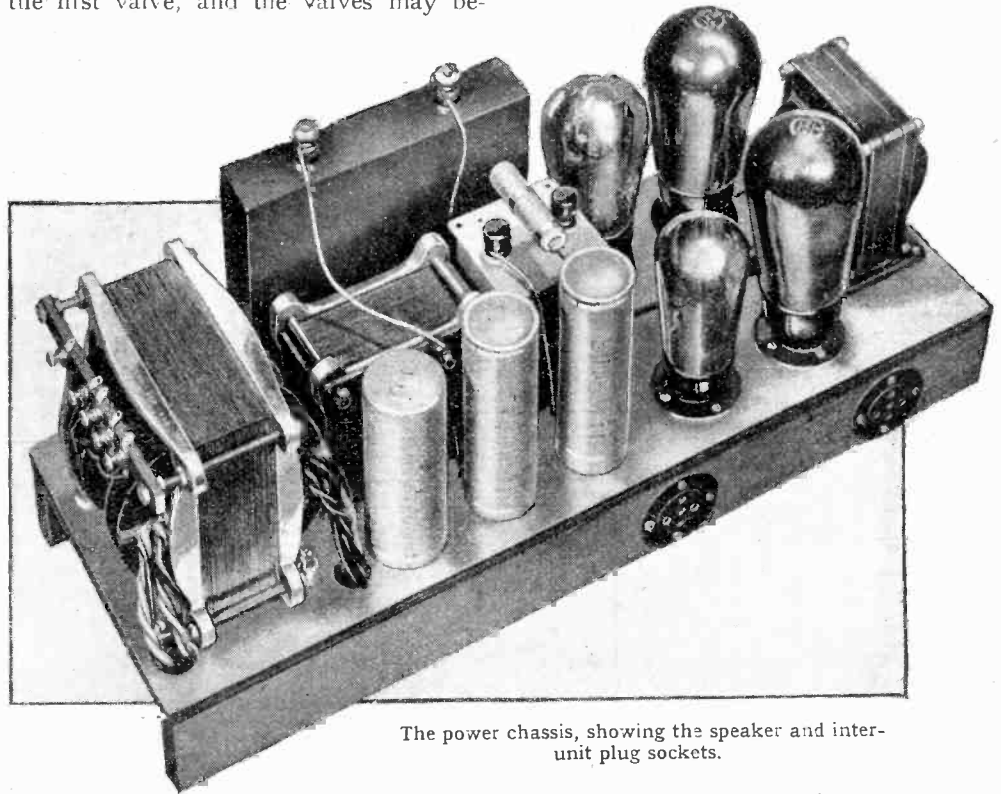
it is quite easy to arrive at the correct condition by ear.

It will be evident, therefore, that during the process of tuning a reduction in the maximum sensitivity is desirable. This is achieved through the use of R₉. With the switch S₁ open, R₉ should be adjusted so that the background found with the set not tuned to a station is as loud as can be comfortably tolerated. During tuning, therefore, the switch is kept open, and nothing louder than the predetermined level will be found. When a station is tuned in, the switch can be closed; if the station is strong there will be no change in apparent volume owing to the A.V.C. system, but there will be a change in the meter reading. If the station is weak, of course, volume will increase. Although there will be no change of volume on closing the switch with a strong signal, it is advisable to do so in case the station starts fading, for if the switch be left open A.V.C. may fail to compensate fully for fading.

The second use of the switch is for local reception. The A.V.C. system will hold the output constant provided the input to the H.F. valve does not exceed about 1 volt; when the set is used with a good

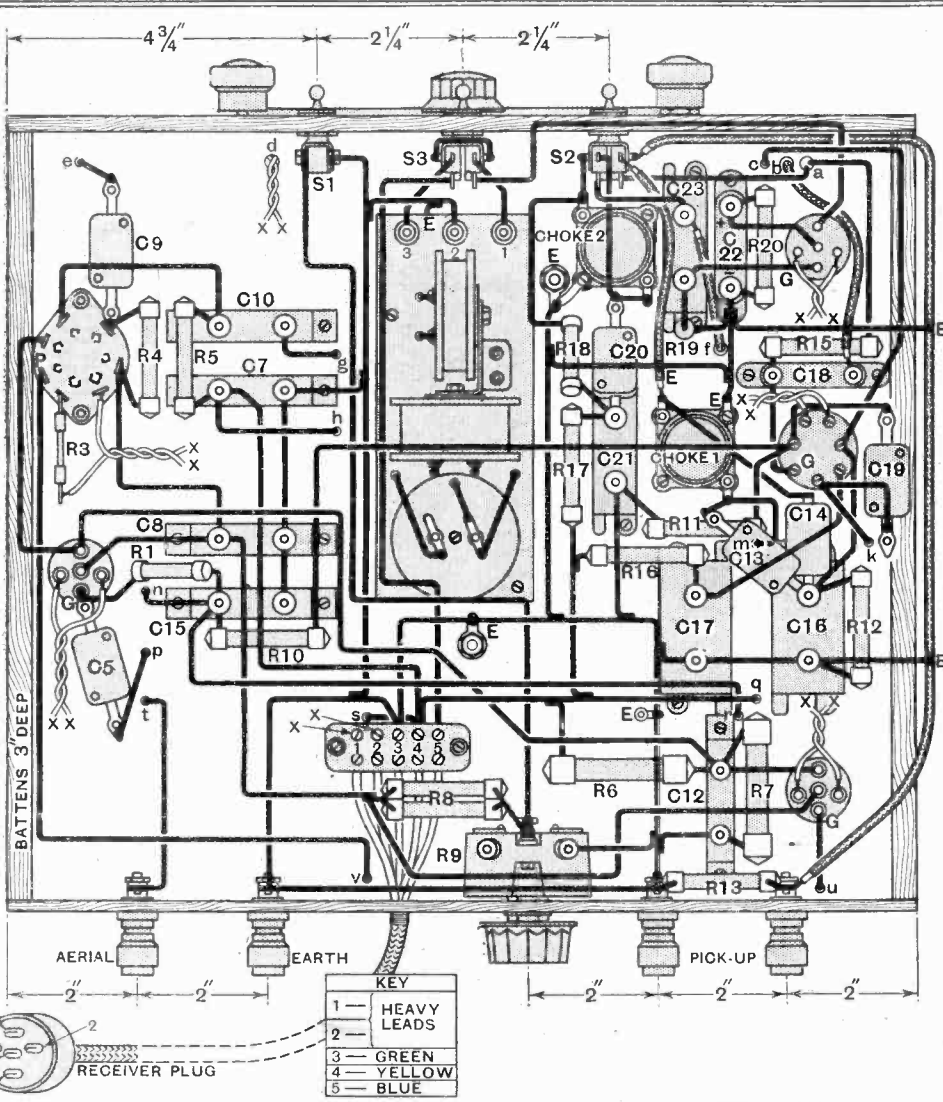
aerial close to a local station, however, some 5 volts or more may be found on the first valve, and the valves may be-

come overloaded. It is usually the I.F. stage which overloads and makes it



The power chassis, showing the speaker and inter-unit plug sockets.

THE NEW MONODIAL SUPER



impossible for the A.V.C. system to provide sufficient bias voltage. Should it be found, therefore, that reproduction from the local station is distorted with the switch S₁ closed, it should be opened and R₉ should be adjusted to such a value that good quality is secured. This point will usually be just short of that at which it begins to have an effect upon the volume.

Every station which is separated from its neighbours by 9 kc/s or more should be receivable without interference, and if use be made of the switch S₃ even stations separated by 5 kc/s can be made to give enjoyable results. The dial settings are bound to vary somewhat with different sets owing to variations in the components, so that little purpose would be served by giving a list of dial settings. In general, however, they will be similar to those of the original Monodial A.C. Super,¹ and the list given for this may be taken as a rough guide. The tuning range has been measured, and was found to be 1,500-525 kc/s and 395-145 kc/s, corresponding to 200-570 metres and 760-2,060 metres.

Mounting the Receiver

The question of cabinets for this receiver has been left to the choice of the constructor, since this is a matter in which personal preference counts for more than technical merit. It may be mentioned, however, that suitable types are obtainable from a number of firms, including Peto-Scott Co., Ltd., and The City Accumulator Co., Ltd.

If the cabinet selected be arranged to include both set and speaker it is wise to mount the receiver chassis upon rubber

¹ *The Wireless World*, April 13th, 20th, and 27th, 1932.

It will be noted that a minimum of leads passes through the base.

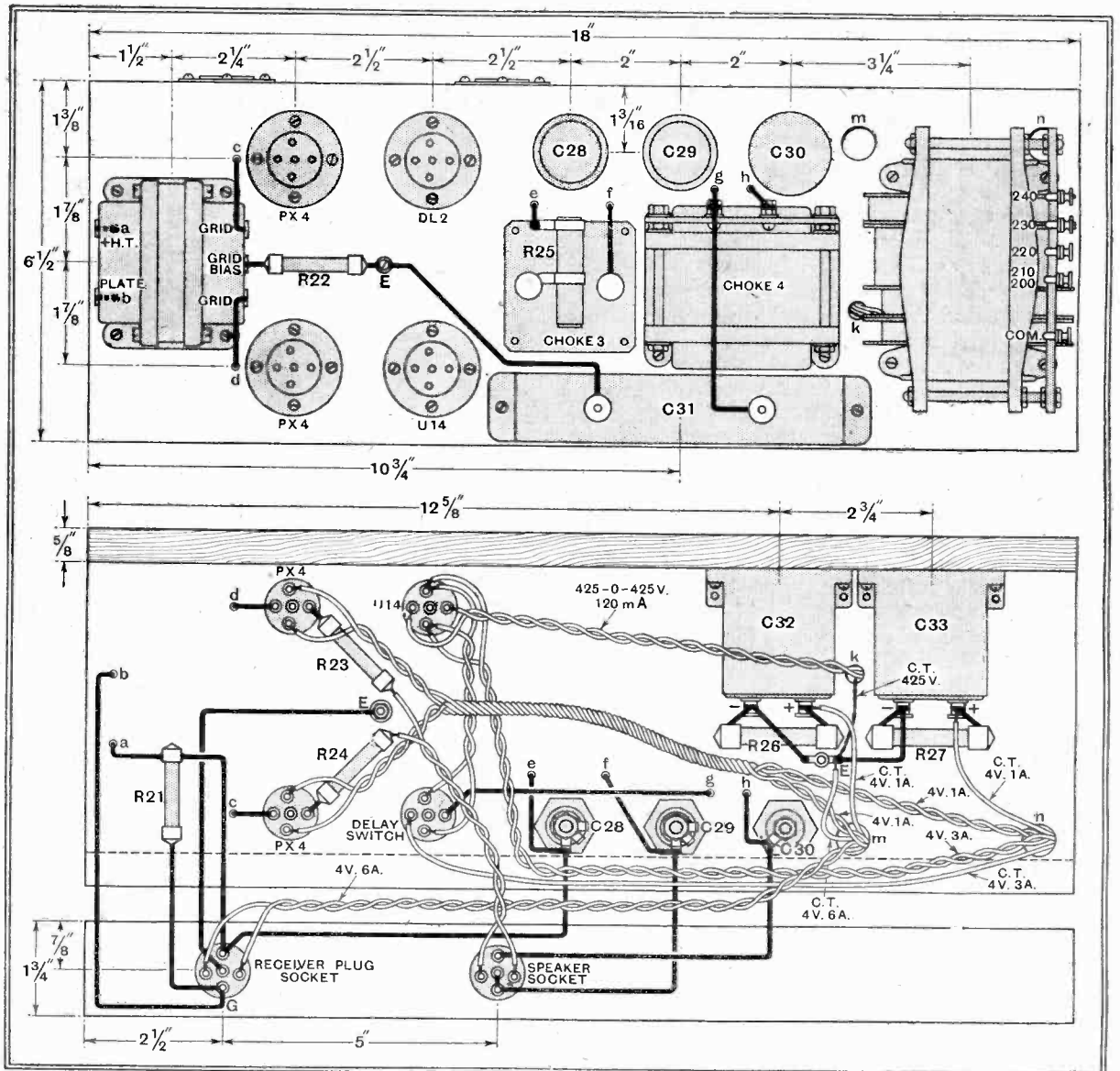
The New Monodial Super-
 cushions, otherwise acoustic reaction from the speaker may cause a low-frequency resonance, or even a sustained howl. An absorbent mounting is easy to arrange by resting the receiver chassis on blocks of sponge rubber so that it can float freely. A gap must, of course, be left between the panel and the cabinet, and this may well be filled with rubber to exclude dust. The precise method of mounting must obviously vary in different cases, but it is usually easy to arrange an absorbent support which is fully effective in eliminating the effects of feed-back.

The choice of a loud speaker is a matter of some importance, but one which is too lengthy to enter into here. It is hoped to deal with this matter in a further article, therefore, and in the meantime it is sufficient to stress the importance of securing a type capable of giving a uniform and wide frequency response, and also able to handle an input of some 6 watts without causing harmonic distortion. A point often overlooked, but not without importance, is the power rating of the output transformer, and here again this must be for 6 watts.

In connection with the table of voltages, it should be mentioned that the columns headed Anode Volts refer to the voltage measured between the chassis and the anode terminal of the valve in question. The bias voltage is measured between chassis and cathode, so that the reading obtained for anode voltage is really the sum of the true anode and the bias voltages. This accounts for the figure of 270 volts for the P.X.4 valve. The actual anode voltage, of course, is $270 - 38 = 232$ volts, which is well within the maker's rating.

It should be noted that the control knobs supplied with the various components do not all match. For the sake of a neat finish, therefore, it may be considered advisable to obtain uniform knobs for the volume and range change controls.

A receiver built to this design is available for inspection at 116/117, Fleet Street, London, E.C.4, and will later be on view at "The Wireless World" Stand at the Olympia Radio Show, August 15th to 24th.



The wiring of the power unit is straightforward, but care should be taken to connect C32 and C33 with the correct polarity.

Those used in the original receiver were the Bulgin types K13 and K14.

BOOK REVIEW

TELEVISION TO-DAY AND TO-MORROW.
 By Sydney A. Moseley and H. J. Barton
 Chapple. Sir Isaac Pitman and Sons, Ltd.,
 London, 1933. Price 7s. 6d. net.

The third edition of this book, which deals in a popular way with the subject of television, mainly from the standpoint of the Baird system, may be said to represent a retrospect of the subject and a record of the achievements of Mr. Baird rather than a forecasting, in any great measure, of the lines on which future developments are likely to occur.

The emphasis, in fact, is throughout upon "yesterday" rather than "to-morrow," and, though it is natural to suppose that Mr. Baird and his collaborators have a great deal more up their sleeves than it would be politic for them to divulge, it is a matter for some regret that, in a book which purports to deal with the subject as a whole, so little is said with regard to the broad issues involved in any attempt to improve the quality of the picture.

Television has now become an accepted fact, and there is no doubt that on this account we are mainly indebted to the genius of Mr. Baird and the energetic way he has

pursued his object. By the results he has achieved he has, to a large extent, confounded those of his critics who denied that anything of practical interest could be transmitted within the restricted band of frequencies dictated by present practical considerations. The eye has, in fact, been proved to have the same tolerant characteristics as the ear, and this circumstance, combined with the ingenuity displayed by those responsible for the transmissions in selecting suitable subject matter, has made possible the broadcasting of combined sound and vision of genuine entertainment value.

At the same time, it is abundantly clear that matters cannot stay as they are, and the whole difficulty of television lies in the fact that any material improvement of the results at present obtainable calls for an increase in the number of "picture lines," and, in consequence, a complete revision of the transmitting conditions. Any consideration of the "to-morrow" of television which passes over the necessity for more "lines" and the difficulties involved in providing them must, of necessity, be partial, and for this reason, if for no other, we would have welcomed any revision of this interesting and well-written book, which, while not necessarily ignoring the glories of the past, gave greater emphasis to the problems of the future and the manner in which these were to be solved.

P. W.

Practical HINTS and TIPS

AIDS TO BETTER RECEPTION



SPEED WITH CERTAINTY. A new Columbia Q.P.P. receiver undergoing tests. All circuits are checked in one operation with the help of an array of meters.

It should also be remembered that, when the converter is operated with a set having ganged tuning, the removal

UNTIL recently, ganged condensers were not matched to a common standard. The various sections of each specimen were adjusted to have the same capacity at various angular settings, but there was no guarantee that these capacities would be the same as those of another condenser of the same make.

Linking Ganged Condensers

As a result, it was most unlikely that, for example, two 2-gang condensers could be linked together mechanically and be used successfully for controlling a four-circuit single-control receiver.

Improved manufacturing methods have brought about a change, and at least one manufacturer now makes a practice of matching all condensers to the same standard. As a result, it becomes possible to link condensers in this way, but this practice should never be followed without the maker's assurance that his condensers are suitable.

THOSE readers who are using short-wave converters of the superheterodyne type in conjunction with a normal "straight" broadcast set will generally find that it pays to take a little trouble to ascertain the best operating conditions

Operating Short-wave Converters

for the set itself when its H.F. amplifier is converted temporarily into an I.F. amplifier for this special purpose. Generally speaking, it will be best to work on the long waves, for the reason that a lower percentage detuning of the frequency changer will be necessary in order to get the right beat frequency.

The longer the wavelength, indeed, the greater the efficiency of the arrangement. This is fortunate, because it happens that many "straight" sets give maximum amplification at a wavelength of about 2,000 metres.

of the aerial from its normal position and the substitution of a converter may bring about a change in the stray capacities of the circuit to which the aerial was originally connected. A slight readjustment of the trimming condenser associated with this condenser should therefore be tried.

ALMOST everyone knows by now that, when modifying a receiver design, instability may be introduced by taking liberties in the rearrangement of the purely H.F. components. But, so far as the L.F. amplifier is concerned, almost the

Layout of Components

only possible ill-effect of making a change is to introduce hum, which is likely to be brought about by an unsuitable position of the L.F. transformer in relation to the power supply equipment of a mains set.

In a superheterodyne, the intermediate frequency amplifier may be regarded in very much the same way as the L.F. part of the set, and, as a rule, it may be altered quite freely without untoward effects. This is due, of course, to the relatively low frequency, and to the fact that most modern I.F. amplifiers have but a single stage.

MOST constructors of highly sensitive sets, and particularly of superheterodynes, have encountered a form of L.F. howling which is due to acoustic reaction between the loud speaker and the vanes of a section (generally the oscillator section) of the tuning condenser. It is not generally recognised that this form of undesirable reaction

Acoustic Resonance

may produce a bass resonance without being strong enough to cause audible howling. Distortion introduced in this way is particularly disturbing, and is none too easy to trace.

The usual remedy is to insulate mechanically the whole tuning condenser assembly, including the drive mechanism from both the chassis and the control panel. Most modern condensers are constructed in such a way that it requires little ingenuity to devise an insulating system which will be quite as effective; usually an arrangement of rubber bushes or rubber packing pieces can be employed successfully.

Finally, it may be pointed out that the addition of a short-wave converter to a superheterodyne receiver seems to provoke this trouble. The probable cause is additional acoustic feedback to the condenser of the short-wave unit, which accordingly should be shielded or mechanically insulated if the trouble is suspected.

IN the "Hints and Tips" page of last week's issue there was described an extremely simple, but often very effective, type of H. F. stopping filter, which is intended to keep stray H.F. currents in the mains out of the receiver circuits.

Modified Mains Filter

The arrangement discussed is especially applicable to D.C. mains, but may sometimes be used with advantage with A.C. supplies.

It will sometimes be found that, instead of connecting the by-pass condenser directly across the mains, as originally shown, it is distinctly better to earth one side of it, as indicated in Fig. 1. Generally speaking, it will be sufficient to make the connection to the normal receiver "earth," but occasionally the use of a separate local earth is beneficial.

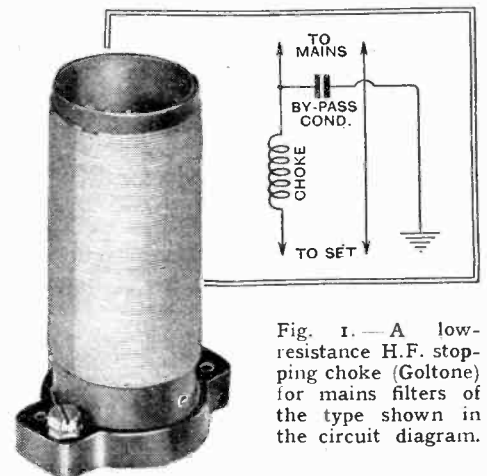


Fig. 1.—A low-resistance H.F. stopping choke (Goltone) for mains filters of the type shown in the circuit diagram.

The benefits of the alternative system of connection now under discussion are especially likely to be felt when the receiver earth is none too efficient; the great advantage is that interfering H.F. energy is by-passed quite clear of the receiver.

PHASE DIFFERENCE

When Alternating Quantities are Out of Step

By S. O. PEARSON, B.Sc., A.M.I.E.E.

WHEN dealing with two alternating quantities of the same frequency, such as the voltage and current in a circuit, it is necessary to know not only their R.M.S. values or their peak values, but also the extent to which the two waves representing them are out of step. For instance, if a sine-shaped E.M.F. wave is applied to a pure resistance it is readily appreciated that the current is at every instant proportional to the value of the E.M.F., according to Ohm's law. Consequently the current wave will be one of exactly the same shape, and it will pass through its maximum positive values simultaneously with the E.M.F. wave, and the two waves will pass through their zero values at the same instants, as shown in Fig. 1. Two waves which are exactly in step like this are said to be *in phase*, there being no relative displacement, or *phase difference*, between them.

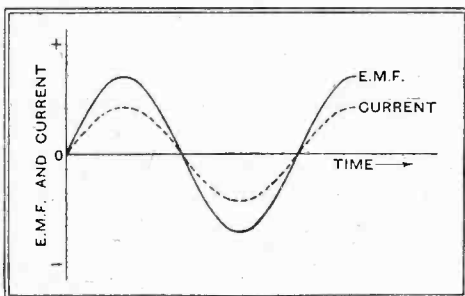


Fig. 1.—Sine waves which are in phase with each other plotted to a time base.

An alternating current is one which is changing in value from instant to instant, and therefore has no fixed values, but it fluctuates between two definite equal values in opposite directions round the circuit, the maximum, or peak, value in each direction being known as the amplitude of the wave. Now an A.C. ammeter gives a steady reading in one direction, this reading being the effective or R.M.S. value of the current. The effective value is equal to the value of the direct current which would have the same average heating effect in a given fixed resistance. It is called the Root Mean Square value because it is equal to the square root of the mean of the squares of all the instantaneous values. For a sine wave of current the R.M.S. value is 0.707 of the maximum value, and this relationship applies to a sine wave of any other quantity, such as voltage.

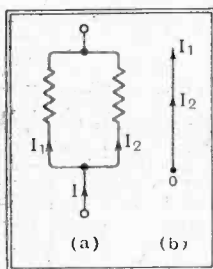


Fig. 2 (a).—A circuit with two pure resistance branches taking currents I_1 and I_2 in phase with each other. The corresponding vectors are shown at (b).

Because the R.M.S. value of an alter-

nating quantity is equivalent to a constant number, such a quantity, for example, current or voltage, can conveniently be represented by a straight line, called a vector, whose length is made to represent the R.M.S. value to some suitable scale; for instance, a current whose R.M.S. value is 2 amperes can be represented by a straight line two inches long, one inch representing one ampere.

It would appear that, by the adoption of the R.M.S. value (or value of the equivalent direct current) to represent the useful magnitude of an alternating current, all question of time and direction had been eliminated.

But this is only true when applied to a single current without reference to any other currents and voltages in the circuit. For instance, the sine waves representing two alternating quantities may be in step as in Fig. 1, or out of step as in Fig. 4 (a), and the question arises as to how the two vectors representing the individual quantities can be made to indicate clearly whether they are in step or not, and if not, the extent to which they are out of step, or *out of phase*. To do this it is necessary for each vector to indicate not only the R.M.S. value of the corresponding alternating quantity but also the passage of time.

What the Vector Shows

This is accomplished by assuming that each vector is rotating about one end, like the spoke of a wheel or the hand of a clock, with constant speed. And the speed is such that the vector makes one complete revolution in the counter-clockwise direction during each cycle of the alternating quantity it represents. For this reason one cycle of a sine wave corresponds to 360 degrees, and sine waves are conveniently plotted to an angle base rather than a time base. A quarter of a cycle then corresponds to 90 deg., and so on. The speed of the vector in revolutions per second is equal to the frequency in cycles per second.

Now when there are two alternating quantities of equal frequency they will be represented by two respective vectors, each rotating at the same speed, and so the angle between these two vectors will be a fixed one, just as the angle between two

WHEN calculation has to be made with alternating currents and voltages, it is not enough to know just the amplitude of the waves. There is the question of the extent to which the waves are out of step. In the case of sine waves this can conveniently be expressed in terms of an angle as explained in the accompanying article.

spokes of a wheel is constant. It is this fixed angle between two rotating vectors which represents the phase difference between the two corresponding alternating quantities.

Application to Circuits

When two non-inductive or pure resistances are connected in parallel to a source of A.C. supply, as in Fig. 2 (a), each will take a current in phase with the voltage, and the currents will therefore be in phase with each other. If I_1 and I_2 are their R.M.S. values, the vectors representing them will be as shown in Fig. 2 (b) by OI_1 and OI_2 respectively. Since there is no phase difference between the currents there is no angle of inclination between the vectors—that is to say, the two vectors are parallel to each other, and so coincide. The total current is in this case simply equal to the sum of the individual R.M.S. currents, being in phase with them. Simple addition in this manner is only permissible where the two alternating quantities are in phase with each other.

Now let us consider a branched circuit such as that of Fig. 3 (a), where the branch currents I_1 and I_2 are out of phase by a quarter of a cycle. The same voltage E is applied to each branch. The current I_1 , taken by the pure resistance branch, is exactly in phase with the voltage, and therefore the corresponding current vector OI_1 , in Fig. 3 (b), coincides with the voltage vector OE , as shown. Now a condenser takes a current which *leads* the voltage by exactly a quarter of a cycle, and so the corresponding vector OI_2 will

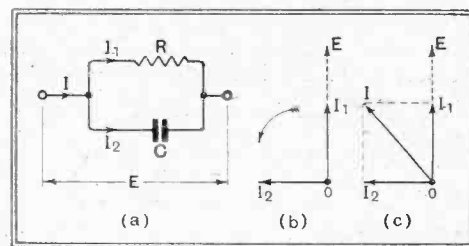


Fig. 3.—A branched circuit taking two currents a quarter of a cycle, or 90°, out of phase. The corresponding vectors are shown at (b) and the method of finding the total current is indicated at (c).

be a quarter of a revolution *ahead* of the voltage vector. The current is said to lead the voltage if it reaches its maximum positive value before the voltage. Since the vectors are assumed to be rotating in the

Phase Difference—

counter-clockwise direction, it follows, in this case, that the condenser current vector OI_2 will be drawn at right angles to the voltage vector *to the left*, so that as they rotate OI_2 is 90° in advance of OE and OI_1 .

Maximum Current Values.

When two sine waves are out of phase by a quarter of a cycle, or 90 degrees, one is always passing through a zero value when the other is passing through a maximum value, and from this it follows that the maximum values never occur simultaneously. Consequently, the maximum value of the total current is bound to be less than the sum of the maximum values of the individual currents, and similarly for R.M.S. values. Actually, the total current is found by completing the

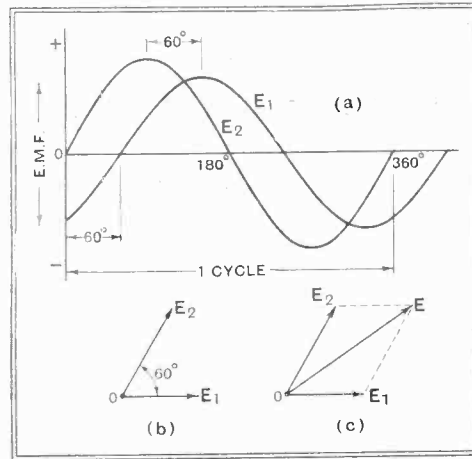


Fig. 4.—Showing how two waves out of phase by $\frac{1}{6}$ of a cycle, or 60° , are represented by two vectors mutually inclined at 60° . The sum is found by the parallelogram method as at (c).

rectangle $O I_1 I_2$, as in Fig. 3 (c). The diagonal OI then gives the total current I to the same scale as the other current vectors. OI may be found by measurement, or may be calculated. (In this case the total current is $I = \sqrt{I_1^2 + I_2^2}$.)

In a more general case the two alternating quantities may be out of phase by some odd fraction of a cycle. For instance, suppose that two alternating voltages E_1 and E_2 in series are out of step by one-sixth of a cycle, as shown by the curves of Fig. 4 (a), then the angular displacement between the two vectors OE_1 and OE_2 representing them would be one-sixth of a revolution, namely, one-sixth of 360 degrees, or 60 degrees, as shown in Fig. 4 (b). The sum of these two voltages is then found by completing the parallelogram $O E_1 E_2$, as in Fig. 4 (c), and measuring or calculating the length OE of the diagonal.

ON THE SPOT

Visits to Foreign Broadcast Stations

IX. Cologne-Langenberg

635 kc. 472.4 m. 60 kW.

MENTION of Cologne-Langenberg always recalls to me the afternoon on which I was privileged to broadcast from that station, and I am still thrilled at the thought of that imposing array of clean tumblers and the big jug of fresh water all carefully aligned for me at the microphone desk.

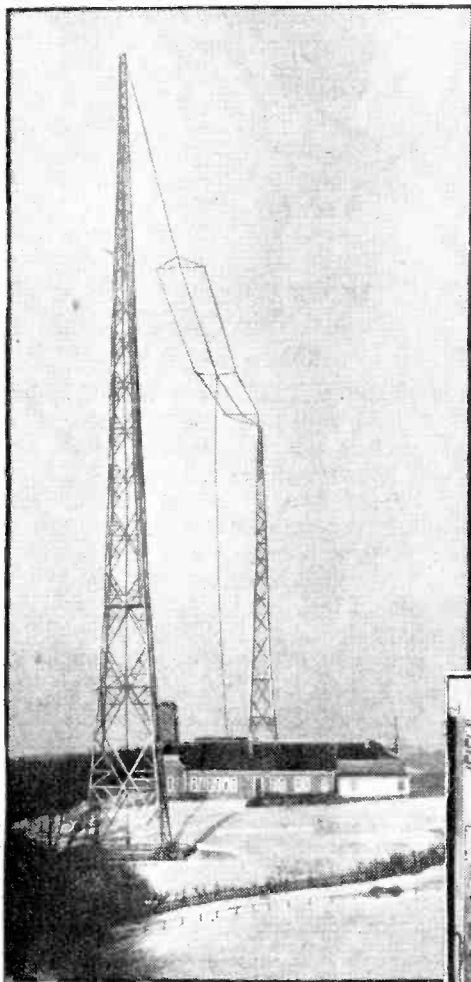
The Cologne Broadcasting House, which serves the Langenberg transmitter, was the first of its kind in Germany. It stands at the corner of the Dagobertstrasse, and, although it was not actually built for broadcasting purposes, Westdeutscher Rundfunk were the first tenants, and were, indeed, fortunate to have their own premises at a time when other German stations were housed in all kinds of out-of-the-way places.

In addition to the main studios in Cologne there are smaller studios at Münster, in Westphalia, and several other towns in the same region, though the original relay stations in those areas have been silent ever since high-powered Langenberg took the place of the old 20 kW. transmitter at Cologne some years ago.

Cologne has become famous throughout Germany for its "Bunte-Abende," or "variety evenings." When the Cologne identification signal is relayed throughout

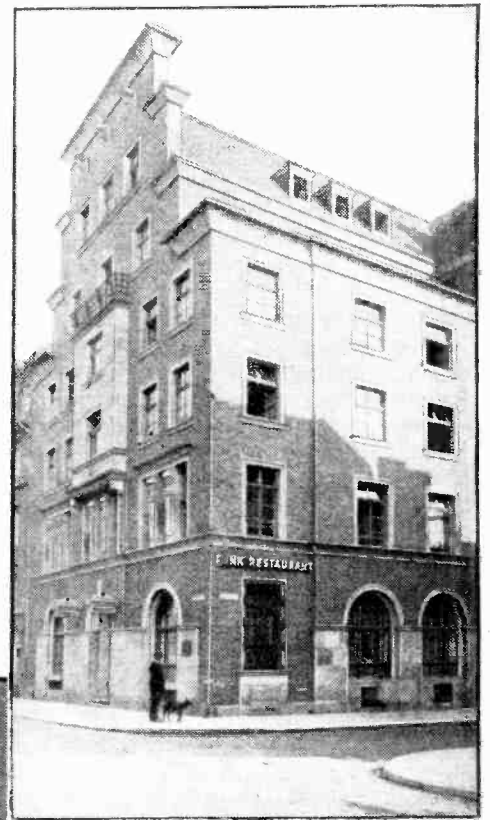
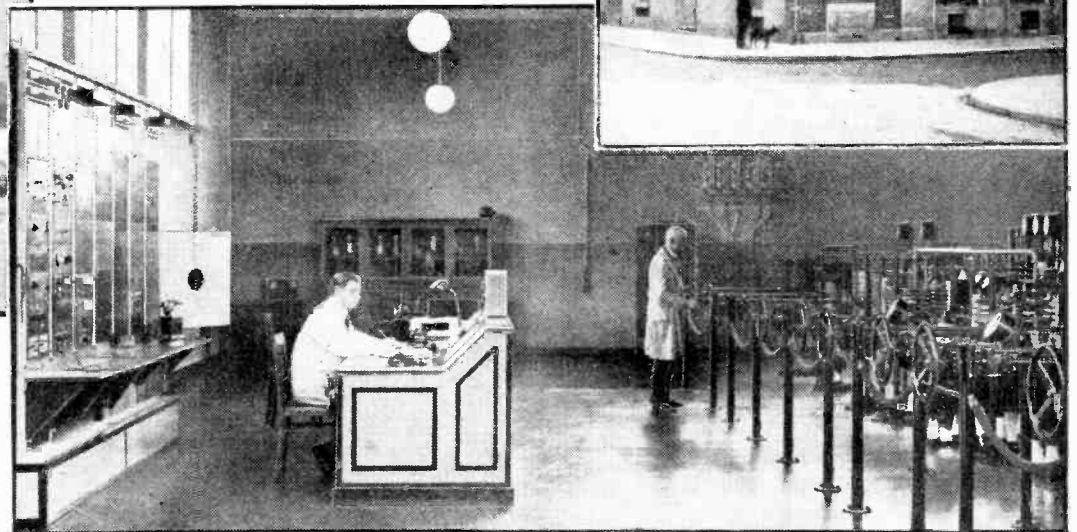
Germany listeners know that it precedes something unusually good.

WANDERING WAVE.



LANGENBERG, the mouthpiece of the Westdeutscher Rundfunk. The studios are located in an unpretentious building in Cologne (seen inset on the right).

The corner of the main transmitter hall at Langenberg, showing the control engineer superintending transmissions.





Girt on my armour to give battle.

Just Units

AS my readers know, truth and accuracy are the twin standards by which I order my life. Consequently I was considerably pained when a kind-hearted reader recently drew my attention to yet another instance of the deplorable looseness of expression so prevalent in the "literature" issued by wireless manufacturers.

Among the items listed in this literature were several models of the ubiquitous electric gramophone motor. Quite properly the makers gave—or perhaps I should say attempted to give—the power rating, so that the intending purchaser could calculate whether his wife's house-keeping allowance would stand the strain of the running costs as well as that of the weekly instalments. As, however, they merely stated that its consumption was *two units*, and omitted to say whether the consumption of these units took a woman's half-minute or merely a couple of hours I quite naturally girt on my armour and, like Don Quixote of old, sallied forth to give battle.

Their first line of defence was a beardless youth who evidently combined the functions of office boy and chief of the "Q. and A." department. I propounded to him the conundrum as to what sort of units these might be and, after being torn betwixt the rival attractions of volts-per-minute and ohms-per-mile, he finally decided that after all they were just plain units and needed no qualification.

Penetrating to the second line of defence, which consisted of the combined forces of all the salesmen in the shop, I was speedily unhorsed, the scurvy knaves taking refuge behind the ever-ready skirts of their printers, and I had to retire discomforted.

It was notable, however, that although they alleged it to be a printer's error I was quite unable to find out what these units did stand for, as, although the day was yet young, the firm's technical man had emulated the masterly example set by his confrères at Olympia, and had "just gone to lunch."

UNBIASED

BY FREE GRID

"Permanent" Magnets

IT is a strange thing that, although most wireless enthusiasts are nowadays quite familiar with the elementary principles of electricity, very few of them are equally acquainted with the fundamental laws of magnetism. For instance, no one would dream of expecting a valve filament to do anything else but wilt if it were accidentally stuck across the H.T. battery, and yet if something analogous is allowed to happen to the magnets of a P.M. loud speaker people are surprised if it peters out.

An example of this sort of thing has recently reached me in the shape of a bitter moan from a reader who wrote to me some months ago, asking me if the magnets of a P.M. loud speaker were really permanent. I told him that, although nothing was permanent in this transitory life, he could safely invest in one and be assured that it would last for a goodly number of years.

He has now written to say that after taking my advice he finds that the magnets are about as permanent as a permanent wave. I felt slightly distressed until he added that even the paper cone was more permanent than the magnets, for the cone was still undamaged, although the loud speaker had fallen off the nail in the wall about half a dozen times!

I Stand Accused

READERS often write to me about their troubles, and I am proud to say that in quite a large number of cases I have been instrumental in bringing recalcitrant manufacturers to heel when a case of obvious injustice to one of their customers has been brought to my notice.



Frivolous and groundless complaints.

I am sorry to say, however, that certain readers have attempted to impose on my good nature by getting me to take up frivolous and groundless complaints with manufacturers; worse still, when their nefarious schemes have been brought to light by the manufacturers concerned they

have rounded on me and bitten the hand that fed them.

Some of them have even gone so far as to accuse me of being a friend of the manufacturers, although in their hearts they must know that I have never sunk so low as that.

Olympia Yarns, 1933

NOWADAYS we almost take for granted the hoary old story of the "secret circuit" which certain loose-moralled manufacturers are so fond of dishing up in the few weeks preceding the



In the small hours.

annual Radio Exhibition. I think, however, that this year matters have gone just a little too far, judging by a yarn which has been dished up to the lay Press—for I can hardly believe that the story could have appeared word for word in over a dozen newspapers in which I have seen it unless it had been deliberately circulated. I feel that only a verbatim quotation of the report will properly bring home to you the absurdity of the whole affair, and so I give it herewith:—

"Engineers and research workers have been sworn to secrecy under guarantee bonds, while one well-known firm has gone to the extent of supplying living rooms attached to the laboratory so that the chief engineer shall not leave the premises during the vital weeks preceding the show."

No provision seems to have been made for the wretched man to take exercise, but I suppose this is too secret even to be mentioned, and that he is led round the back streets by an armed guard in the small hours of the morning. In any case it does not seem that the company concerned have any great opinion of the chief engineer's trustworthiness.

Isn't it about time that this sort of stunt was debunked?

News of the Week

Current Events in Brief Review

Sundays at Athlone

THE Editor of the *Irish Radio News*, 179, Pearse Street, Dublin, is anxious to receive reports from listeners in the South of England regarding the transmissions from Athlone on Sunday afternoons between 1.30 and 2.30 p.m.

Swiss Broadcasting Palace

A "BROADCASTING Palace" is to be opened in a suburb of Lausanne next year. There will be three large studios for concerts and dramas with two smaller ones for talks and gramophone recitals.

August Bank Holiday

THE approach of the August Bank Holiday necessitates slight alterations in our printing arrangements. Miscellaneous advertisements intended for our issue of August 11th should reach this office not later than first post on Friday, August 4th.

Sponsored Programmes Ban

ON account of alleged "breaches of regulations" concerning sponsored programmes, 1ZR, Auckland, one of the most popular B class broadcasting stations in New Zealand, has had its licence withdrawn by the Post Office. It is believed that the Post Office took action after an appeal by the New Zealand Newspaper Proprietors' Association.

Try a 5-Metre Holiday

AN ultra-short-wave test of exceptional interest and importance to listeners in Ireland, Southern Scotland, Wales, North-west England and the Midlands is to be carried out on Saturday, August 12th. The organisers, who desire to remain anonymous until next week, state that all listeners who will be on holiday in the West of England on that date should take their 5-metre receivers with them as opportunities may occur to set up world records.

In our next issue we hope to give full particulars of the test and details regarding special awards to successful listeners.

Radio-equipped 'Planes in Thunderstorms

THE possibility that trailing wireless aerials are a danger to aircraft in thunderstorms is suggested in the Air Ministry Orders, just issued. Only ten cases of British aircraft being struck by lightning have been reported since 1925, and in nearly all instances the aircraft had the wireless aerial trailing. The Ministry states that when wireless is in use an increase in the number or strength of atmospheric discharges would generally indicate that a danger area is being approached; if it is not possible to avoid danger areas, the trailing aerial should be earthed and wound in.

Acid Test

APPLICANTS for an announcer's post in Japan must not only pass an examination in diction, but must also exhibit "common sense."

"Ceylon Regional"

THE site has now been chosen for Ceylon's short-wave relay station to be designed specially for picking-up and distributing the Empire programmes of the B.B.C. It is believed that there will be

Anti-Static Film

HOW to recognise and overcome various forms of electrical interference with radio reception is the theme of a new Pathé film which will shortly be shown at cinemas throughout the country.

Various offenders, such as trolley buses and electrical machinery, will be seen in operation; the sound record will then provide a faithful rendering of the noise produced in the loud speaker.

THE RADIO SHOWS

The National Radio Shows of 1933 are to be held on the following dates:

LONDON (Olympia) - - -	AUGUST 15th - 24th.
GLASGOW - - - - -	SEPT. 1st - 9th.
MANCHESTER - - - - -	SEPT. 27th - OCT. 7th.

no difficulty in covering the entire island, and, judging by quality experienced in the Indian zone, reception will be so reliable that Ceylon could almost be counted as a B.B.C. "Region."

"Broadcasting" at "No. 10"

THE secluded garden of the Prime Minister's house at No. 10, Downing Street, was enlivened with a public address system supplied by Tannoy Products on Wednesday, July 19th, on the occasion of the Hospital Fête. A standard "Tannoy" 6x amplifier was used with three or four giant speakers placed at strategic points. The microphone on the terrace was used by Mrs. Baldwin to declare the fête open.

Herr Giesecke

MINISTERIAL - DIREKTOR Heinrich Giesecke, the Vice-President of the International Broadcasting Union and special commissioner in connection with foreign programmes, has suddenly been placed on the retired list.

Herr Giesecke, who took a prominent part at the Lucerne Conference a month ago, was formerly Director of the Reichs Rundfunk Gesellschaft. Although Herr Giesecke is unable to explain the reasons for his compulsory retirement, it is understood in informed circles that the work of the Foreign Relations Commissioner is to be taken over by the Ministry of Propaganda, which commands all forms of publicity.

400 Announcers Waiting

THE belief that the announcer's lot is a happy one is widespread in New Zealand. The Broadcasting Board in the Dominion reports a waiting list of 400—enough to supply announcers to all the stations of Europe.

Amateur Morse Contest

AT Chicago on Thursday, Friday and Saturday next (August 3rd, 4th and 5th) the battle will be fought for the title of "World's Champion Radio Operator." The contest, organised by the American Radio Relay League, consists of eight classes, ranging from a minimum of eight words per minute to one of forty words per minute. The present holder of the title, Theodore R. McElroy, won in 1922 with a speed of 56.3 words per minute.

Amateurs from all parts of the world will compete.

50 kW from Huizen

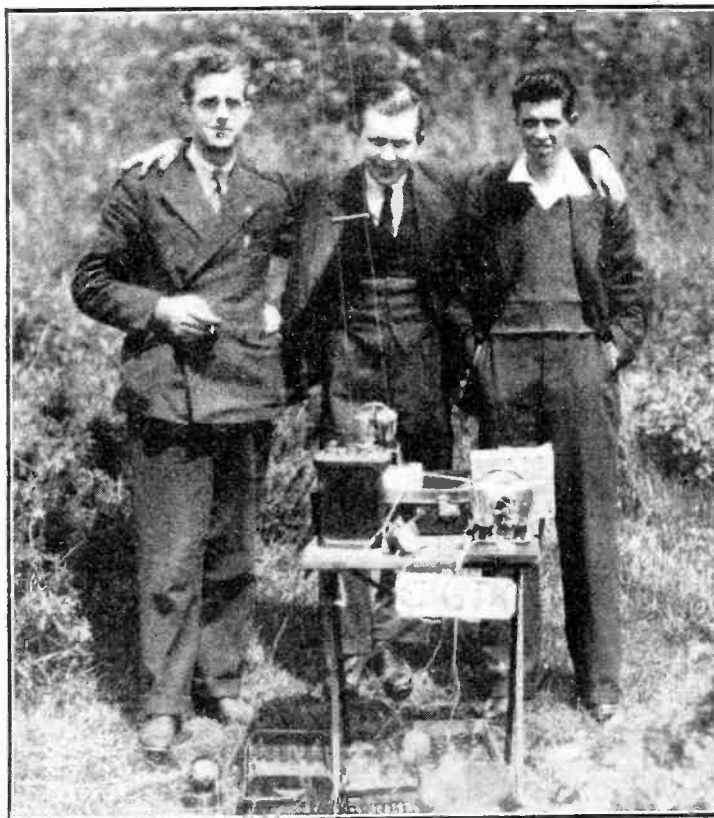
THE remarkable strength of the Huizen transmissions is explained by the news that the A.V.R.O. programmes are now relayed from the Kootwijk station after 4 p.m. on 50 kW.—an increase of over 30 kW. over the normal power. This step, writes a correspondent, is attributed to a desire on the part of Holland to improve its position at the next conference of the International Broadcasting Union at Amsterdam in October. Holland, it appears, is seeking to justify the 1,875-metre wave, which it is unwilling to sacrifice, by using really high power before the signing of the Convention. This means that Kharkoff, which is to share a wave with Huizen, will be under an obligation not to increase its power.

Televisor with Cinema Film Quality

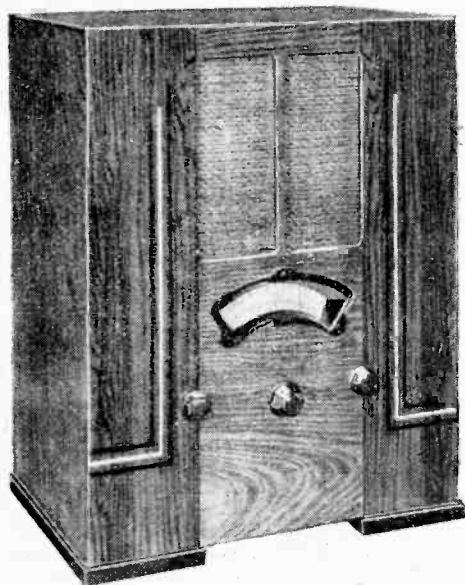
A 180-LINE television receiver giving quality and detail said to be equal to that of the 16 mm. home cinema film is to be demonstrated at the forthcoming German Radio Exhibition. According to our Berlin correspondent, the set is the work of Dr. Loewe and his colleague, Dr. Schlesinger. Ultra-short-waves are used, and it is understood that the 7-metre transmitter in Berlin may shortly be used for experiments.

The German Ministry of Propaganda has expressed its surprise at the improvements achieved since last year, and it is generally assumed that some twenty German towns will soon be equipped with ultra-short-wave television transmitters.

Radio Loewe will be able to manufacture the complete television receiver, comprising cathode ray tube with a half-plate size projector, ultra-short-wave receiver for television, receiver for sound, loud speaker and synchronising unit for under £20. Synchronisation in the Loewe system is secured by a special synchronising signal transmitted with the television image.



"ULTRA SHORTS" IN NORTHERN IRELAND. Mr. F. A. Robb (GI6TK) is the central figure in this group of amateurs who recently spent a 5-metre field day near Belfast.



Higgs "Super B" Receiver

A Battery Superheterodyne with Automatic Volume Control

FEATURES

Type.—Six-valve battery superheterodyne with automatic volume control and Class "B" output stage. Moving-coil loud speaker and provision for gramophone pick-up. **Circuit.**—First detector with band-pass input filter—oscillator—I.F. amplifier—anode bend second detector—driver valve—Class "B" output valve. **Controls.**—(1) Tuning with illuminated dial calibrated in wavelengths. (2) Manual volume control. (3) Waverange and on-off switch. **Price.**—18 gns. **Makers.**—Higgs (Great Britain) Ltd., Westbourne Place, Hove, Sussex.

ated in the receiver itself are few. Those due to second channel interference from the local stations on medium waves were quite negligible and would probably be overlooked unless one knew where to look for them.

In estimating the overall sensitivity of the set it is, of course, necessary to take into account effects due to the automatic volume control. In London, for instance, it is possible to receive North Regional at greater volume than London Regional when both are sending out the same programme. This anomaly is probably due to overload-

THE country listener, who is compelled to rely on batteries as a source of power, has in the past complained bitterly of the apparent indifference of the manufacturer to his requirements. That state of affairs is now rapidly being mended, for the introduction of Class "B" amplification has given to battery receivers the same kind of stimulus that the indirectly heated valve gave to mains sets.

The Higgs "Super B" is typical of the new range of receivers from which the battery user will be able to choose during the coming season. Its circuit is of up-to-date design and there are no less than six stages, yet the consumption of H.T. current is well within the capacity of what used to be known as the "intermediate" size of battery.

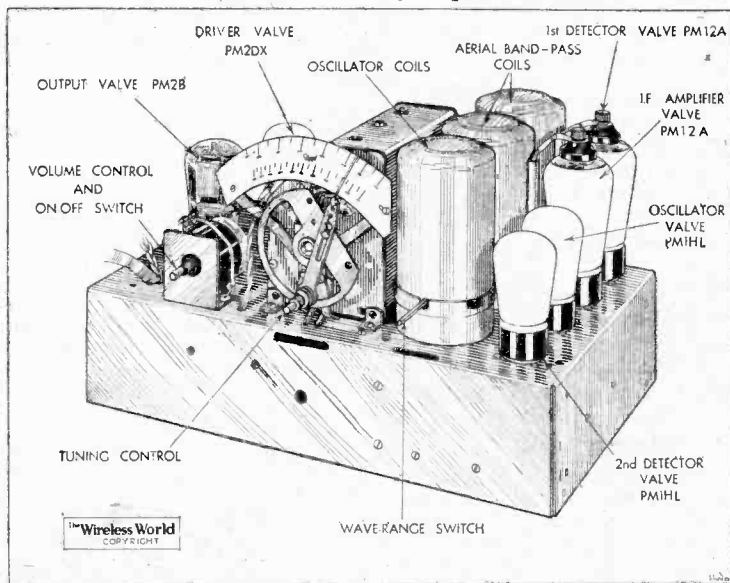
An inductively coupled band-pass filter in the aerial circuit provides an adequate degree of selectivity for the incoming signals before they are passed to the first detector valve. A separate oscillator is employed and is coupled to the plate of the first detector through the primary of the first I.F. transformer. There is a single stage of I.F. amplification, and it is in this stage that the circuit has been arranged to give automatic control. The component by which this is effected is known as the "Plew Anti-fading Unit." It consists of a resistance capacity filter included in the plate circuit of the anode bend second detector, the fluctuations in the mean anode current of which are utilised to vary the screened potential of the I.F. valve.

The second detector is coupled to the driver valve by an auto-transformer across

which is connected a high resistance potentiometer for manual volume control. A Class "B" valve is used in the output stage and feeds a permanent magnet moving coil loud speaker unit. Pick-up sockets are provided, and the input from the pick-up is injected into the grid circuit of the second detector valve. When the pick-up is not in use the sockets must be short-circuited and a tumbler switch is fitted at the back of the cabinet for this purpose.

The set is a pleasant one to handle, and the degree of automatic volume control provided effectively prevents bursts of noise from powerful stations when searching round the dial at maximum sensitivity. The maximum volume available, while it does not perhaps represent the full loading capacity of the output stage is nevertheless quite sufficient for average domestic requirements, and the reproduction is of soft and pleasing quality with no trace of harshness or irritating resonance.

There is a commendable absence of background noise, and on the long waves in particular the stations stand out with exceptional clarity. Heterodyne whistles gener-

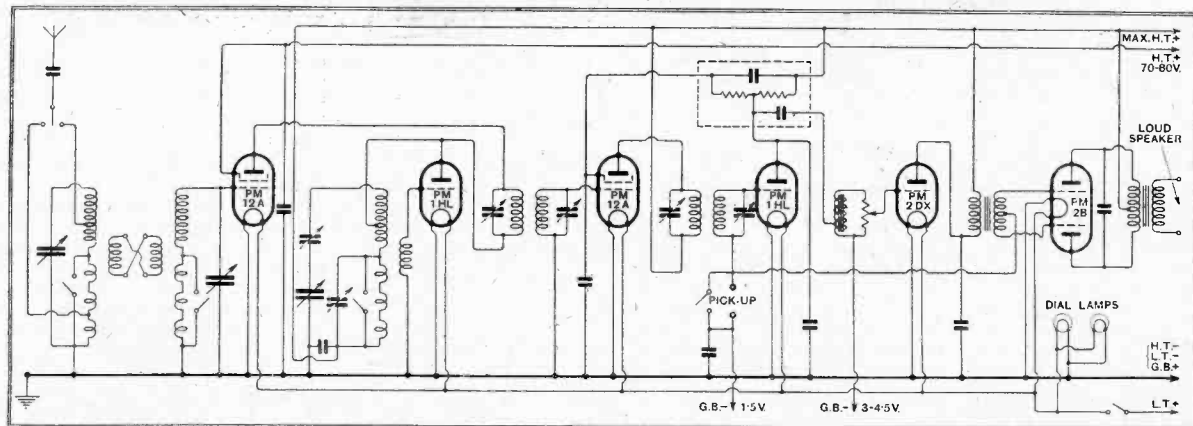


In addition to the controls shown in this view there is a radio-gram. switch mounted at the back of the chassis.

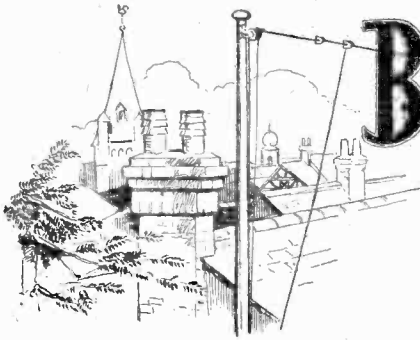
ing of the first detector, as the A.V.C. effectively shields the second detector stage. Shortening the aerial or breaking and twisting up the insulated lead-in to form a small series capacity actually increases the volume from the local station so that it would appear that some form of input volume control might be added to the circuit with advantage. On distant stations, however, the sensitivity is excellent, and five Continental medium-wave stations were received during the middle of the day. As regards selectivity, not more than three channels were lost on either side of the two local transmitters, and on long waves Zeesen was received absolutely clear of both Daven-

try and Radio Paris at good strength and without sideband "splashing."

In addition to the "Super B" there are models for A.C. and D.C. mains at the same price of 18 guineas and a universal model at 20 guineas. The mains-operated sets are also supplied in radio-gram form at 29 guineas for A.C. or D.C. mains, and 31 guineas for the universal A.C.-D.C. model.



Automatic volume control is obtained in the I.F. stage by a varying screen voltage derived from the second detector.



Broadcast Brevities

By Our Special
Correspondent



Those Sunday Evenings

WHEN the B.B.C.'s greatest admirers begin to frown at the Corporation's decisions it is time to ask who, if anybody, is really pleased.

I hear that many of the B.B.C.'s most friendly listeners—those who look to their receivers for regular entertainment—are protesting at the inconsiderateness of the powers-that-be in ordaining that transmissions shall be made during the 6.30 to 8 o'clock period on Sunday evenings.

Is the B.B.C. a Bore ?

Even their beloved B.B.C., it seems, can become a bit of a bore when it chatters and sings unceasingly. After all, there are stations on the Continent which cannot well be heard while the B.B.C. is transmitting. Now, under the new rule which takes effect on September 17th, they will be silent until the reshuffling of wavelengths under the Lucerne Plan brings a merciful variation. The B.B.C. will then eclipse a new bunch of Continental stations.

Sober Programmes

Henceforth, Sundays will be packed with B.B.C. programmes from 12.30 until after 10.30 at night with the addition of a Welsh service at 11 a.m. from Daventry (5XX) once a month.

The lighter evening programmes will be on the Regional wavelengths, and will consist of ballads and light orchestral music interlarded with gramophone recitals. On the National wavelength the programmes will be grouped under such headings as "For the Children," "Missionary Talk," "Chamber Music," "Classical Reading," "Bible Reading," and "Recital."

Challenge to Sponsored Programmes

Whatever else may be said for the new scheme, it is a serious challenge to the Sunday sponsored concerts from the stations on the Continent, but a study of the material which the B.B.C. proposes to offer does not convince me that Radio Paris and Fécamp will confront a very serious rival in the matter of programmes.

No New Music Left

One wonders how the B.B.C. will succeed in filling so much extra programme time when, as at present, they have even abandoned the attempt to put out alternative programmes during the 6.30 to 8 p.m. period on weekdays. Despite the so-called unlimited repertoire of music available, there can be no doubt that the field of music, like any other field, has length and breadth; sooner or later the much ploughed ground will become exhausted.

Encouraging Young Composers

Even to-day how many listeners with any musical ear fail to recognise at least 50 per cent. of the compositions broadcast? There is an irritatingly large number of pieces

which are dead but "they won't lie down."

It is time that the Corporation gave greater encouragement to the young composer instead of restricting him by ordaining that new works shall be judged only once a year.

Hands Across the Sea

MR. MERLIN AYLESWORTH, President of the American National Broadcasting Company, has paid a graceful tribute to Britain by inviting Sir John Reith to give an inaugural address at the opening of the great Radio City in Sixth Avenue, New York, in October next.

"Affectionately yours," concludes Mr. Aylesworth in his letter of invitation, for he and Sir John have met on more than one occasion, and if opportunity permitted, there is no doubt that Sir John would hasten across the Atlantic to please his friend and attend this really important ceremony.

Too Busy ?

It would not surprise me, however, if Sir John stayed at home. Reorganisation difficulties at Broadcasting House and the commencement of the winter season throw a tremendous load on the shoulders of the "D.G." The impressive rearrangement of the staff under the headings of "Output" and "Administrative" is not yet completed and, in justice to Colonel Dawnay, the new "Output" chief, it is likely that Sir John will consider it his duty to super-

When the intervening houses fall vacant the B.B.C. may take over the entire block and thus double the size of Broadcasting House.

As Far as the Zoo

Who knows but what the B.B.C. may eventually extend the half-mile up to Regent's Park itself. This would certainly be appreciated by the animals in the Zoo, who would be spared the indignity, which I witnessed last week, of being transported to Broadcasting House in a common or Zoological garden van. I followed them into the television studio where the rehearsal for last Wednesday's programme took place, and their attitude of offended *amour propre* could not be disguised. Charlie, the Capuchin monkey, suffered also from hiccoughs.

The Man in Disguise

THE "O.B." engineers do not lack imagination. There is something thrilling in the tale of how the microphone will be made to keep in touch with the parading troops during the Tidworth Tattoo on August 5th. It is considered inadvisable to locate the microphones in settled positions. An engineer, therefore, will carry a mike around the arena, but as, in the words of the



HALF-PAST SEVEN AT LUGANO. Here is Signorina Nini, the English-speaking announcer at Lugano, broadcasting the time signal with the aid of a ship's chronometer. The new Monte Ceneri station which broadcasts the Lugano programme, is surrounded by mountains, and considerable secrecy is observed regarding the transmitting plant.

intend the final arrangements for turning the Corporation into a machine.

"No. 16"

A SOMBRE, shuttered and dirty-windowed building in Portland Place—"No. 16" to be precise—will shortly blossom forth as a new office for the B.B.C. There are actually three houses between this and the northern end of Broadcasting House, but as No. 16 has only been taken on lease, there will, I am told, be no underground passages constructed between the two buildings.

official notice, the sight of a civilian amidst the massed bands might create anxiety in the minds of the audience, he will be hooded and dressed entirely in green. This sinister figure, like Robin Hood chasing King John's troops with a hand-mirror, will move inconspicuously against the verdant background.

Queer Thought

This idea might be developed; in fact, I am not at all sure that some of the engineers at the opening of the Southampton Graving Dock were not disguised as ducks.

Correspondence

The Editor does not hold himself responsible for the opinions of his correspondents
Correspondence should be addressed to the Editor, "The Wireless World," Dorset House, Stamford
Street, London, S.E.1, and must be accompanied by the writer's name and address

Automatic Volume Control

ALLOW me to comment on recent correspondence under the above heading which has appeared in your paper during the last few months.

In the issue of May 5th Mr. Haynes adopts the pessimistic view, and amplifies the defects which are, after all, only natural in a system which, although conceived in the dim past, has only recently become a manageable child; if perfection were essential, then would nothing escape condemnation. Taking the broader view, we find that the advantages of A.V.C. far outweigh the drawbacks, and, in fact, fully justify the additional cost involved.

Considering the various methods separately, the original and basic form, simple A.V.C., operates primarily to prevent overloading and consequent distortion when a local station is received on a sensitive set. This overloading may be only momentary, as in the inadvertent reception of the local station during "searching," or it may be continuous, due to the inexpert adjustment of the controls, but in either case the result is undesirable. Thus, from this point of view, a set incorporating simple A.V.C. forms a good commercial proposition, but does not go far enough in the equalisation of signals, due to the operation of the gain-reducing control, even on small signals.

The delayed and/or amplified version of A.V.C. introduces an effect considerably more distressing than the amplitude distortion it is desired to eliminate; when the receiver is disturbed by 3 or 4 kHz. from the local station, the carrier, which is the controlling factor in the A.V.C., is reduced to a very small value, the gain is enormously increased, and the combination of carrier and top sidebands produces a loud, high-pitched mush, the continued reappearance of which during tuning soon becomes intolerable.

The elimination of the above defect is accomplished in the Quiet A.V.C., this giving very satisfactory results.

There is nothing to be gained by a discussion of propagation distortion in connection with A.V.C., as the two are connected only in so far as the A.V.C., by elimination of the major faults in present-day wireless reception, focuses attention on the remaining minor imperfections.

Background Noise

The accusation against A.V.C. of enhanced mush, which is countered by Mr. Redfern in his excellent letter in the issue dated June 2nd, is to some extent justified, in that to obtain good control a high degree of HF (or IF) amplification is required, so that in two receivers of equal sensitivity the one with the greater HF amplification (and less LF amplification) will give more background noise. In practice this defect is not so serious as may be thought, and it is not difficult to arrive at a satisfactory compromise with small background coupled with the advantages of A.V.C. It should here be noted that the rectified current for audio reproduction may be taken from an intermediate point in the HF amplifier, thus removing all ground for

the above objection, the remainder of the amplifier being merely to provide the biasing potential for control purposes.

Mr. Redfern's remarks about cold rectifiers may be construed to mean that these have no application at all in A.V.C., but a little thought will show that this cannot be so; the Westinghouse HF rectifier is the purest example of the genus rectifier, and can in no way be inferior to any thermionic arrangement. The diode, with its inconveniently earthy cathode, demands electrical sustenance during its modest life, while its strangely preconceived offspring, the AB and LG triode rectifiers, aspire to a dual function which they succeed in doing only moderately well, owing to conflicting demands of polarising voltages for the best performance of each function. The argument against the "Westector" is that it insists on doing its own job well; in practice its small physical dimensions and independence of power supplies render it of much greater use in A.V.C. circuits than the multi-function thermionic devices.

I cannot agree with Mr. Haynes' sugges-

DISTANT RECEPTION NOTES

High Power Problems : Outstanding Stations.

AS stated in the "News of the Week" page in July 21st issue, it is the St. Agnan station of Toulouse which is now heard and which I reported upon recently. Permission has been given by the Government, it appears, for the station to be used, though the power is not to exceed 8 kilowatts, which was the amount used by the old station.

Some interesting information is given in the French wireless paper *Le Haut Parleur* in an article dealing with the Lucerne Plan. The writer discloses that Radio Vitus, like Toulouse, has already built a high-powered station and had been hoping for permission to use it, but is not assigned any channel under the new scheme. He also discloses that Radio Lyons has just completed a new transmitter capable of an output of 50 kilowatts. If Radio Vitus and Radio Lyons continue to work at all they will have to do so on one or other of the French common-wave channels and their maximum power will be 5 kilowatts.

I can again record very strong reception from Moravska-Ostrava on Saturday evening. Either a new transmitter is being put into operation at the week-ends or the power of the existing one is considerably increased at these times. Lyons Doua, which has been received so splendidly for weeks and weeks, suddenly disappeared and remained silent for six consecutive nights. I was unable to hear so much as a whisper from this station and began to fear that Lyons Doua might have been a victim of one of these anti-wireless plots of which so many accounts have appeared in the papers recently. Strasbourg, Luxembourg and Vienna have all been threatened, but luckily the plots have been foiled in time to prevent

tion that A.V.C. "limits the tuning spread due to detector overloading," and, in fact, the reverse is the case, for an A.V.C. receiver will bring in the sidebands when detuned from the carrier, these being normally inaudible on an uncontrolled set. It is doubtful, also, whether A.V.C. can give any freedom from atmospheric disturbances, as the time constant of the control circuits must be large compared with the purely transient static discharge. In the case of continuous "man-made" static, the relative volume levels of the station and static will be the same for an A.V.C. set as for one not so equipped.

In conclusion, some of the phenomena associated with Q.A.V.C. may be of general interest. It can be adjusted to eliminate all signals below a given level; thus, in a situation where electrical interference is bad, it may be set to receive only those stations which give a signal well above the background level. A station which is only just qualified by signal strength to be passed on to the loud speaker will be subject to enhanced fading, so much so that, in extreme cases, the signal will be alternately cut in and out as the incoming signal varies above and below the critical cut-off voltage. A sense of extreme selectivity will be experienced during tuning by the sudden appearance and disappearance of powerful signals in a perfectly blank background.

Per pro. Precision Electric, Ltd.
G. FARREN CLARKE,

serious damage from being done. On the last two evenings, however, the station has been received with all its old strength.

It is announced that Monte Ceneri is to continue using a wavelength of 1153.8 metres, which is exactly that of Kalundborg. Since the Swiss station is rated at 15 kilowatts and Kalundborg at 7.5 this means that in all probability we must say good-bye to the Danish station until the Lucerne Plan comes into force next January.

Old Friends Return

The past few days have been marked by the welcome return of several old friends which have not been well received for some weeks. Amongst these are Budapest, which now frequently gives good reception after dark, and Munich, which has been very well received during the entire week preceding the writing of these notes.

Though Kaiserslautern shares a wavelength with both Augsburg and Tampere, its transmissions are frequently to be heard wonderfully well rather late in the evening. This station relays the Munich programmes and is probably synchronised with Augsburg, which also transmits them. It seems likely that Tampere closes down rather early and therefore ceases to interfere.

Last week I mentioned Huizen as an outstanding transmission. Since then it has become even better and readers should make a point of tuning it in. Warsaw and Motala are both in fine form on the long waves.

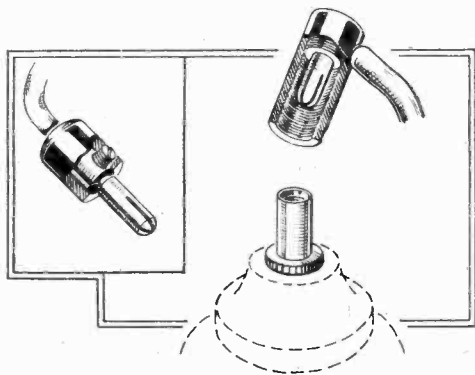
On the medium waveband I can particularly recommend Langenberg, Rome, Leipzig, Strasbourg, Brussels No. 2, Milan, Breslau, Heilsberg, Turin and Nürnberg.
D. EXER.

LABORATORY TESTS

NEW RADIO PRODUCTS REVIEWED

NEW EELEX CONNECTORS

A NEW wander plug just added to the Eelex range of specialities has been designed to ensure a good electrical contact when inserted into battery sockets of different size. It is fitted with a split prong,



Eelex shrouded anode connector and new style wander plug with adjustable prongs.

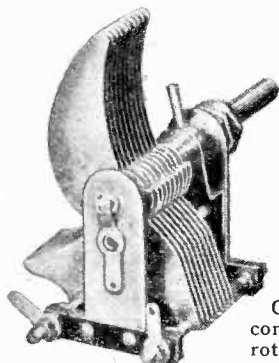
the diameter of which can be varied within small limits. This is effected by turning the wire-retaining grub screw beyond the point necessary to grip the conductor. It is available in a wide range of markings, and the price is 2d. each.

The other new item is an anode connector for use with S.G. valves. Described as the type A, it takes the form of an insulated sleeve completely enclosing a four-prong plug, and into this fits a small metal socket, one end of which is threaded, and replaces the top anode terminal cap on screen-grid valves. As the metal part of the connector which is "live" to H.T. is completely insulated, absolute immunity to short circuits is ensured, even though the lead may become entangled in the wiring when removed from its valve. The price of this new anode connector is 3d., and the makers are J. J. Eastick and Sons, Eelex House, 118, Bunhill Row, London, E.C.1.

GODFREY SHORT-WAVE CONDENSER

SEVERAL interesting and novel features are embodied in the new short-wave condenser developed by F. E. Godfrey (Radio), Ltd., 63-67, Chenies Mews, Francis Street, London, W.C.1.

The plates are shaped to give a S.L.F. law and the moving vanes rotate through 270 degrees as compared with the customary 180-degree movement. This comparatively wide sweep of the rotor provides considerably more space on the dial for logging stations. Obviously a dial



Godfrey short-wave condenser having a rotor movement of 270 degrees.

designed especially for use with this condenser is required, and one fitted with a suitable scale is obtainable from the makers.

Although the condenser is fitted with back and front supports for the moving vanes, the latter alone serves as the main bearing, the rear support acting as a steady bearing only and as an anchorage point for the concealed pigtail. The fixed vanes are bonded together at two points and soldered to their supporting rods; this method of construction not only ensures good electrical contact throughout, but results in a very rigid assembly.

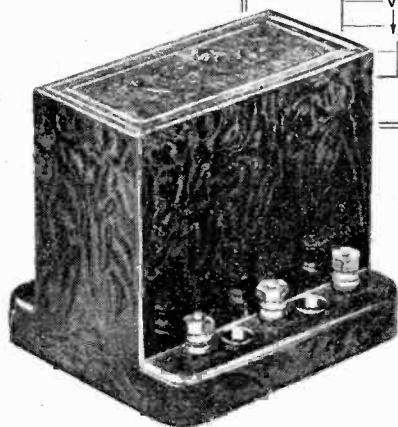
The condenser is made entirely of brass, and Keramot is employed for the insulating strips carrying the stator, this material having been found most suitable for use in the tropics.

On test the condenser was found to be perfectly silent in operation, and the wide sweep of the moving vanes rendered tuning far easier than is the case with the normal 0-180-degree movement.

The minimum capacity of our specimen was 9 m-mfds., and its maximum value 0.000183 mfd., its nominal rating being 0.00016 mfd. A single hole fixing bush is fitted, also a long 1/4 in. spindle, and the price is 7s. 6d.

BULGIN NEW TRANSCOUPLER, MODEL L.F.10

IN its original form the Bulgin Transcoupler afforded a voltage step-up of one to three, but a slight modification has now been made and the turns ratio of the small parallel-fed transformer has been raised to one to four. This has not led to any appreciable reduction in its primary inductance, which is still maintained at a level quite



adequate to ensure a good low-frequency response.

The overall characteristic curve of the new model, here reproduced, shows that at 50 c/s the amplification is sensibly the same as at 5,000 c/s, furthermore, the amplification is well maintained up to 10,000 c/s.

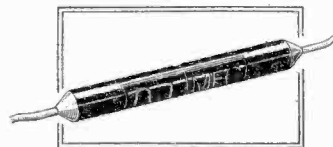
When following a medium impedance amplifying valve, such as one having an A.C. resistance of 18,000 ohms and an amplification factor of 27, an overall stage gain of 65 is attained, a most creditable performance for a component of this type.

Physically the new model is the same as

its prototype, being housed in the familiar green mottled bakelite case, and the price is unchanged, namely, 11s. 6d. The anode resistance is tapped and allows 30,000 ohms for the anode load and 20,000 ohms for decoupling requirements. The makers are A. F. Bulgin, Ltd., Abbey Road, Barking, Essex.

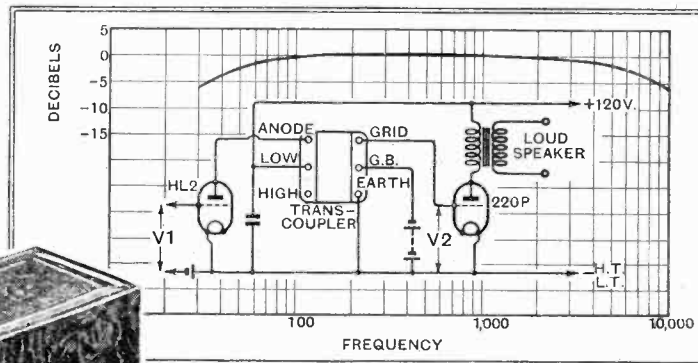
LOEWE GRID-LEAK-TYPE RESISTANCE

THE Loewe Radio Co., Ltd., Fountayne Road, Tottenham, London, N.15, have now introduced a range of inexpensive resistances of one-watt rating. Known as High Ohmic Grid-Leak-Type Resistance, they are



New Loewe grid-leak-type one-watt resistance with wire ends.

made in all the usual sizes from 500 ohms to 10 megohms. The component consists of a small porcelain tube 1 1/8 in. long and 1/4 in. in diameter carrying the resistance material. Wire ends, securely fixed and about 1 1/2 in. long, are allowed for connecting, and the price is 9d. for all values.



Overall characteristic curve of Bulgin L.F.10 Transcoupler which is fitted with a 1 to 4 ratio transformer.

The specimen sent in for test had a nominal value of 100,000 ohms, which, measured, was found to be 104,200 ohms, this being well within the makers' tolerance of plus or minus 10 per cent. This size will pass three milliamps. at one-watt rating, and when doing so shows a small decrease in the value of the order of 3 per cent. The temperature rise is not above normal for a small resistance of this type, and on the whole it represents very good value for money.

TRADE NOTE

A new distributing depot has now been opened at Newcastle by the Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, London, N.7. The address of the new depot is 23, Gallowgate, Newcastle-on-Tyne; the telegraphic address is Eveready, Newcastle-on-Tyne, and the telephone number, Newcastle 26553.

READERS' PROBLEMS

Cost of "Free" Bias

WHEN adapting an existing battery-fed receiver for Class "B" amplification, it is, practically speaking, almost always necessary to abandon any "free" grid bias scheme that may be included in the original set. Bias voltages are always developed across a resistance in the H.T. negative lead, and if the current flowing through this resistance is constantly varying, perhaps between 10 and 40 milliamperes (depending on modulation), it is obvious that a steady grid voltage cannot be obtained in the usual way.

At first sight it might appear possible to overcome this difficulty by inserting the bias resistance in such a position that it is not traversed by the anode current of the output valve in which fluctuations take place. But a little consideration will show that, with ordinary battery valves fed from a common source of L.T. current, this is impossible.

If automatic bias is to be retained when Class "B" amplification is added, it will be essential to feed the output valve from

THESE columns are reserved for the publication of matter of general interest arising out of problems submitted by our readers. Readers requiring an individual reply to their technical questions by post are referred to "The Wireless World" Information Bureau, of which brief particulars, with the fee charged, are to be found at the foot of this page.

heterodyne it is normal that there should be relatively more high-note loss on the long waveband. This loss takes place in the signal-frequency tuned circuits, but as a matter of fact is very small indeed. Most of the lack of brilliancy that our correspondent has noticed is probably due to the fact that the long-wave transmitters are, in general, less perfectly modulated.

The Padding Condenser

FROM the symptoms described by a constructor of an A.C. Monodial receiver, we are inclined to think that the stray capacity associated with the oscillator circuit is excessively high. This may well be

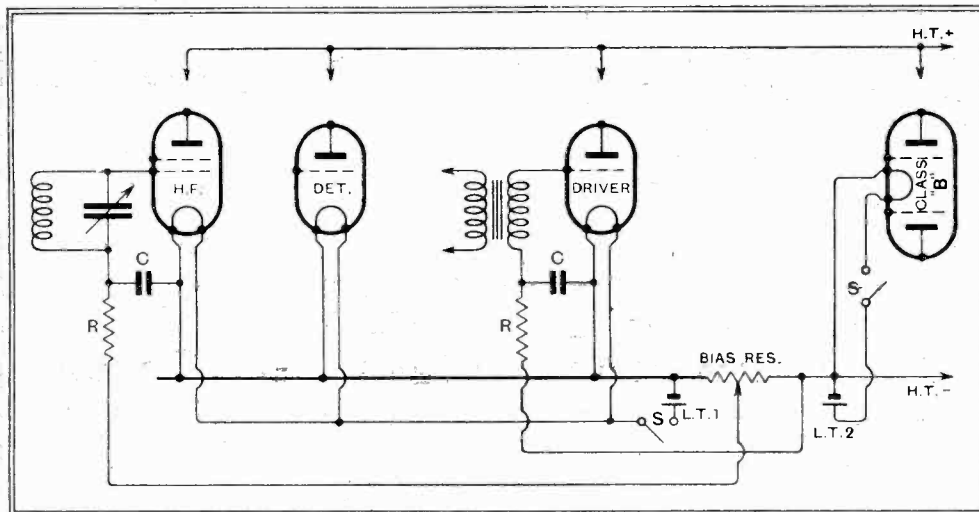


Fig. 1.—To make automatic bias possible in a Class "B" set, anode current variations must be "short-circuited." An extra L.T. cell is needed.

a separate L.T. battery. This is the conclusion reached by a querist, who asks us to confirm its truth, and if so, to publish a circuit diagram showing how the filament and grid bias circuits should be arranged when converting an existing H.F.-det.-L.F. set for Class "B" amplification.

An appropriate system of connections is shown in Fig. 1, from which it will be seen that a separate L.T. cell is employed for the Class "B" valve, and that the anode current of this valve does not pass through the bias resistor.

The Long-wave Handicap

IT is almost impossible to design an ambitious receiver—particularly a superheterodyne—which will have the same performance on both medium and long wavebands. For instance, an observant correspondent, who has recently built a superheterodyne in which *Wireless World* practice has been followed, has noticed that reproduction in general is distinctly "brighter" on the medium band. We are asked to explain why this should be.

In almost every modern type of super-

due to the use of a padding condenser (C₄) which is not of the make specified.

When using other types of condenser, between which and the metal base-plate an excessive capacity may exist, it is recommended that the component should be mounted about a quarter-inch above the base by means of distance-pieces.

Long-wave Failure

AFTER working well for many months, a Monodial receiver built by a reader now shows a serious falling-off in performance on the long-wave band only; medium-wave signals are received as well as ever. The owner of the set asks whether this falling-off should be attributed to decline in emission of one of the valves, and, if this is probable, asks us to say which valve is likely to be at fault.

The tracing of faults in a superheterodyne is generally susceptible to a logical line of reasoning. As all the valves are in operation equally on the long and medium bands it is hardly likely that failing emission is responsible for an impaired performance manifesting itself only on one band.

We consider it much more likely that a fault has developed in the long-wave section of one of the signal-frequency coils, or even in the corresponding section of the oscillator coil assembly. It is not altogether impossible that the oscillator valve has lost some of its emission, but if it has, the fault might be expected to manifest itself by a complete cessation of signals over a part of the band, rather than by a falling-off in strength.

Extra Screening Needed

COMMENTING on the relatively small amount of screening included in the Two-Unit Portable (*Wireless World*, June 23rd), a reader asks whether it would be as easy to make a set on the same lines, but with the substitution of a frame for the "open" aerial specified.

The use of a frame aerial, in the field of which all the H.F. components will be mounted, always calls for more extensive screening, and the design in question would certainly need modification if this alteration were made. It might, however, be possible to retain simplicity of construction by mounting the frame aerial as part of the loud-speaker unit, but this plan would necessitate the use of low-capacity inter-connecting leads. Further, as the capacity of these leads would probably be subject to variation, a completely ganged tuning system would hardly be practicable.

High- and Low-Resistance Loud Speakers

A CORRESPONDENT, referring to our review of the Multitone Class "B" Converter in the issue of *The Wireless World* for July 7th, asks whether the statement that the auto-transformer fitted will match any high-resistance speaker may be taken to imply that the converter is intended only for operation with loud speakers of the moving-iron type.

This instrument is usable with both moving-iron and moving-coil speakers. Although the speech coil of a moving-coil instrument is almost invariably of low resistance, a step-down transformer is fitted to all standard loud speakers, and with the addition of this transformer the instrument may be treated exactly as if it were of the high-resistance type.

This is true of all moving-coil loud speakers with built-in transformers, provided that the external connections be made to the primary winding of the transformer.

The Wireless World

INFORMATION BUREAU

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

Communications should be addressed to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service. The enquirer's name and address should be written in block letters at the top of all communications.