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Editor:
HUGH S. POCOCK.

Editorial,
Advertising and Publishing Offices:
DORSET HOUSE, STAMFORD STREET,
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Telephone: Hop 3333 (50 lines).
Telegrams: "Ethaworld, Watloo, London."

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

BIRMINGHAM:
Guildhall Buildings, Navigation Street, 2.
Telegrams: "Autopress, Birmingham." Telephone: 2970 Midland (3 lines).

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EDITORIAL COMMENT

B.B.C. Unpopularity: The Remedy

Means of Appeal Imperative

THE B.B.C. has just successfully weathered another storm of public criticism. Looking back over our files, we find that just a year ago, to be precise, in our issue of March 3rd, 1933, we congratulated the B.B.C. on the result of a debate in the House of Commons on the constitution and conduct of the Corporation. On that occasion, too, we reported that what was "heralded in some quarters as likely to develop into an earthquake which would shake the foundations of the Corporation, fizzled out instead like the proverbial damp squib."

On the present occasion, whilst we are glad that no irresponsible efforts have been allowed to disturb the present conduct of the B.B.C.'s affairs in general, we trust that the Corporation will not deceive itself with the idea that a great victory has been won. There can be no victory where the aggressor attacks without ammunition and the recent attacks upon the B.B.C. must certainly be regarded as in this class. As far as we have been able to judge, there has been very little substance in most of the particular criticisms with which the Corporation has been assailed on this latest occasion.

Nevertheless, there is undoubtedly a strong feeling of antagonism towards the B.B.C. It is not directed against the present officials, nor against their internal administration, nor even against the programme policy. The resentment goes deeper and is directly attributable to the splendid isolation which the Corporation enjoys under its present constitution.

The revenue which the B.B.C. receives is contributed by the public, yet the public has really no voice in the conduct of its affairs; the Board of Governors is appointed by the Government, yet the Government admits that it has little authority to direct the B.B.C.'s policy and is in no way responsible for the actions of its principals; the Corporation is not hampered by any of the restrictions in regard to trading and other matters which would circumscribe the activities of any Government department, yet it has a monopoly (which it may direct to its own advantage) and enjoys most of the privileges of Governmental association.

We may liken the Corporation to a ship at sea which has so far succeeded in avoiding disaster, not by reason of the seaworthiness of the vessel but because of expert piloting by an able captain and crew. The vessel may be regarded as the constitution of the B.B.C., and the captain and crew the present staff and directing officials.

The public cannot tolerate the knowledge that under the present constitution of the B.B.C. there is no higher authority to which appeal can be made against decisions by its officials.

Some years ago we suggested that the formation of a Ministry of Broadcasting might provide the ideal control of the B.B.C. This proposal still appears to have many points of advantage. Alternatively, the Postmaster-General could be given equivalent powers of authority.

Once such an authority were constituted we venture to suggest that irresponsible bickering over B.B.C. activities would cease, whilst serious criticism would receive proper attention. The very knowledge that a safety valve had been provided would relieve many critics of the urge to kick at the B.B.C., which at present possesses them just for the reason that, as constituted at present, the Corporation always has the last word.

THE TECHNIQUE OF Single-span Tuning

The Aerial and Reaction Circuits

By W. T. COCKING

THE development of single-span tuning, which is now arousing widespread interest, has involved research into many parts of the receiver, and the aerial coupling system is of fundamental importance. The attainment of adequate selectivity at the high intermediate frequency is also a matter which has been specially investigated, and in this article details are given of the methods which have been found, both theoretically and practically, to be the most satisfactory.

IT will be remembered that the chief point in single-span tuning is the ability to cover a wide waverange with only a single small condenser, and that a contributory cause of this is the use of an aerial system which is aperiodic over a wide range. The design of such an aerial system offers special problems, and it is important to understand the factors involved.

The manner in which the energy picked up by the aerial is transferred to the first valve of the receiver must be such that the efficiency of transference is high over the receiving range and low over the second channel range. For broadcast reception with an intermediate frequency of 1,600 kc/s, the efficiency must be high over the 150-1,500 kc/s band and low over the range of 3,350-4,700 kc/s, while it is advantageous if it be also low at 1,600 kc/s.

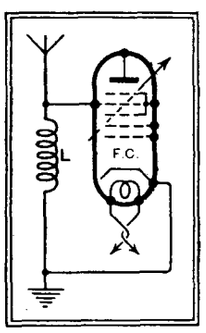


Fig. 1.—A common aperiodic aerial circuit.

It is obvious that high efficiency over the receiving range means increased signal strength. High efficiency in itself, however, is of secondary importance, for the most important factor is a high ratio of efficiency in the receiving range to efficiency in the second channel range. The primary function of the aerial coupling is to reduce second channel interference to negligible proportions.

An aperiodic aerial system commonly employed in S.W. receivers and illustrated in Fig. 1 is of little use for single-span tuning, therefore. The inductance L is a choke of high impedance, and if a suitable component be used, the voltage applied to the grid of the valve is nearly equal to that set up in the aerial by a signal. The efficiency, moreover, can be made very nearly constant over the whole of the 150-1,500 kc/s band. Unfortunately, however, the efficiency is still high over the 3,350-4,700 kc/s band so that there is little discrimination against second channel interference. The variation of efficiency with frequency follows the lines indicated by curve B of Fig. 2, whereas an ideal system would give a response such as that of curve A.

The circuit of Fig. 1, however, will give different results if it be used with a moderate, instead of a high, value for L. The aerial possesses inductance, capacity and resistance, and if the value of L be so chosen that the resonant frequency of the system as a whole occurs towards the middle of the received band some discrimination against second channel interference may be expected.

When the values are selected so that the efficiency over the received range does not vary excessively a response curve such as C of Fig. 2 is obtained. Clearly there is a considerable improvement, but the second channel rejection is insufficient for a satisfactory performance.

Choosing the Aerial Circuit

The next step is obviously to a low-pass filter such as that shown in Fig. 3. A properly built and terminated filter having a sufficient number of sections will give a response curve approximating to curve A of Fig. 2 and have an efficiency of 50 per cent. reckoned on the present basis. In practice, however, a filter of this type gives only moderately good results for the efficiency varies greatly over the pass range due to the fact that correct termination is hardly possible.

For correct results a filter requires to be terminated by resistances, and the aerial does not even approximate to a resistance. A practical form of filter, therefore, gives a response indicated by curve D of Fig. 2. Although this is not of the type required, it is capable of giving moderately good results, and it is by no means useless. For the best results, however, a better form of aerial circuit is required.

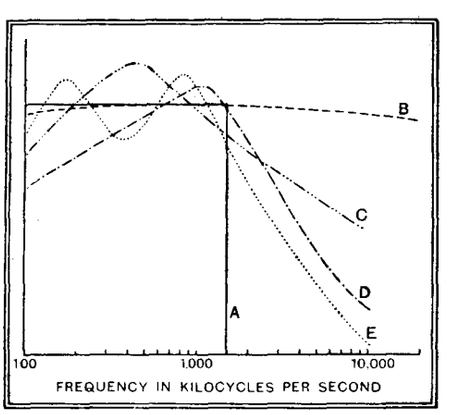


Fig. 2.—Curves illustrating the characteristics of different types of aerial coupling. Curve A is the ideal.

Now the arrangement of Fig. 1, when tuned to the middle of the received band offers the most promising performance, although in itself it is not good enough. It is obvious, however, that if by any means a curve such as E of Fig. 2 could be obtained, the results would be very greatly improved. Although the efficiency would not be uniform over the range, it would not vary greatly, and the efficiency over the second channel range would be low.

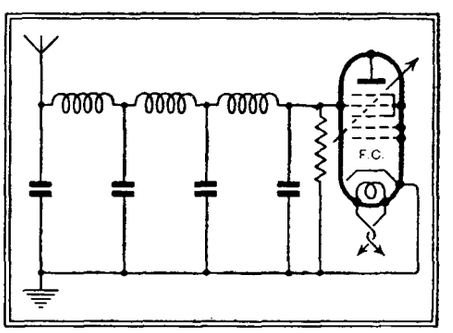


Fig. 3.—A low-pass filter which leads to moderately good results.

A curve of this type is the same as that given by the familiar band-pass filter comprising two tightly coupled tuned circuits. This immediately gives the clue to the system, and one could use a circuit such as that shown in Fig. 4. The capacity of C1 would be made equal to the aerial capacity, and L1 equal to L plus the aerial inductance, while R1 would be adjusted to prevent the efficiency at the peaks rising excessively to give a very uneven response over the waveband. The circuit capacity being fixed by the aerial capacity, the inductance is determined by the tuning range required, and is chosen so that it resonates with the capacity at the middle of the band. The mutual inductance between L and L1 is then given a value such that one peak in the response curve comes

The Technique of Single-Span Tuning—

at about 400 kc/s while the other falls at about 1,200 kc/s. The response is then as indicated by curve A of Fig. 5.

An examination of this curve reveals two defects—the response falls off at the

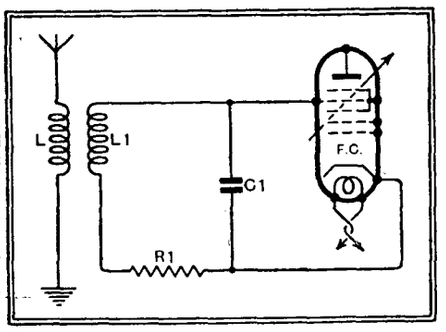


Fig. 4.—A coupled aerial circuit of the band-pass type gives a good performance.

lowest frequencies, and only a moderate attenuation is secured in the second channel region. A little thought shows that these defects are due to the type of coupling adopted, for the reactance of an inductance increases with frequency. It would appear, therefore, that a capacitatively coupled filter would be capable of a better performance. Such a filter is illustrated in Fig. 6. Curve B of Fig. 5 shows the performance, and demonstrates that the theoretical considerations are borne out in practice. A curve of this nature is highly satisfactory, and the variation in response over the whole waveband is limited to within ±8db, while the relative attenuation in the second channel is always over 40 db. An attenuation of this order is sufficient in practice, because signals on the 3,350-4,700 kc/s band are themselves usually considerably weaker than those in the broadcasting range.

Reaction and Selectivity

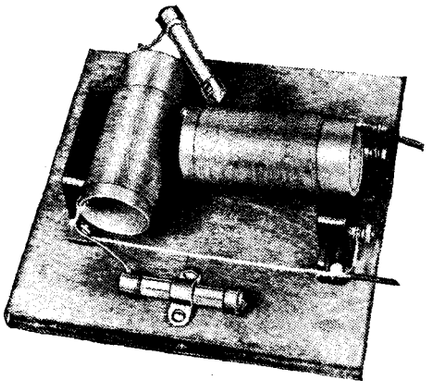
So much for the aerial circuit. Let us now consider some of the problems attendant upon the attainment of adequate selectivity. Operating at a given frequency there are two ways of obtaining high selectivity, a large number of tuned circuits of moderate efficiency may be used, or a small number of high efficiency. Considerations of cost, space, and ease of initial adjustment preclude the use of more than a moderate number of tuned circuits. It is, however, impossible to obtain tuned circuits of high enough efficiency at a high operating frequency without going to extremes in the matter of avoiding incidental losses. It is by no means rare to find that the losses in a valve-base alone are sufficient to halve the selectivity of an efficient circuit, and it is obviously out of the question to employ decapped valves in a receiver for general use.

We must, therefore, have recourse to the benefits of reaction if sufficient selectivity for distant reception is to be obtained economically. In the case of a detector set, reaction leads to little difficulty; this is hardly the case, however, where a high degree of pre-detector amplification is used.

If the full benefits of reaction are to be secured, it must be obtained from a valve to which only weak signals are ever applied. This means that the detector cannot be used to provide reaction, since modern practice dictates that it be supplied with a large input. The weakest signals are obviously to be found in the coupling between the frequency-changer and the first valve of the I.F. circuits, so that reaction would naturally be applied at this point. Even at this point, however, quite large potentials may be found when receiving a station spaced from a local by only a small amount, and such potentials tend to overload the valve providing reaction and prevent the full benefit being obtained from it.

Variable Selectivity

As much selectivity as possible, therefore, should be obtained prior to the reaction circuit, and the valve providing reaction should have linear characteristics so that it can handle a large input. In



An experimental form of the capacity-coupled aerial system of Fig. 6.

practice, therefore, two coupled circuits are used between the frequency-changer and the I.F. valve, and reaction is applied to the secondary, while the valve providing reaction is of the small power class.

Since a special valve is used for reaction it would be natural to suppose that the I.F. amplifier is arranged in normal fashion and the grid of the reactor valve connected in parallel with that of the first I.F. valve. This is not the case, however,

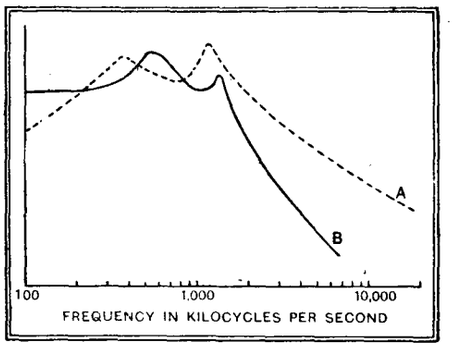


Fig. 5.—The response of coupled aerial circuits. Curve A is for an inductively coupled system and Curve B for a capacity coupling such as that of Fig. 6.

for such an arrangement leads to very unsatisfactory results. It must be remembered that the best screen-grid valve is not perfect, and there is always some coupling existing between its grid and

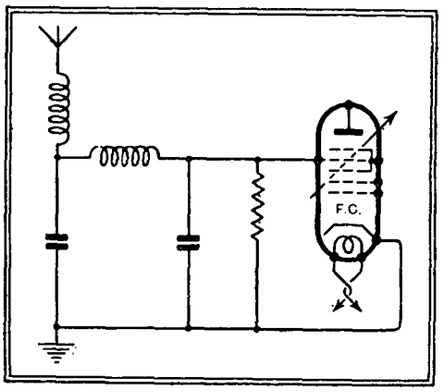


Fig. 6.—The final form of aerial circuit is really a two-stage capacity-coupled band-pass filter.

anode circuits. If the resistance of the grid circuit be reduced sufficiently, therefore, self-oscillation will occur. Consequently, if reaction be applied from a reactor valve, self-oscillation of the I.F. amplifier will occur before reaction is pressed to the degree necessary to make the reactor itself generate oscillations.

These difficulties are very largely overcome, however, by connecting the reactor valve in the I.F. chain. The reactor valve, or as it is perhaps more correctly termed in its new position, the buffer valve, is coupled to the frequency-changer by a pair of tuned circuits to the secondary of which reaction is applied from its anode circuit. The I.F. amplifier proper follows the buffer valve, and the first valve is coupled to it by an aperiodic coupling. Provided that proper precautions to reduce avoidable stray couplings are taken, the net result is a circuit in which reaction affects only the pair of circuits between the frequency-changer and the buffer valve.

Reaction and A.V.C.

The next point about reaction is that as normally applied it requires skilled operation. Reaction does not increase selectivity by reducing interference but only by increasing the strength of a wanted signal relative to the interference. Coupled circuits, on the other hand, reduce the interference without affecting the wanted signal to the same degree. In practice, therefore, where reaction is used to obtain selectivity, it is usually necessary to reduce the amplification, otherwise the only results are to increase the strength of the desired station beyond the value required, and to leave the interference unaffected. This difficulty of operation is got over automatically by using A.V.C., for an increase in the setting of the reaction control then automatically reduces the interference and sharpens the tuning. The application of reaction makes no difference to signal strength, but only affects selec-

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tivity and quality, and the reaction control thus really becomes a selectivity control in more than name.

The practical result of including variable selectivity is to improve the quality of reproduction, for on no station need the selectivity, and hence the sideband cutting, be greater than is dictated by the amount of interference present on that station. When conditions are good, therefore, selectivity may be reduced and a better high-frequency response obtained.

It will be seen, therefore, that the problems involved in the production of a receiver operating on the single-span principle have been both many and varied, and not confined alone to the development of the tuning method. To secure a wide tuning range and a satisfactory performance with freedom from ganging has necessitated research into many matters at first sight unconnected with the principle.

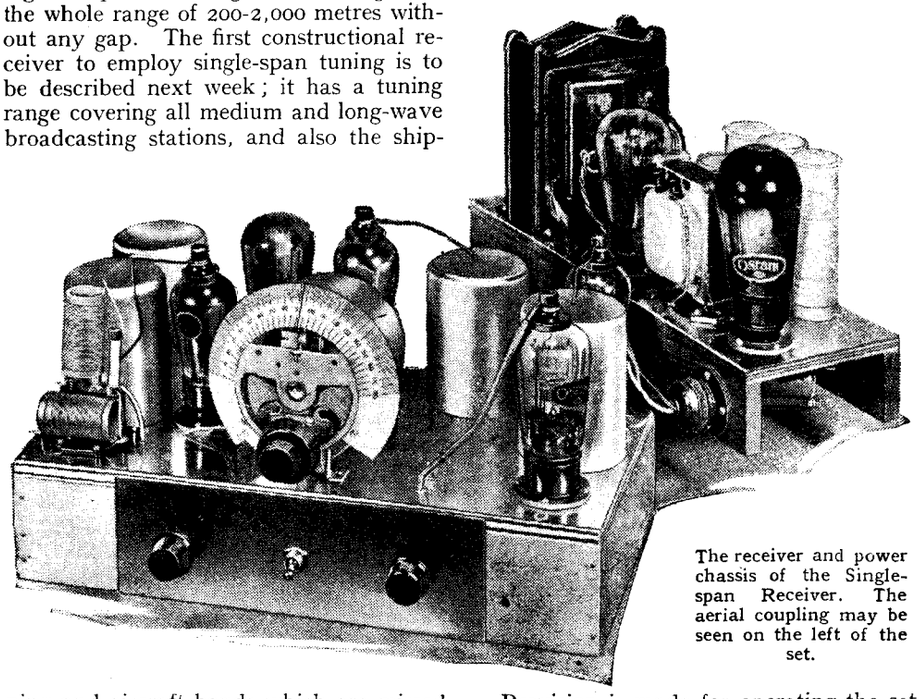
In Next Week's Issue :—

The Wireless World

Single-span Receiver

A Quality Set with Full Waveband Coverage and No Ganging

RECENT issues of *The Wireless World* have contained details of the new principle of single-span tuning which obviates the necessity for any ganging and provides single-dial tuning over the whole range of 200-2,000 metres without any gap. The first constructional receiver to employ single-span tuning is to be described next week; it has a tuning range covering all medium and long-wave broadcasting stations, and also the shipping and aircraft bands which are missed with all ordinary sets.



The receiver and power chassis of the Single-span Receiver. The aerial coupling may be seen on the left of the set.

Tuning is carried out by a single small condenser fitted with a dual-ratio dial permitting rapid searching, yet accurate tuning. No ganging is involved, and no matched coils are required, so that the construction of the various coils is well within the capabilities of the amateur. The initial adjustments are few in number and consist merely of tuning the I.F. circuits to the same frequency and adjusting a single trimmer to ensure the correct waveband coverage being obtained.

The valves are arranged as a heptode frequency-changer followed by a buffer valve and two I.F. valves, while signal rectification, delayed A.V.C., and first stage L.F. amplification are obtained from a duo-diode-triode. This valve is resistance-coupled to an output triode delivering some 2,500 milliwatts to the energised moving-coil loud speaker. An indirectly heated mains rectifier is used.

Provision is made for operating the set to reproduce records, and the manual volume control is operative on both radio and gramophone. The quality of reproduction obtainable is of an unsually high order, due largely to the inclusion of variable selectivity—a new feature which permits the best compromise between selectivity and quality to be obtained under all conditions.

Only four controls are fitted to the set—the tuning control covering 200 to 2,000 metres, the selectivity control, the manual volume control, and the radio-gramophone switch.

On test the receiver proved capable of a high standard of reproduction with adequate volume for most purposes. The sensitivity was sufficient for the daylight reception of numbers of Continental transmissions, while the selectivity proved sufficiently high for general reception under modern conditions. Second channel and similar whistles were completely absent as well as cross-modulation, and the hum level was negligibly small.

LIST OF PARTS

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

RECEIVER UNIT

1 Variable condenser, 0.00016 mfd. **Polar Type "E"**
1 Dial, slow motion type **Polar Micro-drive semi-circular**
2 Bulbs, 6 volts 0.15 amp. **Bulgin 615**
1 Slow motion reaction condenser, 0.0002 mfd. **Eddystone 957**
1 Tapered volume control, 250,000 ohms **Magnum**
(Claude Lyons, Rothermel, Watmel)
1 Double-pole change-over switch **Bulgin S.98**
3 Valve holders, 5-pin **Clix Chassis Mounting Standard Type**
2 Valve holders, 7-pin **Clix Chassis Mounting Type**
1 Compression Condenser, 100 mmfds. **Colvern**
4 Microdensers, 100 mmfds. **Eddystone 900**
6 Fixed condensers, 0.1 mfd. 200v. working **T.C.C. 50**
2 Fixed Condensers, 0.01 mfd. **T.C.C. Type "M"**
2 Fixed Condensers, 0.001 mfd. **T.C.C. Type "M"**
5 Fixed Condensers, 0.0001 mfd. **T.C.C. Type "M"**
2 Fixed Condensers, 0.0005 mfd. **T.C.C. Type "M"**
1 Fixed Condenser, 0.0002 mfd. **T.C.C. 34**
(Dubilier, Graham-Farish, Peak, T.M.C.Hydra, Telsen)
2 Electrolytic Condensers, 50 mfds. 12v. working
(Dubilier) **T.C.C. 501**
2 Metallised Resistances, 250 ohms 1 watt **Dubilier**
3 Metallised Resistances, 2,000 ohms 1 watt **Dubilier**
1 Metallised Resistance, 10,000 ohms 1 watt **Dubilier**
1 Metallised Resistance, 20,000 ohms 1 watt **Dubilier**
2 Metallised Resistances, 50,000 ohms 1 watt **Dubilier**
3 Metallised Resistances, 100,000 ohms 1 watt **Dubilier**
1 Metallised Resistance, 1 megohm 1 watt **Dubilier**
2 Metallised Resistances, 2 megohms 1 watt **Dubilier**
1 Metallised Resistance, 4,000 ohms 3 watts **Dubilier**
1 Metallised Resistance, 6,000 ohms 3 watts **Dubilier**
(Erie, Graham-Farish, Claude Lyons, Seradex, Watmel)
1 Resistor, 30 ohms **Bulgin A.R.30**
1 Resistor, 50 ohms **Bulgin A.R.50**
1 Screened H.F. Choke **Bulgin H.F.8**
1 5-way Connector **Wilburn**
1 5-pin Plug **British Radio Gramophone Co.**
(Bulgin)
1 5-way Cable with twin 70/36 leads **Goltone**
(Harbros)
4 Knobs **Bulgin K.6**
4 Ebonite Shrouded Terminals, A., E., Pick-up (2) **Belling-Lee Type "B"**
4 Coil Screens, 3¾ x 2½ins. diam. **White Bros. & Jacobs**
1 Coil Screen, 4 x 3½ins. diam. **Colvern**
Materials for Coils:
12ins. Paxolin tube, 1in. diam. **Wright & Weaire**
2½ins. Paxolin tube, ¾in. diam. **Wright & Weaire**
Quantity No. 32, 36 and 38 D.S.C. wire.
or 1 Set of Coils
1 Length Screened Sleeving **Harbros**
2 ozs. No. 20 Tinned Copper Wire, 8 lengths Systoflex, wood, etc.
Plymax Baseboard, 8 x 15 x ⅜ins. **Peto-Scott**
Screws:—
14 ½in. No. 4 R/hd.; 36 ⅜in. No. 4 R/hd.
8 ½in. No. 4 R/hd.; 2 ¾in. No. 4 R/hd.
All with nuts and washers.
1 ¼in. No. 6 B.A., with metal thread and nut and washer.
Valves:—1 Ferranti VHT4, 1 Ferranti VPT4, 1 Osram or Marconi ML4, 1 Osram or Marconi VMS4, 1 Osram or Marconi MHD4.

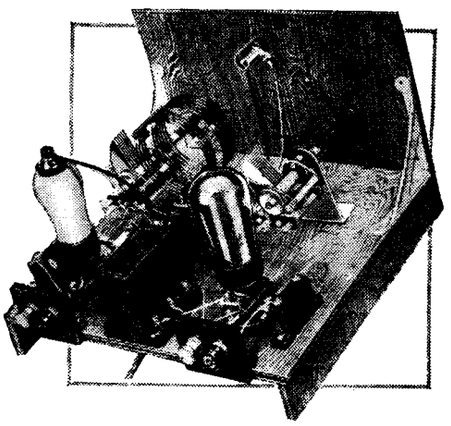
POWER UNIT

1 Mains transformer, primary, 200 to 250 volts, 50 cycles; secondaries, 350-0-350 volts, 100 m.a.; 4 volts, 2.5 amps., centre-tapped; 4 volts, 1 amp., centre-tapped; 4 volts, 5 amps., centre-tapped **Heayberd Type W.W.7**
(B.S.R., British Radio Gramophone Co., Bryce, Challis, Davenset, Claude Lyons, Rich and Bundy, Sound Sales, Vortexion)
1 Smoothing choke, 10 henries **Wearite H.T.11**
(Bulgin, Davenset, Ferranti, Sound Sales.)
1 Fixed condenser, 0.01 mfd. **T.C.C. Type "M"**
(Dubilier, Graham-Farish, Telsen)
1 Electrolytic condenser, 4 mfds., 440v. working **T.C.C. 802**
3 Electrolytic condensers, 8 mfds., 440v. working
(Dubilier, Peak, Telsen) **T.C.C. 802**
1 Electrolytic condenser, 50 mfds., 50v. working
(Dubilier) **T.C.C. 521**
1 Metallised resistance, 10,000 ohms, 1 watt **Dubilier**
1 Metallised resistance, 100,000 ohms, 1 watt **Dubilier**
1 Metallised resistance, 250,000 ohms, 1 watt **Dubilier**
1 Metallised resistance, 700 ohms, 2 watts **Dubilier**
(Erie, Graham-Farish, Claude Lyons, Seradex, Watmel)
4 Valve holders, 5-pin **Clix Chassis Mounting Standard Type**
1 5-pin Plug **British Radio Gramophone Co.**
(Bulgin)
1 Loud speaker with 2,500 ohms field with triode type transformer. **Celestion Type E.8**
(Magnavox, Rola)
Quantity No. 22 tinned copper wire, 2 lengths Systoflex, wood, etc.
Plymax Baseboard, 15 x 5 x ⅜in. **Peto-Scott**
Screws:—
18 ⅜in. No. 4 R/hd.; 12 ½in. No. 4 R/hd.
All with nuts and washers.
2 ¾in. No. 6 BA with metal threads and nuts and washers.
Valves:—1 Osram or Marconi PX4; 1 Osram or Marconi MU12.

Below 150 Metres

LONG distance reception at all times of the day with the simplest of receivers, thousands of stations from which to choose, a general atmosphere of novelty—these are among the inducements which the writer holds out to those who hesitate to try their luck on the short wavebands. Few who read this article will deny that short wave work can be an ideal adjunct to listening on the long and medium wavelengths

By MEGACYCLE



Simplicity of construction is an attractive feature of short wave apparatus. The photograph is of the Short Wave Two described in *The Wireless World* of Nov. 4th 1932. It covers a wave range of 15 to 80 metres, and consists of a screen grid detector and pentode output.

THE wavelengths below 150 metres are not, in the opinion of the writer, getting a square deal, and the reason for this can only be that the average enthusiast simply does not realise how much of interest he is missing.

It is the purpose of this article to outline, without exaggeration, showmanship or superlatives of any kind, the very real attractions of short-wave work to-day.

The Attractions of Short Waves

Short waves, at the moment, are the home-constructor's paradise. The very simplest of apparatus, designed with intelligence, will give excellent results. True, there is a certain new technique to be acquired, but this is surely an additional attraction rather than a disadvantage.

A friend of the writer's, whose experience on the ordinary broadcast waves dates back to the days of Writtle, recently took up short-wave reception for the first time, and confessed that he was recapturing the thrills of his early days in radio, simply by virtue of the "strangeness" of everything.

Short-wave gear can be easily rigged up in a confined space and is ideal for use on field days. The amateurs in the picture were photographed while taking part in inter-Empire tests organised by the Radio Society of Great Britain.

Let us consider, first, the things that are available to the short-wave listener exclusively. On the five principal short-wave broadcast bands, during a week's listening (at a very conservative estimate) he will be able to hear stations in Australasia, Asia, South Africa, South America and other remote parts. North Americans there are in plenty, but, in recent years, these have been available also to the listener on the broadcast bands.

The writer has not yet come across an authentic case of the reception of either South Africa or Australasia on the broadcast waves; yet this is a daily occurrence with the average owner of a short-wave set.

Below 100 metres there are, in active operation, over 100 broadcast stations, mostly grouped into five wave-bands in the regions of 49, 31, 25, 19 and 16 metres. In addition, however, there are numbers of commercial radio-telephone stations which radiate experimental programmes from time to time. As a matter of fact some of these people provide the most interesting items of all, if only on account of their spontaneous and impromptu nature!

Then the reader who is familiar with the Morse code will have available, in addition to these stations, all the vast number of amateur transmissions grouped in the three wave-bands centring round 84, 42 and 21 metres. Quite a number of amateurs are using telephony nowadays, especially in the U.S.A. on the 84- and 21-metre bands.

So much for the stations that one may expect to hear on the short waves. Consider them as Attraction No. 1, although, unfortunately, there *are* occasional black sheep whose transmissions are anything but attractive.

The next point to consider is that of the general characteristics of short waves. There is a vast difference in the behaviour of two transmissions, for example, one being on 80 metres and the other on 19 metres. The latter will be almost a "daylight signal," while the former, if from a great distance will probably be heard only after dark.

This brings us to the important fact that *some* particular part of the short-wave spectrum is likely to be interesting at whatever time of day we happen to be listening. As a concrete example, the American station W3XAL, Bound Brook, N.J., may be heard on 16.87 metres from mid-day until 5 or 6 p.m. From 4 p.m. until 9 p.m. or later, one can listen in comfort to W2XAD, Schenectady, on 19.56, or W8XK, Pittsburgh, on 19.72; and then, with an intermediate stage on either the 25- or the 31-metres band, one can settle down at 11 p.m. and listen for hours to the 49-metre American stations.

Round the Clock

In the writer's opinion this is the most attractive feature of all—the fact that every hour of the day holds something of interest. By the time one has owned a short-wave receiver for a month or so and accumulated a little practical experience, one knows where to listen and when.

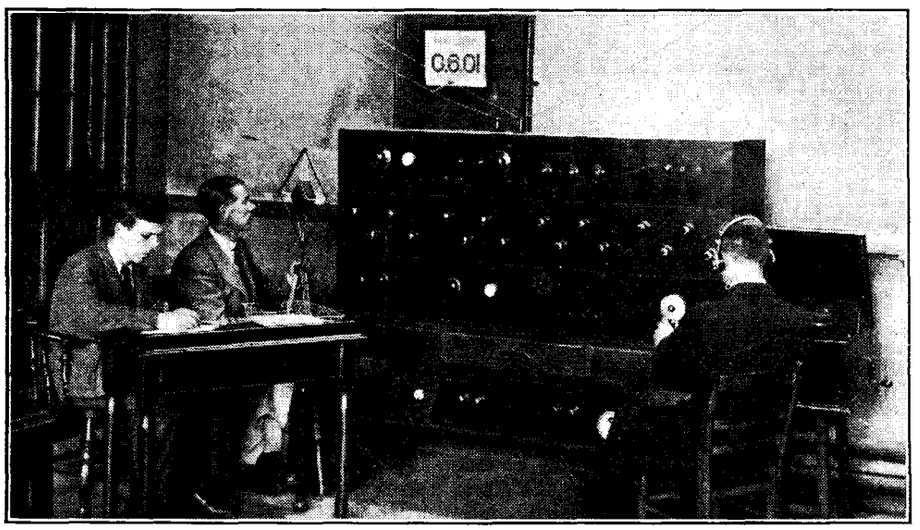
To some, no doubt, the fact that simple gear is nearly always successful would be a great attraction. A straightforward receiver of the detector-and-L.F. type will yield surprising results. After prolonged trials of superheterodynes and multi-stage H.F. receivers, the writer has settled down once more to the homely two-valver.

Below 150 Metres—

Similarly, the most modest of aerial systems seems to work excellently. One hears much talk about screening effects on short waves, but it is the practical experience of most of the old-stagers that the most unlikely-looking locations will often produce the best results. The fact remains that a small indoor aerial will often score over a large outside affair on account of the improved signal-to-noise ratio obtainable.

Perhaps the thought of encountering unknown difficulties frightens listeners away from the short waves?

Let it be quite clear that there is absolutely nothing that one need be scared of. All that the short waves call for are a little extra care in design and construction, and a little extra skill in operation.



A typical amateur short-wave transmitting and receiving station, G 6 01, operated by the boys of King Edward's School, Stourbridge.

Both of these requirements might be profitably employed on the broadcast bands, but they certainly are an absolute necessity if one seeks success below 100 metres.

When one is dealing with frequencies of the order of 15,000 kc/s (as one is on 20 metres) one has to take little precautions in receiver design. Unnecessarily long wiring in one of the H.F. circuits, for example, will make all the difference between success and failure, although on 1,000 kc/s (300 metres) its effect would probably pass unnoticed.

"Converted" Sets

It is an interesting fact that once one has settled down to the technique of short-wave receiver design, one almost invariably finds that one can build a very much better broadcast receiver than before. A broadcast receiver "converted" to receive short waves very often leaves a lot to be desired in the matter of efficiency; but a short-wave set converted for the broadcast waves is almost invariably a huge success.

Surely we may add this to our list of attractions—the fact that one *has* to use intelligence and good workmanship, and that they receive their due reward, whereas on the broadcast waves one very often finds that the untidy and "slapdash" home constructor obtains results far ahead of his deserts!

With regard to operation, nothing need be said beyond the bare statement that one has to cover a much greater wave-band with each coil than one has been accustomed to. For this reason a good slow-motion dial is a necessity, while a steady hand and a delicate touch are very desirable. (Here, again, however, we might say that these things *should* be cultivated even on the broadcast waves.)

A Summing-Up

Let us summarise these good reasons for taking an interest in short-wave work.

1. There are thousands of stations operating below 100 metres that one can never hope to hear on any other wavelength.

2. Long-distance reception is possible at practically any time of day or night by correct choice of wavelength.

3. The simplest of receivers and aerial systems is successful; a short-wave set, not being expensive, may therefore be used as an addition to the broadcast receiving gear that one already possesses.

4. There is a general atmosphere of novelty that more than compensates one for the well-known feeling of being lost!

5. Intelligent designing and operating usually reap their own reward.

Now, to be fair, we must deal with the disadvantages attendant upon short-wave work. First and foremost comes the bugbear of varying conditions. Anyone with the slightest experience of short waves knows what that word "conditions" implies. There are days, and sometimes weeks, when the long-distance stations become weak and unreliable. Fortunately for us, the days of complete "fade-outs" seem to have been banished by the general use of high power and the general improvement in transmitter and receiver efficiency.

Personally, the writer must confess to a feeling that these varying conditions are an attraction rather than a disadvantage—one never knows quite what is going to happen! If one could receive the same stations consistently, day in and day out, they might begin to pall on one, but the erratic behaviour of some of them makes it quite an exciting business to hear them at all. That, however, is but a personal opinion, and "conditions" must undoubtedly go down on the "debit" side of the balance sheet.

Next is the vexed question of "man-made interference." Tramway companies are fitting silencing systems that are doubtless very efficient on the broadcast bands, but the short-wave man, being in the minority, continues to suffer from devastating crackles and arcs.

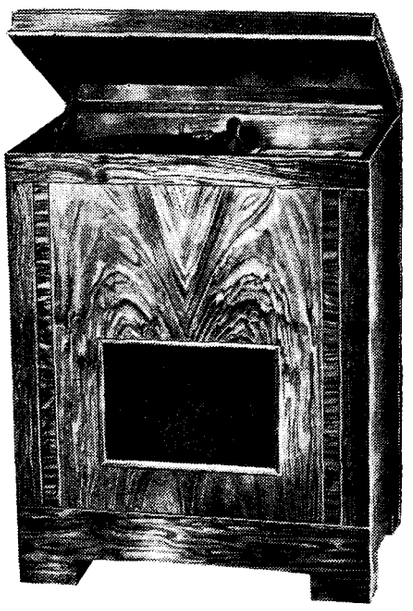
Motor-car ignition is rather apt to be troublesome to those who live near main roads, and any large electrical apparatus can cause severe disturbances over a small radius.

The reader should bear in mind, however, that we are considering short-wave work as an adjunct to his ordinary broadcast reception—not as a substitute. He therefore has everything to gain and very little to lose.

The best recommendation that one can make to anyone who feels that he might possibly be interested in short-wave work is this: get in touch, if possible, with an acquaintance who owns a short-wave receiver and let it speak for itself.

Ekco R.G.84 Radiogram

REMARKABLY good value for money is provided by this latest addition to the Ekco range of receivers. The new model, which costs 21 guineas, incorporates a five-valve superheterodyne chassis with A.V.C. similar to that of the Type 74 receiver. A Collaro induction motor is included, and all the controls are mounted inside the cabinet.



The walnut cabinet is finished in two tones with a semi-matt surface.

HINTS and TIPS

Practical Aids to Better Reception

AN indication of accurate tuning which most of us employed, consciously or sub-consciously, in the days when extreme reaction was the only real aid to sensitivity, may still be turned to good account when operating a modern single control superheterodyne. Users of such sets, when tuning to an unmodulated carrier wave before the start of the programme, should realise that slight detuning will generally produce a high-pitched hiss. The presence of this hiss on each side of the tuning point corresponding to exact resonance is an excellent guide, and by its help one should generally be able to tune almost literally "to a kilocycle."

A Tuning Hint

A MILLIAMMETER, wired in series with the detector anode circuit, enables one to keep a watch on the behaviour of the tuning system, and, indeed, of the H.F. portion of the set as a whole. Those who have become accustomed to rely on the indications provided by a detector anode current meter will generally wish to embody a similar arrangement in sets which include a diode valve detector or a Westector metal rectifier.

Rectified Current Meter

In the great majority of cases it is hardly practicable to obtain a direct indication of the output of a diode. Rectifiers of this type work into a load of extremely high ohmic resistance, and the current that flows in the output circuit is so small that a highly sensitive instrument, such as a micrometer, is necessary to detect it. For the benefit of those few who have a sufficiently sensitive measuring instrument, or are willing to obtain one, it may perhaps be worth while to point out that it should be connected in series with the diode load in the manner indicated in Fig. 1.

With earlier forms of diode detection it was customary to rely upon an indirect reading of the rectifier output by observing the changes in anode current of the valve immediately succeeding the diode. This succeeding amplifying valve was usually so connected that the rectified carrier wave was applied directly to its grid, and so its standing anode current varied in sympathy with the strength of incoming signals.

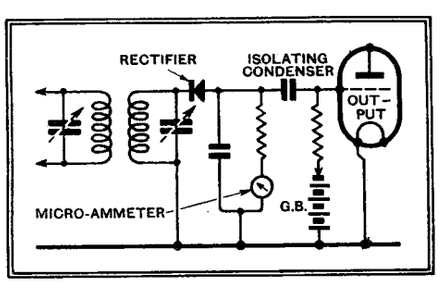


Fig. 1.—A micro-ammeter or sensitive galvanometer connected as a tuning indicator. An arrangement of this kind is applicable either to a diode valve or an H.F. metal rectifier.

Nowadays it is usual—and in some cases it is absolutely necessary—to isolate the succeeding L.F. valve from the diode, so far as D.C. changes of potential are concerned, by interposing a condenser as in Fig. 1. This means that the steady anode current of the succeeding valve will not be affected by the rectified output of the detector.

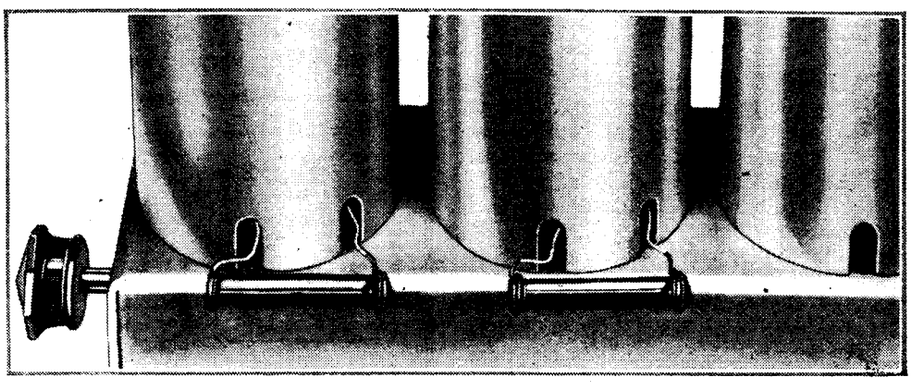
In such cases it will generally happen that the set includes automatic volume control, and it may be remembered that variations in current of the controlled valve or valves provide a direct indication of changes in detector output.

AN important practical contribution to the art of adjusting a band-pass filter (particularly in a superheterodyne receiver) was made when it was suggested recently in the pages of this journal that the effective coupling between the component circuits should be temporarily reduced by shunting the individual circuits which together make up the filter by fixed resistances. Although it may seem rather a drastic procedure to flatten tuning deliberately, there can be little doubt that the operation of "trimming" is greatly facilitated by these means.

Deliberately Flattened Circuits

Reference to this subject reminds us of an earlier application of the principle of deliberately reducing the effectiveness of a tuned circuit as a purely temporary measure. When carrying out the operation of trimming a set it is often of great importance that one should know that the particular circuit that is being worked upon is "taking charge" of the tuning of the set as a whole.

All risk of uncertainty in such cases is removed by connecting across all the circuits, other than the one being worked upon, a resistance of 5,000 ohms, or sometimes a little less. It is almost essential that this resistance should be of the composition or metallised type, with a low self-capacity, and it should be connected as close as possible to the component (coil or condenser) with which it is to be associated. In most cases it is a matter of indifference whether one joins it across the tuning coil or the condenser, but in a few cases (e.g., in tuned anode circuits) there is no choice but to connect it across the coil.



Shunt resistances temporarily connected across tuning coils as an aid to making initial adjustments.

WHEN a mains receiver with indirectly heated valves shows a serious falling-off in performance after, perhaps, a quarter of an hour's work, it is to be suspected that grid emission is taking place in one or more of the valves. Due to the transference of an excessive amount of heat from the cathode to the grid, the latter may be emitting electrons. Confirmatory evidence that grid emission is really the trouble is obtained if the set again works normally after cooling down.

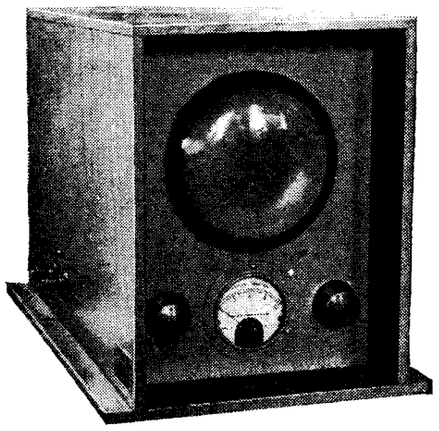
Grid Emission

Fortunately, improvements in valve manufacture have largely removed this trouble, and it is not often met with nowadays. When the symptoms of grid emission are noticed, it is to be suspected that for some reason or another the valve heaters are being operated at an excessive temperature, and in the case of an A.C. mains set it is worth while checking the connection of the mains to the tapped primary of the power transformer. If, for example, a 240-volt A.C. supply were connected to the terminals appropriate for a 200-volt supply, a considerable voltage rise would take place.

The Cathode Ray Oscillograph

Practical Details of the Subsidiary Apparatus Required for Operating the Cossor Tube

By F. H. HAYNES



Box mounting for the oscillograph tube. The inclusion of a filament ammeter or voltmeter is essential.

THE purpose of this article is to give the reader practical information to enable him to set up a cathode ray oscillograph, with its associated apparatus, so that it can be used for a variety of experimental investigations into the behaviour of wireless receivers and other apparatus. Those readers who may not wish to acquire such an equipment at the moment will, nevertheless, be interested in understanding its operation.

RECENT months have shown a rapid growth in the popularity of the cathode ray tube among set manufacturers and experimenters. The visual indication which it can provide as a guide to receiver performance reveals instantaneously many properties of a set where the more complicated method of observing by the aid of several meters and deducing the results might well be expected to take some hours. In the hands of the experimenter the cathode ray tube opens up a vast new field of interest and instruction in a manner which has no ready parallel among the meter methods of test. On the screen of the tube can be observed both the amplitude and frequency distortion which an L.F. signal may suffer in the process of amplification. Only the cathode ray tube can reveal the widely varying load conditions of a moving coil loud speaker due to the characteristics of its diaphragm. Response curves of H.F. circuits are shown at a glance instead of by the laborious system of taking innumerable meter readings. To those who aspire to the possibilities of high definition television the cathode ray oscillograph appears an essential. It can be synchronised by electrical means, thereby removing the severe limitations in picture analysis by the use of revolving apparatus.

In this article the endeavour will be made to put into practical form constructional details of the apparatus required for operating the tube. The internal construction of a Cossor tube is shown in Fig. 1. The complete equipment may be considered as three units:—

(a) the tube with its mounting, 2-volt filament accumulator, filament resistances and filament ammeter;

(b) the high voltage eliminator which produces the gun potential and shield bias; and

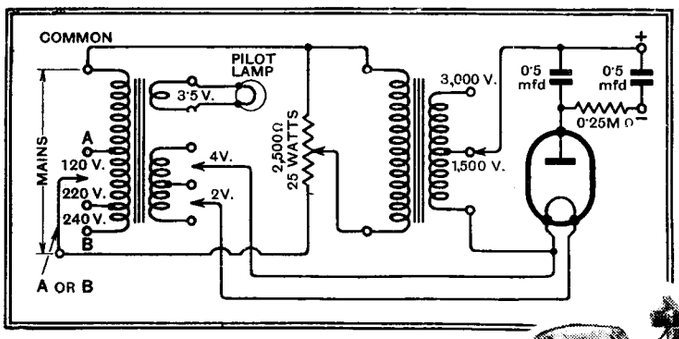
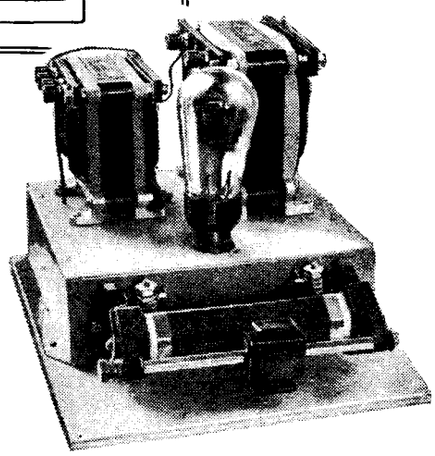


Fig. 3.—*Variable voltage H.T. unit.* Tapping points on the transformers in conjunction with a heavy duty potentiometer permit of continuous D.C. voltage variation from zero to over 3,000.



H.T. unit for providing the gun potential. The output is continuously adjustable up to some 3,000 volts.

(c) the time base unit.

Power is derived from A.C. supply.

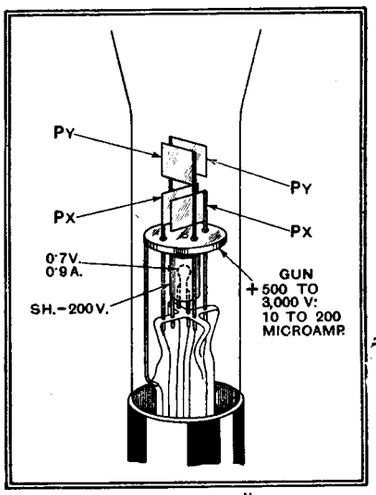


Fig. 1.—*The cathode tube.* Internal arrangement of the electrodes in the Cossor tube.

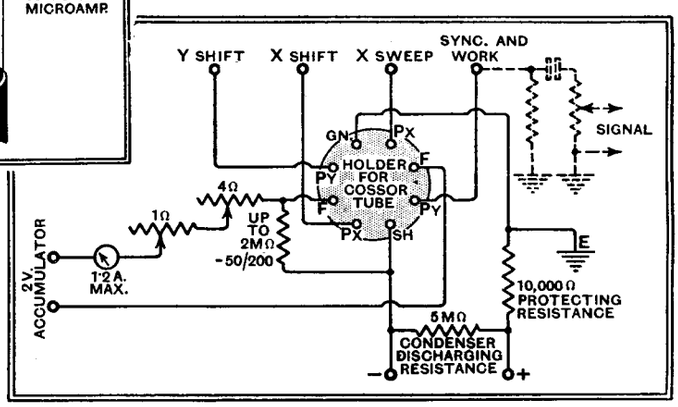


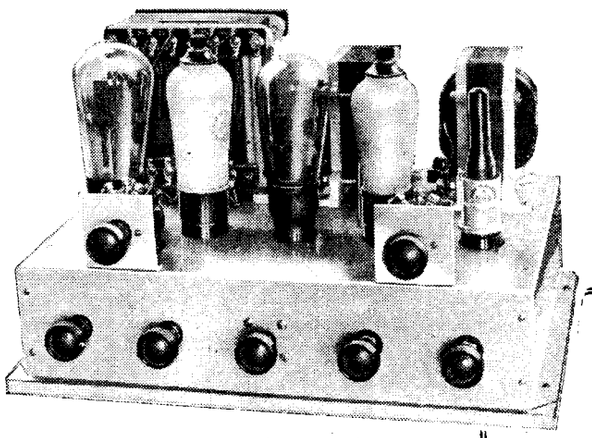
Fig. 2.—*Tube holder circuit.* Critical control of filament current is provided. Negative biasing of the shield is effected through a resistance in the filament to H.T. negative lead. The filament heating accumulator must be insulated from earth.

The Tube Unit

A simple form of housing for the tube is a plywood box with a hole exposing the screen of the tube. This protects the tube from damage, shades the screen and interior from light and gives accommodation for the filament resistances and ammeter, the last-named being an essential. A current of about 1 ampere is required and the precise value is shown on the tube used. Just over a volt is dissipated in the pair of filament resistances

The Cathode Ray Oscillograph—

which provide fine and coarse adjustment. The pin connections and wiring are given in Fig. 2. A negative bias of some 200 volts is applied to the shield by means of a voltage dropping resistance in the negative H.T. lead and takes the form of a leak resistance between the *F* and *Sh* terminals. A protective 10,000 ohm resistance is included in the H.T.+ lead, while a high resistance effects the discharge of the smoothing condensers of the H.T. supply unit.



The Time Base unit. The controls are: velocity, trigger, velocity stepped condenser, amplitude, synchronising, X shift and Y shift.

H.T. Unit

Up to 3,000 volts may be required and an almost continuous variation up to this value is provided. The current drawn is exceedingly small, so that this high voltage eliminator is not unduly costly to construct. Rectification is by a half-wave valve and the variation of output is obtained from a pair of transformers, Fig. 3. Filament heating and H.T. windings are carried by separate transformers and the former by means of a centre tapping on its primary provides for halving the primary voltage applied to the latter. For normal low-voltage working the centre tapping point is used so that the 3,000 volts indicated on the H.T. transformer is only some 1,500, and the 1,500 terminal becomes 750. Between the two transformers is a heavy duty potentiometer which provides further sub-division. Three terminals on the filament transformer give 2, 4 or 6 volts so that the special 2-volt Cossor SU130 rectifier may be used, or, alternatively, almost any 4-volt rectifier, or, on the 6 volts, an old RH1 or even B12 triode.

As only a minute current is drawn from the rectifier the customary smoothing choke is replaced by a high resistance. A pair of high-test voltage condensers assembled as a single unit complete the smoothing equipment. A high-value shunt resistance affords a leak on the rectifier to avoid the condensers retaining a charge.

If, now, the two units are connected together and the filament current cautiously advanced to the stated value, a bright spot will be obtained on the screen. For this test the *Px* and *Py* terminals are all connected to the *Gn* terminal. Use initially the centre tappings on the filament transformer and the secondary of the H.T. transformer while steadily advancing the control resistance from zero.

Time Base Unit

Across the P*x* terminals a time base potential is applied in order that the spot of light may traverse the screen on a horizontal line. The effect may be produced by the 50-cycle supply, but in this case the speed of travel is not uniform, neither could it be varied to synchronise with the predominant frequency of the signal to be examined. The spot must journey at constant speed across the screen and then restore as quickly as possible. A condenser charged through a resistance and discharging through a neon tube is sometimes used as a time base circuit, but this, again, is not linear, as the condenser discharges exponentially.

A linear traverse results as a condenser charges through a constant current device which is, in this case, an H.F. pentode

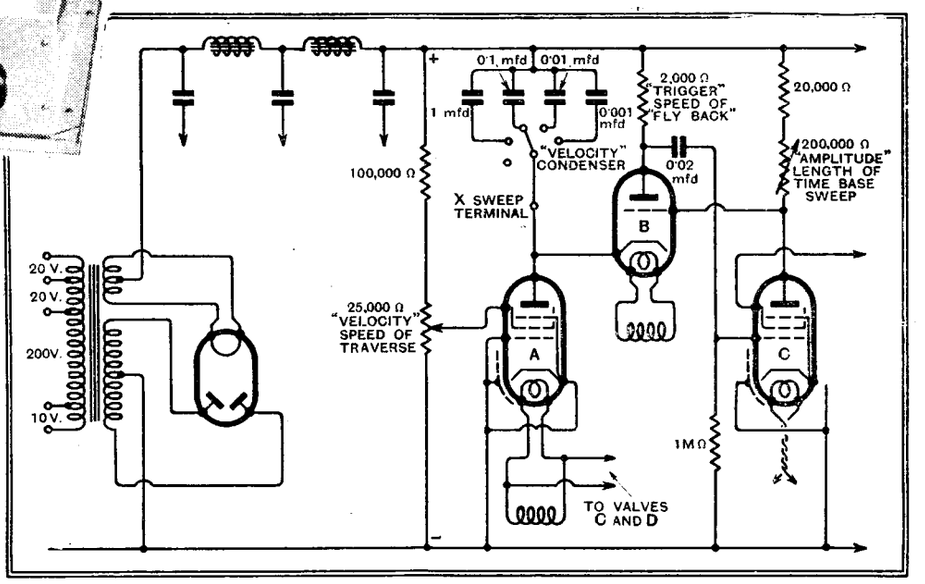
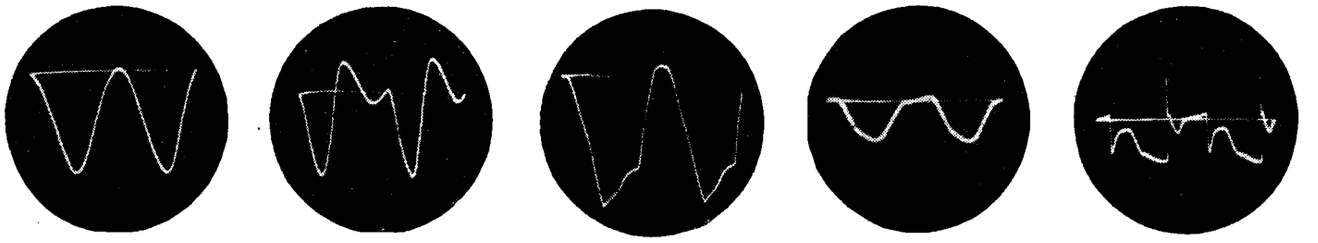


Fig. 4.—*The Time Base circuit.* The time taken to charge the condenser depends upon its capacity and the adjustment of the screen potential of the A. Discharge takes place through B and is accelerated by the action of C.

SOME TYPICAL OSCILLOGRAPHS.

The successive cycles are of uniform width, showing the time base traverse to be linear. The horizontal line is the "fly-back." Its faintness shows that the return of the spot is rapid and a brightening to the left indicates that its velocity, which is due to the discharging of a condenser through a resistance, is non-linear.



(a) (b) (c) (d) (e)

(a) Wave-form of potential developed across the anode load of a 6-watt triode output valve. A constant frequency is applied to the grid. (b) The same output stage, showing the second harmonic content brought about by over-biasing. (c) Effect of insufficient bias. (d) A compensated pentode output stage. (e) Further distortion of the wave-form given by the pentode brought about by reduction of the anode potential.

The Cathode Ray Oscillograph—

valve (MS.Pen, MSP4 or VMP4). It is the steady rise in the potential of the charging condenser which produces the *x* sweep. The rate of charge is controlled by the capacity of the condenser, the screen potential of the pentode valve, and, to a lesser extent, the adjustment of the circuit which shunts the condenser and provides for its almost spontaneous discharge. Fig. 4 shows the action of the time base circuit and the arrangement of the fly-back action. The cycle taking place, if briefly expressed, can be readily grasped, and the procedure is as follows:—

1. The condenser charges through the H.F. pentode *A* (MS.Pen, MSP4 or VMP4), which is operating on the flat part of its anode-volts, anode-current characteristic. The rate of charge is governed by the setting of the screen potentiometer, and this determines the speed of traverse of the point of light across the screen. This adjustment is the *velocity* control.

2. Current is passing in the anode circuit of the H.F. pentode valve *C* (MS.Pen, or MSP4), and the consequent voltage drop produced creates a negative bias on the grid of the triode *B* (41.MP or MH4), the cathode of which connects to the anode of valve *A*. The value of this bias is governed by the variable anode resistance of *C*. This is the *amplitude* control and regulates the length of the traverse line on the screen of the tube.

3. The rising voltage across the "velocity" condenser is applied to the anode and cathode of *B*, and eventually a potential is reached where, in spite of the negativeness of the grid, anode current flows.

4. By virtue of the resistance in the plate circuit of *B*, the flow of anode current causes the voltage to drop at its anode and

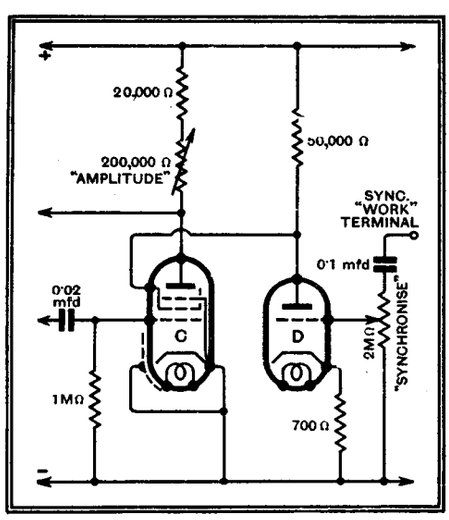


Fig. 5.—*Synchronising control.* A positive potential peak on the grid of D causes the screen potential of C to fall and its anode potential to rise. The negative bias on the grid of B is thus reduced, causing the condenser to discharge. In this way the time base potential is kept in step with the "work" signal.

it becomes less positive. This fall in potential is communicated to the grid of *C*, which, now becoming more negative, passes less anode current. In consequence, the negative bias of *B* is almost completely removed, so that the entire discharge of the condenser can now speedily take place through the anode resistance of *B*. This resistance, which regulates the speed of discharge, is the *trigger*.

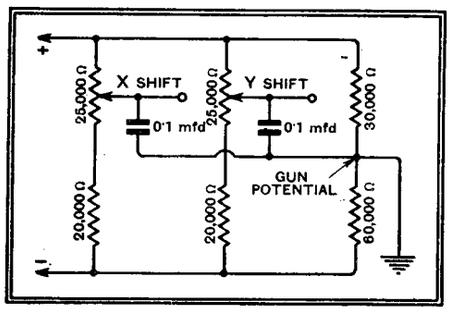


Fig. 6. — *Controls for centring the image.* Adjustment of the potentials applied to the X and Y plates shift the image vertically or horizontally into the centre of the screen.

5. As the discharge proceeds, the anode current of *B* falls, and conditions restore preparatory to the recommencement of the cycle.

Synchronising

The signal voltage applied to the vertical traverse, *Py* (usually called the "work" voltage), may be synchronised with the time base. For instance, if the time base is synchronised with a 50-cycle supply which is also applied as the "work" voltage, a stationary sine wave results. The additional valve *D* (41.MP or MH4) (Fig. 5), is used for synchronising, and part of the "work" voltage is applied to the grid by means of the coupling condenser and adjustable potentiometer, and the action is as follows:—

1. A positive impulse reaching the grid of *D* causes an increase in its anode current. The voltage on the anode of *D*, therefore, falls, taking with it the potential on the screen of *C*.

2. With the fall of screen potential the value of the anode current through *C* lessens, and the anode potential rises.

3. The negativeness of the grid of *B* with respect to its cathode is thus reduced, and the discharge of the condenser through *B* is stimulated. Thus, each positive peak of the "work" voltage throws the triggering effect of the valve *B* with its associated anode resistance into action.

In using the synchronising circuit the "amplitude" control is first regulated, followed by a close synchronising adjustment by means of the velocity control. Just sufficient of the "work" potential is then introduced by advancing the synchronising control as will hold the figure stationary.

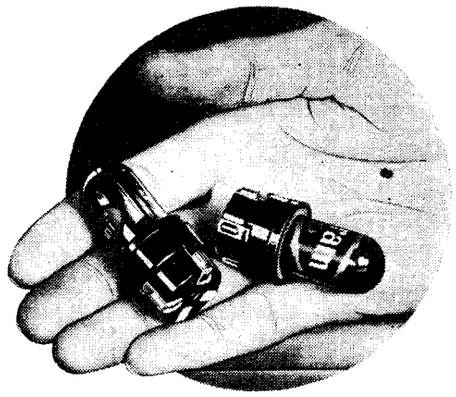
Additional controls provide for suitably locating the figure on the screen. These consist of potentiometers which vary the potentials on the *X* and *Y* plates in relation to the gun potential which is the earth point in the circuit. A pair of potentiometers operating across the H.T. supply are used for this purpose (Fig. 6).

New Midget Valves

Marconi and Osram H.11 and L.11

TWO valves of particular interest to constructors of midget apparatus have been announced. They are Marconi and Osram triodes with filaments rated for a consumption of 0.1 ampere at 1 volt. This unusual rating is brought about through an endeavour to obtain extreme economy and yet retain a robust filament. It is intended that a pair of valves be used with series-connected filaments and operated from an accumulator, or, alternatively, that the filaments be paralleled for heating from a single dry cell.

A marked absence of microphony is claimed to be a feature of these valves, and this is partly due to the robust filament which is used, and partly to the use of an absorbent rubber pad in the mounting of the glass envelope on its base. The valves are not fitted with the usual four-pin base; instead, the base carries four contacts which press against tongues in the special holder.



The photograph speaks for itself when the subject is Midget Valves.

Some saving in space is thus obtained, and this is accentuated by the small dimensions of the glass bulb. The diameter is only 17.5 mm., and that of the base 25 mm., while the overall length, including the base, is 33 mm.

The smallness of these valves renders them invaluable for use in compact receivers, and they have been particularly developed for use in deaf-aids and police receivers where small size and weight are essential features.

Electrically, these valves are less efficient than normal types, and they are rated for a maximum anode potential of 100 volts only, but are intended for normal working at 45 volts. The L.11 has an A.C. resistance of 12,500 ohms and a mutual conductance of 0.4 mA/V., while the H.11 has a resistance of 30,000 ohms and a mutual conductance of 0.5 mA/V.

It is understood that supplies of these valves are now available, and that a special holder for them is being marketed by Messrs. Wright and Weaire, Ltd., of 740, High Road, Tottenham, London, N.17. The price of the valves has been fixed at 15s.

Magnetic Materials at Radio Frequencies. A critical survey of present knowledge, by F. M. Colebrook, B.Sc., D.I.C., A.C.G.I. Special Report No. 14 of The Radio Research Board. A scientific pamphlet on the behaviour of magnetic material with special reference to iron-powder cores for coils. Pp. 22. Published by H.M. Stationery Office, price 6d.

BROADCAST BREVITIES

By Our Special Correspondent

Is the B.B.C. Afraid ?

WITHIN the next three months the B.B.C. will have to stop shilly-shallying on the question of television. Any visitor to these shores might imagine that the Corporation feared the interloper as a factor likely to disturb its complacency and make necessary an entire readjustment of methods and ideas.

No High-Definition Transmission

Not content with cutting down the 30-line transmissions the B.B.C. has abandoned ultra-short wave transmission from the roof of Broadcasting House and is now confining its high-definition television activities to reception tests by engineers in their own homes. The transmissions do not emanate from Broadcasting House, but from the aerials of a well-known firm not a hundred miles from Charing Cross.

"A System a Day"

Now that several high-definition systems are in the air, what fairer thing could the Corporation do than to permit each system to be tested on one day a week on the B.B.C. ultra-short wave transmitter? "A system a day keeps the critics away" would make a very fine motto and disabuse our minds of the unpleasant thought that the B.B.C. is shirking its responsibilities in regard to the broadcasting of vision.

Sir Austen Chamberlain at the Microphone

ON April 23rd Sir Austen Chamberlain will speak at the banquet of the Royal Society of St. George at the Connaught Rooms. His speech will be heard by listeners to the National programme.

Blattnerphoning the Budget Speech

WRITERS who clamour for a broadcast of the Budget Speech cannot have considered how prosy and long even the most sensational of these efforts would sound when heard on the loud speaker. At the same time there is a real opportunity to Blattnerphone the high lights of the speech and to broadcast them in the evening. What about it, B.B.C.?

A New Symphony Orchestra

THERE is no truth in the rumour that the B.B.C. is considering the formation of a second dance band. The cost alone would run to £300 a week.

There is some truth, however, in the story that a new orchestra is under consideration. For some time past the National Symphony Orchestra has shown signs of fatigue, which is not surprising considering that, in whole or in part, it broadcasts nearly every night.

Expensive Item

The second orchestra, which would probably perform within the next six months, would consist of about seventy-five players.

The National Symphony Orchestra costs £80,000 a year with its 114 players. Proportionately, the new orchestra might be expected to cost well over £50,000, or at least three times that of Henry Hall's ensemble.

Big Ben's Understudy

"BIG TOM," the bell which will "understudy" Big Ben during the period of overhaul—beginning on April 30th and lasting two months—was installed at the time the Cathedral was built, and no doubt Sir Christopher Wren himself tried its tone with the hammer which was kept specially for the use of privileged visitors who desired to test the bell's tonal qualities.

The bell strikes the hours only; the quarter chime is rung by less distinguished bells, and consists of two notes only.

Not on Sundays

How many listeners are aware that Big Ben is never heard on Sundays? The Westminster clock chimes are heard at 12.30 and 10.30 on that day; Big Ben, of course, only strikes the hours. Similarly, we shall not hear Big Tom on Sundays.

A Fatal Flaw

A PRESS photograph last week depicted the beautiful façade of Broadcasting House besmirched by belching smoke from a chimney above the clock. It was alleged that the smoke came from the only fireplace in the building, viz., that in Sir John Reith's room.

Unfortunately, the efforts of the touching-up artists were negatived by the fact that the picture, according to the clock, was taken at 6.30—not a time when the "D.G." would be stoking up.

What They Believe

NO one can doubt that the B.B.C. has now considerably widened the scope of the controversialist at the microphone. Two or three years ago there would have been an outcry at the news that a Spiritualist, a Theosophist, a Unitarian and a Rationalist were each to explain their points of view in a broadcast talk.

The series in which they appear is entitled "What I Believe," and starts on April 13th, the talks being given on Fridays. An "enquiring layman" will question the speakers and sum up his conclusions on May 11th.

The Gold Watch

ONE of the hardest worked men at the B.B.C., and one of the most self-effacing, is Mr. S. Kneale Kelley, who shares with Stanford Robinson the direction of the light music programme and conducts the Theatre Orchestra on occasion. To commemorate his long spell of service—Mr. Kelley was at Savoy Hill with Dan Godfrey, jun., in the earliest days—the members of the orchestra have presented him with a gold watch. It is a pretty thing, but the donors have made one mistake: it is not equipped with a 24-hour dial.

BROADCASTING FROM A FREE CITY. A picturesque view of the Danzig station, which relays Heilsberg and Konigsberg on 230.2 metres.

Covent Garden Opera

THE London season is usually assumed to begin with the arrival of Grand Opera at Covent Garden. The opening night this year is April 30th, and the opera "Fidelio." Listeners may expect to hear at least one act.

When Television Arrives

I like to speculate on what a Covent Garden opera broadcast will be like when popular television arrives. Not only shall we see the stout Romeos and buxom Juliets on the stage, but during the interval the B.B.C. engineers will be hauling the projector around the stalls, and we humble lookers-in will gasp with amazement, jealousy or good humour, according to temperament, when we glimpse the diamond tiaras and the heaving necklaces, what time the loud speaker responds to the brilliant chatter and daring badinage.

No wonder the B.B.C. is frightened of television!

News of the Week

Current Events in Brief Review

A Misapprehension

A WIRELESS "pirate" fined at Wigan last week offered the excuse that until he heard a broadcast warning he never suspected that a licence was needed. He then began saving up his money, but the Post Office officials called before he had amassed ten shillings

Is This a Record ?

RADIO LUXEMBOURG probably holds the record for long-distance reception of a long-wave station, having been reported by listeners in Chicago, 4,375 miles distant, and by a listener at Mombasa, which is 4,187 miles away. And now reports come from two amateurs in Cape Town. The distance between the Cape and the capital of the Grand Duchy is 6,875 miles.

A 60-watt Amplifier

AT a gramophone recital on behalf of a children's charity, which the Newcastle-upon-Tyne Radio Society will stage in the City Hall, Newcastle, on Wednesday, April 11th, a specially built 60-watt amplifier will be used. It will feed two power speakers on 5ft. baffles, 2in. thick.

Tickets, which are 6d. (numbered and reserved 1s.) are obtainable at the *Newcastle Chronicle* offices, Westgate Road.

Direction Finder for Submarines

THE Marconi Company has introduced a new wireless direction finding equipment for submarines, utilising a telescopic aerial system. When cruising beneath the surface a submarine is normally "blind" and "deaf" and must rely solely on compass readings, but the new D.F.g.9C direction finder enables the navigating officer to take bearings on any known land station or vessel even when under water.

Direction finding facilities are, of course, of particular value if a submarine, having dived during clear weather, is enveloped in fog on rising, when the only method of ascertaining her position, apart from wireless, is by dead reckoning, estimated according to the course steered and making due allowance for drift. The telescopic frame aerial is normally fitted within the after end of the conning-tower casing. When the aerial is lowered there is no projection above the mine or obstruction wires.

Audio Frequency Broadcasting

"THE Principles of Audio Frequency Wire Broadcasting" will be discussed by Capt. P. P. Eckersley in a paper to be read before the Wireless Section of the Institution of Electrical Engineers on Wednesday, April 11th, at 6 p.m.

Italy's Two Programmes

AT the end of this year the Italian listener will have a choice of two programmes only. Until recently several Italian low-power stations relied upon programmes of their own, but with the linking up of Palermo with the Rome-Naples circuit within the next few months the centralisation scheme will be complete. Thereafter, two programmes only will be distributed throughout the country, to be designated respectively the "North" and the "South."

Radio Conquers All

FRENCH radio reporters have forced the hand of the National Federation of Football Associations, which had refused facilities for broadcasting the Franco-Swiss match. The radio reporters installed themselves in a private house overlooking the grounds, and with the aid of binoculars were able to give listeners a faithful account of the match. The Football Federation has now entered into negotiation with the radio authorities.

It will be remembered that a somewhat similar course was adopted by the B.B.C. in reporting the Cup Final some years ago. On that occasion a number of radio commentators filed out of the Stadium one by one and spoke their account into the microphone in a neighbouring house.

Russian Radio Competition

IT was recently announced that the Marconi Company had received two orders for the construction of new 150-kW. stations at Motala, Sweden, and Brasov, Roumania. Unfortunately for this country, Britain has failed to secure the order for the construction of the new 150-kW. long-wave station at Ankara, Turkey, Russia having obtained the contract.

Direction Finding at Lympne

THE Marconi-Adcock direction-finding apparatus for the assistance of aircraft, which was installed at Pulham, Norfolk, three years ago, has now been adopted for Lympne Aerodrome. The Marconi-Adcock system is noteworthy for its high degree of accuracy at night. Vertical aerials are employed, and it is claimed that the margin of error does not exceed one degree.

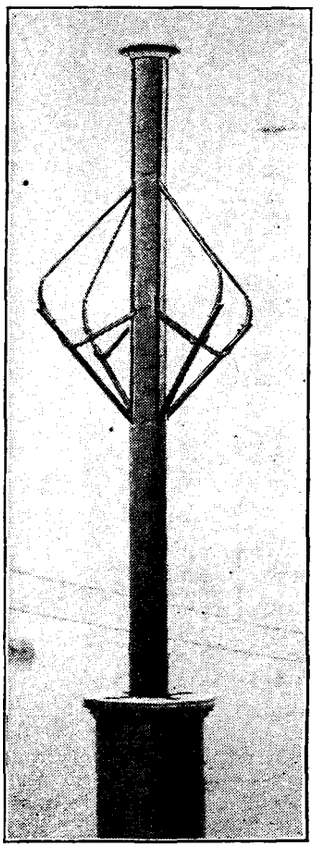
Press Pictures via Ether

"THE unseen hand that wrote mesages across the walls of palaces in Biblical times had nothing on the fountain pen on the receiving end of a facsimile radio set," writes our Washington correspondent, who reports that the *Milwaukee Journal* has applied for permission to construct two experimental facsimile transmitters. These will work on the ultra-short waves. The apparatus will give a picture or facsimile message in one minute.

The only possible trouble seems to be that the ultra-short wave "fans" of Milwaukee will get on the same frequency and pick up the reporters' scoops before they have been edited.

Radio Fish Finder

SWEDISH fishermen have been experimenting with an Echometer, the instrument normally used for determining the depth of water under a ship. But they have found (says a correspondent) that the device does more than this; when a shoal of herrings passes between the instrument and the bed of the ocean the meter needle is instantly deflected. The fishermen are now clubbing together to buy an Echometer of their very own.



The telescopic aerial, with folding loops, enables a submarine with the new Marconi apparatus to take bearings when 35 ft. below the surface.

British Plant Abroad

NO batteries will be used in a 10-kilowatt broadcasting equipment which is to be manufactured in London by Standard Telephones and Cables, Ltd., for the *Journal de Brazil*. The speech input equipment and the necessary microphones will all be operated directly from A.C. mains.

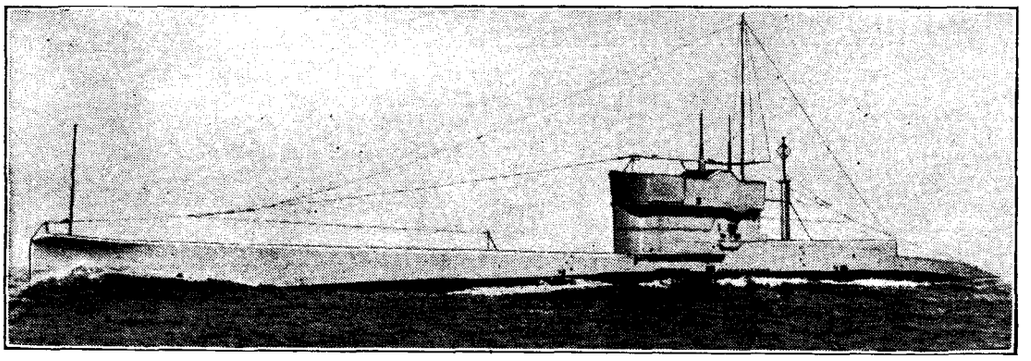
Standard Telephones are already installing a similar transmitter for the Norwegian broadcasting station of Finmarken, which is well within the Arctic circle and believed to be the most northerly station in Europe.

Religious Broadcasting in France

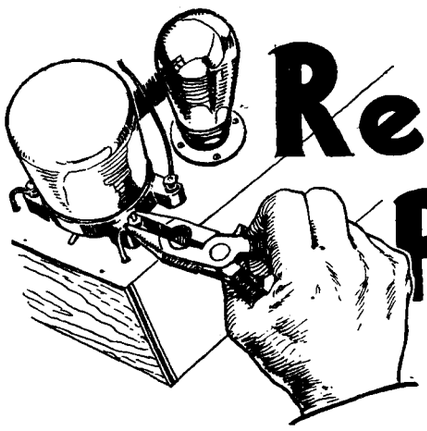
PUBLIC opinion has won the day in France on the question of religious broadcasts. An official statement by the Post Office announces that talks by the clergy—Catholic, Protestant and Israelite—are to be resumed, beginning on Sunday, April 8, with a Catholic address at 12 noon. The Protestant half-hour will be on Thursday and the Jewish on Friday.

The French Postmaster-General imposes one condition, namely, that the discourses must be unaccompanied by propaganda or polemics.

Philosophical talks are also to be permitted and the first of a series will be broadcast from the State stations by the distinguished philosopher, M. Henri Bergson.



"D. F." ON SUBMARINES. Direction finding on submarines has always been restricted owing to aerial difficulties when awash or submerged. This and the upper picture show how ingeniously the problem has been tackled in the new Marconi D.F.g.9C equipment.



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

For H.T. Eliminator Users

IT should be emphasised that almost all the battery-fed receivers with "quiescent" output circuits that are described nowadays are intended solely for use with dry batteries or H.T. accumulators as a source of anode current supply. As a general rule it must be assumed that an H.T. eliminator is not a satisfactory source of anode current for such receivers.

Naturally enough, many owners of eliminators do not wish to "scrap" them, and so, when the time comes to build a new set, decide that it shall be of the type primarily designed for batteries, for which a fair proportion of their existing equipment will still be usable. It is probable that the best advice we can offer to those who have asked for suggestions on the subject is that the particular design they fancy should be modified by substituting a "straight" triode or pentode output stage, depending upon the available output from their eliminators and on personal preference in this matter. The advantages of ordinary push-pull output—as opposed to quiescent—may also be considered.

Testing an H.F. Choke

WRITING about an H.F. choke which he believes to be defective, a querist asks for suggestions as to how a reasonably conclusive test of its condition may be made. In spite of the fact that a continuity test shows a "thorough circuit," and the resistance of the winding appears to be roughly correct, the choke does not seem to function properly, and it is suspected that there may be a short-circuited section.

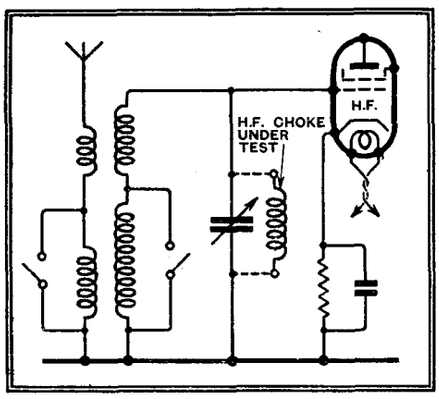


Fig. 1.—A simple but highly effective method of testing an H.F. choke.

In the absence of elaborate testing and measuring equipment, it is generally recommended that an H.F. choke should be tested by connecting it temporarily across a tuned circuit—one of the circuits of an ordinary receiver will do for this purpose. Of course, the addition of a choke will call for retuning (or in the case of a "ganged" receiver for regang-ing) of the circuit across which the choke, which possesses appreciable self-capacity, has been connected.

A good choke, when connected across a tuned circuit of average efficiency, introduces a barely perceptible loss of signal strength. If its addition results in a serious falling off in volume, it may be assumed that the component under suspicion is faulty or of poor design. It is a good plan to make tests at a number of different wave-lengths.

A test of this nature will help in determining the comparative merits of different chokes, especially if some method of making comparative measurements is available.

The Frequency-meter

A WAVEMETER calibrated in cycles or kilocycles becomes a frequency-meter; there is no essential difference between the two instruments, although the frequency-meter circuits might with advantage be arranged to give "straight-line frequency" tuning.

This is in answer to a reader who proposes to recalibrate his wavemeter in "tens of kilocycles." He goes on to express the opinion that, under modern conditions, an instrument calibrated in this way should be very much more useful than the conventional wavemeter.

This is true enough; were it not for the fact that tradition dies hard, the wavemeter would probably have disappeared long ago.

Where There's a Will . . .

A STUDY of the list of broadcasting stations published in *The Wireless World* will show that the long waveband is in a terribly congested condition. Frequency separations of 5, 6 and 7 kilocycles between adjacent channels (instead of the standard 9 kilocycles) are quite common, and so it will be seen that good quality reception without mutual interference is almost impossible in many cases.

A correspondent, who has special reasons for wishing to receive one or two of the more distant long-wave stations, has come to the logical conclusion that the only way of attaining his object is to make use of directional reception. But the A.C. mains receiver at present in use has only an H.F.-det.-L.F. three-valve circuit, and would be insufficiently sensitive for long-distance frame-aerial reception; it is realised that extra H.F. amplification will be needed. Our advice is sought with regard to a suitable design for an amplifier unit, it being stipulated that as the extra apparatus is to be of a temporary nature, it shall be fed from batteries, be as cheap as possible; and the set must not be altered internally.

This is an interesting problem. Bearing in mind the stipulations made by our reader, we consider that the arrangement shown in Fig. 2 is the simplest that can be

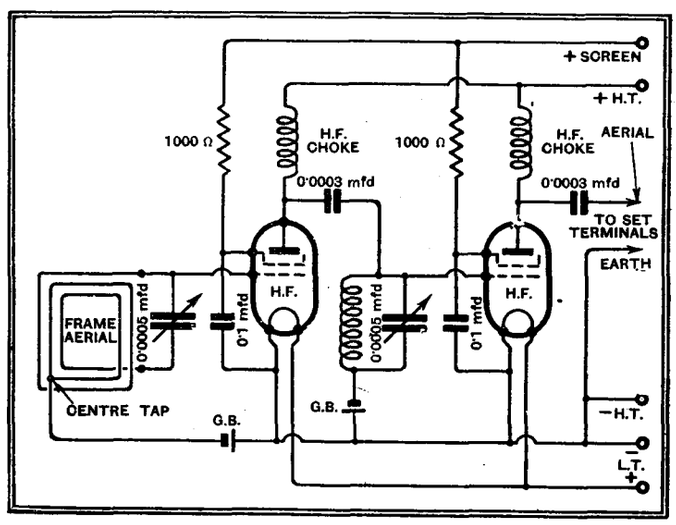


Fig. 2.—An "add-on" unit for converting an existing receiver for directional reception.

expected to yield the desired results.

It will be observed that the frame aerial is centre-tapped in such a way as to prevent it acting to any great extent as an ordinary "vertical" aerial; in this way its directional properties will be greatly improved. Separate tuning of the two circuits of the H.F. amplifier unit will be almost necessary, but, in view of the fact that only one or two stations are required, will not be a serious handicap.

The Wireless World

INFORMATION BUREAU

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

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

Practical Tone Correction

Part II.—Manual Control of Frequency Characteristics

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

(Concluded from page 224 of previous issue.)

THE first instalment of this article dealt with the problem of compensation in the L.F. amplifier for attenuation of the upper sidebands in tuned circuits. The author now discusses variable tone control, in addition to several special correcting circuits

WHEN dealing with tone-correcting devices of the types already described in conjunction with step-up transformers, it should be realised that results will depend very much on the characteristics of the transformer itself. A number of curves referring to typical transformers will help to make this clear. First we shall take the heavy type of transformer, intended for direct connection (not parallel-feed), and normally capable of handling a large output. The Varley DP6 push-pull type is a good example. Fig. 5A shows a straightforward amplification curve for a stage using an AC/HL or similar valve, and refers to the output of one of the two secondaries, so the ratio is 1 : 2½. There is a very gradual rise in amplification as the frequency goes up, until a curious peak and hollow are reached. The hollow is an effect due to the distributed capacity of the secondary winding, and the frequency at which it occurs is unaffected by any external condensers, resistors, etc., though the depth and width of the hollow can be altered. Curve B on the same Fig. shows the effect of using a PA1 valve, having the low A.C. resistance of about 1,000 ohms. The peaks rise higher above the general level. If it were not for the second rise, beyond 8 kc/s, this characteristic would be a particularly good basis for tone correction, and as long as the loud speaker is quite unresponsive up there, or an auxiliary filter is used, the curve is excellent.

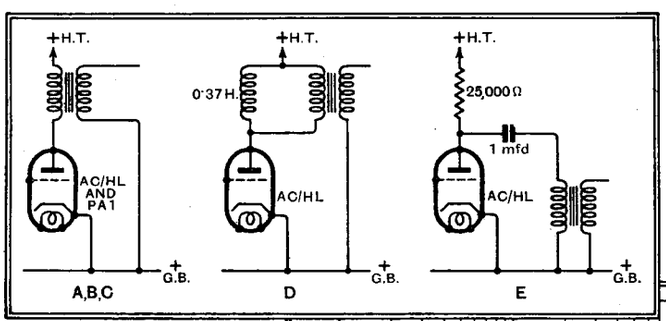


Fig. 5.—Transformer-coupled circuits giving fixed correction and a voltage step-up.

A slightly less heavily built transformer, the Ferranti AF3, is illustrated by curve C of Fig. 5, which is similar except that the level is higher (the ratio is 1 : 3½) and the hollow is farther up in frequency. Curve D shows the same transformer and valve used for tone correction by shunting the primary of the transformer with a Wearite "HFS" choke, having an actual inductance of 0.37 henry, and a D.C. resistance of 300 ohms. Lastly, in this Fig., E shows the result of modifying the arrangement D by parallel feeding, with a 25,000-ohm resistance and 1 mfd. coupling condenser. There is merely a slight reduction in amplification all over.

Comparing curve D with those in Fig. 2, we see that it corrects very well for the cutting due to a single tuned circuit of type A. Fig. 6 gives the combined result of the two. Various by-pass condensers in the set usually round it off to something like the dotted shape, which is just what is wanted. To correct for less sharp circuits, all that is to be done is to insert more or less resistance in series with the choke.

The Multitone transformer is well known in the field of tone-control, and some curves relating to the 1 : 4 model "Toco" are interesting. This model is intended to cut off at a fairly low frequency; there are others for extending the response upwards. And as the curves are taken with the same low A.C. resistance valve (PA1) they show a larger peak than would be obtained with a valve of higher resistance. Curves A, B, and C, of Fig. 7, are obtained using the special high-resistance tone-control potentiometer specified by the makers, and represent the normal tone and the two extremes. Curves D and E illustrate an alternative method of control, shown by the inset circuit diagram. So far as the high-note cutting characteristic is concerned, it is a better method; curve E, in conjunction with various effects which tend to soften down the slight peak at 5 kc/s, is better than the gradual fall of curve C. But as a tone corrector for tuned circuits there is little to choose between the two methods.

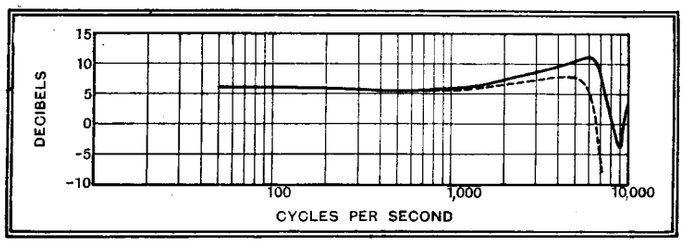
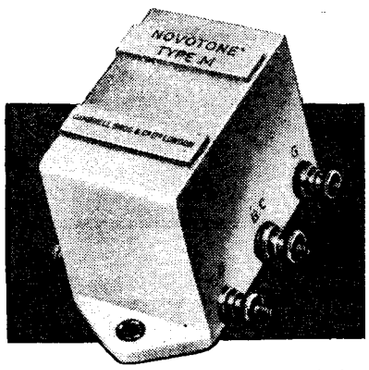
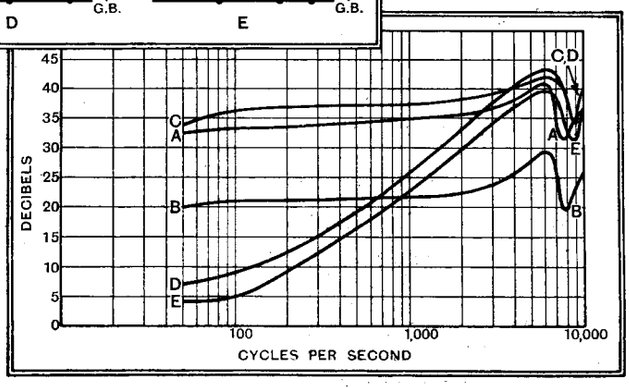


Fig. 6.—How high-note loss is corrected by a suitable L.F. coupling.



A special tone-control transformer designed solely for use with gramophone pick-ups: the latest Gambrell Novotone, Type M.



Attenuating Low or High Notes

As a tone control, for straight-line amplification, with the option of tilting the whole curve either way without introducing sundry peaks or hollows, the small

Practical Tone Correction—nickel-core parallel-fed transformer is the best, and Fig. 8 shows the performance of the R.I. "Auto-Parafeed" used in the inset circuit. This arrangement might well form the basis of a high-quality local station receiver; but for tone correction in a long-range receiver some sort of whistle filter would be required. A drawback is that if the control is variable the resistance in the anode circuit varies, and when in the extreme inductive position is entirely cut out, which may cause an excessive H.T. current to be drawn. This is not so if automatic grid bias is used; in fact, what increase in H.T. current takes place increases the power-handling capabilities of the stage just when they are wanted; moreover, decoupling resistances tend to limit any excessive current rise. But unless the potentiometer is a very good one it is apt to be noisy when used in this way. Unhappily, it is not practicable to get over the difficulty by using a condenser in series with the choke, or by putting the control system across the transformer primary direct, because the capacity required would be enormous; and the resistance of an electrolytic condenser undesirable.

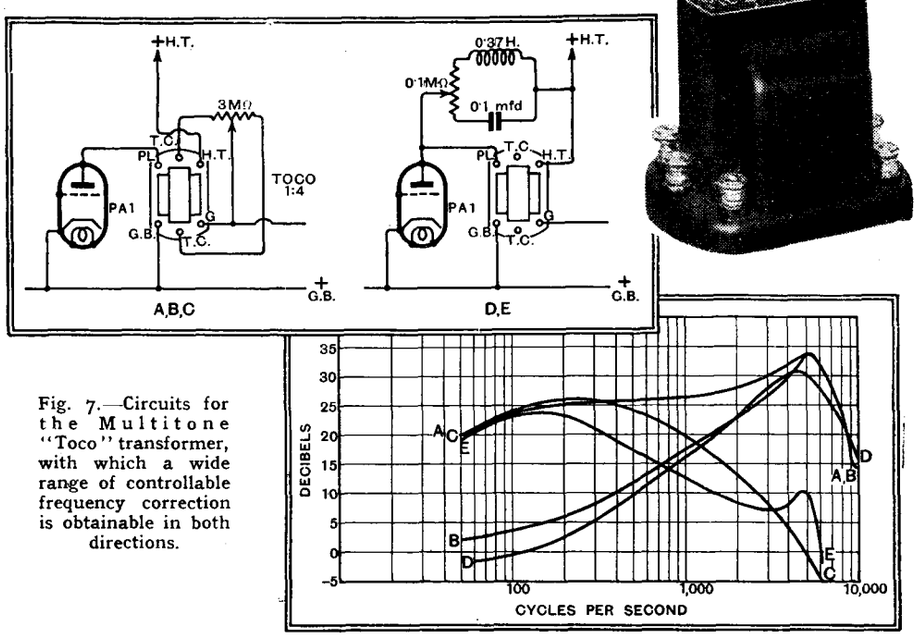


Fig. 7.—Circuits for the Multitone "Toco" transformer, with which a wide range of controllable frequency correction is obtainable in both directions.

Decoupling Precautions

A rather important detail to take care of is the impedance of the H.T. supply. Apart from the resistance of the battery or power unit, a decoupling resistance is almost invariably used in this stage. Now, if the tone control is set to either of the extreme positions, the impedance of the coupling is very low, and any additional impedance is liable to introduce undesirable modifications of the frequency characteristics shown. This is particularly true of the parallel-feed system; so, unless the H.T. is supplied from a low-resistance battery, the primary winding should be returned to the +H.T. side of the anode resistance and *not* to earth, as is customary. This cuts out the auto-transformer method of connection, unless bias for the next valve is supplied by a grid leak and condenser system. In any case, decoupling should be carried out with the largest possible condenser and the smallest possible resistance.

As the tone-control valve is usually used to provide H.F. reaction also, it is quite necessary to use a H.F. choke in the anode circuit. Owing to the presence of the tone control it is *not* possible to rely on the intervalve transformer to provide enough impedance to stop H.F.

The "Varitone" transformer by the same makers gives curves similar to the "Multitone," except that the peak is rather higher—about 6.5 kc/s.

Multi-circuit Receivers

Tone correction is most easily applied where there is one very highly selective circuit. The addition of one or more circuits using small air-core coils without reaction is good for selectivity, and the slight tone cutting can be more or less compensated by using one of the systems which gives a peak before the final cut-off; e.g., Fig. 7, B or D. The correction of more than one highly selective circuit, such as 2B or 3B in Fig. 2, is rather more difficult. One way of correcting is to use a highly peaked tone circuit, made up of a low-resistance choke shunted by a condenser tuning it to the required maximum audible frequency. It is difficult to give definite values because there are so many possible conditions; but a study of Fig. 4 should make the general principles clear. An objection is that the correction ratio (number of decibels difference in level between highest and lowest) is so large that the undistorted output is very small.

The alternative scheme is to use a separate corrector stage for each selective circuit: This is theoretically a good method, but in practice is not very economical, as extra valves and other components are needed.

Resistance-coupled Control System

On the whole, then, tone correction can be most satisfactorily carried out with one very selective circuit, preferably in combinations with one or more relatively flat tuning circuits.

Finally, it may be interesting to compare a resistance coupling system in which a high impedance is maintained in the valve circuit at all frequencies. Fig. 9 shows the curves relating to three different circuit arrangements, which are also given therein. The degree of correction is varied by using, for example, a 0-3 MΩ variable resistance in shunt with the 500 m.mfd. condenser. The 3-henry choke (Fig. 9 C), of course, is to limit the tone

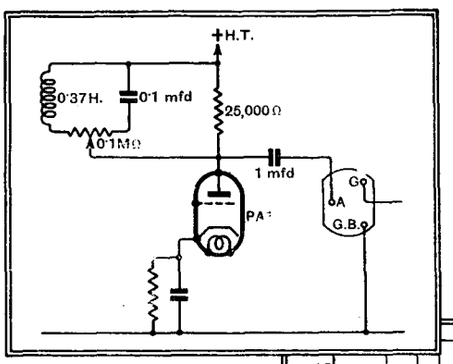
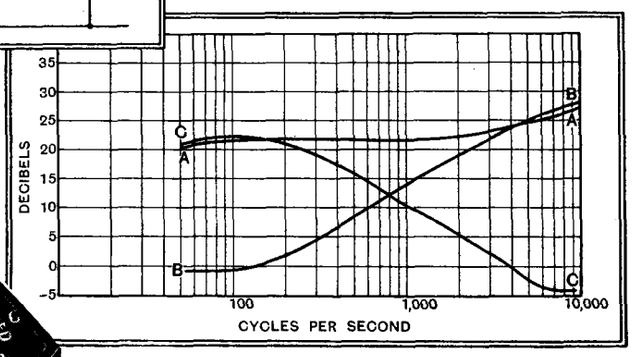
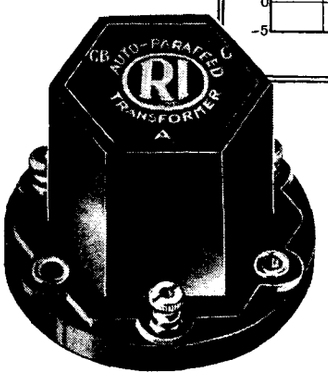


Fig. 8.—The R.I. "Auto-parafeed" transformer in conjunction with an external tone-control system.





Practical Tone Correction—correction, as previously explained. The system has the merit of simplicity, and of avoiding harmonic distortion due to anode circuit overloading; but, in common with all tone-correction circuits, it must not be forgotten that when the amplification is zero, as it is in some of the examples given, one must not expect the signal output voltage to be greater than that which can be handled by the grid. If, say, the valve will take only 3 volts bias, the peak grid swing is about 2 volts, and no more should be expected from the output of the stage.

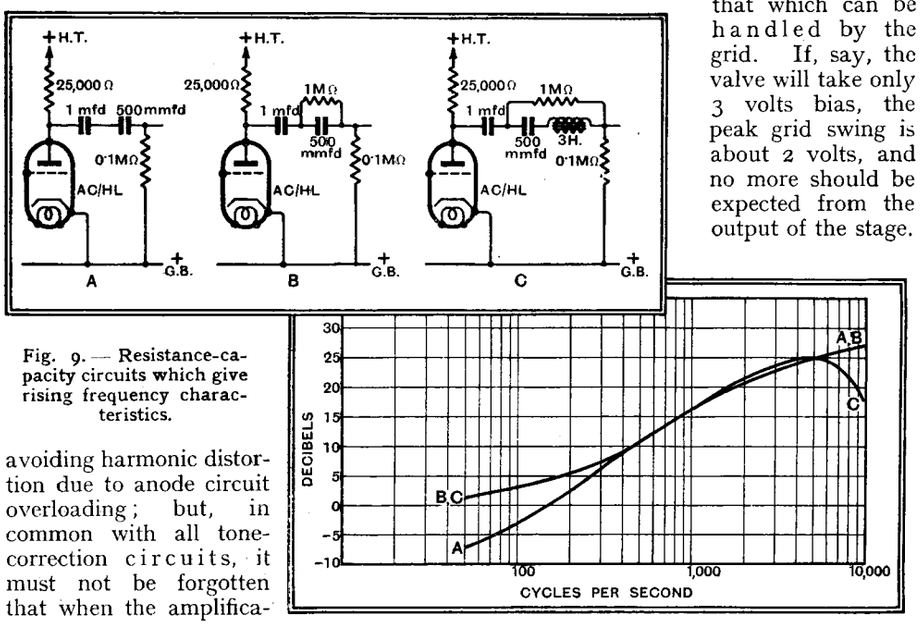


Fig. 9.—Resistance-capacity circuits which give rising frequency characteristics.

UNBIASED

Static, but Moving

By FREE GRID

THE other day I succeeded in tracking down an entirely new form of electrical interference within a stone's throw of my own residence.

The noise seemed to suggest all the characteristics of a vacuum cleaner, but it almost invariably occurred in the evening, a period which I am credibly informed is more or less a close season for these offensive offsprings of civilisation.

Considerably puzzled, I had in the end to fall back on the crude plan of bribing the window cleaner to let me take over his round for a week or two.

I did not, of course, expect to obtain any direct evidence, as the hours during which I plied my trade did not coincide with those when the trouble occurred. My plan was the subtler one of endearing myself to the maidservants, a class of person whom I have always found to be extremely susceptible to flattery.

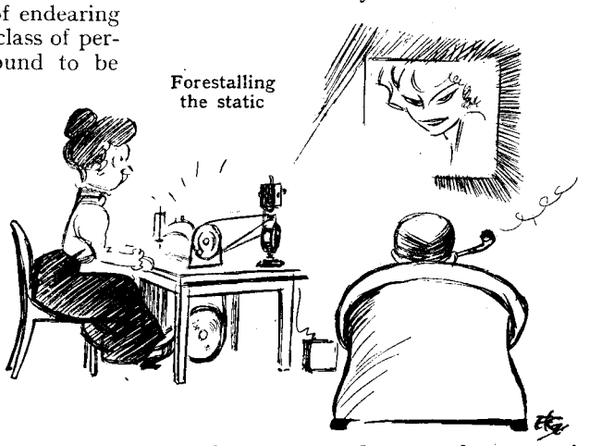
To cut a long story short, I soon found out the cause of the trouble, which was coming from the works of a motor-driven home-movie projector.

A polite but grmly worded letter to the owner brought forth nothing but abuse in reply; apparently he is blind to the necessity of fitting suitable suppressors to the motor.

Personally speaking, I should like to see legislation introduced to restrict users of these instruments to a clockwork motor if they are too lazy, as would appear to be the case, to propel the mechanism with a hand- or foot-crank. This is no idle suggestion, for I know of at least one case where a ciné enthusiast, not blessed with sufficient cash to indulge in an electric motor, secures his propulsive power from the treadle of his wife's sewing machine, he having trained the good lady to work through a full 400ft. reel without faltering.

A Long Journey

FOR some time past I have been pestered by an acquaintance living down in the West country who has been fool enough to pay good money for a certain American superhet. Recently I became so exasperated that I yielded to his demands that I should help him to get the wretched contraption working and I have just returned after a fruitless journey of some hundreds of miles and a most unpleasant week-end sojourn in a wretched Severn-side bungalow damp enough to give even a duck rheumatism.

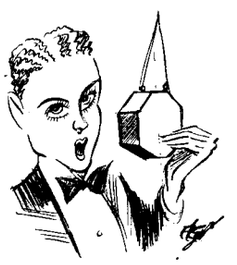


Laying the Ghost

The symptoms of his trouble were an unusually fine crop of howls and whistles which, so he explained in his numerous letters, appeared unexpectedly at various parts of the tuning scale, commencing and leaving off suddenly in a strange and unaccountable manner. I referred him to various articles in "W. W." such as "Why the Whistles," but this appeared to have made matters worse as it goaded him into attempting to regang his set, with disastrous results, and neighbours were threatening to complain to the Postmaster-General.

When I arrived at his place I first set about reganging the receiver, which was a far better instrument than I had expected. This having been done, I swiftly ran up the tuning scale, bringing in station after station with an absolute minimum of trouble. Whistles and howls were conspicuous by their absence.

To my surprise, however, my friend still maintained his glum look and remarked that the set had beaten me after all. Leaning back in amazement, I motioned him to take the helm and tune me in the mysterious caterwaulings which troubled him. Twirling the dials he quickly brought in a dance band in the midst of one of their cheeriest efforts. "There you are," he said triumphantly, "a perfectly good and well executed dance-tune spoilt by howling; tune *that* out if you can." I was still mystified as the transmission seemed perfectly normal and, in fact, singularly free from any form of interference or background noise.



. . . the crooner . . .

It was only after repeated questions and answers during which we appeared to be talking at cross-purposes that it suddenly dawned on me that what the idiot took to be some form of heterodyne interference was merely the voice of the crooner. All I can say is that fools who cannot appreciate good music when they hear it, should not be allowed to possess wireless receivers.

Not Her Bent

"SIGHT waves, unlike sound waves," says the lady writer of a two-column article on television in a very well-known daily, "cannot bend very much or go beyond a range of about thirty miles." Surely she must have forgotten to allow for the effect of the wind. Remember Einstein.

Letters to the Editor :—

Single-span Tuning

The Power of Droitwich : Reception Conditions : Television

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

Single-span Tuning

IT was with the greatest interest that I read in *The Wireless World* the description of an entirely new system of tuning. The system seems to me to be one which, if properly applied, will revolutionise all the present methods of tuning to such an extent that in the near future all sets that are put on the "market" will employ, if not this actual system, a modification thereof.

You state also that a set employing this new system is soon to be described in *The Wireless World*. It is my hope that this set will bear the great name "Monodial."

This name, to all such as take an intelligent interest in wireless, is significant of quality of the highest degree, and I feel that the first set using the new tuning system should also have the honour of belonging to the "Monodial" family.

Sussex. MONODIAL USER.

CONGRATULATIONS on ever being to the front in design. The article on single-span tuning is most interesting, and at one swoop appears to eliminate most of the snags and expense in multi valve sets.

It appears, though, that a new dial will have to be designed, otherwise there will be tremendous crowding; another point which strikes me is that there may be less magnification at 1,600 kc than at 110 kc, also signal frequency amplification appears to be ruled out unless that genius Mr. Cocking has got a means of doing that also which he is keeping quiet about for the moment.

I might add that I have been a reader of your paper for more than twenty years, and that it is the only radio journal which I have any time for (I know your sister journal *The Wireless Engineer* is also excellent, but for me it is not much use, as I am not much of a mathematician), as it is reliable and more technical than the other journals; it leads the way and is always very modest about it.

MARCUS D. MANTON.

Golders Green, N.W.11.

IN common with your other readers, I have read with considerable interest the article by W. T. Cocking on single-span tuning. As a "twelve-year-old" reader, I should like to congratulate you on the discovery of what may well prove to be the most revolutionary thing in radio technique since the advent of the thermionic valve. Its beauty appears to be its very simplicity, and the advent of the new wonder is described with your customary reticence and modesty. I await with keen interest the publication of further details.

N.8. HORNSEY.

The Power of Droitwich

THE announcement in "Broadcast Brevities" that the new Droitwich National transmitter will use an aerial power of 120 kW. instead of 150 arouses disappointment and apprehension in the minds of listeners who are situated outside the service area of the Regionals.

In Cornwall, for example, we have no British station which even by a flight of the imagination can be regarded as a "local." Our hopes bid us turn to Droitwich. Are we to be disappointed?

The B.B.C. Handbook for 1934 appears to state that a power of 150 kW. has been sanctioned. What was sanctioned is presumably regarded as necessary.

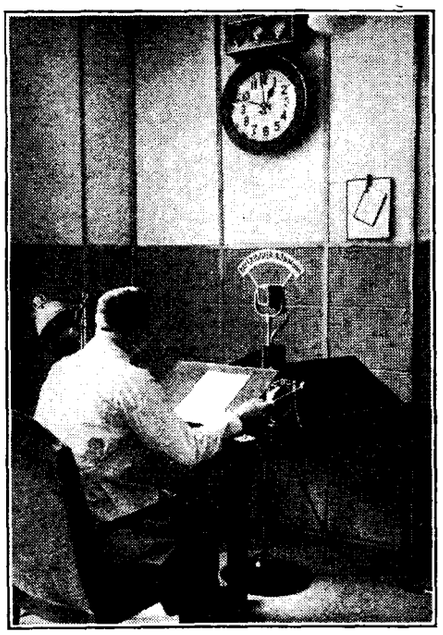
The B.B.C. has a unique opportunity of discharging through the Droitwich service what may be regarded as its chief obligation to a vast audience of listeners.

(Rev.) J. G. LANE-DAVIES.

Falmouth.

Reception Conditions

IN *The Wireless World* dated March 2nd, 1934, in "Broadcast Brevities," your correspondent states that the B.B.C. are quite jaunty on the subject of the Lucerne Plan, for only Daventry long wave appears to be troubled by foreign interference.



THE MUNICH TIME SIGNAL. Going . . . Going . . . GONG. The announcer prepares to broadcast the one o'clock signal

If he were to make a test here I am confident he would make quite a different comment. There are only two broadcast stations in this country from which we can really expect consistently good reception. Daventry, it is agreed, is interfered with.

The West Regional station is situated about sixty miles from here as the crow flies, and is capable of giving very good reception with very little fading. Before the wave change it was possible to get some results without undue interference from other stations, but since the wave change conditions have been much worse.

It appears to me that instead of making so much effort to squeeze in as many stations as possible an equal amount of effort would be better applied in spacing them for good reproduction.

Totnes, Devon. P. PINCH.

Television—the Cossor System

IN your recent issues you have referred very kindly to the television system developed in the Cossor laboratories. In the article entitled "Television Prospects," in your issue of March 9th, there occurs a remark which, though perfectly correct, appears to have been misinterpreted by a number of people who would appear to have obtained a wrong impression as to the extent to which mains synchronisation is used in the Cossor system. We would like to make it clear that with reference to the overall system this extent is actually zero. Although the 50-cycle mains is used at the transmitter as a convenient way of deriving a 25-cycle timing pulse, this pulse could be derived from any other source; the pulse itself is transmitted, and it is not necessary for the receiver to have either synchronised mains, or, indeed, any mains supply at all.

We are anxious to emphasise this point because, in fact, we regard synchronisation by the use of supply mains as illegitimate on the following grounds:—

(*a*) Because of the incomplete state of the grid system in this country we consider mains synchronisation to be inexpedient at the present time.

(*b*) Even on completion of the grid system there still remains the possibility of phase variations which would result in frame wandering of the picture.

(*c*) Mains synchronisation could hardly provide solid automatic framing in any circumstances, and would therefore necessitate a framing control.

The principle which we have adopted throughout our development has been to make the transmission itself contain the full intelligence for the rendering of a picture correctly synchronised and framed, without recourse to any outside communication channels which may or may not exist.

L. H. BEDFORD,

Research Department, A. C. Cossor, Ltd.

The Monodial Super

HAVING constructed the "New Monodial Super" as soon as the design appeared in *The Wireless World*, and using components as specified by the author, together with a Rola loud speaker, I can now say, after every possible test, that its performance in every way surpasses anything I have ever heard or seen.

Every wireless friend who has seen it agrees that its work is tip-top.

Do you intend publishing anything in the way of a "short-wave adaptor" for the Monodial? If this is possible I would welcome the chance of making one.*

Bristol. H. HOYLE.

---

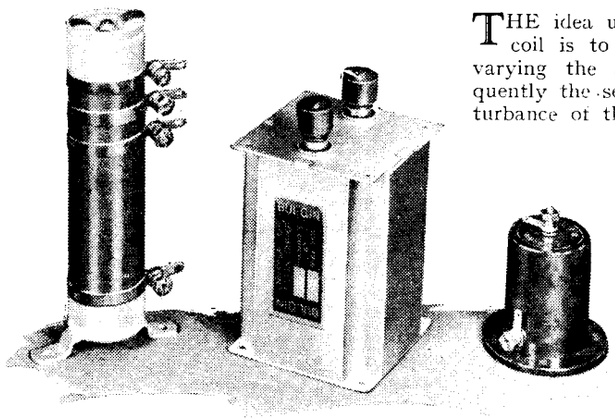
* Universal Short-wave Converter described in issue of 28th April, 1933, is entirely suitable.—ED.

NEW APPARATUS REVIEWED

Latest Products of the Manufacturers

BULGIN COMPONENTS

BULGIN skeleton D.C. mains resistances are wound on porcelain tubes 1⅛in. in diameter and 4⅝in. long, and there are no fewer than twelve models in the range. Six are for use with the 16-volt 0.25 amp. indirectly heated D.C. valves and the remainder suit the 20-volt 0.16 amp. type. Each is tapped for supplies of from 200 to 250 volts and resistances are available for use with any number of valves from two to seven. The price is 4s. each.



Selection of Bulgin components consisting of skeleton D.C. mains resistance, L.F. choke and Junior H.F. choke.

The specimen tested is listed as the M.R.8 and intended for use with three 16-volt 0.25 amp. valves. Its measured resistance is correct for this number of valves, and the unit will carry its rated current indefinitely without over-heating, despite the fact that about 50 watts are dissipated in the resistance.

The Junior H.F. choke is a very efficient component at a low price, its measured inductance being 196,000 mH. at 1,000 cycles. It is fitted with an iron core and enclosed in a bakelite case measuring 1¼in. in diameter and 1¾in. high. The D.C. resistance of our specimen is 407 ohms, and the choke is effective from well below 200 metres up to about 1,800 metres. The price is 2s.

Bulgin L.T. type terminal with castle-head wire grip.

On the whole Bulgin L.F. chokes are very moderately rated, as with most models the permissible maximum of D.C. that may be passed through them is much in excess of the figure given for the type. For example, a 20-henry 50 mA. model had an inductance of 26 henrys when passing this current, and its inductance did not fall to 20 henrys until the current reached 75 mA. With no D.C. flowing the value obtained was 30.5 henrys. Listed as the type L.F.14, it is enclosed in a metal case and costs 10s. 6d. Its measured D.C. resistance is 430 ohms.

A recent addition to the Bulgin range is a new terminal. Styled the L.T. model, it is fitted with a castle-head wire grip and a non-detachable insulated head. The stem is threaded for 4BA nuts, and the price is 3½d. each, engraved and with either black or red moulded heads.

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

VARLEY BIFOCAL COIL

THE idea underlying the design of this coil is to provide a ready means for varying the aerial coupling, and consequently the selectivity, with the least disturbance of the tuning. It is effected by fitting an adjustable iron dust core which can be varied so as either to increase or decrease the inductance of that portion of the coil in the aerial circuit with reference to the whole coil.

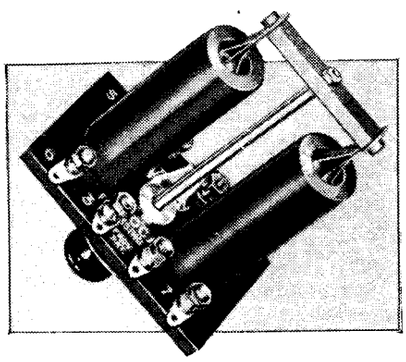
The effect might be described as moving the aerial tapping up or down the coil from the earth end, but this would necessitate a series of tappings and a multi-stud switch, and the Varley scheme is so much simpler. Separate formers are used for medium- and long-wave coils, and there is a core in each. They are linked together and adjusted by a single rod passing through the centre of a single-hole fixing bush.

Tested in a typical det.-L.F. circuit change in position of the cores led to a very marked alteration in the selectivity and, of course, in the sensitivity. We noticed a slight de-tuning of the circuit as the cores are moved, also some slight readjustment of the reaction condenser was needed occasionally.

The measured inductance of the coil with the cores set for maximum sensitivity was 165 mH. and 2,000 mH. medium- and long-wave sections respectively, so that the wavebands covered by this coil when tuned by a 0.0005 mfd. condenser will be about normal.

The best reaction conditions were obtained with the reaction condenser joined between the coil and the anode of the valve. Its efficiency is good and compares well with other iron-cored coils, and it is compact. The price is 10s. 6d.

The makers are Varley (Oliver Pell Control, Ltd.), 103, Kingsway, London, W.C.2.



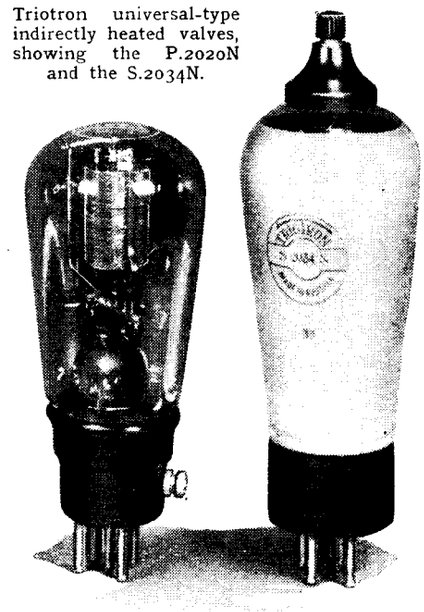
Varley Bifocal coil in which selectivity is varied by a movable iron core.

TRIOTRON UNIVERSAL VALVES

IN the Triotron range of valves is a series of indirectly heated types fitted with 20-volt filaments and taking 0.18 amp. each which have been designed for use either on A.C. or D.C. supplies, the customary arrangement being to join their heaters in series and drop the surplus volts in a resistance. These are suitable for use in universal-type sets, and the series includes two screened H.F. pentodes—one a variable-mu type—a triode, and an output pentode. There is also a half-wave H.T. rectifier with a 30-volt filament taking 0.18 amp. for use in conjunction with these valves on A.C. supplies. It gives 70 mA. D.C. output.

A specimen variable-mu pentode, type S.2034N, was tested with 200 volts on the anode, 100 volts on the screen, and at zero grid bias had a mutual conductance of 2.7 mA. per volt. The amplification was 1,900.

Triotron universal-type indirectly heated valves, showing the P.2020N and the S.2034N.



It passed 5.8 mA. in the anode circuit and 2.6 mA. in the screen circuit. The valve is metallised and fitted with a five-pin base with the anode terminal at the top of the bulb. A grid bias of 7.5 volts changed the conductance to 0.05 mA./V, while the amplification fell to 900.

The S.2035N H.F. pentode was also tested and quite satisfactory results obtained. It has a five-pin base and a metallised bulb. With the P.2020N output pentode a mutual conductance of 1.5mA. per volt was obtained under working conditions, that is to say, with 200 volts on the anode and on the auxiliary grid, and with -18 volts grid bias. It passed 21.5 mA. anode current and 8.4 mA. in the auxiliary grid circuit, making a total of 29.6 mA. in all. It is rated to give 1,350 milliwatts output when working into a 10,000 ohm load.

The price of each of these three valves is 12s. 6d., and the suppliers are Triotron Radio Co., Ltd., Triotron House, Bloomsbury Street, London, W.C.1.

The Wireless World

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24th Year of Publication

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EDITORIAL COMMENT

Importance of Quality

Will Relays Compete?

MANUFACTURERS of receivers to-day do not, we contend, pay sufficient attention to the question of quality. In efforts to make wireless sets cheaper there is a definite tendency to allow quality of reproduction to suffer. It has been suggested that the public does not really care about quality, and that for this reason it is unnecessary for the manufacturer to go to special pains to provide it, entailing as it does additional costs in manufacture, resulting in lower profits or higher prices.

If all broadcast reproduction were poor in quality there might be some excuse for not bothering to produce anything better, but the radio set manufacturer must beware of going too far. Whenever the public is in a position to make a comparison between good and bad quality, then the good quality will always be recognised and preferred.

Where a system of relay services has been established it is comparatively easy to provide the listener with good quality, and in many cases this is done. The public is thus able to make a comparison of reproduction with the capabilities of a cheap modern set and the relay then shows up to advantage—and at the expense of the cheap wireless set.

It is fortunate for radio set manufacturers that the public appreciates the advantage of being able to select from more than, say, two programmes and that foreign stations are popular, for otherwise the radio set would have little advantage, so far as the non-technical and local listener is concerned, over the relay system.

At all costs the quality of reproduction must be maintained and improved so that there may be no risk that reproduction is recognised as a wireless set because of its poor quality.

Relay services undoubtedly have a very useful sphere of activity but they should never take the place of a wireless set unless they are allowed to do so as a result of failure on the part of set manufacturers to maintain a proper standard of broadcast reproduction.

Single-Span Tuning

Widespread Public Interest

FROM all parts of the country and from many places abroad we are receiving letters of congratulation on having introduced "Single-span" Tuning, which offers such outstanding advantages, especially in simplification of receiver design.

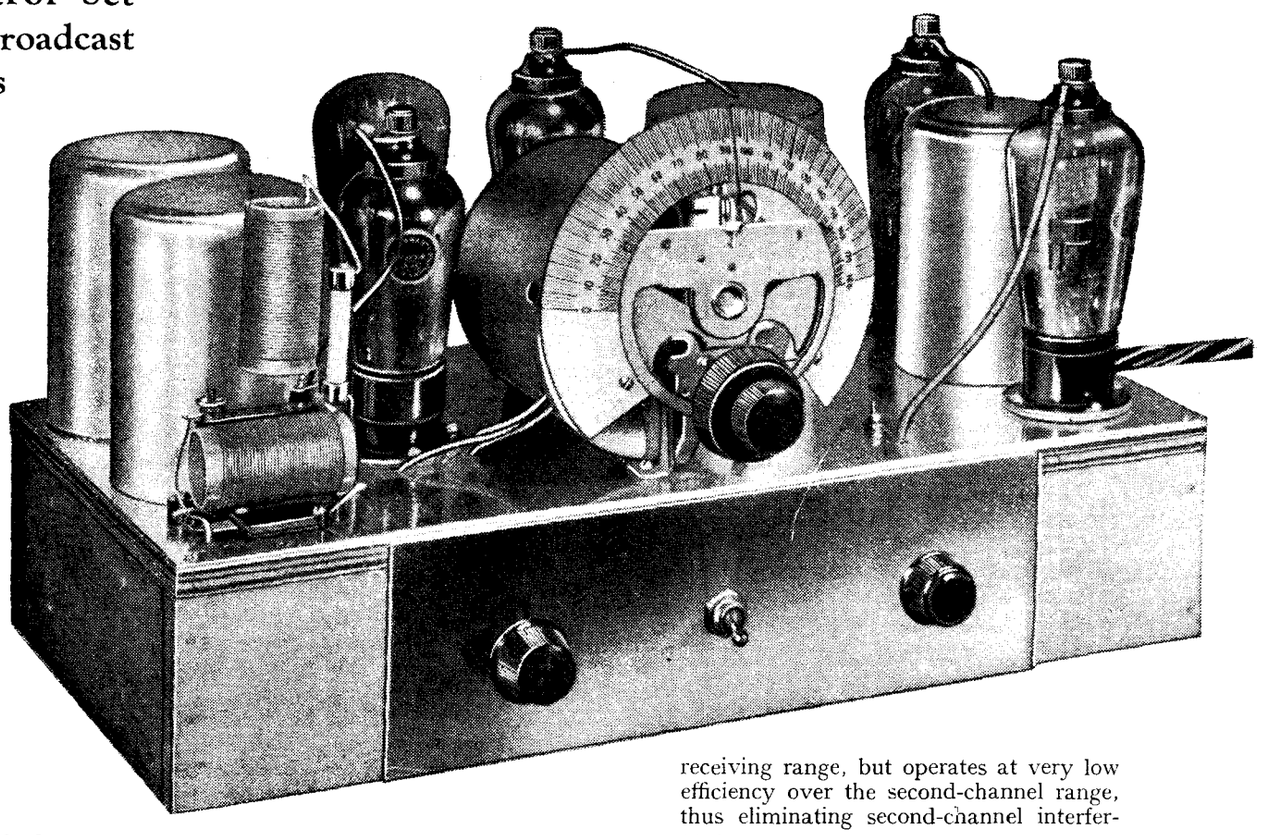
The absence of switching, ganged condensers, and necessity for carefully matched coils is an enormous advance in design from the point of view of the home constructor. Sets having a high standard of performance have tended to become very complicated of late, and the home constructor has been handicapped by reason of these complications and the difficulties of adjusting and ganging a set, even after it has been satisfactorily constructed. "Single-span" tuning brings home construction within the capabilities of everyone again and provides an assurance of satisfactory results.

The set manufacturer is attracted because the present cost of manufacture is largely due to matching and ganging which has to be carried out so accurately in the factory.

In this issue we include the first instalment of a practical design for a "Single-span" receiver which experience over a long period in the development of the set enables us to put forward to our readers with complete confidence.

The Wireless World Single-Span

A Single-control Set Covering All Broadcast Wavelengths Without Ganging



By

W. T. COCKING

DETAILS of the new single-span tuning system which offers so many advantages over older methods have appeared in recent issues of "The Wireless World," and this article deals with a more practical aspect of the matter in the form of the description of a receiver which lengthy tests have shown to set an unusually high standard of performance. The set is completely A.C. operated and includes the new feature of variable selectivity; there is neither ganging nor waveband switching, yet the tuning range is rather greater than 200-2,000 metres and there is only a single tuning control!

THE principle of single-span tuning has been recently described in *The Wireless World*, and it will be remembered that a set of this type is essentially a superheterodyne fitted with aperiodic signal-frequency circuits and using an intermediate frequency higher than any signal in the desired receiving range. Consequently, tuning is carried out by the oscillator condenser only, and a very wide range of wavelengths can be covered. The net result is a great simplification of technique. The accurate matching of coils and variable condensers and the use of waveband switching—the two most troublesome items of ordinary practice—both become unnecessary.

The various whistles found in most superheterodynes when the ganging does not hold with complete accuracy are almost impossible with single-span tuning, and tests have shown them to be absent even under bad conditions. It may truly be said, therefore, that under all normal receiving conditions there is complete freedom from second-channel interference and similar forms of whistle production.

Tuning is carried out only by the oscillator condenser, with the result that a very wide waverange can be covered and that dial settings are unaffected by the characteristics of the aerial. The combination of reaction and automatic volume control not only increases the sensitivity of the set and largely counteracts fading, but makes it possible to obtain truly variable selectivity so that the quality of reproduction can always be the highest that interference will permit.

The circuit diagram of the receiver unit of the Single-Span Receiver is shown in Fig. 1, and it will be seen that the first valve in the set is a frequency-changer of the heptode type. The coupling between the aerial and the control grid of the tetrode portion of this valve gives a substantially even response over the required receiving range, but operates at very low efficiency over the second-channel range, thus eliminating second-channel interference.

The coil L1 has an inductance less than that of L2 by the inductance of an average aerial, and C2 is given a value of 0.0002 mfd., since this is the capacity of the average aerial. The two coils and condensers, therefore, form a band-pass filter capacitatively coupled by the 0.0001 mfd. condenser C1. Resonance occurs towards

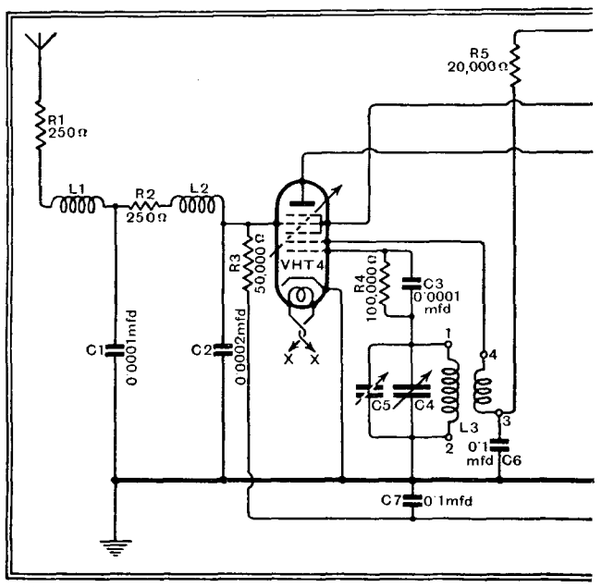
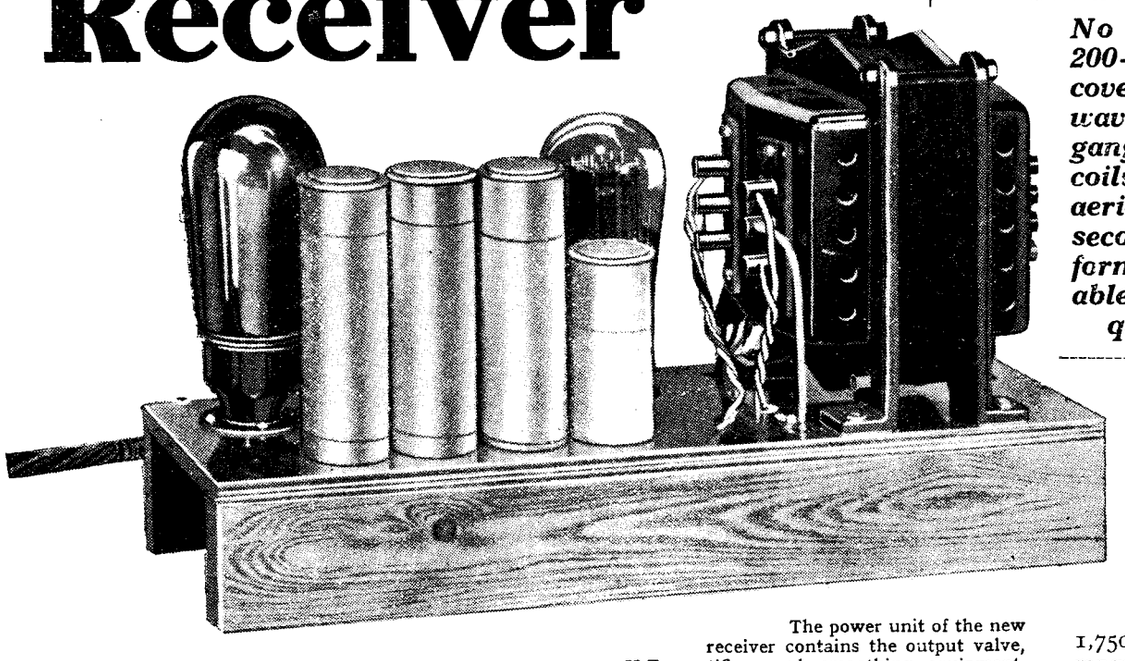


Fig. 1. The complete circuit diagram of the receiver unit metres band and yet eliminate second channel interference.

Receiver

Features of the New Set

No ganging adjustments. 200-2,000-metres waveband coverage without gaps. No waveband switching. No gang condenser or matched coils. Tuning unaffected by aerial characteristics. No second channel or kindred forms of interference. Variable selectivity. Improved quality of reproduction.



The power unit of the new receiver contains the output valve, H.T. rectifier, and smoothing equipment.

the middle of the receiving range, but, owing to the tight coupling between the circuits, peaks in the response occur towards the two ends of the tuning range. The response at these peaks is determined by the circuit resistance, and decreases with an increase in resistance. In order to avoid an excessive disparity in response at the peak and trough frequencies, therefore, the two resistances R1 and R2, each of 250 ohms, are inserted.

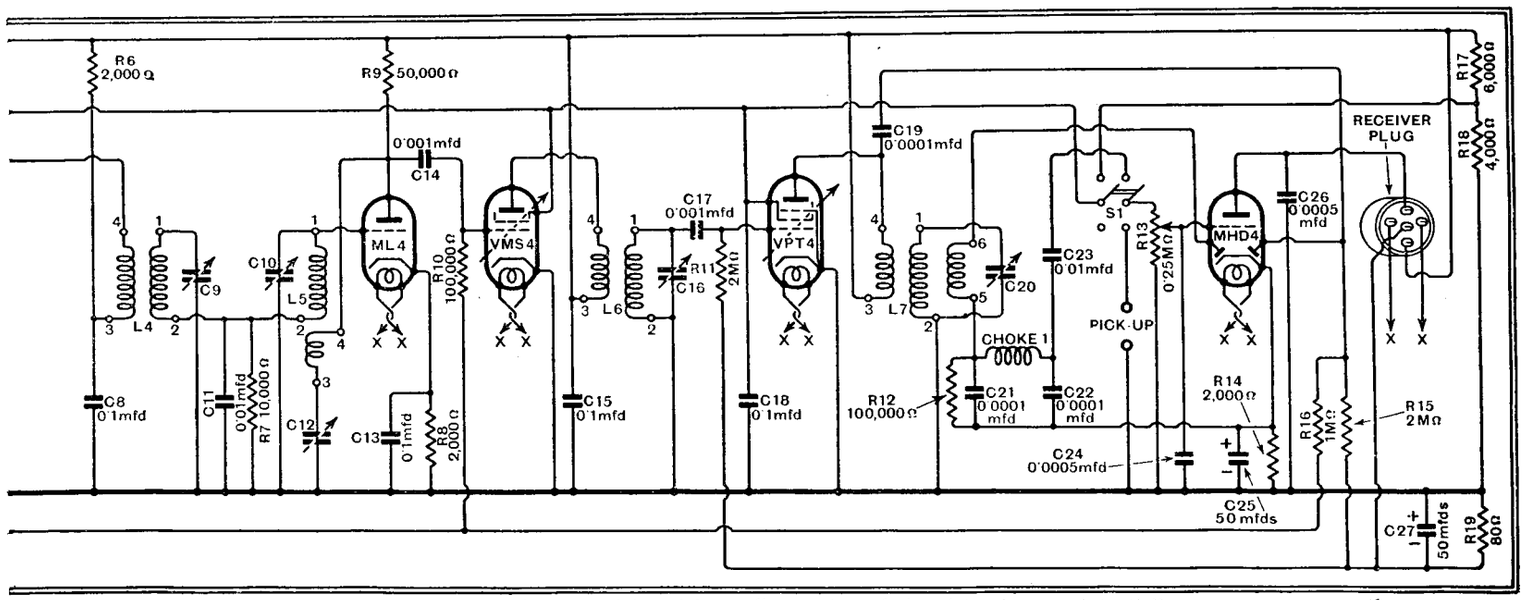
The oscillator electrodes of the frequency-changer are connected to the coil assembly L3. The tuned winding has an inductance of 41 μH. and is tuned by the condenser C4 of 160 mmfd. maximum capacity. In order to limit the tuning range, the minimum capacity is augmented by the parallel condenser C5. This can hardly be a fixed condenser, since variations in wiring somewhat affect the minimum obtainable. It is, therefore, a semi-variable condenser, which is adjusted once and for all to secure the required tuning range.

All tuning is carried out by this variable condenser C4, and it is fitted with a dial having a double ratio, so that both accurate tuning and rapid searching are easy. The cathode of the frequency-changer valve is returned directly to the earth line, and the tuned oscillator circuit is taken to the same point. This absence of a biasing resistance and by-pass condenser in the cathode circuit avoids any risk of coupling between the various circuits, and avoids a possible cause of radiation from the aerial. The bias for the oscillator grid is derived from the grid current flow through the 100,000 ohms resistance R4, the usual grid condenser C3 of 0.0001 mfd. being included. The oscillator anode is fed through the 20,000 ohms resistance R5 from the 200 volts H.T. line, and a 0.1 mfd. by-pass condenser C6 is employed.

The oscillator tunes over a range slightly greater than 3,100-1,750 kc/s, consequently signals over a range a little greater than 1,500-150 kc/s can be transferred to the I.F. circuits, which are tuned to 1,600 kc/s. The receiving range has been made rather wider than is strictly necessary in order to avoid difficulties due to the inevitable variations between different components only nominally identical.

The I.F. Circuits

In the tetrode anode circuit of the frequency-changer valve is connected the primary of the first I.F. transformer L4. This transformer consists of a cylindrical air core coil of 98 μH. inductance tuned by an air-dielectric condenser C9 of 100 mmfd. maximum capacity. This winding is the secondary of the transformer, and the primary is very tightly coupled, has the same number of turns, and is untuned. This circuit is coupled



shows that the frequency-changer valve is preceded by a special aerial coupling system, designed to give a substantially even response over the 200-2,000-
A triode valve is used to provide reaction, and it is resistance-capacity coupled to the first I.F. stage. All tuning is carried out with the oscillator condenser C4.

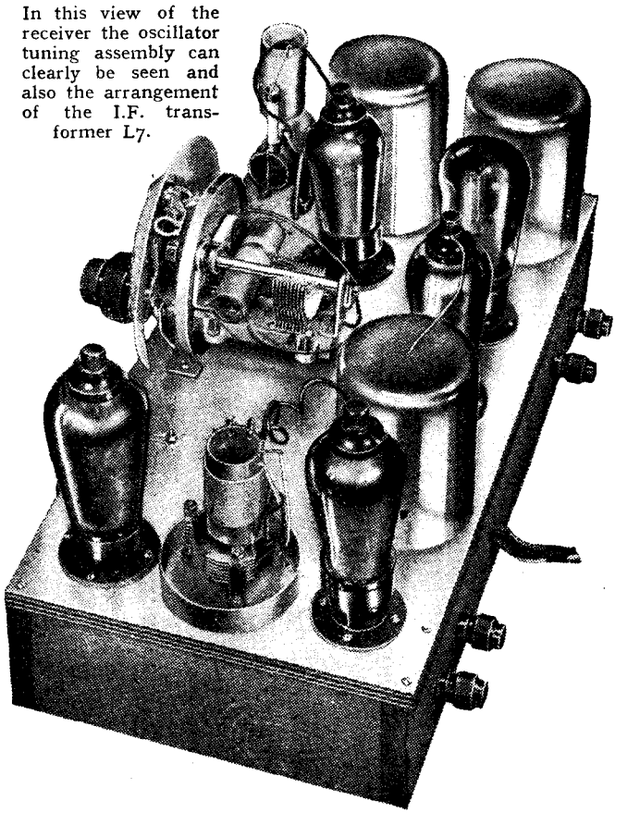
The Wireless World Single-Span Receiver.—

to another similar tuned winding L5 by the common capacity C11 of 0.01 mfd., which is shunted by the 10,000 ohms resistance R7 to permit bias being applied to the next valve.

This next valve, the first in the I.F. circuits, is the buffer valve and is a small power triode. Actually an ML4 is used, and it is biased negatively by the voltage drop along the 2,000 ohms resistance R8 shunted by the 0.1 mfd. condenser C13. The valve is coupled to the succeeding stage by a resistance-capacity circuit, the anode resistance R9 being given a value of 50,000 ohms, the coupling condenser C14 a capacity of 0.001 mfd., and the grid leak R10 a resistance of 100,000 ohms. Reaction, which forms the basis of variable selectivity, is obtained from the anode circuit of the buffer valve and is controlled by the 0.0002 mfd. variable condenser C12.

The valve following the buffer stage is a variable-mu tetrode, since this type has a somewhat lower grid-anode capacity than the usual H.F. pentode, and a large output at this stage is not required. It is coupled to the second I.F. valve through the transformer L6, which is of fairly high ratio. The tuned winding is identical with those of the other transformers, but the primary is smaller, so that the ratio is 1-2. This is of considerable importance in obtaining satisfactory reaction effects.

The second I.F. valve is also of the variable-mu type, although this is unimportant, since it is operated at a fixed bias. It is an H.F. pentode, as a large output is needed under certain conditions for A.V.C. purposes. The basis of the intervalve coupling L7 in its anode circuit is a tuned circuit identical with those of the other I.F. transformers. This is the secondary, and the primary of fewer turns is connected in the anode circuit of the I.F. valve. The detector diode,



In this view of the receiver the oscillator tuning assembly can clearly be seen and also the arrangement of the I.F. transformer L7.

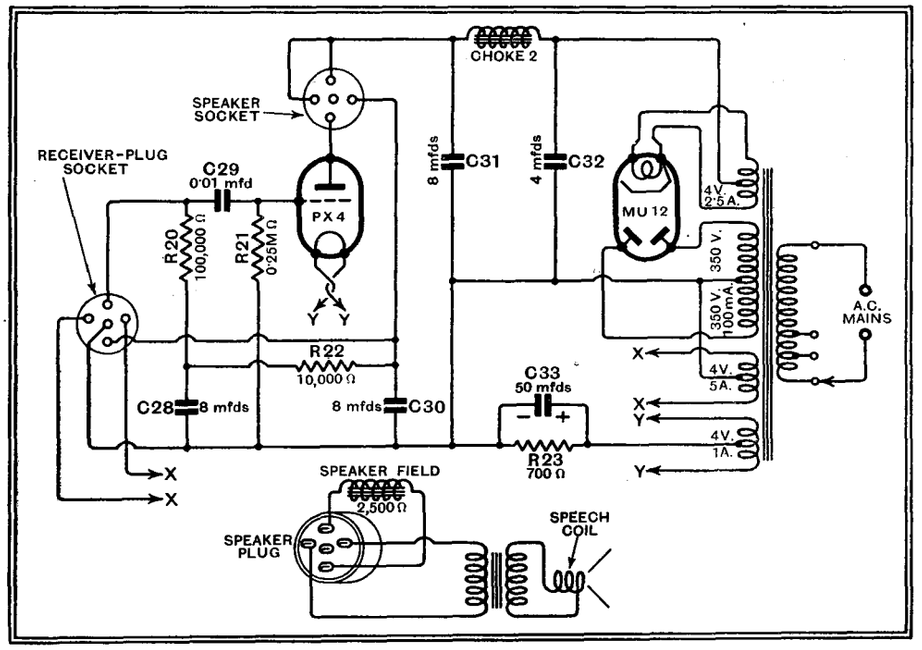


Fig. 2. The circuit diagram of the power unit. The last valve of the receiver is resistance-capacity coupled to the output valve.

LIST OF PARTS

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

RECEIVER UNIT

1 Variable condenser, 0.00016 mfd., **C4** — **Polar Type "E"**
1 Dial, slow motion type — **Polar Micro-drive semi-circular**
2 Bulbs, 6 volts 0.15 amp. — **Bulgin 615**
1 Slow motion reaction condenser, 0.0002 mfd., **C12** — **Eddystone 957**
1 Tapered volume control, 250,000 ohms, **R13** — **Magnum** (Claude Lyons, Rothermel, Watmel)
1 Double-pole change-over switch, S1 — **Bulgin S.98**
3 Valve holders, 5-pin — **Clix Chassis Mounting Standard Type**
2 Valve holders, 7-pin — **Clix Chassis Mounting Type**
1 Compression Condenser, 100 mmfds., **C5** — **Colvern**
4 Microdensers, 100 mmfds., **C9, C10, C16, C20** — **Eddystone 900**
6 Fixed condensers, 0.1 mfd. 200v. working, **C6, C7, C8, C13, C15, C18** — **T.C.C. 50**
2 Fixed Condensers, 0.01 mfd., **C11, C23** — **T.C.C. Type "M"**
2 Fixed Condensers, 0.001 mfd., **C14, C17** — **T.C.C. Type "M"**
5 Fixed Condensers, 0.0001 mfd., **C1, C3, C19, C21, C22** — **T.C.C. Type "M"**
2 Fixed Condensers, 0.0005 mfd., **C24, C26** — **T.C.C. Type "M"**
1 Fixed Condenser, 0.0002 mfd., **C2** — **T.C.C. 34** (Dubilier, Graham-Farish, Peak, T.M.C.Hydra, Telsen)
2 Electrolytic Condensers, 50 mfds. 12v. working, **C25, C27** — **T.C.C. 501** (Dubilier)
2 Resistances, 250 ohms 1 watt, **R1, R2** — **Dubilier**
3 Resistances, 2,000 ohms 1 watt, **R6, R8** — **Dubilier**
1 Resistance, 10,000 ohms 1 watt, **R7** — **Dubilier**
1 Resistance, 20,000 ohms 1 watt, **R5** — **Dubilier**
2 Resistances, 50,000 ohms, 1 watt, **R3, R9** — **Dubilier**
3 Resistances, 100,000 ohms 1 watt, **R4, R10** — **Dubilier**
1 Resistance, 1 megohm 1 watt, **R16** — **Dubilier**
2 Resistances, 2 megohms 1 watt, **R11, R15** — **Dubilier**
1 Resistance, 4,000 ohms 3 watts, **R18** — **Dubilier**
1 Resistance, 6,000 ohms 3 watts, **R17** — **Dubilier** (Erie, Graham-Farish, Claude Lyons, Seradex, Watmel)
1 Resistor, 30 ohms, **R19** — **Bulgin A.R.30**
1 Resistor, 50 ohms, **R19** — **Bulgin A.R.50**
1 Screened H.F. Choke, Ch1 — **Bulgin H.F.8**
1 5-way Connector — **Bryce**
1 5-pin Plug — **British Radio Gramophone Co.** (Bulgin)
1 5-way Cable with twin 70/36 leads — **Goltone** (Harbros)
4 Knobs — **Bulgin K.6**
4 Ebonite Shrouded Terminals, A., E., Pick-up (2) — **Belling-Lee Type "B"**
4 Coil Screens, 3¾ x 2¾ins. diam. — **White Bros. & Jacobs**
1 Coil Screen, 4 x 3¾ins. diam. — **Colvern**
Materials for Coils:
12ins. Paxolin tube, 1in. diam. **Wright & Weaire**
2½ins. Paxolin tube, ⅝in. diam. **Wright & Weaire**
Quantity No. 32, 36 and 38 D.S.C. wire.
or 1 Set of Coils
1 Length Screened Sleeving — **Harbros**
2 ozs. No. 20 Tinned Copper Wire, 8 lengths Systoflex, wood, etc.
Plymax Baseboard, 15 x 8 x ⅜ins. — **Peto-Scott**
Screws:—
14 ½in. No. 4 R/hd.; 36 ⅜in. No. 4 R/hd.
8 ½in. No. 4 R/hd.; 2 ¾in. No. 4 R/hd.
All with nuts and washers.
1 ¾in. No. 6 B.A., with metal thread and nut and washer.
Valves:—1 Ferranti VHT4, 1 Ferranti VPT4, 1 Osram or Marconi ML4, 1 Osram or Marconi VMS4, 1 Osram or Marconi MHD4.

POWER UNIT

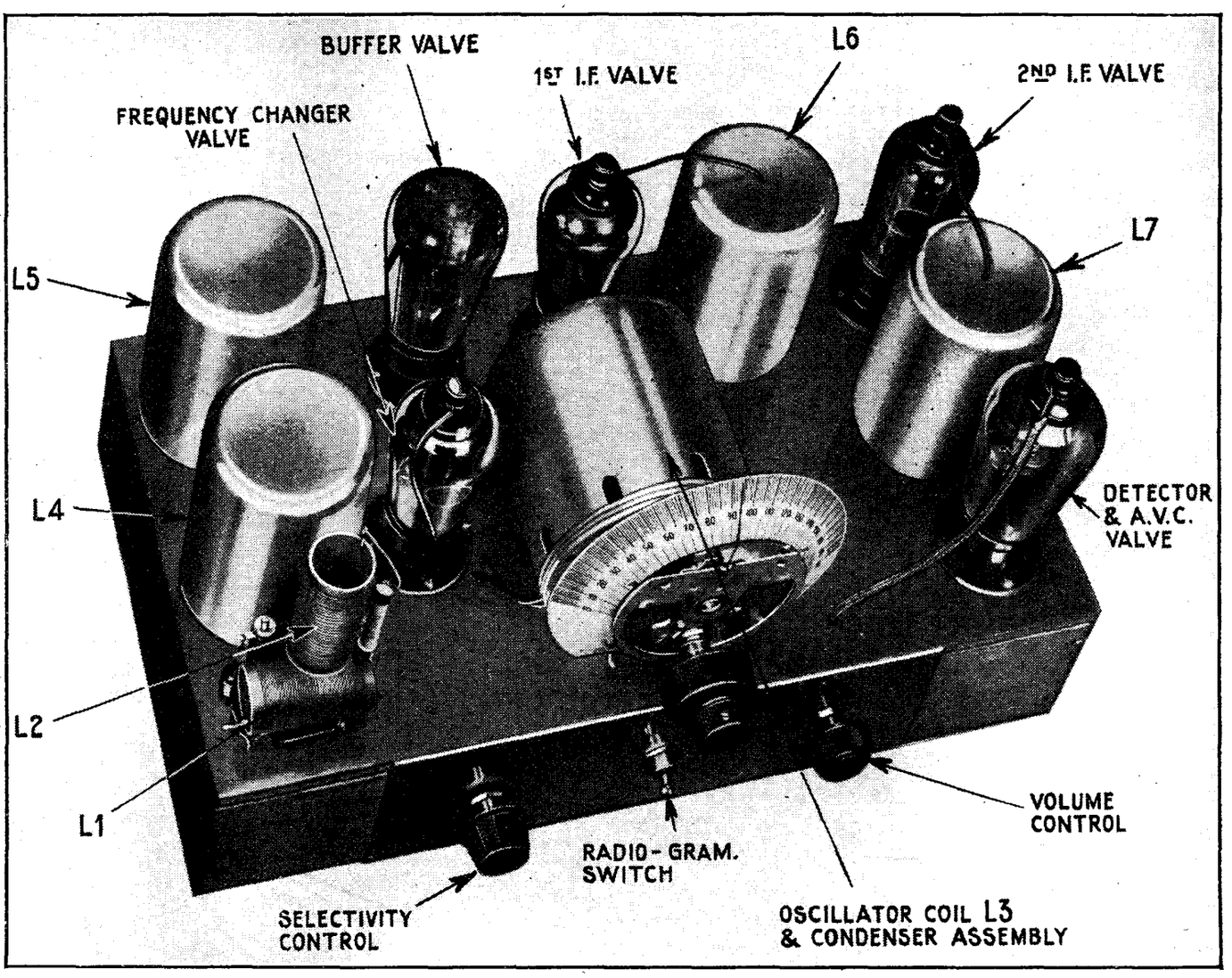
1 Mains transformer, primary, 200 to 250 volts, 50 cycles; secondaries, 350-0-350 volts, 100 m.a.; 4 volts, 2.5 amps., centre-tapped; 4 volts, 1 amp., centre-tapped; 4 volts, 5 amps., centre-tapped — **Heayberd Type W.W.7** (B.S.R., British Radio Gramophone Co., Bryce, Challis, Davenset, Claude Lyons, R.I., Rich and Gundy, Sound Sales, Vortexion)
1 Smoothing choke, 10 henrys, **Ch2** — **Wearite H.T.11** (Bulgin, Davenset, Ferranti, R.I., Sound Sales.)
1 Fixed condenser, 0.01 mfd., **C29** — **T.C.C. Type "M"** (Dubilier, Graham-Farish, Telsen)
1 Electrolytic condenser, 4 mfds., 440v. working, **C32** — **T.C.C. 802**
3 Electrolytic condensers, 8 mfds., 440v. working, **C28, C30, C31** — **T.C.C. 802** (Dubilier, Peak, Telsen)
1 Electrolytic condenser, 50 mfds., 50v. working, **C33** (Dubilier) — **T.C.C. 521**
1 Resistance, 10,000 ohms, 1 watt, **R22** — **Dubilier**
1 Resistance, 100,000 ohms, 1 watt, **R20** — **Dubilier**
1 Resistance, 250,000 ohms, 1 watt, **R21** — **Dubilier**
1 Resistance, 700 ohms, 2 watts, **R23** — **Dubilier** (Erie, Graham-Farish, Claude Lyons, Seradex, Watmel)
4 Valve holders, 5-pin — **Clix Chassis Mounting Standard Type**
1 5-pin Plug — **British Radio Gramophone Co.** (Bulgin)
1 Loud speaker with 2,500 ohms field with triode type transformer. — **Celestion Type E.8** (Magnavox, Rola)
Quantity No. 22 tinned copper wire, 2 lengths Systoflex, wood, etc.
Plymax Baseboard, 15 x 5 x ⅜in. — **Peto-Scott**
Screws:—
18 ⅜in. No. 4 R/hd.; 12 ½in. No. 4 R/hd.
All with nuts and washers.
2 ¾in. No. 6 BA with metal threads and nuts and washers.
Valves:—1 Osram or Marconi PX4; 1 Osram or Marconi MU12.

The Wireless World Single-Span Receiver.— however, is fed from a tertiary winding of the same number of turns as the primary.

A step-down ratio from the tuned winding is adopted in order to reduce damping and so increase the selectivity. If this were all, the diode could be shunt-fed from the primary in the same way as the A.V.C. diode, but if this were done a large increase in the H.F. filtering after detection would be necessary. The use of a separate winding on the transformer the resistance being chosen to give an improved high-note response. The L.F. potentials which appear across R12 as a result of rectification pass through the H.F. choke Ch1, which in conjunction with C22 of 0.0001 mfd. largely filters out the H.F. potentials, and are applied through C23 of 0.01 mfd. and the volume control R13 of 250,000 ohms to the grid of the triode. In order to reduce still further any H.F. potentials which may exist after the filter, a 0.0005 mfd. condenser C24 is connected to earth from the resistance R15 of 2 megohms being returned to a point about 3 volts negative with respect to the earth line. The steady voltage developed across this resistance as a result of the application of a signal of sufficient strength is applied as A.V.C. bias to the frequency-changer and first I.F. valves through the filter circuit comprising the 1 megohm resistance R16 and the 0.1 mfd. condenser C7.

The receiver unit is supplied with about 200 volts at 40 mA. from the power unit, and the anodes of the buffer, and two I.F.

IDENTIFYING THE PRINCIPAL FEATURES OF THE RECEIVER



The layout of the chief components and valves on the upper side of the baseboard of the receiver unit is clearly shown in this illustration. The aerial coupling consists of the assembly of coils, condensers, and resistances on the left of the chassis.

for the detector diode enables the circuit to be arranged in such a way that the H.F. potentials appearing across the load resistance are about one-twentieth of what they would be with shunt-feed.

The potentials appearing across the tertiary, therefore, are applied to one diode of the duo-diode-triode, which provides signal rectification, A.V.C., and first stage L.F. amplification. The diode load consists of the 100,000 ohms resistance R12, with a 0.0001 mfd. by-pass condenser C21, this unusually low value for slider of this control, and for the same purpose a 0.0005 mfd. condenser C26 is joined between the anode of this valve and earth.

The cathode of the duo-diode-triode is connected to earth through a 2,000 ohms resistance R14 by-passed by a 50 mfd. electrolytic condenser C25 to provide the bias for the triode portion of the valve and a portion of the delay voltage for the A.V.C. diode. This diode is fed from the anode of the second I.F. valve through the 0.0001 mfd. condenser C19, its load valves are fed from the positive line without de-coupling. The frequency-changer, however, is de-coupled by the 2,000 ohms resistance R6 and the 0.1 mfd. condenser C8, and the duo-diode-triode anode circuit is de-coupled by equipment included within the power unit. The chassis is not at the potential of negative H.T., but is maintained at 3 volts positive by the current flow through the 80 ohms resistance R19, which is by-passed by a 50 mfd. condenser C27. The grid returns of the frequency-changer and the two I.F. valves are

The Wireless World Single-Span Receiver.— taken to negative H.T., but their cathodes to the earth line; the 3 volts drop across R19, therefore, forms the initial bias of these valves. The A.V.C. diode load resistance is returned to negative H.T., but the cathode of this valve is positive with respect to the earth line, so that the delay is equal to the sum of the voltages across R14 and R19.

The screen-grids of the early valves are all fed at about 80 volts from the tapping on the potentiometer made up of the two resistances R17 and R18 of 6,000 ohms and 4,000 ohms respectively, a 0.1 mfd. condenser C18 being shunted to earth. The switch S1, as well as changing the duo-diode-triode connections for gramophone reproduction, removes the screen potential from the early stages on gramophone in order completely to avoid any possibility of a break through of radio signals.

Turning now to the power unit, the circuit diagram of which appears in Fig. 2, this includes the coupling between the duo-diode-triode and the output valves. Resistance coupling is used in spite of the fact that a triode output valve requiring an input of some 33 volts peak is employed, for the higher amplification afforded by a transformer is unnecessary. The coupling resistance R20 is given a value of 100,000 ohms, and de-coupling is provided by the 10,000 ohms resistance R22 in conjunction with the 8 mfd. electrolytic condenser C28. The coupling is completed by the 0.01 mfd. condenser C29 and the 0.25 megohm grid leak R21.

The five early valves and the dial lights are all heated from a single winding on the mains transformer, but a separate winding is provided for the output valve, which is a PX4 rated for an output of 2,500 milliwatts. Bias is obtained by the voltage drop along the 700 ohms resistance R23, shunted by the 50 mfd. condenser C33.

The H.T. winding is rated at 350-0-350 volts at 100 mA., and the unsmoothed output of the MU12 indirectly heated rectifier across the terminals of the 4 mfd. condenser C32 is about 360 volts. Preliminary smoothing is effected by the 10 H. choke Ch2 and the 8 mfd. condenser C31, and the potential across this condenser is about 300 volts. The supply for the output valve, some 50 mA., is then tapped off, and the rest of the current (about 40 mA.) passes through the 2,500 ohms speaker field. The field is thus energised and the power dissipated in it is 4 watts, the voltage is dropped to the value required for the early stages, and further smoothing is obtained in conjunction with C30 of 8 mfds.

A supply of about 300 volts for the output valve, which is rated for 250 volts only, at first sight seems excessive. Actually, however, 283 volts are required for H.T. and grid bias, and the difference is allowed for the drop in the output transformer primary.

Constructional details of the receiver, together with wiring diagrams, will appear in next week's issue.

A MYSTERY STATION

What I Found at Radio-Kasbah

By HANS W. PRIWIN

IN the wavelength lists of the International Broadcasting Union there has been for some years a station which can scarcely be heard beyond its own frontiers, which is practically unknown to the rest of Europe, which has no identification signal, no regular programmes, no announcements, and none of the other features which make for popularity. This is the mysterious station, "Radio-Kasbah," transmitting in the French Colony of Tunis on a wavelength of 1,350 metres.

When I reached the Avenue Foch, Tunis, I found terraces of cafés in which Arabian sheiks sat with French officers and elegant women wearing the most up-to-date Paris creations.

But I wanted to see the broadcasting station, and asked the manager of a large radio shop.

"Which station?" he replied. "There is no station in Tunis."

Disappointment, and then . . .

"There must be a station in or near Tunis," I said, "for it is in the official U.I.R. wavelength list and is called Radio-Tunis, 1,350 metres."

I never saw a man so astonished. He recommended me to try the old military station at Carthage. Arrived there, I asked a French soldier the same question.

"A radio station? Sorry, sir, but you are wrong. The next one is in the desert, near Toggourt."

Disappointed, I returned to Tunis. The next morning the hotel porter told me that the Arabian word "kasbah" meant fortress, and he mentioned that a kasbah existed near the centre of the town, just behind the Arabian quarter.

Off I want through the evil-smelling streets, emerging finally to a broad avenue; there I saw white barracks, round which were standing French and Arabian soldiers. I went to the top of a little hill, where I found a small house with a smaller tower. Radio-Kasbah!

"Where is the manager of the station?" I asked a young officer.

"The manager?" he laughed. "I am the manager, the announcer, the technical supervisor, and the chief engineer; in fact, I am the staff. Will you have a drink, Sir?"

As we refreshed ourselves he continued:—

"This is the famous Kasbah station. Would you like to see our studio?"

I nodded.

"Then," he smiled, "look around."

I did so and saw nothing but some chairs, cupboards, and tables. In the corner of the room was a box with three knobs, some coils, and an ammeter.

"That," he said, "is the amplifier, but as for a studio, 'nitshevo,' as the Russians say."

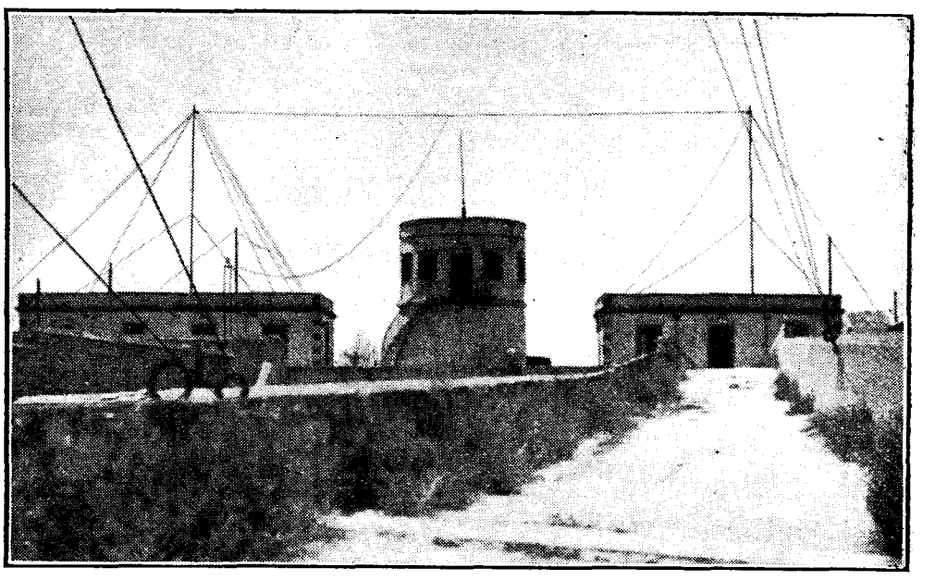
"But you must have a microphone," I said.

"Of course, but it is now in the Café de Paris."

"Then you only transmit O.B.'s?"

"Yes, sir," and the lieutenant smiled. "We broadcast the piano-playing of an old lady in the Café. Shall we stop the performance?"

He twisted the knobs of the amplifier.



"I went to the top of a little hill where I found a small house with a smaller tower. Radio-Kasbah!"

"So, now it is done—that was the close down of Radio-Kasbah."

And thus ended my visit. Next year, I understand, a big station will be established in Tunis by the Tunisian Government in co-operation with the amateurs. Let us hope that the new Radio-Kasbah will have a more powerful voice, so that we can enjoy the melodious Arabian music of which we have a taste when tuning in Radio-Algiers and Radio-Maroc.

Practical HINTS AND TIPS

AIDS TO BETTER RECEPTION

THE experience of those responsible for the maintenance of broadcast receivers would seem to indicate that, sooner or later, most wave-changing switches are bound to give trouble. Perhaps this explains why the principle of single-span tuning (which does away with these switches entirely) is now exciting so much interest among both amateurs and professionals.

Waveband Switches

Faults in wave-changing switches do not always take the form of a complete contact failure. Of course, when the switch is used in the ordinary manner for short-circuiting the long-wave section of a tuning coil, it should have an almost immeasurably low resistance when in the "closed" position. Occasionally, however, the switch contact is found to have a resistance varying from 2 or 3 ohms upwards.

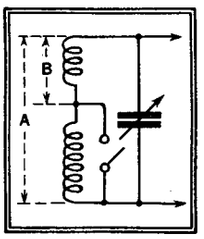


Fig. 1.—Testing the contact resistance of a wave-range switch.

It is for detecting faults of this nature that one of the many excellent multi-range testing instruments now available are especially suitable. A test is conveniently made by switching the instrument to the "ohms" scale and connecting it across the whole winding (position A in Fig. 1) with the switch closed. A note of the resistance reading should then be taken, and the meter is next connected in position B. If the same resistance is indicated in both positions, it may be assumed that the switch is beyond suspicion, but if lower across A than across B the contacts have appreciable resistance.

DUE to the general adoption of A.V.C., it is becoming customary to fit a manual volume control in the L.F. section of the receiver. A few cases have recently been encountered where the operation of this control produces H.F. instability when it is set at the maximum position.

L.F. Controls and H.F. Instability

Here we have a certain indication that the trouble is due to the presence of H.F. currents in the L.F. circuits, and a warning that better H.F. filtering is needed. At any rate, we know almost definitely that the instability is being provoked by passing on a greater proportion of the unwanted H.F. energy to subsequent L.F. circuits as the control is set towards maximum volume.

Before taking drastic measures in altering the filtering system, it may be remembered that troubles of this nature are sometimes due to passing the loud speaker leads in close proximity to the aerial end of the set—or, alternatively, to passing the aerial close to the output end, which amounts to very much the same thing.

IN the "Hints and Tips" section for March 16th it was urged that when the current output of an eliminator or H.T. supply unit is in excess of requirements, it is better to connect a parallel resistance to absorb the surplus rather than to join a resistance in series.

Series and Parallel Resistances

At first sight there would appear to be little to choose between the two methods, but actually one of the greatest advantages of the parallel resistance system is that an undesirable rise of voltage under exceptionally light load is avoided or at any rate minimised. As a consequence, smoothing and by-pass condensers are safeguarded, or, alternatively, one can economise by using condensers of lower voltage rating.

Another practical point in favour of the parallel loading resistance is that the amateur is seldom in a position to estimate with reasonable accuracy the rise of voltage that will take place under light loads, and with nothing more to guide him than the rating of the valve, he has insufficient data for calculating the value of a series resistance.

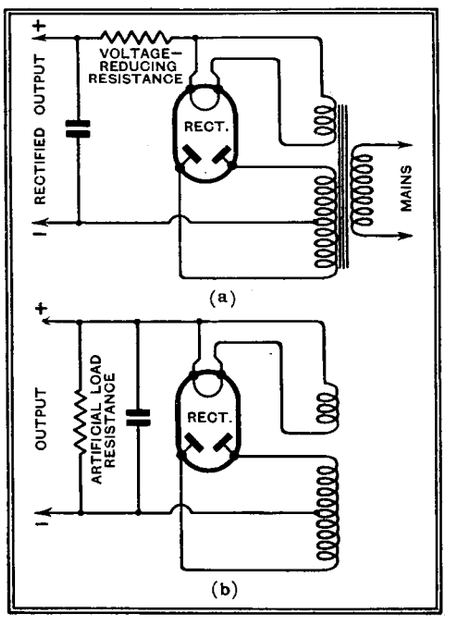


Fig. 2.—The "series" and "parallel" methods of reducing the voltage output of an H.T. rectifier.

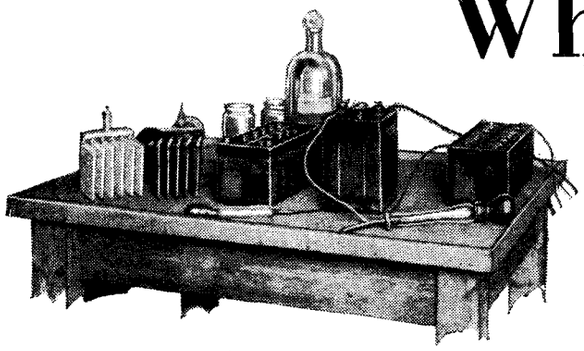
In spite of all this, it may be pointed out that the use of a series resistance is sometimes almost essential, as, for instance, when the maximum voltage output required from the eliminator is considerably less than the rating of the rectifier valve. In such cases it is usually a good plan to combine the two methods: to load up the output so that the voltage is brought down to the normal rated value, and then to insert a series resistance to absorb the surplus.

A GOOD deal of energy is dissipated by the modern loud speaker, and it is wise to bear in mind the need for the highest possible degree of mechanical rigidity in this instrument and in everything associated with it. For instance, an insecure mounting on the baffle, or anything loose in the vicinity of the cone, is likely to produce distressing rattles or "comb and tissue paper" noises. Effects like this are often traceable to the fabric backing which is sometimes secured behind the "fret" which conceals the loud speaker aperture. This fabric should be glued down securely, both around the periphery of the aperture and also to any cross-bars or ornamental devices that may be fitted.

Loud Speaker Rattles

WHEN unaccustomed interference in the form of crackling or "sizzling" noises becomes evident, it is more than possible that the cause will be an electric lamp which is overdue for replacement. It has been proved that an old lamp will sometimes act more or less as an arc transmitter, radiating interference over the whole of the house. Sometimes when the lamp is in a particularly bad condition it can be observed to flicker, and the flickerings will coincide with cracklings heard in the loud speaker. It is generally believed that the effect is due to arcing across a defective spot in the filament.

Electric Lamp Transmitters



When to Renew?

Part I.—Recharging and Replacing Batteries

A LITTLE care must be devoted to the maintenance of any broadcast receiver, and battery-fed sets require rather more attention than those operated by the mains. This article shows how a receiver may be efficiently maintained with a minimum of trouble and expense

IN common with most other earthly possessions, the parts of a wireless receiver wear out. Unlike most of the other things, however, the marks of old age are not readily discernible and are liable to be the subject of premature anxiety or needless tolerance of poor results, according to the temperament of the owner. The wearer of garments which are no longer sound is almost certain to have his attention drawn to their condition by candid observers, even if the evidence is situated out of sight of his own eyes. The same does not apply to the replaceable parts of a receiver—batteries and valves—which often mislead even the investigations of the "expert."

Apart from components that "go wrong" the following are the only ones that normally may need replacement during the lifetime of a receiver, probably in the order given: (1) Accumulator (recharge), (2) H.T. battery, (3) Grid bias battery, (4) and (5) Accumulator (renewal) and valves.

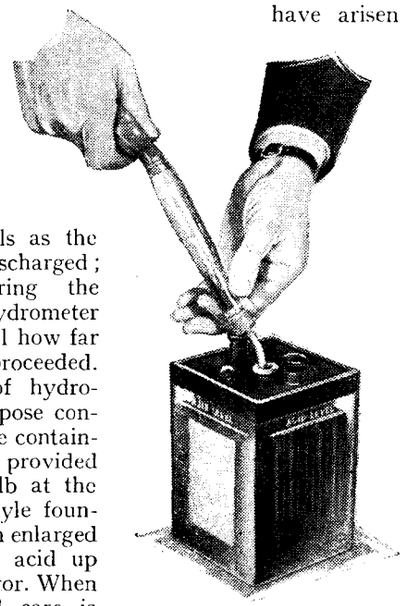
Whether accumulator or valve gives out first depends largely on how they are treated. The subject of valve renewals will be covered later; here we are considering batteries only.

The L.T. Accumulator

Perhaps no reader of these pages belongs to the proportion of new listeners who send their sets back the first time the accumulator runs down, explaining with varying degrees of acidity that the thing has gone wrong. Nevertheless, without a voltmeter even the time for recharging is not obvious. Probably the commonest (and worst) method is to do nothing about it until suddenly it is discovered that reception is ebbing away into complete extinction, most likely just before or during an important programme. If an alternative battery is always kept ready to remedy this "technical hitch" the listener may think he has exhibited all the providence and care that can be expected of him. It is just this type of owner who is most likely to find himself protestingly obliged to buy a completely new accumulator in an uneconomically short time. He may be compared with the motorist who drives his car until the tank runs dry in the middle of the road.

If the L.T. battery is kept at work until reception is on the point of fading out altogether, it means that its voltage (normally 2) is down to about 1. This, although strictly contrary to the makers' instructions to recharge immediately the voltage per cell drops below 1.8, is not likely to shorten the life of the battery drastically if it is put on charge *at once*. As most people depend on charging stations for this service, it may be at least a week-end before any recharging can be done: such treatment practically ensures sulphation—the grey hairs of accumulatordom.

Some means of detecting the approaching end of a charge is needed. There are methods of telling the state of the charge with considerable precision, but unfortunately they call for appreciable effort (or expenditure) and are therefore unlikely to be used by the majority of persons. For instance, the gravity of the acid gradually falls as the accumulator is discharged; and by measuring the gravity with a hydrometer it is possible to tell how far the discharge has proceeded. The usual sort of hydrometer for this purpose consists of a glass tube containing a "float" and provided with a rubber bulb at the top, like an old-style fountain pen filler on an enlarged scale, for sucking acid up from the accumulator. When this is done, and care is taken to see that the float is not touching the outer tube anywhere but is floating freely, the level to which the float rises out of the acid indicates by a scale the specific gravity. For the benefit of the unlearned an alternative coloured scale is usually provided, marked "Full charge," "Half charge," "Discharge," or similarly. The trouble about this is that if the accumulator makers' ideas as to gravity differ from those of the hydrometer maker, or if the gravity was wrong to start with, these broad directions are, like the verbal scale of the household barometer, subject to latitude of interpretation. If a hydrometer is to be used really intelligently the figure scale should be observed in conjunction with the accumulator makers' advice given on the label, or readily obtainable on enquiry. In this way it is possible to tell not only when the cell needs recharging but also when the acid should be renewed.



Density of the electrolyte indicates the state of charge.

Charge Indicators

To save the expense and trouble of a hydrometer, some cells are fitted internally with coloured floats, or even a pointer indicator. These are open to the same criticism as the above; and complaints have arisen that they cannot be relied upon in every case. Probably there never can be a completely fool-proof system; but the indicator system does save a great deal of trouble. If a voltmeter is available there might seem to be no difficulty. Actually, however, the seven-and-sixpenny moving iron type, or even a moving-coil instrument of dubious origin, may be worth rather less than nothing for this purpose. The difference in voltage between 90 per cent. charged and fully discharged is so small that unless a really accurate instrument is used one may be badly misled. Another point is that unless the voltage is measured when the accumulator is delivering its normal current the true state of affairs cannot be ascertained. A cell that is well below 1.8 volts on load may read nearly 2 volts when standing idle. Of course, one may fall into the opposite error by connecting the voltmeter at the receiver end, when even the slight voltage drop in the leads may cause the reading to indicate the discharged condition too soon. The voltmeter should always be applied right on to the terminals of the cell, with a clean, firm contact.

When to Renew?

But what about the majority who have no instrument? There is usually no appreciable audible warning until too late. The colour of the plates afford a rough indication. When fully charged the positive plates are a dark chocolate and the negative plates silvery grey. As they are discharged the chocolate becomes paler and the grey darker and duller. Obviously one cannot tell with great exactness. So some people, particularly those who use their sets very regularly, make a point of charging their L.T. batteries at regular intervals of time, frequently enough to ensure that they are never run right out. Assuming that the charging is carried out in a reasonable manner, this system is quite favourable to the life of the battery; but of course it may be uneconomical if there is a fixed payment for charging, and one has to consider whether it would not pay to get a hydrometer or voltmeter.

A rough idea of the number of hours' use to be had from one full charge can be obtained by dividing the actual ampere-hour capacity by the current in amperes drawn by the receiver. Thus a 40 amp. hour cell should run a set containing three 0.1 amp. valves and one 0.2 amp. valve (total 0.5 amp.) for 80 hours. A study of Fig. 2 will show, however, that the ampere-hour capacity given by one charge is by no means a fixed quantity, but depends on the rate of discharge. This is particularly true of the "mass" or "block" type cell, as distinct from the type with thin, closely interleaved plates.

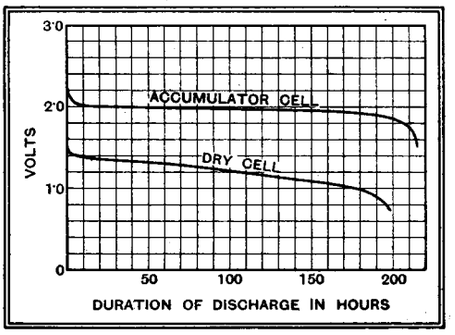


Fig. 1.—The voltage of an accumulator cell is well maintained during most of the discharge period.

Expectation of Life

After a time—something like two years of not-too-good, not-too-bad use, as many as five years or more of very careful use, and only months of really bad use—an accumulator shows a tendency to run down after a much smaller number of hours' discharge. Once this tendency has started it usually advances rapidly. Apart from the nuisance of having to be continually changing batteries, it becomes very costly in recharging, and it pays to buy a new battery. This is a good opportunity for making a resolution to abstain from the maltreatment which led to the premature decease of the old one.

A number of L.T. recharges having been lived through, the next experience is usually a falling off in results which cannot be ascribed to L.T. failure, but which may pretty safely be put down to the H.T. (assuming it to be a dry battery. H.T. accumulators *must* be treated as well as L.T. accumulators *ought* to be; one should never try to get on without a reliable voltmeter, nor must one ever wait until reception is disappearing). As the dry battery cannot be recharged the natural tendency is to hang on to it as long as possible. It is merely a matter of how bad one can tolerate reception. As the H.T. runs down much more gradually than the L.T., it is often astounding how horrible the reproduction can be before the throwing - out point is reached.

There are several symptoms of old age in H.T. batteries. One is a strong tendency to emphasise a particular note, or even to burst into a continuous howl or whistle, which is independent of H.F. reaction or reception of any sort, and is due to the increasing resistance of the battery causing L.F. instability. If the receiver circuits are very thoroughly decoupled, this particular effect may never show itself. On the other hand, the resistance may act to reduce amplification severely before there is much loss due to lowered voltage. Inadequate decoupling may thus waste money by needlessly pushing forward the point at which reception becomes unendurable.

The effects of falling voltage are usually first noticed at the reaction control if there is one, because it provides a definite scale for comparison. The knob requires to be advanced farther to cause oscillation, and it may even become impossible to reach that point at some parts of the wavelength scale. Then range begins to fall off, and also one can no longer get the same volume from the local station without harshness and distortion. Generally, one can do something to postpone the evil day by reducing grid bias a peg or two, because a drop from 108 volts to 80 might cause almost a complete cutting-off of anode current when the bias is unaltered, whereas a proportional reduction in bias enables fair results still to be obtained.

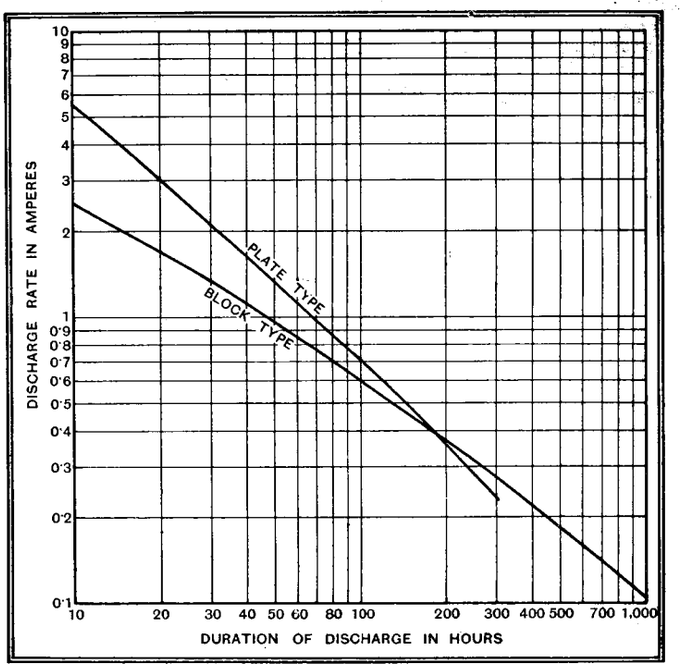
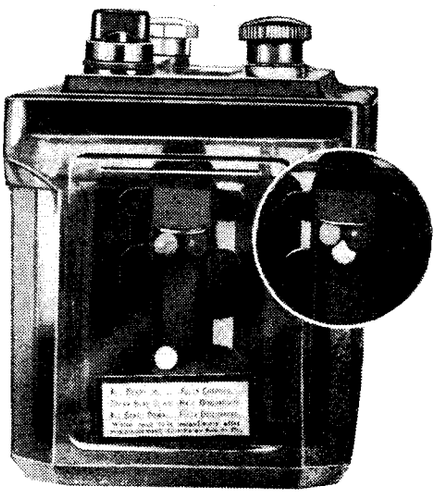


Fig. 2.—The popular block-type accumulator cell is particularly suitable for a slow discharge rate.



Tell-tale beads offer many of the advantages of a hydrometer test without its messiness.

Artificial Discharge Resistance

The bias question is of particular importance in Class B and Q.P.P. systems, where it is very critical; and arrangements are often made to discharge the bias battery through a suitable resistance, so that its voltage falls at such a rate as to give the best results all the time as the H.T. voltage falls. There are so many possible conditions that actual figures cannot be detailed here. If, however, anybody thinks of trying this scheme for an ordinary "straight" set, some idea of the right discharge resistance to use for the bias battery can be got by multiplying the bias voltage by 1,000 and dividing by the number of milliamps. normally taken from the H.T. battery. That assumes the G.B. cells to be of the same size and type as the H.T. And don't forget to switch off the G.B. as well as the rest of the set!

Returning to the signs of old age in H.T. batteries: the gradual deterioration

When to Renew?

is occasionally accompanied towards its latter end by rustling or frying noises. They persist when the aerial is disconnected, but usually disappear temporarily after the set has been switched off overnight.

Any or all of the H.T. symptoms may be imitated by failing valves and other faults; so, unless a satisfactory term of H.T. service has been obtained, some further investigation should be made before casting aside the battery. The best sort of investigation, of course, is that which is made by a voltmeter. But a valuable clue is that a dry battery recuperates considerably after a period of rest, whereas a valve is very much less likely to do so. In measuring the voltage, some regard must be paid to the type of instrument. The cheaper moving-iron models take a larger current—sometimes a *much* larger current—than the whole receiver. So it is better to measure the volts with the receiver off; and even then the voltmeter may make things look worse than they are. A good moving-coil meter, 1,000 ohms per volt, on the contrary, may fail to show the badness of a battery unless the test is made under working conditions and after the receiver has been running for some hours. If the volts are down to about 70 per cent. of normal, the battery may be considered to have served its day.

Class B and Q.P.P. are rather special, because they are particularly sensitive to increasing resistance and decreasing voltage of the H.T. A good voltmeter connected when the receiver is working may be expected to show slight downward kicks, even when there is still some useful life left; but severe kicks corresponding to full loudness, from an initial voltage which is already well below normal, may be considered to be the death signals. If the full economy benefit of these systems is to be derived, one must do as much as possible by grid bias adjustment before pronouncing approaching distortion to be incurable, short of H.T. renewal.

The G.B. battery has already been mentioned. If no discharge resistance is used, it is likely to last a year or even two years. But unless a voltmeter is available it is most unwise to bank on such longevity, because the effects of a dead grid battery are disastrous. Economy in G.B. is far more than offset by the expense of H.T. and probably valve renewals.

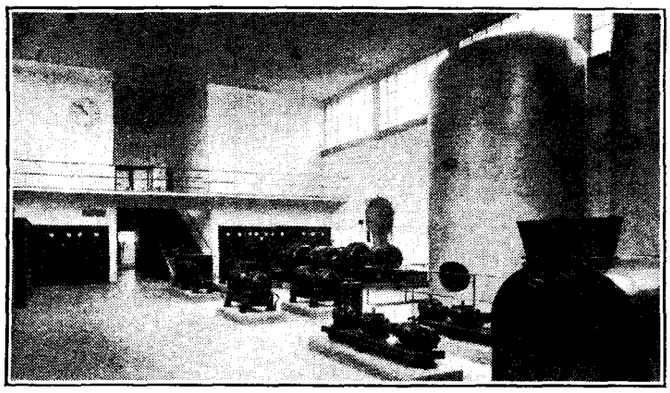
So it is quite usual to combine H.T. and G.B., ensuring their simultaneous renewal. Six months is about as long as it is wise to run a grid battery, in absence of voltmeter evidence of its continued effectiveness. If by any chance the H.T. runs out in an abnormally short time, insufficient bias is the first thing to suspect, and increased bias volts should be tried, just short of the point at which obvious distortion is introduced by consequent starving of the valves.

(To be concluded.)

ON THE SPOT

Visits to Foreign Broadcast Stations

XV. Munich
405.4 metres
740 kc/s
100kW



A section of the Munich transmitter hall.

"ERDINGER MOOS" is the local name for the district in which the Munich high-power broadcasting station is situated. The transmitter is in marshy ground at least fifteen miles from the centre of the town.

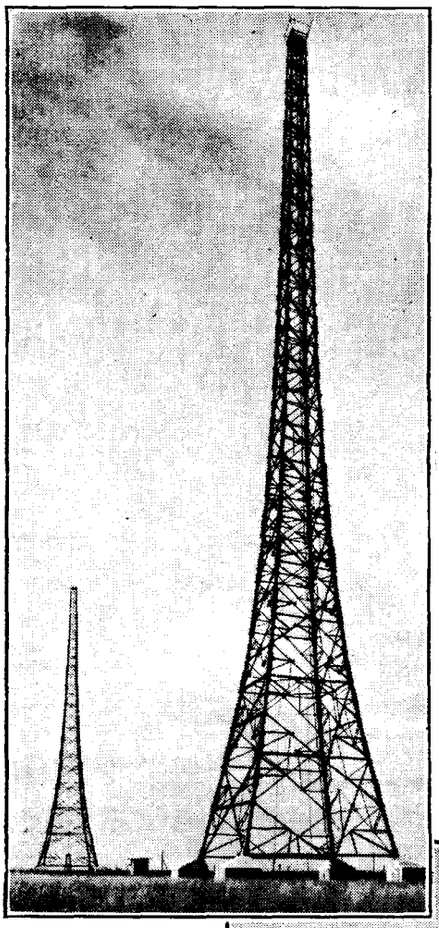
Munich was the first German station to have its specially built "Broadcasting House." This is on the "Rundfunkplatz," next to the Ministry of Transport building, which accommodated the first studios and transmitter.

In 1925 Munich became the proud owner of the first broadcast transmitter working without valves. A high-frequency machine apparatus similar to that used for telegraphy stations was employed, but this had to be abandoned as it was not adaptable to high-power medium-wave requirements.

The present transmitter has wooden masts of stronger construction than those of the old station, which were blown away in a gale about two years ago.

Unlike Leipzig, the Munich transmitting buildings are unusually impressive in appearance with their dazzling whiteness and powerful architecture. This is perfectly appropriate, considering that Munich is one of Germany's most modern stations.

"WANDERING WAVE."

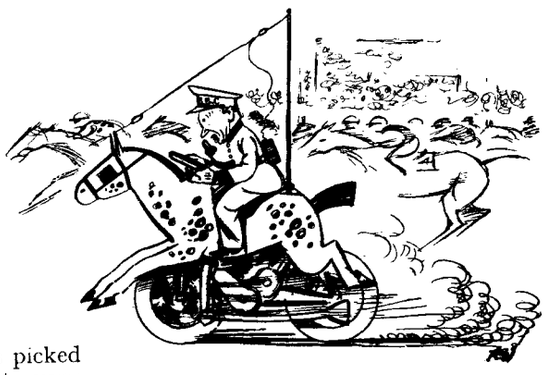


These immense wooden masts at Munich may shortly be abandoned in favour of a single mast carrying an anti-fading aerial. On the right is seen the transmitter buildings.

UNBIASED

By

FREE GRID



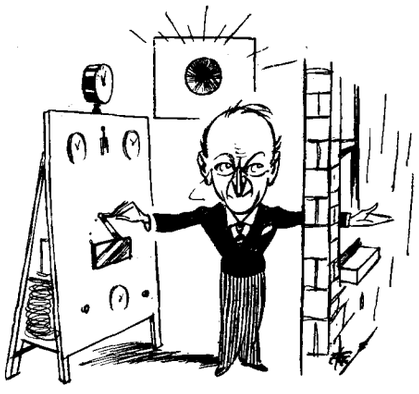
The Derby commentator.

A.P.C.

THE various opinions now current concerning the menace of high-powered stations leave me rather bewildered. The whole business seems to boil down to the fact that the present war in the ether is caused by stations overstepping the limits of the service area for which they are designed.

When transmitters are intended to provide reliable reception over a certain area it is natural that they should be given sufficient power to provide a healthy signal during daylight along the extreme edges of the area. The consequence is that when night comes old man Heaviside upsets matters by vastly increasing the extent of the area so that stations slop over into each other's territory.

It has been proposed in influential quarters that arrangements should be made for each station to change its power according to the time of day and according to any other phenomena which tend to bring about a change in etheric conditions. It is pointed out, however, that at certain times conditions vary so rapidly and in such an eccentric manner that it would necessitate a skilled man on the power knob all the time.



A skilled man on the power knob.

Surely, however, such an opinion points to a tremendous lack of enterprise and inventive ingenuity on the part of those in authority, and I am much minded to write to the U.I.R. to suggest that they get a Bill passed, an agreement made, or whatever it is they do, to the effect that after a certain date all transmitting stations must be fitted with automatic power control.

As I shall explain in my letter, A.P.C. could quite easily be carried out by having a special receiving station on the fringe of a station's service area, this being left permanently tuned to the wavelength of the transmitter concerned. Any changes in receiving conditions would at once affect the strength of the signals picked up by the receiver and enable it to vary the power of the sending station accordingly, by feeding back suitable impulses via the landline, which would connect it to its master transmitter.

I am now engaged in building castles in the air, planning what to do with my award when it comes along.

That Mains-controlled Clock

IT is astonishing what a lot of dense people there are in the world. I should have thought that the brief explanation of the working of my mains-controlled wireless clock in the March 30 issue of this journal was clear enough, but judging by the contents of my postbag this is not so.

In the first place, objections have been raised on the grounds that during daylight hours the 50-cycle fluctuations from the lamp would be absolutely swamped out by the steady flood of light from the windows. Surely those who have written in this strain might have realised that this little point did not escape me. Naturally I employed a form of Thalofide cell which is strongly responsive to infra-red rays. Used in conjunction with a filter to exclude all ordinary light and a sort of lens hood to concentrate the thing on the lamp and exclude the infra-red coming in with the daylight or electric light, the apparatus has been highly successful.

Yet another correspondent suggests that the landlady must be quite untrue to type if she does not object to the light being left on all day. Having had considerable experience of landladies and their muddled mentality in my younger days, it is not likely that this point would have escaped me. Naturally enough I made arrangements for my friend to change his ordinary gas-filled bulb during daylight hours in favour of one filled with fog; indeed he puts in the fog-filled bulb when he retires in order to prevent his being annoyed by the light shining on his face all night.

A Real Running Commentary

IT is some time yet before we shall all be contributing our quota to the Bookies' Annual Benefit Day at Epsom, but it is none too soon to call attention to the lack of enterprise and initiative which the B.B.C. show in their running commentary on the Derby and other horse races.

They seem to adopt the right methods in carrying out the annual boat race broadcast, and I cannot for the life of me think why they do not adopt similar arrangements at Aintree, Epsom and elsewhere. They would not think of giving the boat race broadcast through the medium of several commentators stationed at various points along the river bank, and I cannot see why they should adopt such an archaic method at race meetings.

If they can arrange for the commentator to follow the boat race in a boat fitted with a transmitter, surely they can arrange for the Derby commentator to follow the competitors on a radio-equipped horse. Short-waves would, of course, be used, as in the case of the boat race, the receiving point being on the roof of the grand stand.

Tally-ho

It is not as though there were any technical difficulties in the way. The Japanese authorities have long since shown the way by having a radio-equipped horse at their army manœuvres and indeed "W. W." published a photograph of him in the issue of January 5th last. If the Japanese can do it, surely it is not beyond our own B.B.C.

I feel sure that by the adoption of my suggestion we should all get an entirely new angle on the Derby.

The interest of such an arrangement would be even greater at the Grand National owing to the interposition of the jumps; the commentator would, I feel sure, be able to "get over the air" to us the same thrill as is experienced by those taking part in the race.

In addition, of course, the general scope of running commentaries could be enormously extended to include such things as foxhunting and similar events to which only an equestrian commentator could possibly do justice.

Another idea which might meet with the approval of the ladies would be a dress commentary by a radio-equipped female announcer roaming round the paddock at Ascot.

NEWS of the WEEK

Current Events in Brief Review

"FOR DISTINGUISHED CONTRIBUTION TO RADIO," Rear-Admiral Richard E. Byrd, the Antarctic explorer, has been awarded this medal by the U.S. Columbia Broadcasting System. Admiral Byrd's expedition has broadcast regularly to American listeners.

Compulsory

THE municipality of Berne, Switzerland, has promulgated a decree that every school must contain a wireless set capable of loud speaker reception.

More High Power

CZECHOSLOVAKIA, determined to keep pace with its European neighbours, announces that the Brno and Bratislava stations are to be increased in power to 100 kW.

Ganging the Receiver

BURGLARS recently apprehended by the Paris police in Montmartre while making off with a wireless set pleaded that the receiver was their property and that the jemmies and other housebreaking tools which they carried were for the purpose of adjusting it.

Radio Boomerang

BY a strange irony of fate an exhibition of home-made wireless apparatus, held recently under the auspices of the Nottingham Passenger Transport Department Radio Club, was spoilt by interference from the Transport Department's own trolley buses. Among the interesting exhibits was a home-constructed television set, which it was impossible to demonstrate owing to the almost ceaseless bus static.

The Lucky Thirteenth

ALTHOUGH the British Wireless Dinner Club's reunion at the Trocadero Restaurant on Saturday last, April 7th, was the thirteenth in the annual series, the attendance was very nearly a record. Commander Slee occcupied the chair.

Originally membership of the Club was confined to officers in the wireless branches of the Army and Navy during the War. The scope is now extended, however, to include officers now serving and, in certain cases, persons engaged in a somewhat similar capacity in the commercial sphere. The Hon. Secretary is Mr. C. F. Tripp.

Up-to-Date Hungary

HUNGARY has issued an anti-static decree whereby all new electrical apparatus must carry an official certificate that it does not radiate to the extent of causing interference with broadcast reception.

A Call from Chicago

DURING Chicago's revival this year of the Century of Progress Exposition, radio amateurs will again transmit messages from the Travel and Transport Building to sightseers' friends all over the world. Last year's call-signs—W9USA for code and W9USB for telephony—will probably be used this summer.

500 Kilowatts

WLW, Cincinnati, America's "wonder" station on 500 kW., began a period of regular full-time test transmissions on March 21st, concluding the series on April 3rd. With its tenfold power increase the station's signal strength is said to have reached at least 325 per cent. of its original power at all reception points. Should the technical data collected from these tests prove entirely satisfactory, it is expected that WLW will apply for regular authority to use 500 kW.

"On Tick on the Air"

THIS is not a reference to the B.B.C.'s original interval signal, but to a sad fact in connection with political radio in America. According to our Washington correspondent, something like $266,000 is still owed to the national radio networks by the Democratic and Republican Committees, for "time on the air" purchased during the last presidential campaign. The Democrats owe $155,211 and the Republications $111,563. The networks are hoping that the money will come in before the next presidential election.

The Private Loud Speaker

AN important statement on the subject of noisy loud speakers operated by private individuals has been made by Sir John Gilmour, the Home Secretary, in the House of Commons. In reply to Mr. Harcourt Johnstone, the Home Secretary said that representations had been made to him as to the nuisance caused to residents in some urban areas by the inconsiderate use of wireless loud speakers and gramophones by their neighbours, and after careful consideration of the circumstances he had decided that the matter could properly be dealt with by a bylaw under Section 23 of the Municipal Corporations Act, 1882. It was hoped to have available shortly a form of bylaw on the subject suitable for adoption by local authorities where there was adequate evidence of the existence of this nuisance.

Cult of the Hitler Set

THE Hitler wireless set, reduced in cost to less than £4 by State-encouraged mass-production methods in Germany, has caught the imagination of Poland and Hungary. The Governments of both countries will shortly sponsor the production of "people's receivers" at low cost.

Prizes for Commentators

A SEVEN-VALVE wireless set has been awarded as first prize to the winner in a competition organised by our contemporary, *Petit Radio*, to discover promising radio commentators. The winner, M. Charles Brulat, gave a vivid description of the printing of a daily newspaper. The second-prize winner described activities at Le Bourget aerodrome, and the third gave a word picture of an afternoon in a Champs Élysées cinema.

The Half Million Mark

OFFICIAL figures just released show that the number of wireless licences in Czechoslovakia at the end of December last was 569,455.

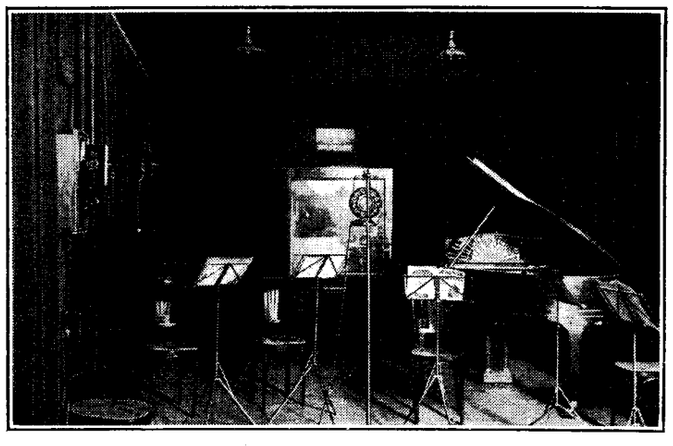
Berlin's Running Commentator

DR. PAUL LAVEN has been appointed chief sports commentator to the Berlin station. Dr. Laven has obtained fame in Germany for his vivid word pictures of sporting events in Rome, Paris and London.

Programmes for Nomads

IT would appear that a portable wireless set is now part of the equipment of the desert wanderer. At all events this is the view taken by the Turkish Government, which has arranged for a special series of programmes from Ankara designed to interest the Kurd tribes. These programmes will be largely educational, but the organisers will give the pill a coating of jam in the shape of bright music.

The new venture suggests the possibility that wireless will be used in future colonisation schemes. Where independent tribesmen may be adamant against attacks by gun and bayonet they may graciously yield to the even stronger influences of sweet music and vaudeville wisecracks.



IN SUNNY SPAIN. "Union Radio," San Sebastian, working on 238·5 metres under the Lucerne Plan, is one of the lesser Spanish stations. Above is a view of the main studio.

France Points the Way

FRANCE is now ahead of Britain in the matter of legislation against electrical interference with broadcast reception. On April 1st the anti-static law came into effect, and although the French Post Office has not yet completed its organisation for enforcing the law the listener is already greatly helped by having the law on his side in cases of dispute. For the present the authorities are appealing to listeners themselves to help in locating offending apparatus, but expert squads are being formed to cover the country in search of noisy apparatus.

"Come to Mexico" Station

WITH the object of encouraging touring, the State Railways of Mexico are proposing to erect a high-power broadcasting station capable of being heard all over the United States. This station, transmitting in several languages, would describe the attractions of Mexico and persuade the listener that the "Southern Pacific" railway offers him cheap travel and is the only real road to happiness.

Page 261 follows after the Programme Supplement

Time By Telephone

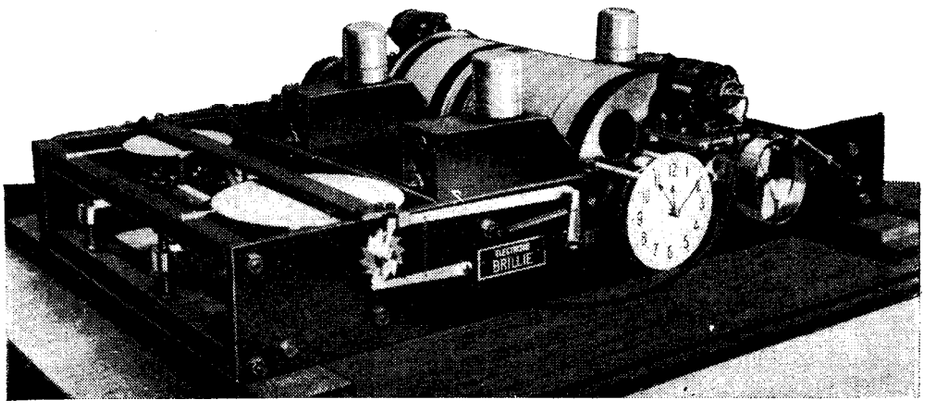
The Speaking Clock and How it Works

"ODEON 8400, s'il vous plait!" calls the modern Parisian, and in a few moments a clear voice at the other end of the 'phone gives him the correct time in hours, minutes and seconds. The ingenious mechanism of the "speaking clock" is here described.

PARTICULARLY interesting and ingenious use is made of well-known principles in the recently installed "time-by-telephone" service in Paris. This system makes accurate time available to everyone over the ordinary telephone lines, and is completely automatic. Although the subscriber ringing up hears a voice repeating the hours, minutes and seconds, no human agency whatever is employed.

The system was devised by the famous French clock manufacturers, Brillie Frères, and has become known as the "speaking clock." Every ten seconds it can be heard announcing the time, and the exact moment is indicated by pips similar to those heard in the B.B.C. time signals.

The various announcements made by the clock were recorded on strips of paper $\frac{1}{8}$in. wide by the method used in the production of ordinary talking films. Separate strips are used for each hour, minute and seconds announcement. These strips, ninety in all, are fastened parallel to each other around a rotating cylinder. They are arranged in three groups, one of twenty-four for the hours, one of sixty for the minutes, and a third of six for the seconds, the latter including a special phrase which is heard at the full minute.

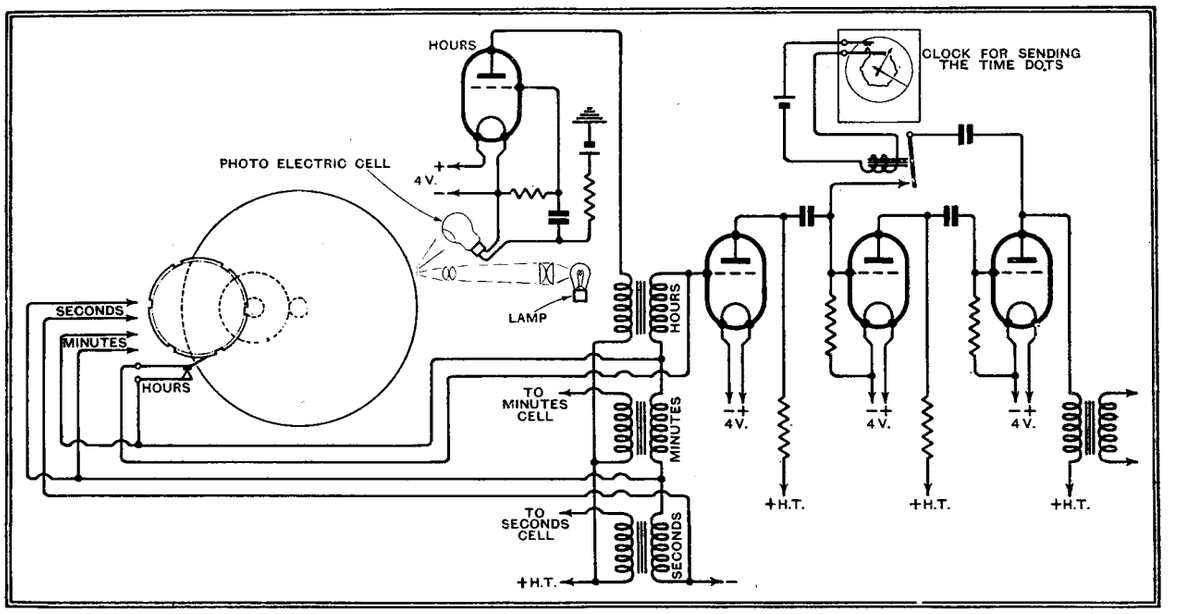


This side view of the "speaking clock" shows, in addition to the dial, the second control cam for actuating the time pips every ten seconds.

Opposite each group is a chamber containing a lamp, an arrangement of lenses by means of which the lamp filament is focused on to the strip, and a photo-electric cell. The photo cell receives the light reflected from the strip as it revolves on the cylinder, and the variations of current thus set up are amplified by a three-electrode valve. The anode supply of this valve is fed through a low-frequency transformer, the secondary of which goes to the input side of a three-valve R.C. coupled amplifier. There is a separate valve and transformer for each group, but the secondaries of the three transformers are joined in series.

During a single rotation of the cylinder the hour, minute and second strips which happen to be opposite their respective photo cells will *simultaneously* impress their announcements on the circuit. If these were all allowed to proceed *via* the secondaries of the transformers and the amplifier to the subscribers the result would be an unintelligible jumble of the three phrases associated with any specific time. For instance, "Quinze heures," "Cinq minutes" and "Dix secondes" would be heard simultaneously.

To overcome this the secondary of each transformer is given a short-circuiting contact, controlled by a cam operated by the cylinder. The cam is arranged to close two of these contacts at any time, leaving the third open. Therefore, when the three phrases occur simultaneously two of them are rendered ineffective by the shorting of the secondaries into which they are induced, while the third goes through without interference. The three phrases are repeated simultaneously three times, and the cam operates to short-circuit two different secondaries each time, so that the effective result is that the three required phrases are allowed to pass

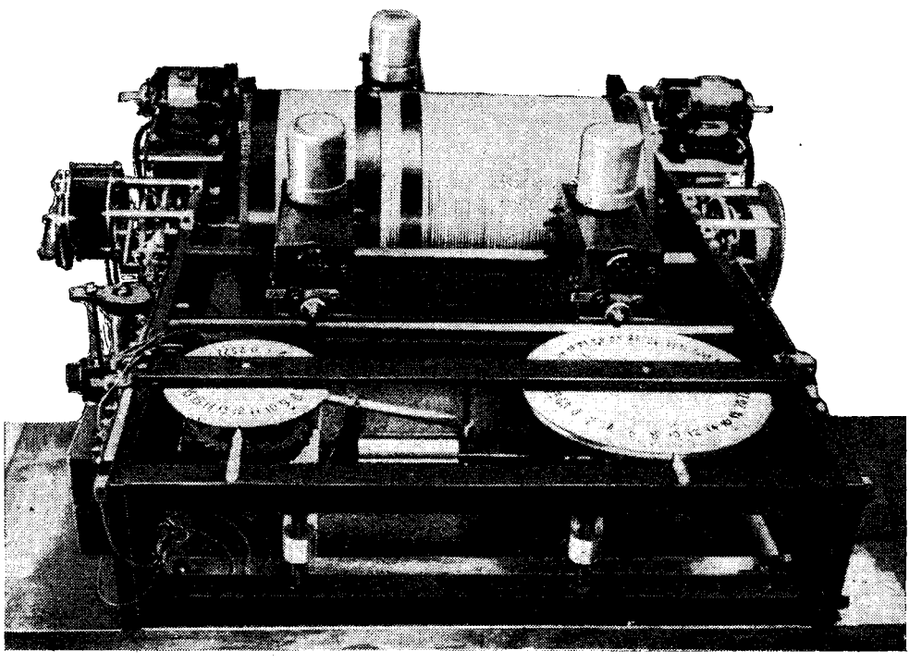


A circuit diagram of the "speaking clock" and its main amplifier. The photocell receives light reflected by rotated strips of paper on which the time announcements have been recorded.

Time By Telephone—

through to the amplifier only at the appropriate moments.

The method of producing the musical note for the pips which indicate the exact moments is also ingenious. A cam driven by a standard clock is made to close a contact at the exact moments when the pips are required. The closing of this contact joins the anode of the third valve



A closer view of the clock showing the rotating drum and the photocell chambers. The associated dials indicate to an observer whether the clock is functioning correctly.

in the amplifier to the grid of the second valve, *via* a condenser, and thus sets the circuit into L.F. oscillation, producing the note which is heard.

Subscribers could be joined to the output of this amplifier, but if more than one person were connected at the same time they would be able to speak to each other. To obviate this sixty one-valve units are used, each taking its input from the main amplifier. Thus, sixty subscribers may ring up simultaneously, each one being separately connected to the output of one of these small units.

Asking the Time

When a subscriber is connected, a relay, with three contact points, is actuated. One of these brings into action a meter to record the number of calls; the second connects an accumulator to the filament of the valve; while the third connects up the batteries to the valves and photo cells at the main amplifier, if these are not already in circuit. A reserve valve is provided in each unit, and, if the working valve burns out, the cessation of its current operates a relay which automatically brings the reserve valve into circuit, and enables it instantly to assume the function of the burnt-out valve.

The whole apparatus has been given a telephone number (Odeon 8400), and any subscriber calling up that number is put straight through to the clock.

EMERGENCY TRANSMITTER FOR YACHTS

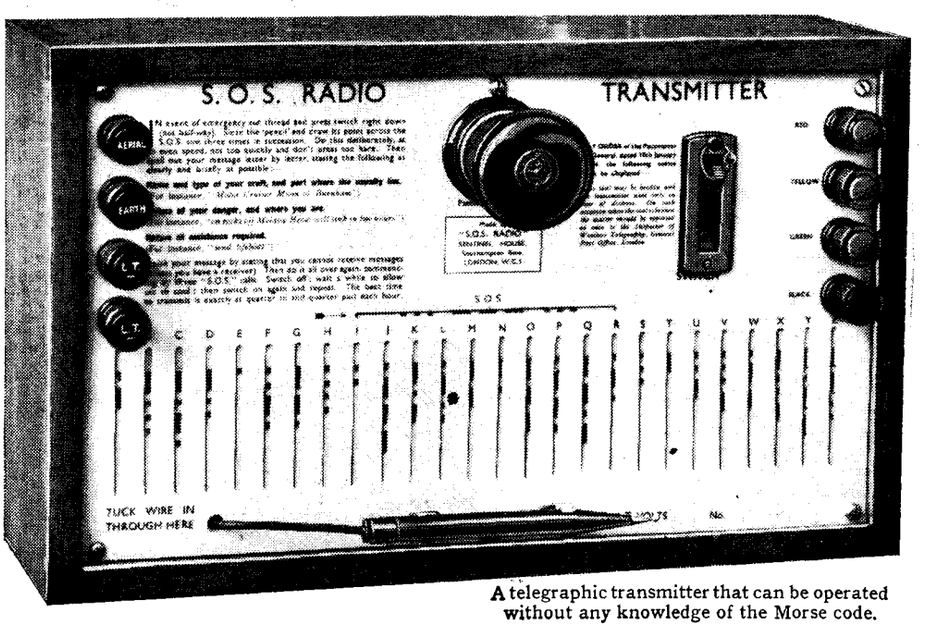
WERE it not for the difficulty of the Morse code it is probable that a number of yacht owners would instal wireless transmitting apparatus, even on the smallest craft, purely as a safety measure in the event of serious accident.

There is a saying—exaggerated, but with a grain of truth in it—that no one over twenty years of age can learn Morse really well. So far as the yachtsman is concerned there is no longer any vital need to try, as a very ingenious method has been devised whereby anyone, even without the slightest acquaintance with the code, can transmit a call for help.

The S.O.S. Radio Transmitter, made by S.O.S. Radio, of Sentinel House, Southampton Row, London, W.C.2, comprises a buzzer-modulated oscillator valve fed either from dry batteries or from an accumulator and rotary converter; it operates on the fixed wavelength of 600 metres, and is stated to have a range of about thirty miles.

On the front panel are a series of narrow slots, one for each letter of the alphabet and one for the S O S signal. At the base of each slot are fixed strips of metal, corresponding to the Morse symbols, and so arranged that, as the metal point of a special "pencil" is passed lightly over them, the transmitter circuit is "made" and "broken" in the correct sequence for sending out the desired letter. After a little practice no difficulty was found in working this semi-automatic keying system.

The apparatus is approved by the Post Office for emergency use, and no transmitting licence is required.



A telegraphic transmitter that can be operated without any knowledge of the Morse code.

The Radio Industry

A PORTABLE "talkie" projector, handling standard 16-mm. film, has been developed by the B.T.H. Company, of Rugby. It is sufficiently compact to be transported in the back of a car, and is intended for such diverse purposes as education, training of industrial employees, publicity, etc.

◈ ◈ ◈ ◈

When referring recently to the lack of D.C. sets designed for low voltages (in the order of 100 volts) we forgot that the Philips Models 834-C and 634-C are available for these voltages, and we are reminded by the makers that the limitations with regard to power output are largely overcome by fitting parallel output pentodes.

◈ ◈ ◈ ◈

"Peak" condensers and terminal blocks, previously sold by Wilburn & Co., will in future be marketed by W. Andrew Bryce & Co., Woodfield Works, Bury, Lancs.

◈ ◈ ◈ ◈

A new Philco car radio receiver, Model 10, has just been introduced at the low price of 16 guineas. This is a 6-valve single-unit receiver with full A.V.C., remote tuning control, and manual tone control. High-tension current is supplied from the car battery by means of a built-in vibratory generator.

BROADCAST BREVITIES

By Our Special Correspondent

A New One

THERE seems little doubt that the power of Droitwich will be restricted to 120 kilowatts. The B.B.C. engineers are contending that they prefer not to over-run a station. This is something new to me. For years Daventry 5XX, nominally 25 kilowatts, was agitating the ether to the tune of between 35 and 40 kilowatts.

Strange Logic

Perhaps Mr. Ashbridge's hopes will be justified and Droitwich will satisfy everyone when using only 75 per cent. of its output. It is argued that a few kilowatts up or down do not matter, but when the difference amounts to 30 kilowatts one may be forgiven for doubting the theory. A station using only 50 kilowatts less than Luxembourg should make considerably more noise than one which the Delectable Duchy exceeds by 80 kilowatts. However, we shall very soon see.

A Bad Interval Signal

BOW Bells will soon make their last bow on the ether. At least this is how I read the signs and portents, for the B.B.C. men are surprised at the heavy opposition to the use of church bells as an interval signal.

As was pointed out in these columns on March 9th, the sudden peal of joy bells often jars on the solemnity of a preceding programme; and other critics are now hinting that the bells have sacred associations and thus consort badly with vaudeville shows and variety turns.

Attacked from two opposite camps, the bells will have to go.

Why Not a Frequency Tester?

The B.B.C. will probably revert to the clock tick signal, which has never been challenged on the grounds of incompatibility. And yet few people would agree that this "death watch in goloshes" is the ideal interval call. A medal should go to the listener who suggests the ideal signal: a sound that neither elates nor depresses, that neither disgusts after continued hearing nor (as in the case of Bow Bells) pleases so much that listeners may prefer it to the actual programme.

Why not a piano scale over five or six octaves enabling us to check the frequency response of our loud speakers?

Is There a Formula?

THE more one hears of the B.B.C. censorship organisation, the more one doubts whether any established formula covers the use of the blue pencil. The other evening, in a gardening talk, the speaker, inviting listeners to send in little essays on whether the tomato is fruit or vegetable, offered as a prize a copy of his book, just published.

A week or two before a prominent woman novelist, discussing the trials and triumphs of the past week, made the most pointed references to her books then in the press.

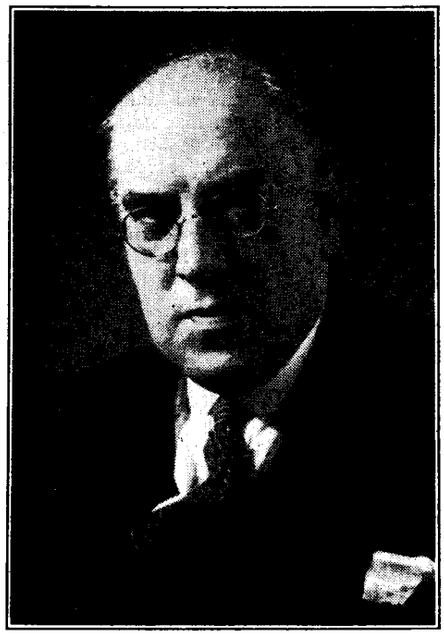
Talkers must live, and we cannot blame the happy opportunist; but where is this sort of thing to stop?

By Royal Command

BY arrangement with the organisers of the Variety Artists' Benevolent Fund the B.B.C. will broadcast from the Royal Command Variety Performance, which is to be given at the London Palladium on Tuesday, May 8th. This year the relay from the stage will form the most important part of a two-hour programme devoted to the variety profession and entitled "A Royal Night of Variety."

Studio Interludes

In a programme arranged for the stage certain items must inevitably have a purely visual appeal which the microphone cannot transmit. This year as many items as possible will be relayed from the London Palladium, the rest of the broadcast programme consisting of studio and other interludes to which the variety profession is to contribute.



"AND SO SAY ALL OF US." Sir Walford Davies, whose appointment as Master of the Music to His Majesty the King in succession to the late Sir Edward Elgar, has met with universal approval. Sir Walford has won a unique position in broadcasting by his talks on "Music and the Ordinary Listener."

"In Town All Night"

MAX KESTER, who has just accepted a position in the light entertainment department at Broadcasting House, figures in a delightful record poking fun at the "In Town To-night" feature. The record, H.M.V. B8145, commences in exactly the same way as "In Town To-night," and then proceeds to interview an extraordinary collection of artistes.

Film stars seem to get younger and younger, and in the record we hear an interview with Britain's youngest film star, who can only reply by crying as she is not old enough to speak. Comment on B.B.C. censorship is indicated in a supposed interview with Mae West, who has to stop talking as soon as a blue light shows.

The Big Change-over

"TIME, gents, time," is the thought at the back of every mind in Broadcasting House these days. There is no chance of suppressing it, for at every turn one comes across horological experts busily adapting the clocks to the 24-hour system.

The new numbering has been doubly necessary on the studio clocks, which up till now have borne no figures, but merely light strokes to indicate the hours round the dial.

Clock As "Conversion Table"

This "modern" mode of unfigured clock faces is a little difficult to justify, unless it is meant to flatter the observer's elementary arithmetic. With the inauguration of the 24-hour system, numbers become imperative because, for a period, at any rate, the announcers and artistes will still think in terms of 12-hour time, and will look upon the clock as a kind of conversion table.

Under the new arrangement the hour marks on the studio clocks are being given double numbers.

Those S O S Calls

AN average of more than 4.5 SOS calls per day were broadcast during the second half of 1933, the total being 858. Of these 384 were successful.

No fewer than 533 related to cases of illness, and 276 calls brought the required persons to the sick bedsides. In all, there were twenty-one police messages, nine of which were fruitful.

When Television Comes

The efficacy of SOS messages should vastly increase with the introduction of television. Indeed, the 180-line transmissions of to-day are quite adequate to deal with portraits of wanted criminals and other missing persons.

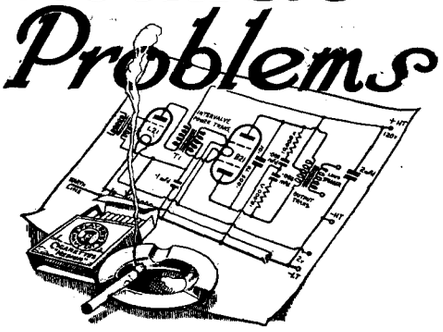
When the other day I sat in Film House, Wardour Street, and saw enacted on the cathode ray screen a snappy little drama in which a Baird "police inspector" at the Crystal Palace sought help in apprehending a burglar whose portrait was exposed to view on the ether, it seemed to me that the Bill Sikes in question would have had small chance of escaping recognition.

The Fatal Flaw

A PIQUANT tale reaches me from a Vienna friend who reports a strange enquiry which the Budapest broadcasting authorities recently received from Paris. It appears that in a French divorce suit, the suspected wife contended in her evidence that she could not have been in the company of a certain gentleman because at the time in question she was in the hotel radio room listening to Schumann's "Traumerei" broadcast from Budapest. The Paris court appealed to the Budapest authorities asking whether "Traumerei" was broadcast during the evening of February 4th.

As this particular piece was not played at any time during February, the Hungarian radio organisation had to leave its faithful listener in the lurch.

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.

Electrostatic Hum

FROM the symptoms described by the user of a three-valve D.C. receiver, we are confident that the high-pitched hum which troubles him is due largely to electrostatic "pick-up" by the detector grid circuit. This is by no means an uncommon fault, although, fortunately, the hum is seldom loud enough to be really annoying.

Before more drastic measures are applied, we suggest an experimental rearrangement of the detector grid wiring, special care being taken to mount the grid condenser and leak as close as possible to the terminals of the valve holder, and to move all heater leads as far away as possible from this section of the receiver. If this plan fails, it would be wise to screen the detector valve and all the components associated with its grid circuit. The tuning coil will probably be already screened; extra shielding should be added in the manner indicated in Fig. 1, from which it will be seen

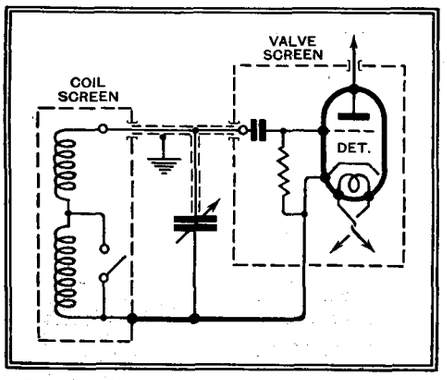


Fig. 1.—Shielding of detector grid circuit components.

that we suggest mounting the grid leak and condenser inside the valve "can." If suitable components are chosen, it should be possible to do this without difficulty.

A Vicious Circle

IT is asked whether the bias voltage applied to an indirectly heated valve is directly proportional to the ohmic value of the cathode bias resistor; in effect, would bias voltage be doubled by doubling the value of the resistor?

Here we have quite a pretty example of the vicious circle, and at the outset it may be stated that with the self-biased arrangement in question, bias voltage is by no means proportional to cathode circuit resistance. The reason is that anode current tends to fall as bias is increased; as there is less current flowing through the bias resistor, less voltage will be developed across it. It will, therefore, be fairly clear that a comparatively large increase of resistance is necessary to obtain a small increase of bias. This explains partly why automatic bias systems are to a great extent self-regulating.

Magnifying Television Images

A CORRESPONDENT asks whether there is any practical reason why a received television image should not be magnified to a much greater extent than usual.

The definition of the transmission sets a practical limit to the amount of enlargement that is advantageous. From this point of view, the image is strictly comparable with the "half-tone" illustrations reproduced in the pages of this journal, the dots of which the picture is composed representing the lines of the television image. A practical test made with a magnifying glass will show that details of the reproduced illustrations are seldom made any clearer—rather the reverse. We can carry the comparison a little farther by magnifying a reproduced "line" drawing, which may be compared to television of infinitely high definition; in this case magnification may be used with advantage to any extent.

Second-channel or Instability?

THE user of a superheterodyne receiver, who describes the shortcomings of his set, seems to be uncertain whether the excessive number of whistles that are produced are due to second-channel interference or to instability in the H.F. or I.F. stages.

We are inclined to think that severe second-channel interference is possible, but suggest that he should make a conclusive test by observing whether the whistles disappear as soon as his local twin stations close down. If they do, second-channel interference is probably responsible, and it is safe to assume that the tuned circuits of the receiver are incorrectly aligned, or possibly that the I.F. circuits are adjusted to an incorrect frequency. Overloading of the first valve by signals from the local stations is another possible cause.

The Wireless World INFORMATION BUREAU

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

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

Effect of Detuning

EMPHASIS has recently been laid on the fact that more or less serious distortion is likely to be introduced by slight detuning of the receiving system of a modern receiver. It should be made clear that this trouble is only likely to be apparent when dealing with highly selective sets, and particularly with superheterodynes.

Writing on this subject, a correspondent tells us that he fails to detect any distortion whatever as a result of detuning the single circuit of his local-station quality receiver. Indeed, this is his usual method of volume control. In view of these circumstances, we are asked to say whether any improvement could be effected by fitting some other form of volume control.

One would hardly expect any distortion to be introduced by detuning in the circumstances described. In any case, this distortion is only apparent when the circuit or circuits are slightly detuned to an extent not greater than the frequency range corresponding to a channel or two. In other words, quality does not suffer if the receiver circuits are widely detuned, although, of course, interference from other stations may then be brought in.

Charging in Parallel

IN the issue of *The Wireless World* for March 16th, a diagram was published showing a method of charging 10-volt H.T. accumulator units in parallel. Referring to this diagram, a querist now asks whether it is not a fact that, due to the resistance of the connecting leads, individual units would be charged at different rates.

If one were dealing with large accumulator cells having an extremely low internal resistance, it would certainly be necessary to pay attention to this point. But the internal resistance of small H.T. accumulators is by no means negligible, and in practice this difficulty seldom arises. In special

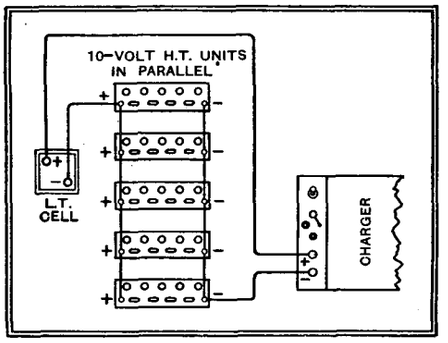


Fig. 2.—Charging H.T. units in parallel: by arranging the connections in the manner shown, differences of resistance are avoided.

cases, however, all possibility of unequal charging could be overcome by joining up the batteries in the manner indicated in Fig. 2; this diagram is submitted by another reader who writes on the same subject.

It will be seen from the diagram that by connecting the charging leads to opposite ends of the parallel-connected bank of H.T. units, it is ensured that the same length of connecting wire will be in series with each unit. The principle is, of course, equally applicable to parallel-connected banks of single cells.

Letters to the Editor :—

Single-Span Tuning

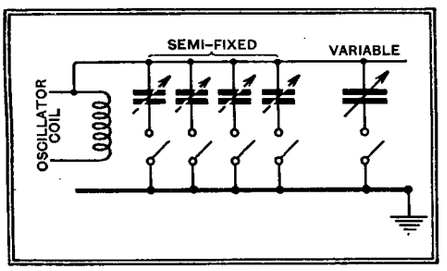
Importance of Long Waves : The Electronic Organ

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

"Push-button" Tuning

I HAVE read with much interest Mr. Cocking's article on your "Single-Span" tuning idea. May I suggest that when you have developed this, you might turn your attention to a "push-button" set?

With only the oscillator circuit to be tuned, it should be comparatively easy, I imagine, to incorporate a number of semi-fixed condensers, especially as the oscillator condenser in your proposed scheme is to have a maximum capacity of the order of .0001



mfd. Half a dozen of these condensers would probably be sufficient for the average user; they would be tuned to the favourite stations, a variable condenser being used for occasional station-hunting. If the set also had A.V.C. it would for many people approach the ideal, particularly as for the non-technical members of a family it is not an easy matter to tune even the local station for optimum quality on a modern selective A.V.C. superhet.

The oscillator circuit would be arranged on the lines indicated in the diagram, and miniature switches would appear on the panel with labels for the different stations.

I am aware that this idea is not entirely new, but with apparatus available up to the present it has not been practicable owing to the three or more variable condensers necessary for each station. With "Single-Span" tuning, however, I think it is a possibility, and I hope that you will consider the suggestion. W. H. CHAPMAN.

Cheam.

Importance of Long Waves

I SHOULD like to endorse what Mr. Graham Hunt says in your issue of March 23rd. I have found that here in West Dorset it is impossible with a good quality receiver such as he mentions to get interference-free reception. We, here in the West Country, had to wait until the last for our local transmitters, and now we have them the results are very disappointing, as far as good quality local station reception is concerned. We can only hope that the new Droitwich transmitter will be a solution to the problem, and even then we shall not have a reliable alternative programme. Your correspondent, Mr. Brooks, obviously has no knowledge of the facts and no thought for others when he suggests doing away with the long wave transmitter.

Bridport. A. RENDALL.

YOUR correspondent, Mr. Graham Hunt, seems to have missed the point of my letter re the design of commercial receivers; otherwise he would have seen that I had no desire for the "abandonment" of long wave transmitters, which are undoubtedly necessary in certain areas.

My letter rather pointed out that if manufacturers must turn out cheap sets, reliability and quality of reproduction should be considered of greater importance than the reception of half a dozen extra stations, which, as often as not, are accompanied by heterodyne whistles or static ("man-made" or otherwise).

Obviously sets covering both wave ranges must be available for use in badly situated districts, but these could be special models, the prices being correspondingly higher.

Isleworth. M R. BROOKS.

The Electronic Organ

MR. RAVEN-HART contributed an interesting article in your issue of December 22nd on our Electronic Organ, and we are obliged to him and to you for bringing our new instrument to the notice of the public in England.

Mr. Raven-Hart, however, is mistaken when he says that "whatever register is in use the sound commences in exactly the same manner. This appears to be a serious disadvantage . . . etc." That is not so. The different timbre-producing filters modify simultaneously the vivacity of the "attack." For example, as the filter which gives the trumpet tone does away with very few harmonics, it produces through the loud speaker an "attack" analogous to that of the reed in a pipe organ; on the other hand, the flute filter, by its strong self-induction, will produce a more softened "attack," like that of a flute pipe.

Extremely rapid trills can be played on the lowest notes without the slightest risk of error as to the nature of the register. Moreover, an infinite variety of new organ tones, produced by combinations of yet unknown harmonics, has been built up by us.

As to the matter of voltage, which Mr. Raven-Hart also raises in his article, ½ volt above or below the 4 volts would not interfere with the pitch. In fact, such a variation in tension should not happen with a good dynamo. But a variation in the voltage of the filament would not interfere with the tone colour.

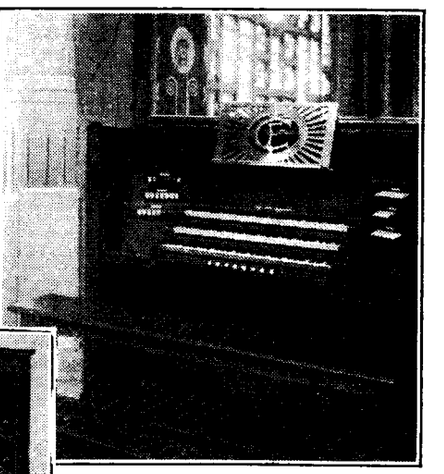
In conclusion, we would like to say this. We have been builders of ordinary pipe organs for upwards of 60 years. Like all our colleagues, British and French, in the organ-building world, we are proud of our art. In no circumstances, therefore, would we have allowed our name to become attached to a new type of organ had we not satisfied ourselves *absolutely* that this new child is in every way worthy of our previous progeny.

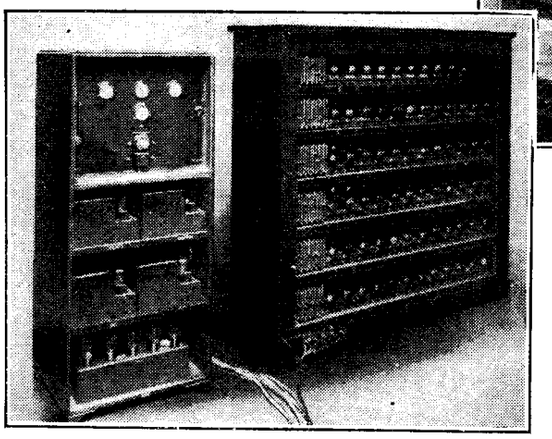
There is, however, this difference between its predecessors and itself, on which Mr. Raven-Hart has not been informed. We mean its substantially lower cost.

COUPLEUX FRÈRES.

Lille, France.

[Major Raven-Hart writes: I am obliged for the information as regards voltage. As to the "attack," it is, of course, obvious that any filter will also alter this, but there is no provision for altering it *by itself*; i.e., a sharp attack with a smooth note or a smooth attack with a rich timbre are not possible.]

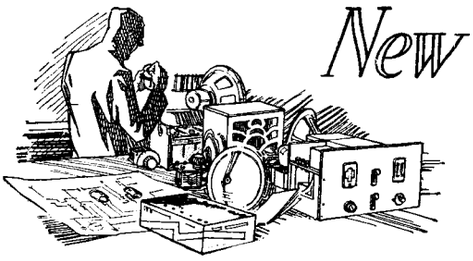




The console of this electronic organ, erected in a French church, closely follows pipe organ practice.

The lower illustration shows the amplifier racks and associated filter units.

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

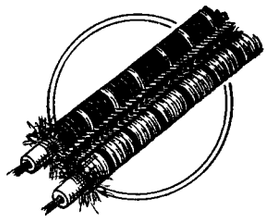


New Radio Products Reviewed

Latest Products of the Manufacturers

EASYFIX FLEXIBLE WIRE

TWIN flexible wire in which the two conductors are laid flat and spaced about $\frac{1}{16}$in. is now obtainable from A. Rist (1927), Ltd., Waveney Works, Lowestoft. In the samples examined each conductor consisted of fourteen strands of No. 36 S.W.G. wire. They are rubber-covered with an overwinding of silk, and the silk is braided to form the spacing medium for the leads.



Rist's Easyfix low-capacity twin flexible wire.

This style of flex naturally has a comparatively low capacity and, furthermore, it can be fixed in position by drawing pins inserted in the braiding between the two conductors.

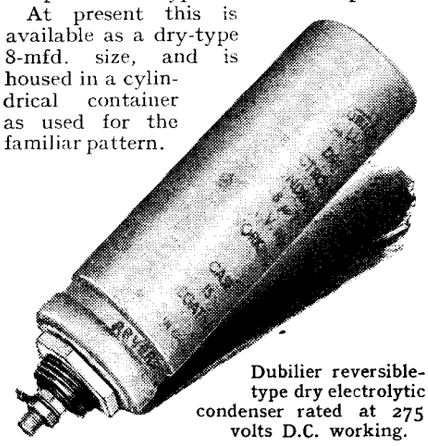
Easyfix is made with a variety of coloured coverings, and each lead is of a different shade to facilitate identification. The wire is suitable for loud-speaker extensions, interior wiring of sets and cabinets, and wherever a low-capacity twin conductor is needed.

The price is 3d. per yard.

DUBILIER REVERSIBLE ELECTROLYTIC CONDENSER

THE electrolytic condenser with which we are most familiar, whether the dry or the aqueous type, is polarised and must accordingly be connected the right way round and used only in D.C. circuits where there is no likelihood of a reversal in polarity. The Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3, have now developed a new type which is not polarised.

At present this is available as a dry-type 8-mfd. size, and is housed in a cylindrical container as used for the familiar pattern.



Dubilier reversible-type dry electrolytic condenser rated at 275 volts D.C. working.

The maximum peak voltage is given as 275 D.C., and being non-polarised can be used in either A.C. or D.C. circuits.

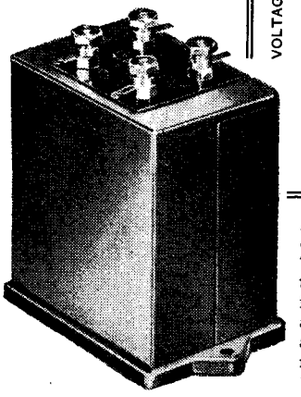
Some specimens tested showed the very small leakage current of only 0.2 mA. in either direction at the working D.C. voltage, and each model withstood a considerably higher potential without damage.

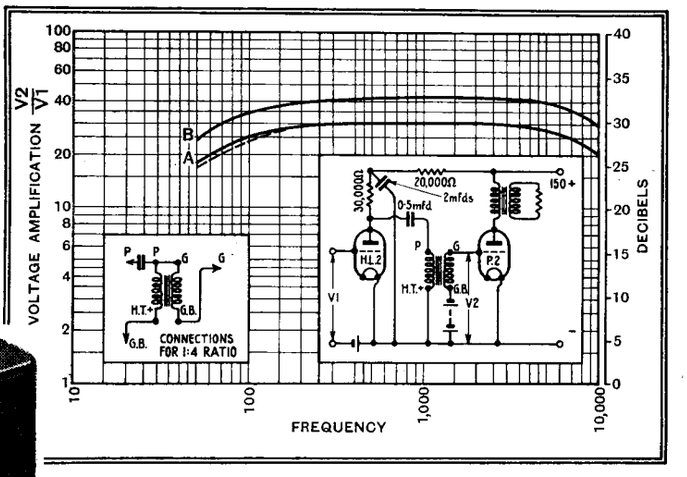
The margin of safety is high, and these new models should prove very useful in universal-type sets. The price is 7s. 6d.

TELSEN D.R.3 TRANSFORMER

THE Telsen D.R.3 transformer is one of two models made by the Telsen Electric Co., Ltd., Thomas Street, Aston, Birmingham 6, especially for use in parallel-feed circuits. It has a step-up ratio of 1 : 3, and the other model, the D.R.5, a ratio of 1 : 5.

The primary inductance of the specimen D.R.3 tested was of the order of 90 henrys when measured at 50 cs. and with 3 volts A.C. across the winding. Connected in the usual manner for parallel-feed working, and arranged for a 1 : 3 voltage step-up, substantially uniform amplification was obtained over the audible scale, and although the curve—A on the graph for this particular case—shows a slight falling off at either end, it does not amount to more than 3.5 decibels at 50 cs., and only a shade less than 5 decibels at 10,000 cs., and these changes will be barely discernible in normal broadcast reproduction.





Amplification curves of Telsen D.R.3 transformer. A for a 1 : 3 ratio and B as an auto-transformer of 1 : 4 ratio.

Our tests were made with a valve preceding the transformer of 18,000 ohms A.C. resistance and a nominal amplification of 27; the anode resistance was 30,000 ohms, and the coupling condenser 0.5 mfd. A one-mfd. condenser gave no improvement, for, as will be seen by the dotted portion of curve A, the bass amplification is actually a shade less than with 0.5 mfd. The latter value is that recommended by the makers.

Further measurements were then made with an auto-transformer connection giving a 1 : 4 step-up, and curve B was obtained.

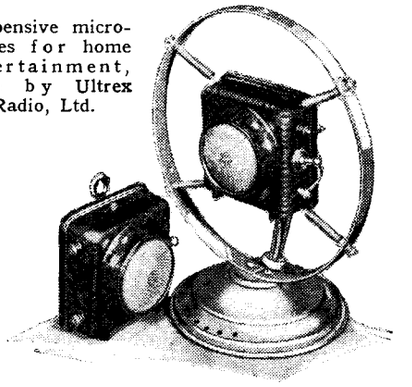
The performance of this transformer is unusually good, considering that its price is but 8s. 6d. It is a little larger than the average transformer of its type, and is enclosed in a metal case with the terminals arranged on the top.

ULTREX SOLO MICROPHONE

ULTREX RADIO, LTD., 129, Newington Causeway, London, S.E.1, have introduced an inexpensive microphone for home use. It is mounted in a moulded bakelite case measuring 3in. square and $1\frac{3}{4}$in. deep, within which is contained also the transformer. There is a switch on the side to disconnect the battery when the microphone is not in use. A $4\frac{1}{2}$-volt flash-lamp battery suffices to operate the instrument as the current pass is quite small.

During our tests the best results were obtained by speaking in a normal conversational tone and close to the microphone. This gave good, clear speech, voices could be recognised easily, and there was no appreciable background noise.

The unit should be shaken occasionally to keep the carbon granules loose; if they pack sensitivity falls off and more current is taken from the battery. The amplification provided by joining the microphone to the pick-up terminals of the set is sufficient for home needs, and the price is 15s. for the unit alone, or 20s. mounted in a small table-type stand.



Inexpensive microphones for home entertainment, made by Ultrex Radio, Ltd.

CATALOGUES RECEIVED

Watmel Wireless Company, Ltd., Imperial Works, High Street, Edgware, Middlesex.—Booklet describing potentiometers, volume control and variable resistances.

Lectro-Linx, Ltd., 79a, Rochester Row, Westminster, London, S.W.1—Clix wall plugs and sockets.

The Wireless World

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EDITORIAL COMMENT

Unlicensed Transmitters

A Menace to Amateur Interests

FAR too much has been heard recently of illicit operation of unlicensed amateur transmitting stations. Unless it is that there has been a dearth of other news and, in consequence, special prominence has been given to recent cases of pirate broadcasting, it would seem that this form of law breaking is rather on the increase.

Amateurs and experimenters who can satisfy the Postmaster-General that they have a serious interest in transmitting and have sufficient knowledge to enable them to conduct experiments without interfering with other transmitting and receiving stations are granted a licence. This licence is quite readily given, provided that these obligations in the common interest are met. This being so, there can be no excuse for transmitting without a licence, nor for transmitting in such a way as to cause trouble or inconvenience to others.

In this country there exists a small but most enthusiastic band of amateur experimenters whose work has often proved of great value and whose honourable observance of the Post Office regulations has earned high esteem. It has been suggested that, because these illicit transmissions have been taking place, the Post Office might have to reconsider the question of giving facilities for amateur transmitting experiments. It would be deplorable if the amateur community were made to suffer for the offences of one or two misguided individuals whose very actions would preclude them from membership of the Radio Society of Great Britain, which is the representative body of the amateur transmitting community.

In our view, the most drastic action which the law permits should be taken against unlicensed transmission, but that such isolated offences should never be permitted to reflect upon the amateur transmitting community as a whole, nor should they influence the Post Office to curtail legitimate experimental activities.

Bluffing the Consumer

Attitude of Electricity Supply Departments

YET another electricity supply authority has been in the news and again it is over a matter which is far from being to their credit. Over and over again, when a change from D.C. to A.C. takes place the supply authority of the district endeavours to bluff the public into believing that the supply department has no responsibility in the matter of wireless receivers or, in fact, any apparatus which may, by the change-over, be rendered unserviceable.

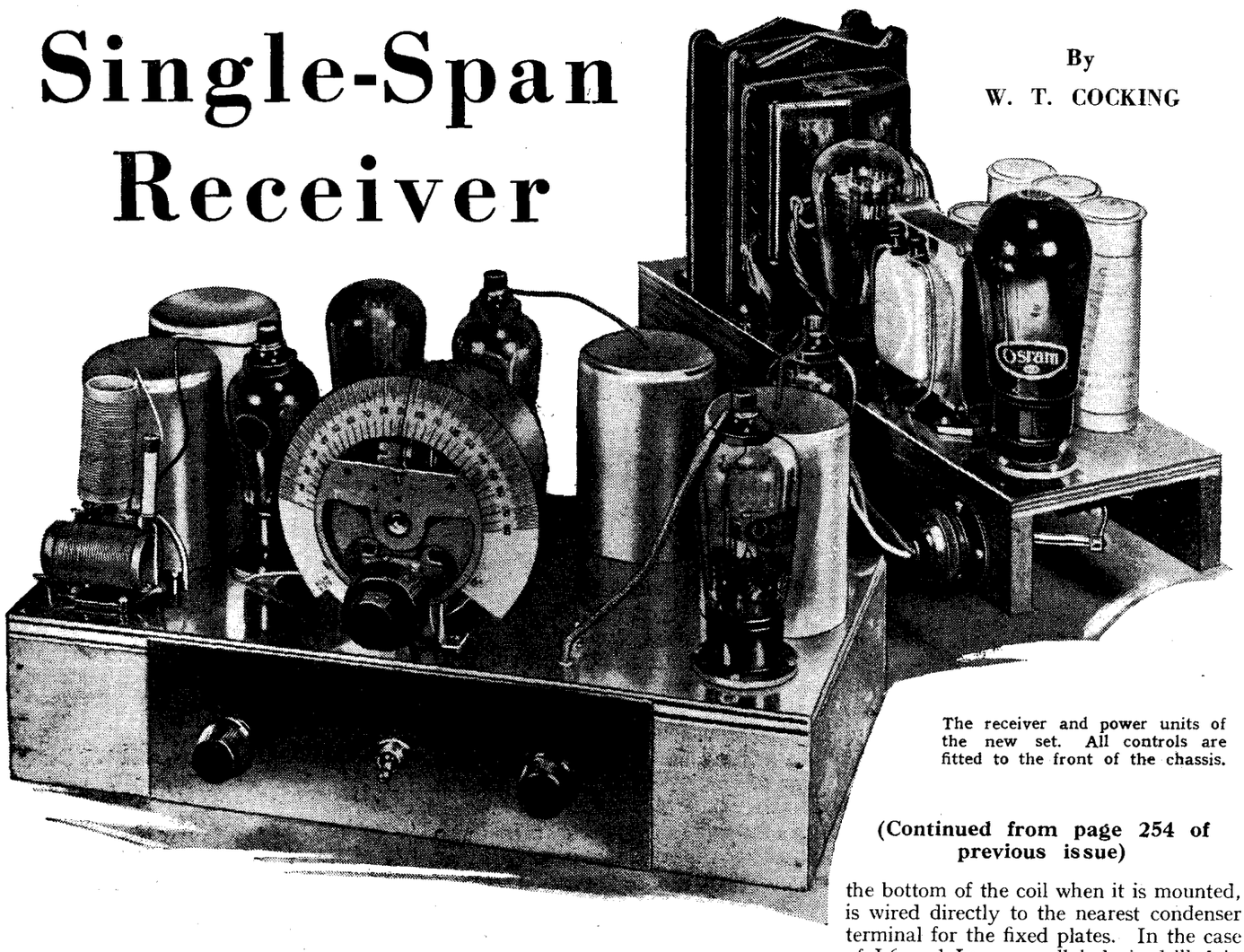
Naturally, some sympathy can be felt for supply authorities who find themselves confronted with the cost of modifying or replacing wireless sets in the homes of a large proportion of their consumers, but this does not relieve them of their legal responsibility, and when a public service endeavours to circumvent the law to its own advantage at the expense of the community it serves it is time to protest.

The law must be respected and even if the supply authorities consider they have a grievance and that the law is a hard one in their case they do nothing to enlist sympathy nor even consideration from their consumers by such action.

The Wireless World

Single-Span Receiver

By W. T. COCKING



The receiver and power units of the new set. All controls are fitted to the front of the chassis.

(Continued from page 254 of previous issue)

Constructing the New Set

NOT the least of the advantages of single-span tuning is the greater latitude which is obtainable in the choice of a layout. The space occupied by a gang condenser and a set of matched coils is saved, and the abolition of waveband switching makes it possible to mount those coils which are still used in the best electrical positions instead of being forced by the switches to a choice based largely on mechanical grounds.

The elimination of components results in a considerable saving of space, and the receiver chassis measures only 15in. by 8in., while the power chassis is even smaller; it is the same length, but only 5in. wide. The chassis are built from metal-covered plywood, and may be obtained with the large holes ready drilled. For rigidity, the front supporting batten of the receiver chassis is of thick wood, but is cut away in the centre to permit the mounting of certain of the components on a thin aluminium plate.

The construction is quite straightforward and little difficulty will be found. The details of the various coils will be given in next week's issue of *The Wireless World* for those who wish to make them, but coils made to this specification will no doubt be available ready made from many firms, as requests from them for details have already been met. It may be as well to say a few words about mounting the finished coils. In each I.F. transformer the trimming condenser is mounted by its one-hole fixing bush through a hole in the centre of the base of the screening can. A large hole is drilled in the chassis beneath the can so that the condenser vanes may be adjusted from under the chassis. The screen base is then screwed to the chassis with three small screws. A number of holes for connections must be drilled through both screen base and chassis.

Adjusting the Receiver

The coil itself is mounted with the aid of a small bracket on the condenser terminal for the *moving plates*, and the high-potential coil terminal, which comes at the bottom of the coil when it is mounted, is wired directly to the nearest condenser terminal for the fixed plates. In the case of L6 and L7, a small hole is drilled in the top of the screening can for the anode lead to the valve.

In the large screening can for the oscillator coil L3 many other associated components are located. The first step should be to bolt L3 to the condenser frame, for in this will be found three holes; it is easiest to insert the bolts through the coil former with a pair of thin-nosed pliers and to place the nuts beneath the condenser frame. The grid condenser C3 should then be bolted underneath the frame, inserting a thick washer, for which a 2BA nut will serve, between the condenser frame and the fixed condenser. A hole should next be drilled in the screen base, off centre in the position shown in the drawings (see next week). The condenser bush must be pushed through the hole, the mounting bracket supplied with the dial placed over the bush on the outside and the nut run on and tightened up. The trimming condenser, the adjusting screw of which can be reached through one of the slots in the screen cover, should next be mounted on two small brackets, and the internal wiring of the unit completed. The tuning unit may then be mounted as a whole on the chassis by means of the bracket. When

The Wireless World Single-Span Receiver—

fixing the dial care should be taken to see that the soldering tags of the dial lights, the mounting for which is detachable, do not come into contact with the screen.

The two aerial coils L1 and L2 are supported by their connecting leads, which should consequently be of stiff wire, and the method of mounting will be clear from the drawings and photographs.

When putting the receiver into operation the four I.F. circuits must be lined up at about 1,600 kc/s, and the trimmer C5 adjusted for the correct waveband coverage. First of all, screw C5 fully home, and then unscrew it about one complete revolution. Then set each of the four I.F. trimmers at maximum, removing the cans to make sure that the plates are fully enmeshed, and make a pencil mark on the receiver base opposite the pointer on each of the knobs controlling these trimmers. Replace the cans and switch on.

After leaving time for the valves to warm up check over the voltages and currents and make sure that they are reasonably in accordance with the published figures. Then set each I.F. trimmer in the manner now to be described. Take the pencil mark opposite the trimmer pointer as 180 deg. on an imaginary scale, turn the knob controlling C20 in an anti-clockwise direction until the pointer is set roughly at 130 deg.; a division by eye is accurate enough. In the same way set C16 at 150 deg., C10 at 160 deg., and C9 at 120 deg. The circuits are now roughly tuned to 1,600 kc/s.

The next step should be to advance reaction until the set is nearly oscillating. When the buffer valve goes into oscillation A.V.C. will bias the controlled valves heavily, and the sensitivity will be low.

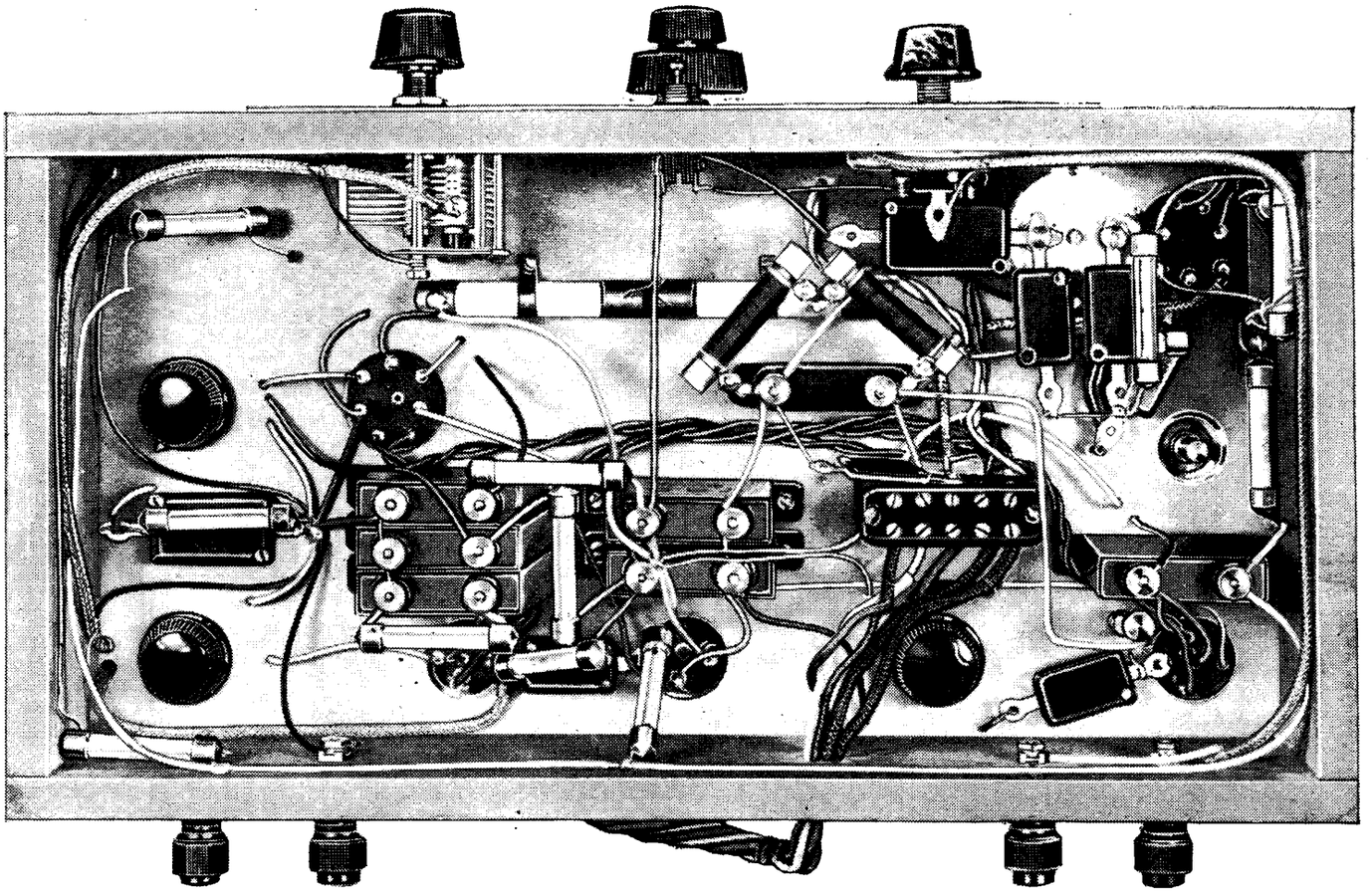
THE theoretical details of the new receiver were given in last week's issue of "The Wireless World," and this article deals with the construction and gives an account of the performance obtained under test. The set has been thoroughly tried out in different localities and gave a very good account of itself. As explained in detail in this article, the feature of variable selectivity proved most valuable, and was largely responsible for the unusually good quality of reproduction obtainable on the stronger stations.

When the set is only just oscillating a noise similar to motor-boating may be found, due to A.V.C. starting and stopping oscillation. A station should next be tuned in, so that the I.F. circuits can be accurately adjusted. Unless the station is a very weak one a milliammeter should be used as a tuning indicator, and connected in series with the decoupling resistance R6 of the frequency-changer. Minimum current indication on the meter corresponds to maximum signal strength.

Each I.F. circuit must now be adjusted to exact resonance. Start with C20 and adjust it for maximum signal strength, and then adjust C16 in the same way. If critical reaction is being used it may be necessary to slack off this control somewhat as the circuits are brought into resonance, otherwise the set may break into oscillation. C9 must next be adjusted and the effects of this adjustment may vary somewhat in different cases, depending upon the characteristics of the particular components used and upon the precise adjustment of the other circuits.

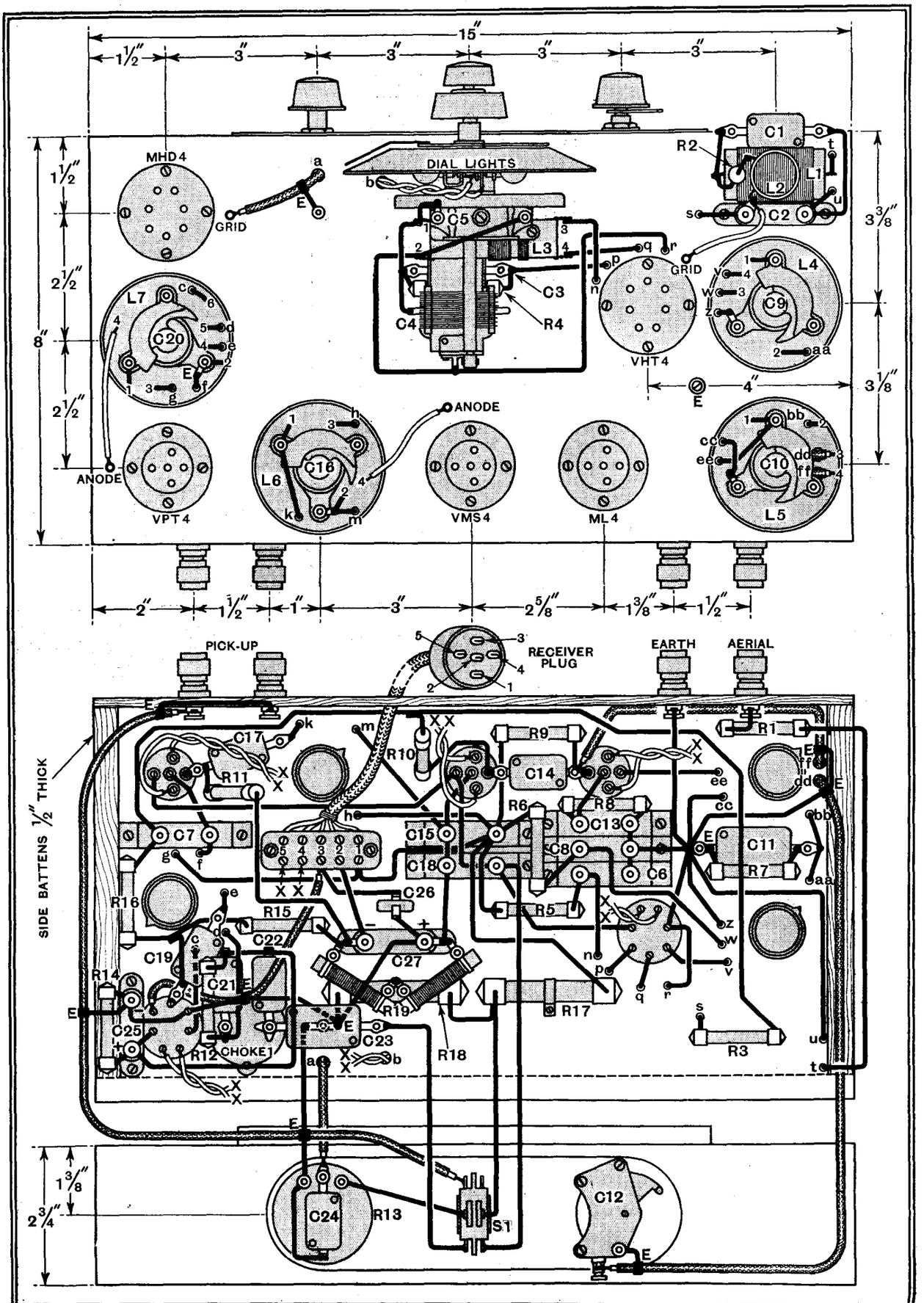
Most probably a definite optimum setting will be found, in which case it should be set to it. When using critical reaction, however, it may happen that there are two apparent optimum settings each just short of a point at which the set breaks into oscillation. The correct setting is then mid-way between the two, and it will be found that reaction can be considerably increased before oscillation occurs. If these two points should be found care should be taken to see that they are both on the same side of the maximum trimmer setting. The vanes are rotatable through 360 deg., so that any setting between maximum and minimum has its duplicate in the second 180 deg. of rotation.

In general, no adjustment to C10 will be needed, for if critical reaction be used when first tuning in a station, this circuit will take charge of the tuning, and the



An under-baseboard view of the receiver chassis. The knobs controlling the I.F. trimmers are clearly visible, but in the case of C20 the knob has been removed to show the projection of the condenser spindle through the base.

PRACTICAL WIRING DIAGRAM OF THE RECEIVER CHASSIS



The details of the Single-Span Receiver are clearly shown in this illustration. It should be noted that the leads to the I.F. coils are numbered and should be connected to the coils accordingly. Details of the coils themselves will be given next week.

The Wireless World Single-Span Receiver—

other circuits will be lined up to it. It will only be necessary to adjust it if later tests show that the circuits have been lined up at a frequency widely different from 1,600 kc/s.

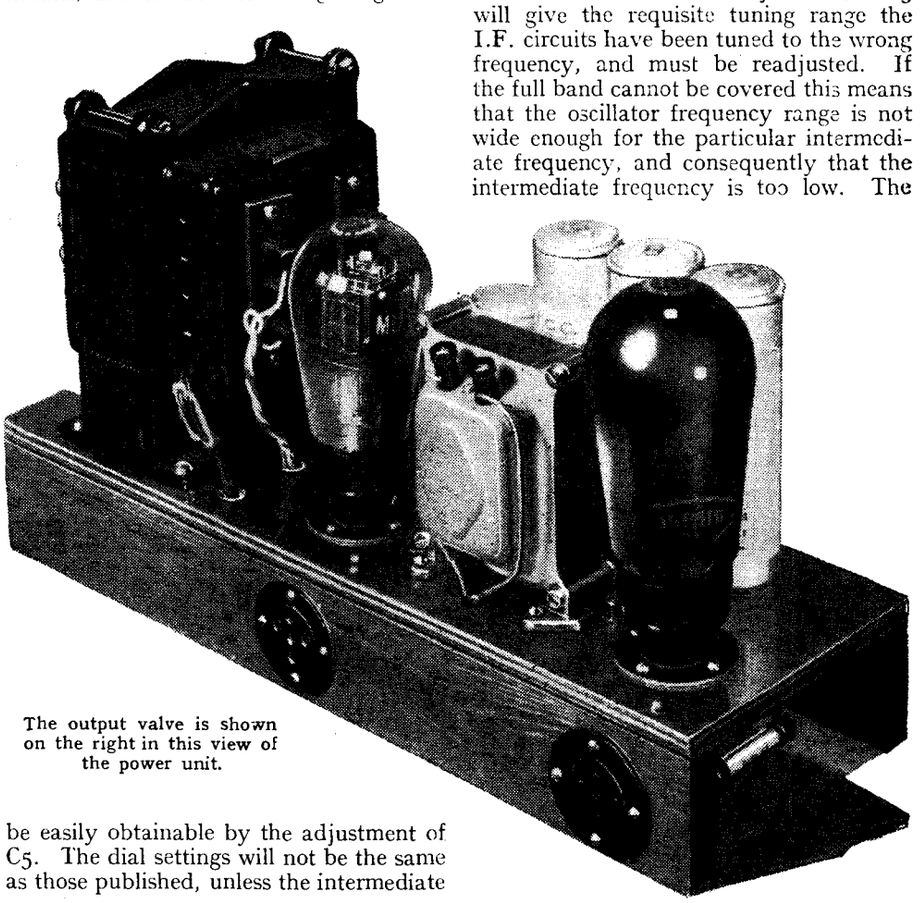
The only other adjustment is to C5. Set the tuning control at a setting corresponding to the frequency of an easily identifiable station, and tune this station in by adjusting C5. A number of other stations which are readily identifiable should now be found, and if their dial settings agree reasonably well with the published figures it may be taken that all is well. It is improbable that the dial settings will be exactly repeated, and discrepancies of a few degrees are unimportant, for a fresh calibration chart for the particular receiver can easily be prepared in the usual way. If the errors are so great, however, that the full band of 200-2,000 metres cannot be covered, it is a sign that either C5 has been given the wrong value or that the I.F. circuits have been lined up at the wrong frequency.

Thus, if it be found that although the set will tune well below 200 metres (1,500 kc/s,) it will not tune up to 2,000 metres (150 kc/s,), C5 should be screwed up a little more. This will make all stations tune in at lower dial settings and raise the minimum and maximum wavelengths. Conversely, C5 should be unscrewed if 200 metres cannot be reached, but the set will tune well above 2,000 metres, as evidenced by a babel of morse at the maximum dial setting.

If care has been taken in the construction and initial adjustments it will be rarely necessary to alter the setting of the I.F. circuits, and the correct tuning range will be easily obtainable by the adjustment of C5. The dial settings will not be the same as those published, unless the intermediate frequency is the same as that of the original receiver.

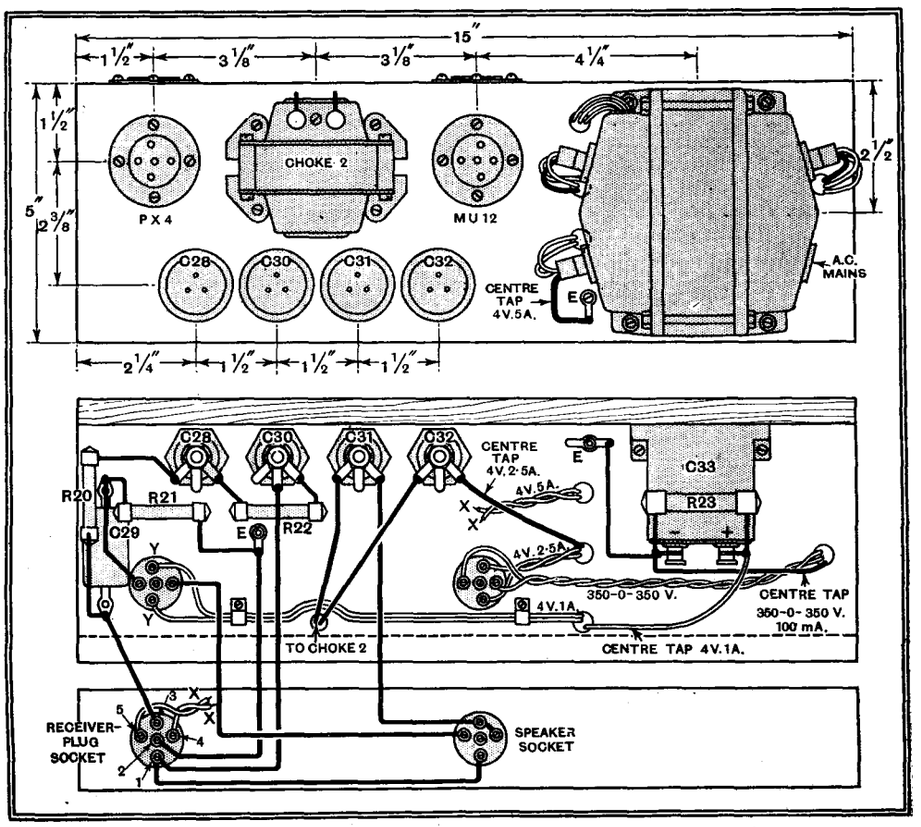
If it be found that no adjustment of C5 will give the requisite tuning range the I.F. circuits have been tuned to the wrong frequency, and must be readjusted. If the full band cannot be covered this means that the oscillator frequency range is not wide enough for the particular intermediate frequency, and consequently that the intermediate frequency is too low. The capacity in each I.F. trimmer should be reduced somewhat, therefore, and the circuits again lined up accurately. Should the intermediate frequency be too high, of course, the tuning range will be much wider than usual. The full waveband can be covered, but it occupies an unusually small proportion of the total dial spread.

It may be remarked that the frequency at which the I.F. circuits are set is not very important, as long as the full waveband coverage is secured. Unlike the ordinary superheterodyne, in which the accuracy of ganging depends upon the exact intermediate frequency, the performance of the set is not affected by quite large changes in the value of the intermediate frequency.



The output valve is shown on the right in this view of the power unit.

WIRING CONNECTIONS FOR THE POWER UNIT



The power chassis contains both the output stage and the mains equipment and follows normal practice.

Variable Selectivity

With the reaction control at minimum the selectivity of the set is not high, and tuning is quite flat. As a result, there is very little sideband cutting, and the quality of reproduction reaches an exceptionally high order. This condition is usually the most suitable for local reception, since the high power of such stations renders high selectivity unnecessary, and, indeed, disadvantageous from the quality viewpoint. For reception of the stronger Continental stations the selectivity should be increased by applying reaction, and this also sharpens the tuning and increases the sensitivity, while for the reception of weak stations or ones suffering from interference,

The Wireless World Single-Span Receiver—

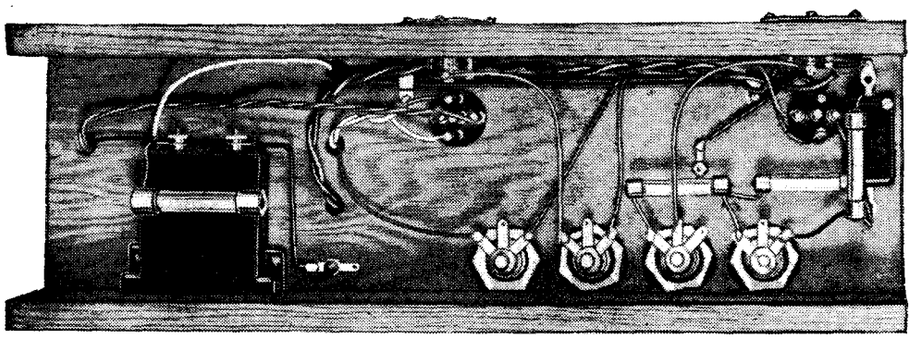
critical reaction can be brought into use.

The receiver has been thoroughly tested in various localities and gave a very good account of itself. Used with an outdoor aerial of average efficiency at some nine miles from the Brookman's Park transmitters the selectivity proved high enough to permit enjoyable reception of large numbers of distant stations without interference. In daylight, when distant stations are weak, the spread of the local covered about 70 kc/s on either side of its frequency. In other words, each local occupied about sixteen channels. As will be explained later, however, this is due entirely to the peculiar characteristics of reaction—A.V.C. selectivity, and at night, when distant stations increase in strength to the point at which their reception is worth while through the inevitable background of atmospherics and man-made static, stations up to about 30 kc/s distant from the local could be received with ease. Under these conditions, which represent the usual receiving case, the total effective spread is no more than seven channels—three on either side of its own channel.

As regards distant reception, tests proved that all the stronger and musically worth-while stations could be received free from all interference from their neighbours, except in some cases for a certain amount of the inevitable sideband splash. Weak stations on channels adjacent to much stronger ones could not always be satisfactorily received; thus, Zeesen could not be obtained clear of Daventry National. Since these weaker stations are usually accompanied by a background of mush and sideband splash with the most selective sets, their loss is of minor importance.

The sensitivity proved adequate for all ordinary requirements, and the output valve could easily be overloaded on all the stronger Continental transmissions. A.V.C. functioned well, and operating the reaction control made little or no difference to volume on many stations, as one would expect, since this is a good test of A.V.C. Its control proved sufficient to keep the local within the range of the manual volume control, and it introduced no distortion. Even on the local the manual control permitted the volume to be varied smoothly from a whisper to full output.

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

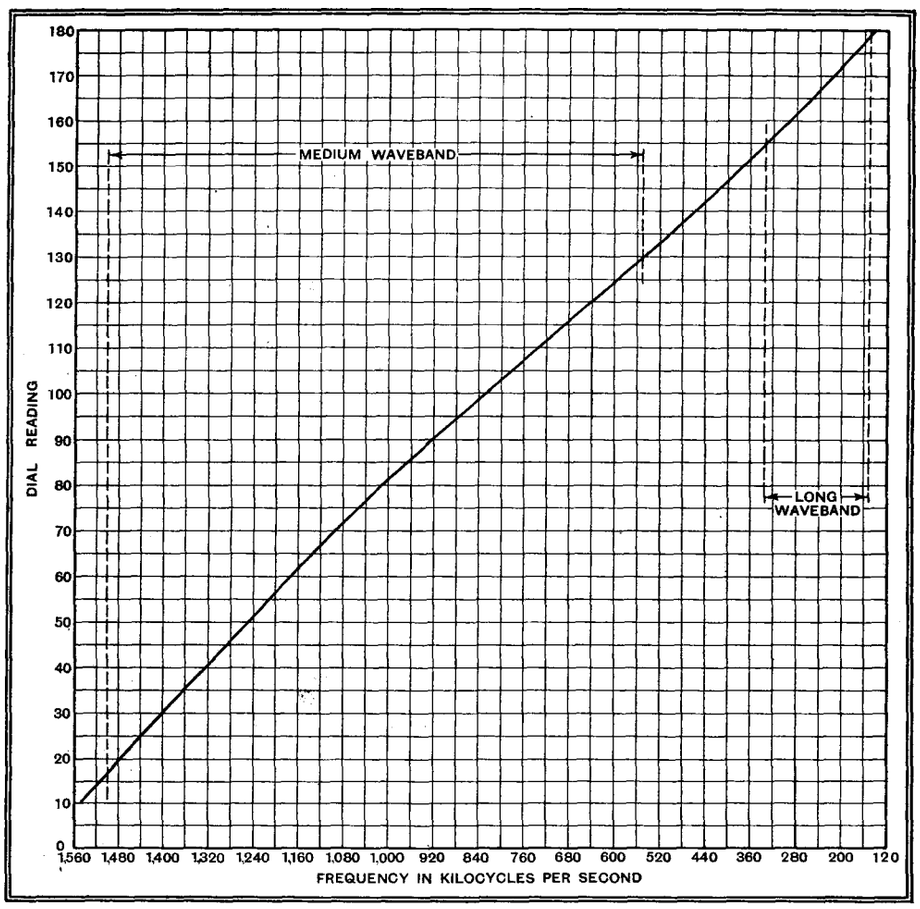


An underbase view of the power unit. The output valve bias resistance and electrolytic by-pass condenser can be seen on the left.

The quality of reproduction proved to be exceptionally good, and with the selectivity control set for the broadest tuning it was quite the equal of most local station quality receivers. Few sets fail to give satisfactory reproduction in the bass, and it is the treble which is responsible for much of the poor quality that is heard nowadays. Due to the inclusion of variable selectivity the treble response of the Single-Span Receiver proved on test to be unusually fine.

No trace of cross-modulation was found during the tests, and second-channel interference also proved to be absent, thus demonstrating the usefulness of the particular aerial coupling system adopted.

To sum up, it may be said that in addition to the various special advantages of single-span tuning which do not need to be enumerated here, the Single-Span Receiver sets a new standard for quality reception of local and distant stations. While not providing extreme selectivity it will give interference-free reception at high quality of most of the stronger Continental transmissions.



This curve shows the dial settings for frequencies within the tuning range in a typical case. It should not be expected, of course, that the settings will be exactly reproducible in all cases.

VOLTAGES AND CURRENTS

	Valve.	Anode Volts.	Screen Volts.	Grid Bias.	Anode Current.	Screen Current.
					mA.	mA.
F.C.	VHT4—					
	Tetrode ..	190	70	−3	0.9	1.7
	Oscillator ..	115*	—	—	3.5	—
Buffer	ML4 ..	60*	—	−3	2.7	—
1st I.F.	VMS4 ..	195	70	−3	5.9	1.8
2nd I.F.	VPT4 ..	195	70	−3	2.25	0.9
Det.	MHD4 ..	80*	—	−1*	0.8	—
Output	PX4 ..	270	—	−32	49.0	—

Voltage across C32 = 305 v.; C31 = 297 v.; C30 = 195 v. Current through Ch2 = 88 mA.; through speaker field = 39 mA. * True voltage appreciably higher than measured figure.

UNBIASED

By FREE GRID

Behind the Scenes

I THINK that the B.B.C. make a very great mistake by permitting photographs to be taken of the "effects" studio and by explaining how all the various noises are produced. By so doing they greatly lessen the value of their broadcasts, as they destroy the whole artistic illusion of reality.

No theatre manager would be so wooden-headed as to allow the audience to come behind the scenes and see such things as the beauty chorus in the raw, minus their war paint and other aids to deception.

Personally, I can never listen to a broadcast in which sylvan brooks are supposed to be babbling without visualising half a dozen people in the "effects" studio gargling and cleaning their teeth in front of the microphone.

The Talks Filter at Work

I HEAR from a reliable source that there have been great goings on in the engineering department of the B.B.C. since the incident a few weeks back when a broadcaster put one over on the Corporation by ejaculating a few unexpected remarks in place of the dope which had been prepared.

The Moguls, Mandarins, and Great Panjandara of Broadcasting House determined that never again should such sacrilege be allowed to occur, but the difficulty was how to prevent it. No one, not even the most expert psychologist in fact, can foretell what is in a broadcaster's mind, and no matter how quick on the switch the control room people might be, it would be possible for anyone to "spill the beans" before he could be cut off.

Accordingly, so my informant tells me, a fiat went forth to the engineering department that they must solve the problem or get out. Faced by the prospect of the dole, the engineering staff rose to the occasion in a highly praiseworthy manner.

Their invention is, in actual fact, a modified form of Blattnerphone. In this instrument it is well known that the moving tape passes successively through a wipe-out coil, a recording coil, and a reproducing coil, so that in the space of a few seconds an old recorded programme can be expunged and a new one put on the tape and straightway reproduced.

In this case they have placed a wipe-out coil immediately *following* the recording coil, and this is connected up to an ordinary switch in the control room, where sits a watchful Mrs. Grundy appointed by the "D.G." The output from the microphone, instead of being fed into the transmitter *via* the usual amplifiers, is led to the recording coil, and the output of the reproducing coil is taken to the transmitter; thus there is actually a delay of a second or two between the uttering of speech in the talks studio and its radiation from the transmitter.

The faithful watchdog in the control room sits with a pair of 'phones on, these being connected in parallel with the recording coil. Immediately she hears anything not fit for our delicate intellects she presses the switch, thus turning on the juice in the wipe-out coil and eradicating the offending passage before it has reached the reproducing coil.

The only snag in this ingenious arrangement, so far as I can see, is that listeners, hearing a sudden hiatus in the speech, may become mildly annoyed at being treated as children, and I suggest that a further recording coil be put in just before the one used for reproduction, so that the gap in the speech could be filled with artificially manufactured screeches and howls—a microphone, a caged cat, and a hatpin would be all the additional apparatus needed—thus suggesting to us simple listeners that we had missed the naughty words owing to a neighbour oscillating.

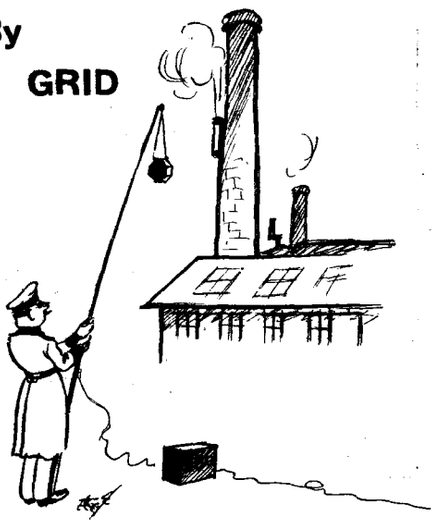
A watchful Mrs. Grundy.

Alternatively, of course, the censor could speak into a microphone and thus fill the blank space with a few soothing phrases.

Why Not a Hooter?

IN the interests of provincial listeners I must make a public protest against the B.B.C.'s proposal to harrow their feelings by foisting on to them the sound of yet another London bell, to wit, Big Tom, during the temporary silence of Big Ben. Surely the Westminster chimes and Bow Bells are quite enough for them to put up with without this further insult. Why cannot the B.B.C. use something redolent of our rural life, such as the factory hooters at Manchester?

I would have suggested that the town hall clock in that city be pressed into service, but I am told that this is always kept a couple of hours or so slow in common with other public clocks up north, so that the good folk who dwell there may be deluded into thinking that their much-vaunted habit of early rising has some foundation of truth in it.



Music from Manchester.

How I "Saw" Macbeth

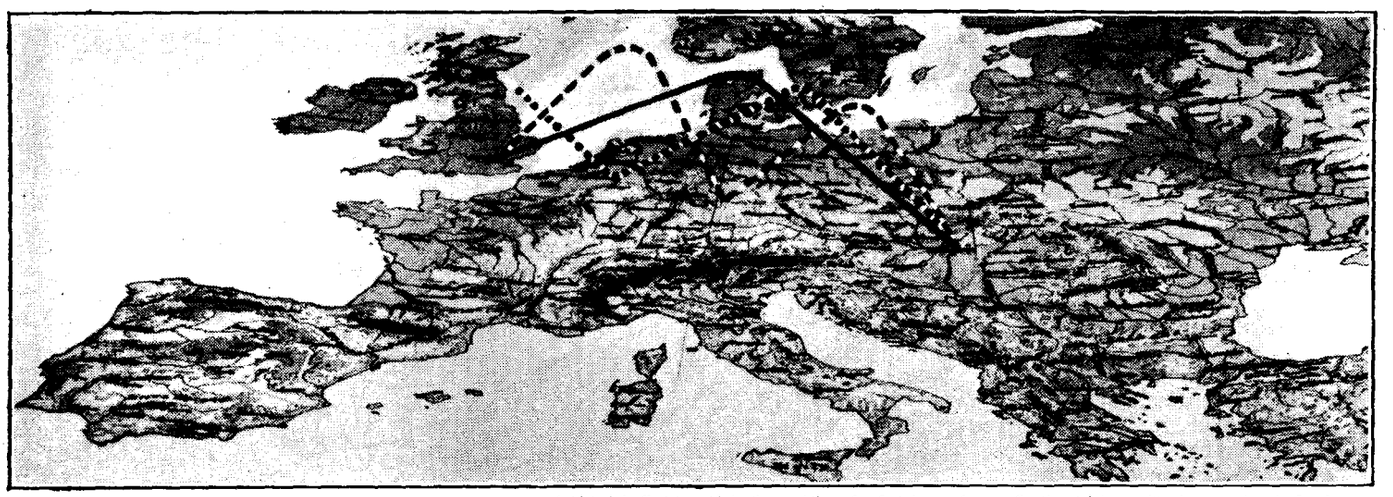
I SUPPOSE that a great many people besides myself welcomed the broadcast of "Macbeth" the other Sunday, but few can have enjoyed the advantage I did of actually seeing the play on the screen at the time as it was being broadcast.

All the thrills of perfected television were obtained in an extremely ingenious manner. My host was a man who combines the hobbies of wireless and amateur cinematography. He had in his possession a silent film of "Macbeth" which had been made some time previously by an amateur cine society. It was, of course, a sub-standard film, from which he had cut out the sub-titles.

All would have gone well had the B.B.C. stuck to what Shakespeare wrote instead of hacking great chunks out of the play. Quite frequently in the broadcast we would come to a point where the words took a flying leap over a couple of scenes, leaving the actors on the screen gibbering away in hopeless confusion.

Apart from these little annoyances, the whole performance was thoroughly enjoyable, even though "lip-synchronisation" was not achieved. Indeed, it set me wondering why the B.B.C. cannot, until the time when television is perfected, make a film at a special full dress rehearsal of every broadcast play and, at a reasonable fee, supply copies to listeners. This would, I feel sure, result in an enormous demand for amateur cine projectors and enable the starving radio manufacturers to earn an honest crust by making them.

By having a projector in the studio showing the film made at the dress rehearsal the actors would, by watching themselves on the screen, be able to synchronise their speech with the film. Alternatively, a Blattnerphone record could be made at the dress rehearsal simultaneously with the film and the actors dispensed with at the actual broadcast. In this latter case complete synchrony would be assured.



A pictorial effort to explain the reception of reflected rays from a Continental transmitter by a receiver in London.

Fading and Its Vagaries

Extent of Scientific Knowledge

There is still much to learn concerning the phenomenon of fading. The important question of how far fading is general or local has not yet been decided. This article outlines the extent of present knowledge.

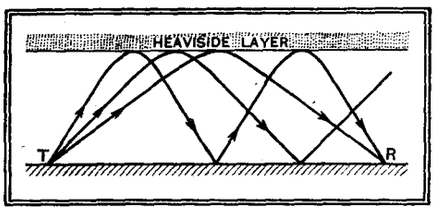
WHILE the general causes of fading are broadly understood, there remain several aspects of the subject on which our knowledge is still very far from complete. Fortunately, knowledge is always improving, indeed it has improved in the past year particularly as a result of the wireless observations during the Polar Year between August, 1932, and 1933.

One of the aspects about which uncertainty still appears to exist is the extent to which fading is general or local in its effects. For example, one hears a report from an accustomed listener that during this winter he had experienced little fading, while correspondents in other parts of the country had reported to him that they had had fading evening after evening on foreign stations which he had been receiving regularly.

This certainly looks like local fading, and, if real, some explanation should be forthcoming. This article, however, does not purport to explain it, but contents itself with a brief review of some of the facts about fading of which we are now aware.

Errors of Estimation

Unfortunately, the fact of different distant-signal reception in different places is one on which it is very difficult to get any reliable information. General wide statements, such as that quoted above, give very little information as to the nature of the phenomenon. Mere aural estimation is far from reliable and may well be due to differences of modulation, to say nothing of purely psychological factors such as what each individual would describe as "bad" fading or the degree to which the observer is really interested in the programme and, therefore, objects to any interference with it. For any real estimate of the effects it would be necessary to have observations conducted simultaneously at a number of places and over a few hours' continuous period. Hopping lightheartedly from one station to another provides little reliable evidence, either of reception conditions or of the simultaneity of effects.



Two reflected signal rays received at R may interfere with each other and cause fading.

Then, again, such broad statements take no note of possible differences between receivers; for example, between square law and linear detectors, or between straight sets and superheterodynes working under the conditions of optimum heterodyne. With modern sets we must also take into consideration the effect of automatic volume control.

As stated in our opening sentence, the general causes of fading are moderately well known. It is due to the effect of the ionised layer of the atmosphere, now generally known as the ionosphere. Our knowledge of the ionosphere now tells us that there are really two regions of electrical activity (ionisation) in the upper atmosphere—the Heaviside layer at about 60 miles and the Appleton layer at about 160 miles.

It is the Heaviside layer that is chiefly concerned with the reception of distant signals in the medium broadcast band. In daylight the layer chiefly absorbs the signal rays reaching it and returns very little to earth. Reception is, therefore, due only to the signal which has travelled directly across the ground from point to point. This ground signal loses strength rapidly with distance—the process described as attenuation. With the arrival of darkness the Heaviside layer ceases absorbing and begins to repeat the signals reaching it. Why precisely it does so is beyond our present scope, but the subject has been discussed on previous occasions.* The result, however, is that it causes signals to appear at considerable distances—at distances, indeed, where the ground ray has fallen to a completely negligible amount.

Unfortunately the layer is not a very even one; it has been compared to the uneven structure of a cloud. Moreover, like a cloud, it apparently varies rapidly as clouds can be seen to do. Its reflecting properties, therefore, vary, and consequently reception of distant broadcast stations, as is also common knowledge.

Fading Not Proportional to Distance

Incidentally, there are intermediate distances where fading is particularly bad. These are distances at which the ground ray is still strong, and, indeed, may even be of a strength comparable to that of the signal returned from the Heaviside layer. In this case signals are liable to wide variation, depending upon phase variations between the direct and reflected signals. For example, if these are equal in strength and arrive at our aerial

* See *Wireless World*, November 11 and 18, 1932.

Fading and its Vagaries—

in phase, their effect is double that of the ground ray, but if the reflected signals become reversed in phase they oppose each other and the net result is zero. This variation of phase may happen very easily, due to small changes in the layer. For example, it can easily be calculated that, with a distance of sixty miles between transmitter and receiver, a variation of only three or four yards in the height of the Heaviside layer is enough to give this reversal of phase in the case of a signal of 300 metres wavelength. This critical distance varies according to wavelength, but in the medium wave broadcast band it is about 100 to 200 miles. A very noteworthy example is that along the Sussex and Hampshire coast it is a general experience that the London stations fade abominably; Northern Regional is, at night, pretty good, but the best British medium-wave station is Scottish Regional, reception of which is by the reflected wave only.

Phase Fading

The most severe fading is thus at these intermediate distances. At greater distances where the ground ray has fallen effectively to zero, reception is by the reflected wave only and fading is due to the variation of this, as the result of variation of the layer that has been indicated above. Even at these distances, however, there is a type of fading somewhat similar to that described above in connection with the more critical distance. This is when the signal arriving at the receiver is made up of several rays, say of one reflected once, and another reflected back and forward twice between ground and Heaviside layer in its journey from transmitter to receiver. In this case it is again possible for these two to interact on each other in exactly the manner already described, so that sometimes their phase relations cause them to assist and at other times to oppose each other. Fading of distant stations may thus be due to either or both of two conditions, (a) variation in strength of a single ray, according to the degree to which it is reflected by the Heaviside layer (" intensity " fading), or to (b) variation in total strength due to varying phase relations between two signal rays (" phase " fading).

The aurora borealis is a remarkable example of abnormal ionisation of the atmosphere.

Actually the conditions are even more complicated than those stated above, but enough has been said to illustrate the difficulties of predicting the conditions to be expected.

The Appleton layer, at a height of 160 miles or so, is little concerned with the propagation of broadcast signals, but is more involved in the transmission of really long-distance short-wave signals, as, for example, the transatlantic channels and the Empire short-wave service of the B.B.C.

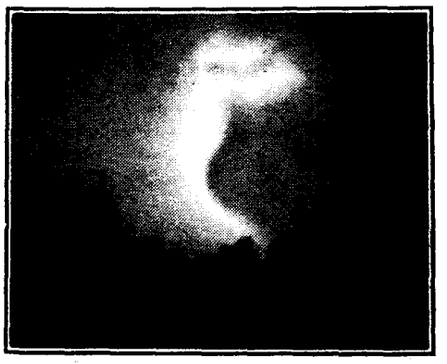
Heaviside and Appleton Layers

The facts of propagation given above are now quite well known. Up to a year or two ago scientific opinion was not agreed about the cause of the layers. It was agreed that the Appleton layer was pretty certainly due to the density action of the ultra-violet light of the sun, but it was also suggested that the Heaviside layer might be due to particles or corpuscles shot from the sun into our atmosphere. Recent work has now shown fairly certainly that the regular daily formation and variation of both layers are due to an ultra-violet-light effect. But it has also shown that while this is true of the *normal* Heaviside layer, this layer is also affected by other things which frequently tend to make it abnormal. The recent Polar Year work (in which scientists of all countries made observations on various cosmic phenomena in Polar Regions), included wireless observations made in North Norway. These showed that the Appleton and Heaviside layers existed in Polar regions just as in our own more moderate latitude. They also showed that while the normal electrification in England is greater, the Heaviside layer in Northern latitudes is subject to much greater abnormal variations.

Magnetic Storms

These abnormal variations appear to be particularly connected with magnetic storms, which are, of course, especially active in Polar regions. Magnetic storms are known to be associated with the aurora borealis, which, in turn, is now believed to be due to electrified particles from the sun entering the earth's atmosphere, particularly in the region of the Poles. Most probably they are actually directed through space more towards the equatorial regions, but are deflected by the earth's magnetic field and enter the atmosphere near the Poles. Auroræ are known frequently to penetrate into the atmosphere to a height much the same as that of the Heaviside layer, so that it is not surprising to find that they have an effect on that layer. Their effect is naturally more pronounced in the Polar regions, but it is, nevertheless, of widespread influence, and is known to have effects on propagation conditions in England and similar latitudes. Unfortunately, there is little information available on the subject, or, at least, it has not been correlated into a form that throws immediate light on vagaries of propagation, or enables us to predict or to explain the differences mentioned at the beginning of this article.

Fading due to the ordinary variations of the Heaviside layer is the normal quick-period variation with which we are all acquainted, and this is obviously liable to vary instantaneously at different places, although the *average* effect over a length of time should be generally the same. This length of time would, however, require to be several hours' listening to *one* foreign station. As already suggested, short periods on various stations provide little evidence. On the other hand, the abnormal variations of the Heaviside layer, due, say, to magnetic storms, are likely to be different as we go forth. This is a possible explanation of the difference of receiving the same Continental station at different parts of the country, even although the total distance from transmitter to each receiver may not differ much. Another influence on which relatively little information has appeared is the relation between the line of propagation and the direction of the earth's magnetic field. Yet it appears certain that this must be taken into account before we can write the whole story of wave propagation.



Another photographic attempt to capture an impression of the "Northern Lights."

Another cause of abnormal effects in the Heaviside layer has also been suggested to be due to thunderstorms. At present this effect is not fully understood, and the information available does not suggest how widespread its influence might be. At first sight it might well be a cause of relatively " local " differences, local being in this case a rather wide term. It might also prove to have an influence on the different " localities " of the layer involved in reflecting the signal from one distant station to two different parts of this country. At present we simply do not know.

Lastly, there is yet another influence which is still a subject of investigation. This is the effect of sunspots, which are also associated with magnetic storm activity. The study of the subject is one that is bound to take a number of years.

Thus, while we know the general story of the travel of wireless waves, we have a great many gaps to fill up. The completion of the story is under way, but there is a lot to learn.

NEWS of the WEEK

Current Events in Brief Review

"Hitler Tag"

ALL German radio programmes to-day (Friday) celebrate the anniversary of Herr Hitler's accession to power.

Back to the Clock Tick

THE clock tick has been chosen as the new interval signal for the Vienna broadcasting station. It is stated that musical interval signals have become irritatingly monotonous.

A Programme from Bermuda

THE Old Town of St. George, Bermuda, is celebrating St. George's Day (April 23rd) this year with a historical programme, and Imperial and International Communications, Ltd., are giving a programme transmission at 29 metres (10,335 kilocycles) from 7 to 9 p.m. (G.M.T.).

St. George is the oldest Colonial town in the Empire.

Tasmania's "B.H."

TASMANIA is to have a "Broadcasting House" at Hobart. The new structure, planned by the Australian Broadcasting Commission, will include eight studios and an auditorium capable of accommodating an audience of 360 and a choir and orchestra of some 250 performers.

Interference at Sea

"INTERFERENCE with Communications in Mercantile Marine" is the title of a paper to be read by Commander J. A. Slee, C.B.E., R.N., before the Wireless Section of the Institution of Electrical Engineers on May 2nd, at Savoy Place, London, W.C.2.

Early Morning Music

ZAGREB, Yugo-Slavia, has a broadcasting station of only 1 kW. output, which is rarely heard in Western Europe. A better opportunity now occurs, however, as the station is to broadcast folk music between 12 and 12.30 a.m. G.M.T. on the 1st of each month.

Short-wave Television

A READER wishes to get in touch with amateur transmitters in the London area with the object of arranging short-wave television tests. Letters will be forwarded by the Editor.

Three in Five

THREE out of five million homes had wireless sets on January 1st, 1934, according to a census just made by one of the U.S. radio networks. There are now 17,948,162 wireless receivers working in America.

Broadcasting from Portugal

THE new 20-kilowatt broadcasting station at Lisbon, built by Standard Telephones and Cables, Ltd., of London, has begun testing on 476.9 metres. The official opening is to take place on May 28th.

Six and a Quarter Million

APPROXIMATELY 515,600 British wireless licences were issued during March, representing a net increase of 62,200 in the month. The total number of licensed listeners on March 31st was 6,254,400.

Photo Cells at Work

AT an informal meeting of the Institution of Mechanical Engineers on May 4th, Mr. R. C. Walker, B.Sc., will give a lantern lecture on "Photoelectric Cells and their Application." Full particulars can be obtained from the Secretary, Storey's Gate, St. James Park, London, S.W.1.

AS THE BAND SEES IT. An unusual view of the microphone and distant audience, taken in the Griego Theatre, Barcelona. The municipal band, shown above, broadcasts frequent Sunday morning concerts from the Palace of Fine Arts.

Wireless Signalling on Railways

WIRELESS is being enlisted in the service of safety on the French railways. The Ministry of Public Works has submitted a scheme to the technical department of the Post Office. If the verdict of the experts is favourable, the system may be applied to the main lines throughout the country.

Radio Patents in 1933

PATENTS relating to radio valves of "multiple" form were a feature of 1933, according to the annual report of the Comptroller-General of Patents, Designs and Trade Marks. Special attention was directed to short-wave wireless research, particularly for aerial navigation.

Many electrical patents were concerned with cathode-ray tubes for television and as oscillation generators. Photoelectric cell patents were also prominent.

The report is obtainable from H.M. Stationery Office, price 4d.

What is Interference?

AT what stage does electrical interference become troublesome?

The Commission set up in France last December to frame the anti-interference Bill, which has now become law, has decided that legal action can be taken in the case of radiations interfering with a transmission having a field strength in the disturbed area of at least 1 millivolt per metre. This applies to reception in the country. In towns a field strength of 10 millivolts per metre is considered the minimum for satisfactory reception.

Reception is to be considered as sufficiently "troubled," states the Commission, if the level of disturbance is within three nepers of a signal produced at a field strength of 1 millivolt at 30 per cent. modulation on a frequency of 800 cycles per second and if the duration of the interference is at least three seconds.

This interesting pronouncement is to be used throughout France as the "yard stick" for the measurement of interference.

Our New Sister-Journal

"FLIGHT," the oldest weekly aircraft journal in the world, founded and edited since 1909 by Mr. Stanley Spooner, has been acquired by Iliffe and Sons Ltd., proprietors of *The Wireless World, The Autocar, The Motor Cycle,* and associated journals. This arrangement is the result of a link which has existed for some years between Mr. Spooner and Mr. Geoffrey Smith, a director of Iliffe and Sons Ltd. The transfer includes "The Aircraft Engineer," which appears as a monthly supplement with "Flight."

"Flight" is published every Thursday, price 6d.

Paying the Piper

NOW that the French listener has to pay, the broadcasting authorities are having their first taste of real public criticism. Whereas, before the licence system was inaugurated, Frenchmen accepted the wireless transmissions on the understanding that "beggars cannot be choosers," a very different attitude is prevalent to-day. According to our Paris correspondent, murmurs are already abroad that the existing programmes show parsimony and lack of imagination.

THE LISTENER'S VOTE. Dr. Nevil Hopkins with the mains device referred to in our issue of March 30th. "Yes" and "no" knobs indicate whether the listener is satisfied with the programme. It is claimed that the votes could be computed from the current drain on the electrical system.

This, however, is the form of criticism to which every public service must learn to grow accustomed.

The Pirate Transmitter

THE recent epidemic of illicit transmission by amateurs has seriously perturbed the Post Office and, according to an official warning, a continuation of the offence may lead to a tightening-up of the rules governing radio transmitting experiments.

There are over 1,000 amateur stations in this country licensed for transmission on short waves. At present the Post Office encourages the amateur, recognising his many contributions to radio science. It would be a pity if this official recognition were jeopardised by the thoughtless few.

English Talk from Warsaw

AT 9.40 p.m. on Monday next, April 23rd, Mr. Thad Ordon will broadcast a talk in English from Warsaw entitled "Poland for Health." Letters to the station may be sent c/o *The Wireless World*.

Page 277 follows after the Programme Supplement

BROADCAST BREVITIES

AN EASTBOURNE DEBUT. Mr. Leslie Jeffries, the new musical director of the Grand Hotel, Eastbourne, rehearsing with the orchestra for his first broadcast on Sunday next, April 22nd.

By Our Special Correspondent

Free Gift for Listeners

MR. ASHBRIDGE has a lovely surprise for us. Although, as forecast by *The Wireless World*, the Droitwich 150-kW. transmitter is to be restricted to a 120-kilowatts output, the three English Regionals—London, West, and North—are each to be increased in power by 5 kilowatts!

So who cares if Luxembourg does blot out Droitwich?

The Ribbon Microphone

A LOT of pother seems to have arisen over my disclosure of the recent work of Mr. Alexander, the young B.B.C. research engineer, in developing the ribbon microphone.

And Now a Non-directional

I can now reveal that the B.B.C. will very shortly test an 180-degree "mike." This, it is claimed, will be absolutely non-directional and will thus overcome many of the troubles set up by acoustic peculiarities of certain studios. These difficulties came to a head when the Balance and Control section attempted, some time ago, to introduce automatic "control" of the organ broadcasts in the Concert Hall.

Automatic Control Difficulties

To be quite frank, I cannot reveal the exact system employed, beyond just saying that two microphones were used, the first being nearer the organ and taking advantage of the lag in the travel of sound waves. But it was found that resonances peculiar to the building caused some waves to reach the more distant microphone before they touched the first. The directional properties of the microphones were also a hampering feature.

However, with a non-directional microphone in the offing, we may very soon expect some interesting new studio technique.

Hollywood-ho!

ELSTREE or Hollywood? The B.B.C. must choose one or the other, for who can doubt that broadcasting and the films are to be very closely interlinked as time goes on?

It looks as if Hollywood will win.

At the moment two of the most influential B.B.C. men—and by "influential" I mean the men who *do* things, rather than administrate—are racing neck and neck to Hollywood. Actually, Roger Eckersley, Director of Programmes, is nearly there; Gerald Cock, prince of "O.B." men, is not far behind.

Three Months in 'Frisco

They will be there for three months, ostensibly on holiday, but in reality soaking in the American talkie atmosphere in a way which must certainly affect the B.B.C. programmes when they get back. It could hardly be otherwise; most of us go Yankie after two hours in the local cinema. Whatever can be the effect of three months in Hollywood itself?

"You got us all wrong," Eckersley and Cock may say to me when they return. I'll say I'm sorry.

Egyptian Flavouring

Just to flavour the dish next autumn, we shall have back with us J. Beresford Clarke, Empire Programme Director, who will be returning from Egypt after helping the Government there to organise the new broadcasting system at Cairo.

Behind the Times

"FREE GRID" has often bewailed the backwardness of radio manufacturers, but these gentlemen appear like Mercury on ball bearings when compared with clockmakers.

A friend of mine anxious to prepare himself and his family circle for the advent of 24-hour timing by the B.B.C. on Sunday next has nearly bisected himself racing hither and thither in an attempt to find a 24-hour clock face.

No Excuse

Perhaps the ordinary clockmaker has never heard of the B.B.C.'s 24-hour stunt, but there is no excuse for the maker of electric clocks, whose business should surely keep him in touch with all wireless and electrical matters. The electric clockmaker has had a real opportunity to put out a double-figured dial in which one set of numbers would be illuminated between midnight and noon, and the other set—13 to 24—when the meridian was passed.

But perhaps the clockmakers have little faith in the B.B.C.'s effort to make us 24-hour conscious.

Shorter Radio Plays

A MOVE towards shorter radio plays is indicated by the new plans for radio drama which I can now reveal.

The average length of forthcoming microphone dramas is to be between forty and fifty minutes, the only exception being "The Skin Game," by Galsworthy, to be broadcast in September next. This will last an hour and a half.

"Mr Pym Passes By"

The second in the "Famous Trials" series is the "Trial of Simon, Lord Lovat," of Jacobite rebellion notoriety. This is to be broadcast on May 18th.

In July we are to hear A. A. Milne's "Mr. Pym Passes By," and a little later there will be a revival of "Crisis in Spain," by John Watt and E. H. Harding. Tagore's rendering of "Omar Khayyám" will be heard in September.

Why Go Out?

NO one with a wireless set will need to go outdoors on Whit Monday. All the fun of the outside world is to be brought to our loud speakers. We are to hear the Yorkshire-Lancashire cricket match, the fun of the fair at Hampstead and Blackpool, and the sounds at a great railway station as the holiday-makers return in the evening.

Rolling the Cheese

We shall hear, too, the old ceremony of rolling the cheese at Cooper Hill, Gloucester, besides listening to the clatter of knives, forks, and tongues in a Youths' Hostel. Another original move of the "O.B." department will be to place a microphone at a strategic point on one of the main roads out of London. Thus we shall hear the swish of wheels and the toot of car horns. I hope there will be no tinkle of ambulance bells.

A car radio enthusiast might have the queer experience of listening to himself coming along the road, and the still queerer one, perhaps, of hearing the commentator's remarks on the "sights one sees on the roads these days."

I Heard Last Week

"IN our efforts to brighten up broadcast variety we shall leave no turn unstoned."

Hear! Hear!

When to Renew ?

Part II.—Valves : Visible and Audible Signs of Incipient Failure

(Concluded from page 258 of last week's issue)

BATTERY renewals, discussed last week, force themselves on the attention of every owner of a battery-driven receiver. Possessors of mains-driven sets, among whom are most of the thoroughly non-technical people, are equally affected when it comes to valve replacements—a subject concerning which there is far more uncertainty.

There are three ways in which a valve may "go," corresponding to sudden death, lingering illness and honourable old age. One day a deathly silence may answer the awakening touch on the switch, rendering investigation inescapable. No discussion is required to urge the need for renewal when the fault has been traced definitely to a valve. Usually the filament has burnt out.

Other ailments, although not immediately fatal, are severe enough to be easily noticed. Among them are variable leakages causing rustling or other noises; and "softness," or loss of vacuum, resulting in excessive H.T. current and a degree of paralysis. When these troubles are so obvious as to compel attention there is little doubt about renewing.

But after several years of uneventful service the question arises as to whether any of the valves are due for replacement. At least, it ought to arise; because if one takes no notice of anything short of a more or less complete breakdown the results may be well below par without awareness of the condition. The deterioration may be so slow as to be imperceptible. Most often old age shows itself as a gradual loss of faculties; but it is also possible for an increased background noise to go unnoticed until it is compared with the correct condition. The difficulty is that even when these symptoms are noticed they are easily confused with those due to batteries. So before renewing a battery it is advisable to make quite sure that it is needed, as explained last week. There are, of course, still other possible faults that cause deterioration of range, volume or quietness.

Valve-holder Contacts

It would be very easy if a complete set of spare valves, known to be sound, were available for successive substitution. Even then one has to be careful to see that a bad contact with the valve socket is not causing poor results. Permanent or intermittent fading of this type is most usual with A.C. valves, because of their relatively heavy-current heaters; the more so as some valve pins are solid and some are springy. The little matter of pins should be attended to as a preliminary to any of the following investigations. Spring pins of the "banana" type are easily opened out with the point of a knife; solid pins can usually be made to fit more firmly by bending them very slightly, but it is better to transfer one's attention to the sockets in such cases.

Of course, if there are spare valves, these should be tried; and even if there are not it is quite a good idea to interchange any valves in the set which are of the same type. If one of them has deteriorated badly it *may* give itself away more readily when doing duty in a different socket.

WITHOUT making a measurement of anode current, it is difficult to decide when a valve is due for replacement. But there are generally audible indications of approaching failure : the interpretation of these signs is fully discussed in this article.

More informative even than spare valves is a milliammeter. People who are really systematic stick a little label on the valve cap with the date of installation and the anode current reading. It should be remembered that if the current to one valve alters, the readings of the other valves are affected; this is so even in a battery-driven set, if there are any resistances common to more than one valve. Allowance must be made, of course, for changes in H.T. battery voltage, and, in some districts, even mains voltage. A general reduction in anode currents throughout a mains receiver is *probably* due to a failing rectifier valve; but the thing should be kept under observation a day or two, as it might be a case of unusually low mains voltage.

As an example of how difficult it is to know where one stands without a milliammeter it may be mentioned that in one set half of a full-wave rectifier went out of business because of a faulty holder contact, without any very obvious consequences except, perhaps, when full volume was called for. It is possible for the valve itself to "half-wave" due to one filament failing. It causes some change in the character of the hum, but that is not easily noticed unless the hum is unduly loud and the fault takes place while working. Filaments almost invariably fail between one period of use and the next.

Push-pull Circuits

Another fault which is rather more easy to detect by listening is the total failure of one out of a pair of push-pull valves. The maximum undistorted volume is reduced—but surprisingly little!—and the hum is very considerably increased, if the designer took advantage of his push-pull to economise in smoothing components. The same is true to a less extent if one pair loses its emission more than the other.

Loss of emission generally occurs most rapidly in output valves in any case, owing to the relatively large current they pass. On a milliammeter this shows as a reduction in anode current under the original conditions of bias and H.T. voltages; and it is obvious that even if the normal current is but little affected the current shortage in an upward direction is likely to cause severe distortion and *downward* milliammeter kicks when giving full volume.

Owing to the differences between various types of broadcast transmission the effects of over-modulation at the transmitter, distortion due to night fading, and other external circumstances, it is really difficult to be sure of anything less than a very considerable decline on the part of valves when judging by ear. That does not mean that valve trouble is unimportant; taken over a period of time the general results are unsatisfactory to an extent that can be realised fully only when the old valves are replaced.

Continuing backwards along the row of sockets: the H.F. and detector valves are not so likely to lose emission badly enough to suffer noticeably. They do in time, but the evidence is more in the form of reduced amplification than of distortion. A reaction control gives useful

When to Renew?—evidence of this; when it needs to be further advanced, then the detector valve—usually, but not invariably, the one responsible for reaction—is less good than it once was. There are so many other things, both within and without the receiver, that may give an impression of reduced range that it is extremely difficult even for the most experienced listener to diagnose faults without a meter.

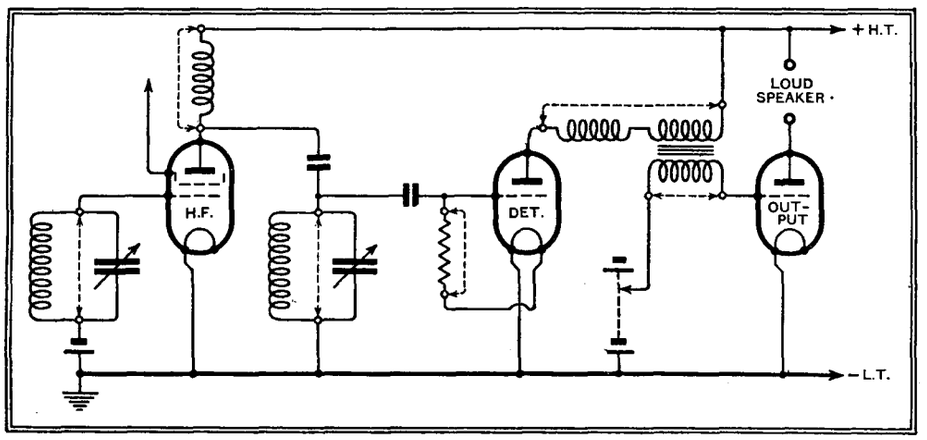
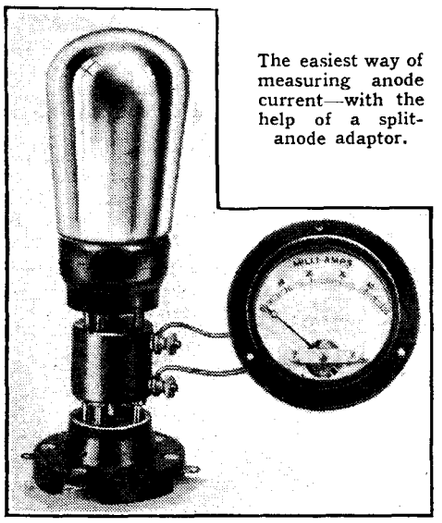


Fig. 3.—Skeleton circuit diagram with alternative positions for applying temporary short-circuits shown in dotted lines

The Frequency Changer

If a superhet. goes dead over any part of the scale—indicated by cessation of hiss—or "pulls in" when nearly in tune with a powerful carrier wave, it is possible that the oscillator (or combined frequency-changer) valve is going into a decline.

Apart from the output valve and power rectifier, it is more common for valve renewal to be desirable on the ground of noisiness. The variety of noises is legion,



The easiest way of measuring anode current—with the help of a split-anode adaptor.

but perhaps the commonest is a gentle rustling sound, which may be continuous or intermittent, and is due to mains valves more often than battery. Some idea of which is responsible can be gained by pulling them out one by one, starting at the aerial end. The last one pulled out before the noise ceases is the suspected culprit. The whole business is liable to be very baffling, because the sound may cease fortuitously on making a change and mislead one into supposing that there is some connection. For example, the extraction of the first H.F. valve may silence the noise, not because that is the guilty valve, but because the upheaval has shifted something at the seat of the trouble. In fact, an alternative procedure, that has much in its favour, is to tap the valves in turn, and with increasing vigour. Any internal looseness or bad contact is generally shown up in this way.

But such thing as leakage across heater insulation or pinch may not be disturbed by this treatment. Still another receiver method, then, is the short-circuit test. The whole receiver may be regarded as a chain of links along which the "signal" passes from aerial to loud speaker. It may be in high or low frequency form, but it can be stopped off by short-circuiting at any of a number of stages in the sequence. The same may be done by open-circuiting (or disconnecting), but restoration of a connection is generally much less rapid and convenient than "unshorting." An exception is perhaps the aerial itself, which is easily detached to make sure that the noise or other fault is internal. The opposite conclusion—that it is external—is less sure. The fact that a noise ceases on removing the aerial does *not* prove that it was coming in from outside. Some faults in H.F. valves show up only when they have a carrier to work on.

But, generally speaking, if the noise ceases when the short-circuit is made just on the loud speaker side of a valve, and continues when it is made just in front of the same valve, then that valve, or its associated components, is the guilty one. Fig. 3 is a typical circuit diagram showing a number of pairs of points which it is safe to short-circuit. Not every point is always readily accessible; but, as can be seen, there are often alternative "shorting" places between any two valves. Obviously, it does not do to go poking about at random; unless the diagram for the receiver is at hand one is more likely to make faulty valves than to trace them.

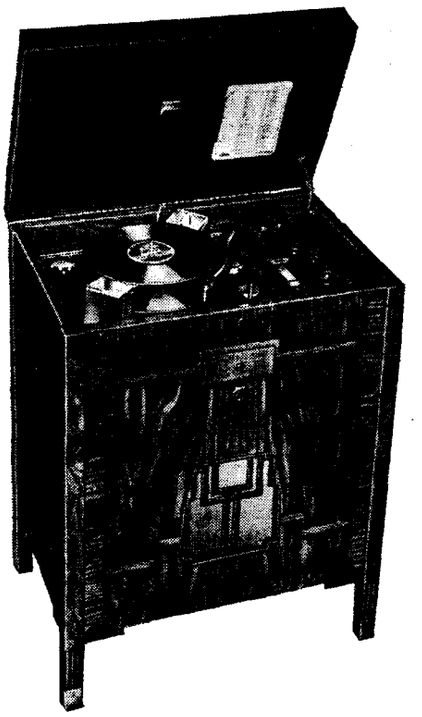
The conclusion of the matter, then, is that with a milliammeter and a pair of testing prods—which can be easily extemporised from stiff wires covered by sleeving except at the points—one is very well equipped to solve the valve renewal problem (in its technical aspect at least); whereas with merely a pair of ears as guides much dissatisfaction, conscious and unconscious, may be suffered.

THE RADIO INDUSTRY

A NEW company—Universal High-Voltage Radio, Ltd., of 28-29, Southampton Street, Strand, London, W.C.2—has been formed to manufacture receivers incorporating Ostar-Ganz valves. Some very interesting receivers have already been designed, including an all-wave model covering waves of from 17 metres upwards, and also a "Colonial" model for short waves between 12 and 85 metres, in addition to the medium broadcasting band. Both sets are superheterodynes.

◇ ◇ ◇ ◇

For the benefit of those who wish to wind their own coils for the "Single-Span" receiver, Wright and Weaire, Ltd., of 740, High Road, Tottenham, London, N.17, are supplying a set of the necessary formers, complete with brackets, screws, etc., and pierced ready for winding. The set costs 3s. 6d.



JUST RELEASED! The new Marconiphone Automatic Radiogramophone Model "288," which incorporates the Model "286" "Lucerne Special" chassis, and an eight-record changing mechanism. The price is 27 guineas.

Mains Power Radio, Ltd., of Broadway Works, Eastern Road, Romford, Essex, have been appointed distributors to the trade of coil screens manufactured by Messrs. White Bros. and Jacobs, Ltd. These screening covers were specified for the "Single-Span" receiver.

◇ ◇ ◇ ◇

The Ferranti A.F.4 transformer has "staged a come-back"; at any rate, this popular transformer, which was partially withdrawn from the market some years ago, is, we see, described in a newly issued leaflet.

Letters to the Editor :—

Single-Span Tuning

Dead Areas : Broadcast Television

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

"Single-Span" Tuning

ALTHOUGH only a young man I have been a reader of your famous radio journal for quite seven years, and find it is the only radio journal which has any modesty.

But I think even you are too modest about this new system of tuning, the "Single Span." May I congratulate you on your first "Single-Span Receiver," which I know will revolutionise radio, and which I am anxiously awaiting to see next week. This is the first time I have written to you, so, while I am on the job, may I say please keep your star contributor, "Free Grid," going strong, and perhaps "wangle" him a little more room? G. D. RANSOM.

Brighton.

Transients

YOUR description of "Single-Span tuning" is most interesting—that is putting the matter mildly.

It prompts the following observations and query: To get a simulacrum of what is happening in the broadcasting studio we require the quality of *naturalness* in our receivers. That, I believe, is associated with ability to reproduce transients, particularly the characteristic transient commencement of every note.

The low-frequency side of this question is touched upon from time to time in wireless publications, but although I have been a regular reader of *The Wireless World* for some years I am unacquainted with the high-frequency side of this problem—if, indeed, H.F. amplification has any bearing on this question.

Some observations on this would be very welcome to those of your readers who are interested above all else in the best quality reception. W. A. SADGROVE.

South Croydon.

The New Monodial

A FEW words in appreciation of that wonderful receiver the "New Monodial Super,"* which is, to my mind, the finest instrument I have yet heard. The quality is truly amazing, and one cannot detect any difference in the quality of the prominent foreign transmissions from the local, and that is during the "rush" period.

As a very satisfied owner I wish to thank the designer and all concerned in the production of such a wonderful item of entertainment.

I am prompted to write this while listening to a foreign serenade, and the quality is really equal to the local.

Belfast. HOWARD TOPPING.

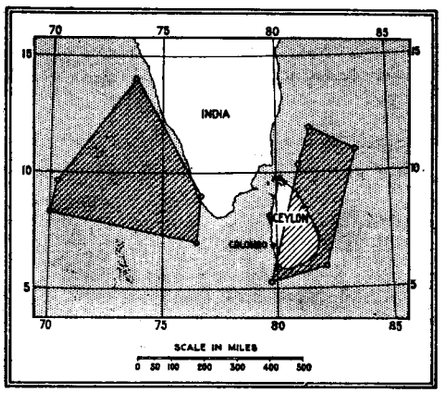
Dead Areas

AS an excuse for the shortcomings of inefficient receivers, the so-called "blind spot" is convenient. But are these areas, where signals are supposed to be unreceivable or receivable with difficulty, really so common as seems to be generally believed?

So far as I can ascertain, the only properly authenticated "dead" area embraces parts of Ceylon, of Southern India, and a neighbouring expanse of open sea. Have your readers knowledge of any others? I do not refer, of course, to large cities or mountainous districts, where local screening provides a ready explanation for poor wireless reception. "RADIOPHARE."

London, N.W.3.

[*The Admiralty List of Wireless Signals*, referring to the Colombo Wireless Station, says, "There are areas within the normal range of the station in which, for reasons not yet precisely determined, it is not feasible to ensure proper communication."



The shaded areas represent "blind spots" which cannot be entirely accounted for by local screening.

The approximate positions of these areas are shown on the accompanying sketch map.—ED.]

Television

I FEEL that the thanks of those interested in the development of television are due to you for the outspoken article in your issue of March 2nd.

The attitude of the B.B.C. to the public is truly amazing, and I feel that the publicity you have given to this matter may do something to disturb their monopolistic complacency.

The B.B.C. should realise that it is their duty to provide a television service, and not only for London, but the rest of the country. The intended change in wavelength would limit the service to the London area, and whilst all will agree that higher definition is desirable, this is no justification for curtailing the present transmissions. On the contrary, these should be extended, and items included in the normal programmes. Surely there is ample scope for brightening some of these, and the technical difficulties, of which the corporation is so fond, are not insuperable.

Your article on "Broadcast Television" is very constructive. I must disagree, however, with your contributor in his view that the present thirty lines is only suitable for head and shoulder scenes. My experience has been that the extended views gain very much in that the imperfections are not so prominent as in close ups.

I wonder did your contributor look-in on the boxing match transmitted last August? I received this at my home in Lancashire, and had friends to see the show who were entirely new to television. The most convincing proof of the definition I can give is to quote the statement of one that "he almost forgot he was watching a televised scene." This despite the novelty of the apparatus.

The eye and brain are very accommodating in many things, and here we have a case where actual results are much superior to what theory would lead us to expect.

The two diagrams which you publish, whilst interesting, are grossly misleading to anyone who has not seen good television, and I think that in the best interests of the science it ought to be made clear that these diagrams do not fairly represent the actual definition obtained with the present transmissions.

May I add that I have been receiving television since the old days of Baird transmissions at Long Acre. My experience is that the present thirty-line transmissions have definite entertainment value, and are being appreciated. Both close up and extended views should continue to be used, and the present system must not be curtailed till such time as the higher definition system can be operated on a National basis.

Dudley, Worcs. A. GRAHAM.

PRINCIPLES OF RADIO, by Keith Henney, M.A. Second edition. Pp. 491. XII. John Wiley and Sons, Inc., New York, and Chapman and Hall, Ltd., 11, Henrietta Street, London, W.C.2. 21s. 6d.

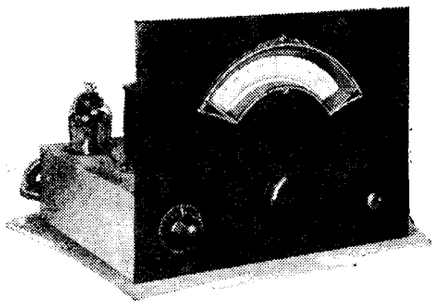
This is not a treatise dealing with the mathematical aspects of the subject as the title might suggest, but an elementary textbook admirably suited to the needs of those who have limited mathematical knowledge. It is very complete and thoroughly up to date.

The first five chapters are devoted to the fundamentals of electricity and magnetism and the laws of circuits in general. No attempt has been made to give proofs of formulæ used, but the text is interspersed throughout with worked examples and simple problems for the student to work out for himself. About half the book is devoted to valves and valve circuits, and their performance is very clearly illustrated by numerous curves, nearly all plotted to actual and not arbitrary scales.

The style of writing is precise and clear, and explanations are lucid. The diagrams are notably well produced, although there is one instance where a slight error has escaped the notice of the author. This refers to Fig. 85, where the instantaneous power curve is drawn as a pointed wave, whereas in reality it is sine-shaped.

The final chapter deals with facsimile transmission and television, and two useful tables are given at the end of the book. The author is to be congratulated on the production of a well-balanced text-book which can be highly recommended. O. P.

*See *W.W.*, July 21st and 28th, 1933.



EDDYSTONE KILODYNE 4

FEATURES. ***Type.*** *—Four-valve "straight" short-wave receiver for battery operation.* ***Circuit.*** *—Screen-grid H.F. amplifier, grid detector with reaction, L.F. amplifier, pentode output valve.* ***Controls.*** *—(1) Tuning, with 100-degree slow-motion dial. (2) Reaction with slow-motion dial. (3) On-off switch.* ***Price.*** *—Set of parts (including valves) £9 1s.* ***Makers.*** *—Stratton & Co., Ltd., Eddystone Works, Bromsgrove Street, Birmingham.*

A Sensitive and Stable Short-wave Receiver

THE design of receivers for short waves is an art requiring a good deal of experience, and there are few firms who can claim as long an association with short-wave work as Messrs. Stratton & Co., Ltd.

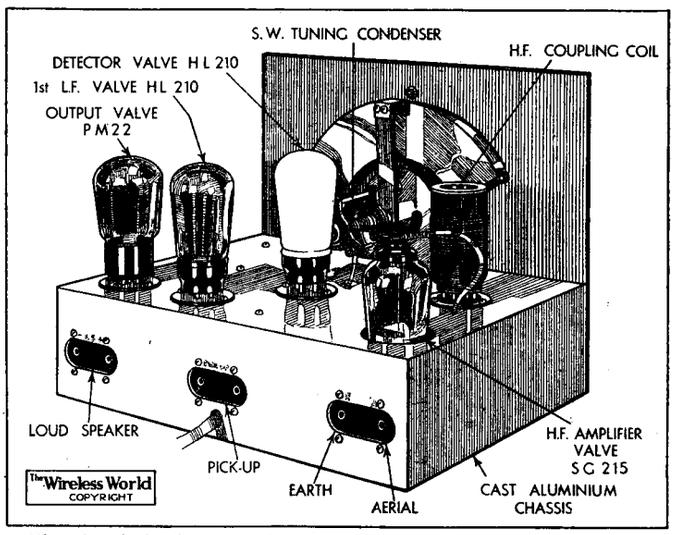
Their latest model covers wavelengths from 12½ to 2,000 metres, and although quite good results are obtained on the ordinary broadcast wavebands, it is on its performance on short waves that the set must be primarily judged.

The model tested was designed for battery operation, and the measured H.T. and L.T. currents under working conditions were 15.5 mA. at 148 volts and 0.65 amp. at 2 volts respectively. From the first moment of switching on there could be no doubts as to the sensitivity and range of the set. All three short-wave ranges appear to be equally efficient in this respect, though the apparent sensitivity will vary according to the time of day or night. After sunset the middle and higher ranges gave better results than the lower range, but in the afternoon the 12-26-metre band produced some very lively signals. Conditions were not too good for really long-range reception at the time of the test, but Schenectady W2XAF on 31.48 metres and Pittsburgh W8XK on 48.86 metres were definitely identified. European broadcasts, on the other hand, were exceptionally free from fading, and Rome (2RO), on 25.4 metres, was quite as reliable and gave as good quality of reproduction as the local B.B.C. station.

We were very favourably impressed with the low level of background noise and the stability of the set in general. Hand capacity effects are entirely negligible provided a reasonably short earth lead is employed, and there is no tendency for the tuning to drift. Reaction is beautifully smooth on all waveranges, and nowhere was there any trace of blind spots or threshold howl.

The set is not calibrated as sent out, but the constructor should have no difficulty in preparing his own charts from the settings of a few known stations. Our own curves gave the following ranges for the three short-wave coils in the set tested: Coil LP, 12.2—24.9 metres; Coil Y, 20.9—43.7 metres; Coil R, 40.1—85.6 metres. The medium-wave broadcast coil (6G) covered 211 — 468 metres. Calibration is considerably simplified by the fact that stations appear at only one setting and there is no second channel duplication as in some superheterodyne short-wave receivers.

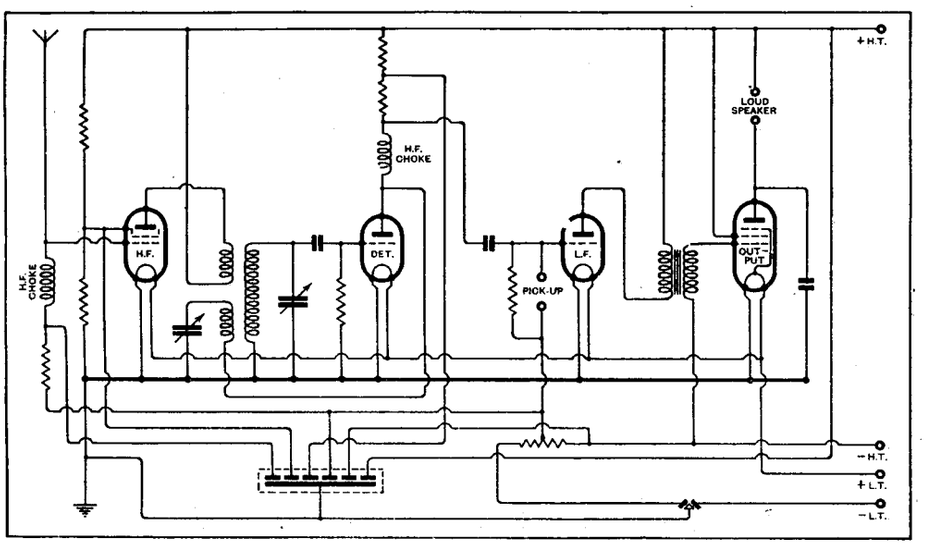
There are four valves in the circuit, the first of which is a screen-grid amplifier with an aperiodic choke in its input circuit. This valve, besides giving considerable amplification, acts as a buffer which renders the tuned circuits independent of aerial capacities. Transformer coupling is employed between the screen-grid valve and the grid detector, and reaction is applied to the H.F. transformer. Between the detector valve and the pentode output valve there is a high magnification L.F. stage which is resistance-coupled to the detector and transformer-coupled to the output valve. Grid bias is obtained automatically from a resistance included between −H.T. and −L.T.



The chassis is simple in design and has for its foundation a solid aluminium casting.

The chassis is an aluminium casting finished in grey cellulose. In addition to giving great mechanical rigidity, the possibility of parasitic noises due to loose joints is obviated. The tuning condenser has also been chosen to overcome the possibility of contact noises and the flexible pigtail connection is carried through a hollow spindle. Substantial bearings at each end of the condenser are mounted in moulded "Keremot" end plates. A 22 : 1 slow-motion dial gives easy control of tuning and a very open 100-degree scale has been provided. The reaction condenser itself is also fitted with a slow-motion movement and a small divided scale. Tuning coils are of the plug-in type and are fitted with six-pin non-reversible bases. The phenol fibre front panel provided is only about 1/16in. thick, and care should be exercised to avoid damage before the chassis is fitted to a cabinet.

The set is supplied as a kit of parts together with coils covering wavelengths from 12½ to 92 and 230 to 490 metres. The long-wave coil is an extra. There is also an A.C. mains kit costing £15 3s., including valves.



Complete circuit diagram. Automatic bias is included and the by-pass condensers are mounted in a single block.

NEW APPARATUS REVIEWED

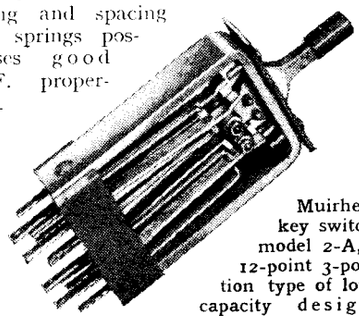
Latest Products of the Manufacturers

MUIRHEAD LOW-CAPACITY KEY SWITCHES

LOW-CAPACITY key switches designed primarily for use in laboratory test sets yet equally suitable for incorporating in public address equipment and similar high-grade apparatus are obtainable from Muirhead and Co., Ltd., Elmers End, Beckenham, Kent, in a wide variety of types. They are made with from four to twenty-four contact points, and in two- and three-position models. There are switches in which the contacts remain set in all positions, or return to the centre on release of the lever. Also models which remain set in one direction, but have a spring return to centre in the other direction.

These switches are assembled in stout metal frames with the springs of generous length and having sufficient movement to give a wiping and self-cleaning action. Special quality phosphor-bronze is used for the springs and gold-silver contacts are normally fitted, but where for certain purposes a very low contact resistance is desirable platinum contacts can be supplied.

The material used for fixing and spacing the springs possesses good H.F. properties.



Muirhead key switch, model 2-A, a 12-point 3-position type of low-capacity design.

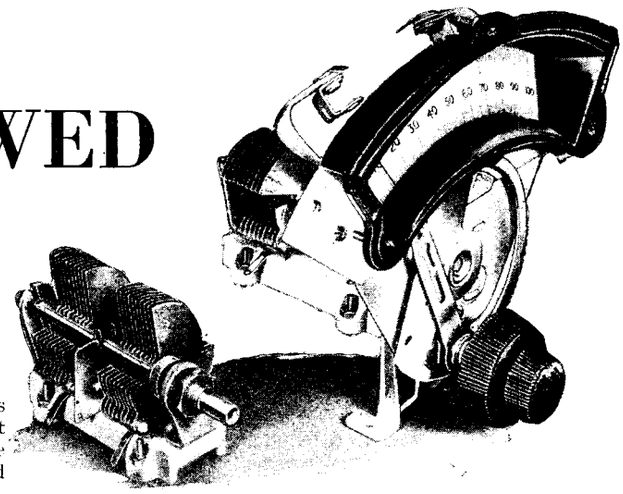
The switch lever and cover plate are chromium-plated, and the metal parts behind the panel are nickel-plated. It is essentially a high-grade product, and the prices range from 8s. 6d. to 21s., according to type and number of contacts provided. The model illustrated, a twelve-point three-position type, costs 12s.

NEW POLAR SHORT-WAVE CONDENSER

THE Polar type E is a new short-wave condenser recently introduced by Wingrove and Rogers, Ltd., 188-189, Strand, London, W.C.2. It has a nominal capacity of 0.00015 mfd. yet is quite a miniature affair, as the stator vanes measure only 1½in. across. Single and two-gang models are available, and, despite the close spacing necessary to obtain the capacity in such a small compass, the matching between the two sections is exceedingly close.

With the specimen tested the largest discrepancy throughout the capacity range was only 0.3 micro-mfd. The minimum capacity is 6 micro-mfds., and the maximum capacity 0.000139 mfd. This style could be used as a series gap condenser where a small capacity is needed for ultra-short-wave work, and it is also ideal for incorporating in a Colpitt's circuit either for receiving or for low-power transmitters where the close spacing would be permissible.

Particular care has been taken to render the condenser as efficient as possible at the price, for it is assembled on a Steatite base, which material is noted for its good H.F. properties. Phosphor-bronze springs are used to make contact with the moving vanes, and where these rub on the spindle a graphite-oil lubricant is applied to ensure a low contact resistance and silent working, and in this respect is quite as good as a pigtail connection.



Polar E type short-wave condensers showing a single model mounted on the Micro-Drive Arcuate dial using the special bracket supplied.

For use with these condensers there has been designed a new two-speed slow motion dial. Known as the Micro-Drive, it gives reduction ratios of 7 to 1 and 100 to 1 respectively, the latter being obtained by using the small knob mounted concentric with the larger one on the driving spindle.

These dials are available in the new Polar styles, viz.: Arcuate, Horizontal, Semi-circular, and with moving scale in place of the moving pointer.

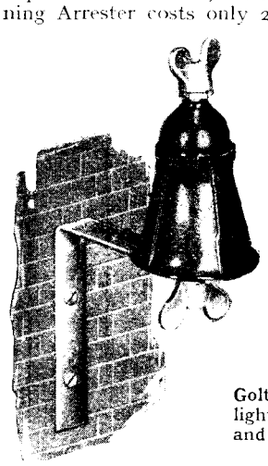
Single E type condensers cost 5s., and the two-gang model 10s. 6d. The first three mentioned dials with two-speed drives cost 7s. 9d. each, and the moving scale model 6s. 6d. A special bracket is included for mounting the condenser.

We understand that future production models of the Type E condenser will have a capacity of 0.00016 mfd.

GOLTONE LIGHTNING ARRESTER

THE function of this device is to provide an easy path to earth for any heavy charges that may accumulate on the aerial during an electrical storm and in the remote possibility of the aerial being actually struck by lightning. The inclusion of a safety device is a wise measure and quite an inexpensive one to wit, for the Goltone Lightning Arrester costs only 2s. 6d.

It consists of a moulded bakelite cowl with two brass rods fitted so that there is a small air gap between them. The upper one is joined to the aerial down-lead and also to the receiver, while the lower one is taken direct to a good earth connection. These rods are of large diameter, the threaded portion on which the wing nuts are fitted being ⅜in. in diameter. A galvanised iron wall bracket is included, and the makers are Ward and Goldstone, Ltd., Frederick Road (Pendleton), Manchester, 6

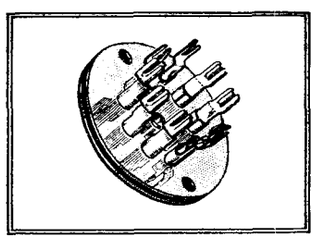


Goltone bakelite lightning arrester and wallbracket.

NEW BENJAMIN NINE-PIN VALVE-HOLDER

THIS chassis mounting valve-holder recently introduced by the Benjamin Electric, Ltd., Brantwood Works, Tariff Road, Tottenham, London, N.17, is fitted with new pattern oval-shaped sockets loosely riveted to a bakelite disc 2in. in diameter. Another disc of the same size, positioned by a single rivet in its centre, acts as a guide for the valve pins and serves also to insulate the heads of the sockets, so that contact between these and the valve cannot be made unless all are correctly aligned.

The sockets are semi-floating, yet, being oval, cannot rotate, and no undue strain is imposed on the wiring.



Benjamin chassis mounting nine-pin valve-holder.

Tests made with a specimen valve-holder showed that perfectly satisfactory contact is made throughout. From the springy nature of the material used, and the design of the sockets, there seems little likelihood that they will lose any of their resiliency with normal use.

A useful feature is the engraving of an arrow head on the top plate indicating the two heater sockets. The price is 9d.

NEW BULGIN TERMINAL

IT should be noted that the new Bulgin terminal reviewed in our issue dated April 6th last is styled the TL model, and although the insulated head is not accidentally detachable, it can be removed if required by giving it a straight pull when fully unscrewed.

The Wireless World

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EDITORIAL COMMENT

Interference

The Problem of a Definition

ONE of the most difficult tasks met with in the investigation of interference from the point of view of paving the way for legislation is to decide what exactly constitutes interference and when it is to be regarded as sufficiently troublesome to justify taking action to suppress it. It is obvious from the outset that any attempt to obtain suppression of every form and degree of electrical interference by means of legislation would be foredoomed to failure. It would be unreasonable to suppose that, where the interference required very sensitive apparatus to detect it, it should be regarded as illegal.

It is necessary to decide at what point the interference reaches an illegal intensity. Just as the intensity of radiation from a wireless transmitting station can be measured, so some similar scheme will probably have to be devised and a decision taken as to what value of interference noise comes within the law.

In framing legislation, it should only be necessary to require the suppression of interference if it is up to a considerable strength and is detectable with comparatively insensitive apparatus. Our reason for saying this is that although some listener may be experiencing interference which is troublesome to him, although not up to a sufficient intensity to justify taking action, it is probable that neighbours located nearer to the source of disturbance will be experiencing the same disturbance but at greater strength. If suppression of the interference is brought about by those in close proximity to the source, the lesser interferences farther afield will also disappear.

If the procedure decided upon eventually is that complaints of interference will be investigated at the listener's home, it may be necessary for those who are troubled by weak interference to ascertain the source of the disturbance and move temporarily to its immediate vicinity, in order to obtain redress ; they could then move back to their permanent abodes after their appeals had been met with the desired suppression of the trouble !

"Single-Span"

Features of Special Appeal

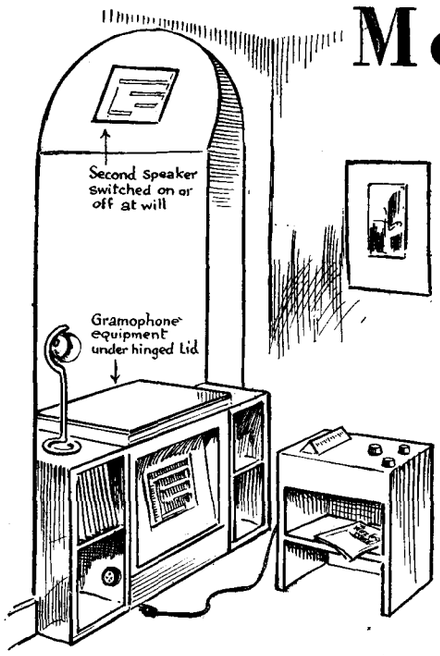
APART from the fact that in the Single-Span Receiver we have a practical development of ideas hitherto regarded as definitely unpractical on account of apparently inherent shortcomings, the design appeals because of the many new features of peculiar advantage.

The absence of switching is particularly welcome, and with it, of course, comes the elimination of troubles arising from faulty contacts, which have often proved so troublesome.

Ganged condensers and matched coils, too, have had their disadvantages, particularly in relation to the initial adjustments required.

The feature, however, which seems to have provoked the greatest amount of interest is provision for variable selectivity.

Hitherto, there has always had to be some sort of compromise between selectivity and quality. If full justice was to be done to local-station reception then, with fixed selectivity, the set tuned too broadly for individual reception of distant stations without interference. Now, however, the broadest tuning with consequent high quality can be enjoyed on local stations, while the selectivity can be increased to what is required for reproduction of distant stations.



A two-unit receiver suggested by Mr. Sidney Woodward. Apparatus associated with the signal-frequency circuits and detection is housed in a semi-portable unit arranged for chair-side control. Power equipment, L.F. amplifier, gramophone reproducing apparatus, and two loud speakers (one near the ceiling) are mounted separately and housed in an alcove.

More Ideas on Outward Form

Improvements Suggested by Readers

BROADCAST receivers have reached such a high standard of technical excellence that attention may now be directed to the possibilities of external improvement. Many original and valuable ideas on the subject have been contributed by readers. Those who believe in remote or semi-remote control will welcome the Single-Span tuning system as offering a practical solution of the problem.

BY a perfectly natural process of evolution, the home broadcast set has been developed from the commercial radio-telegraphic receiver. Although the functions of these two instruments are now widely different, there is still surprisingly little basic difference between them in outward form. The first type of set is more or less ornamental, while the second is wholly business-like in appearance.

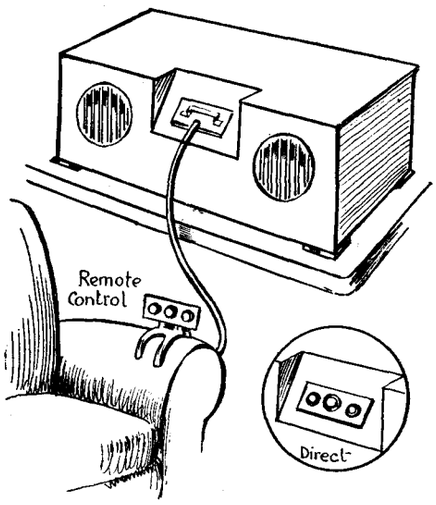
The wireless operator, while working his telegraphic receiver, must be seated before it at a bench, but the broadcast listener is under no such necessity; indeed, such a position is entirely inimical to a proper artistic appreciation of the programmes. One thing both types of receiver have in common; it is important (but for different reasons) that the operations of tuning and wavelength changing may be carried out conveniently and with the maximum of speed and accuracy.

Since the suitability of the average broadcast receiver for its purpose was first questioned in these pages, an unexpectedly large number of readers have expressed strong views on the subject. Almost all our correspondents are agreed that receivers can be improved, and, as to radio-gramophones, there is complete unanimity in maintaining that the present-day instrument is most unhandy.

Of all the receiver designs submitted, the alternative distant or direct control system first advocated by a continental reader, Mr. Tore Sjögren, seems to be one of the most attractive and worthy of development. This system in another form is illustrated in an accompanying sketch. Briefly, it is intended that the receiver should be fitted with sockets, into which may be plugged at will either a direct control panel or a remote control device, in which the operating knobs are connected mechanically to the set through either a Bowden wire mechanism or flexible shafts. It seems likely that the best plan would be to combine both electrical and mechanical controls in a single cable. The whole arrangement is, of course, reminiscent of the car set; difficulties associated with remote control from a distance of four or five feet have been satisfactorily overcome, and there is no reason to think that this distance could not be extended to a similar number of yards at least, thus enabling a set to be comfortably controlled from any part of an ordinary room. Several other readers have submitted variants of this idea.

Chair-side or Remotely Controlled Sets?

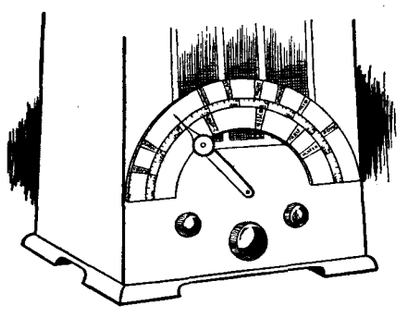
Another school of thought holds that the ideal receiver should be a semi-portable chair-side affair, with the knobs at a height convenient for operating from the depths of an armchair. As a rule a separate loud speaker is suggested.



Direct control or semi-remote control at will. The set may be operated from the distant point either mechanically or by a combination of mechanical and electrical controls.

Most of the exponents of this method of housing the set acknowledge the Ferranti "Companionette" as their source of inspiration.

So far as can be seen, the only valid objection to this plan is that it involves trailing leads across the floor for aerial, earth, and mains connections, and possibly a pair of loud-speaker leads as well. However, it would often be possible to overcome this objection by fitting sockets on the skirting board and arranging matters so that the set, when operated in a fixed position or out of use, would be run on its castors against the wall. In any case, by a suitable re-arrangement of furniture it would often be possible to avoid unduly long and straggling leads.



An alternative to the almost universal rotary tuning control. In his provisional patent specification, Mr. W. J. K. Norton suggests a lever system of tuning in conjunction with a large scale.

We must not overlook the fact that since most of these designs were prepared, a new factor has arisen. This is Single-Span tuning, which opens up great possibilities for simple remote control from one side of the room to the other, or even at much greater distances. Indeed, it may be urged that if the Single-Span system had no other advantage, it would be well worth considering for this reason alone.

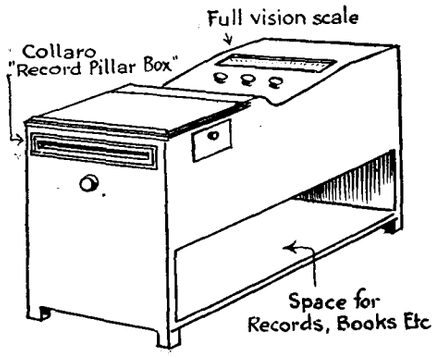
The present discussion goes deeper than the mere appearance of our wireless sets, but present-day cabinets have been criticised severely on æsthetic grounds. It seems rather futile and pointless to offer any comments on questions of taste, but it is worth while drawing attention to the

More Ideas on Outward Form—

undoubted truth that most of us like the things we are accustomed to. Rightly or wrongly, the wireless receiver has assumed a definite and typical outward shape which is already familiar to nearly everyone; if it be really susceptible to improvement, let something be done quickly before we become set in our possibly misguided tastes.

There follows a selection of receiver designs submitted by readers; it is not suggested that any of them are ideal, but all have sufficient originality to provoke comment and to suggest different and possibly better methods of attacking the problem.

IF the maximum benefit is to be derived from the capabilities of the modern wireless set it is essential that controls should be more sensibly arranged. We English are reputed to take our pleasures sadly, but it is surely unnecessary that we should have to sit bolt upright before our



A chair-side radio-gramophone.

sets, waiting to change the programme when something more attractive offers. The alternative of walking across the room is equally unattractive.

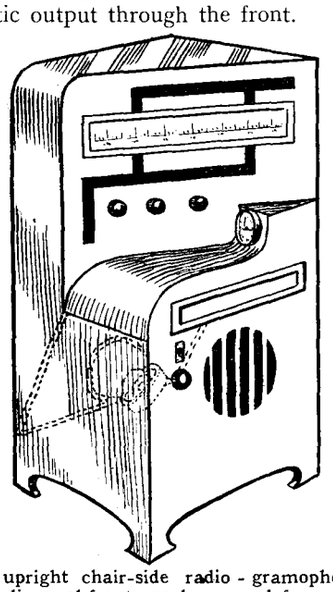
I suggest a chair-side set similar to that already described, possibly with a height adjustment so that the control knobs would fall in the most convenient position. The control panel should be on the slope, and be fitted with a really large and readable tuning scale, accurately calibrated in tens of kilocycles on the American plan. We could then forget wavelengths altogether, and think in terms of frequency.

A Collaro "pillar-box" record player would do away with the need for "fiddling" with the pick-up, etc., which always seems to detract so much from the enjoyment of gramophone music.

R. J. PERRY.

I SUGGEST that the chair-side type of receiver might be greatly improved both with regard to appearance and convenience by mounting it in an upright cabinet, as shown in the accompanying sketch. Floor space would be saved, and by setting the front panel diagonally the control knobs and tuning scale would face the user squarely. Height of the scale should correspond with normal eye level.

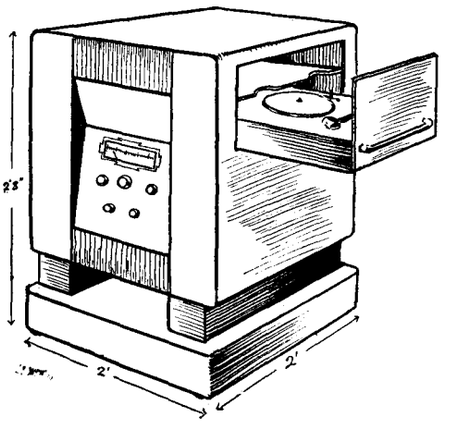
Housing the loud speaker is admittedly a problem, but I think it might be mounted on an inclined baffle in the base, facing *away* from the user, who would probably be able to hear quite well through a small aperture behind it. Other occupants of the room would receive the full acoustic output through the front.



An upright chair-side radio - gramophone with diagonal front panel arranged for more comfortabls operation.

If this plan is considered unworkable a separate loud speaker must be used, the space in the base of the cabinet then becoming available for books and a gramophone record store. An automatic record player like the Collaro would be ideal for this type of set. L. L. ROEBUCK.

THE shape and general design of casework for the radio receiver or radio-gramophone should be as inevitable as that of the pianoforte, in that a piano, whether grand or upright, must conform to the general shape of its frame, must



The originator of this design suggests that the angle of the control panel should be carefully determined with relation to height.

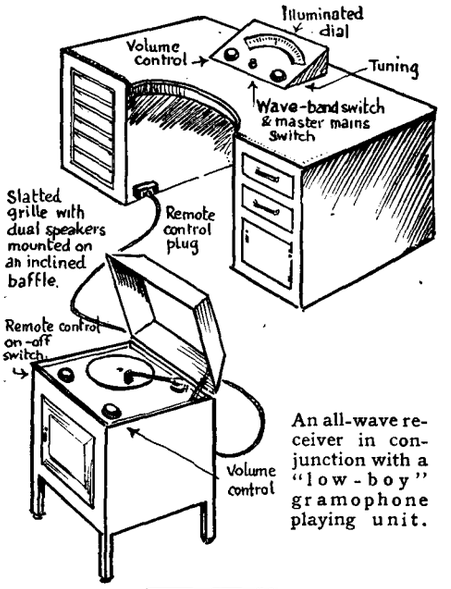
present its keyboard and pedals in what are proved to be their most easily accessible positions, and must, above all, deliver its music with the greatest attainable degree of acoustic efficiency.

If we accept this, it becomes possible to reduce the variations in cabinet design to a very small compass, and as the wireless set is not linked with the actual sound reproducer mechanically, it seems inevitable that the loud speaker should be housed apart from the set, so that it may be placed in the position best suited acoustically for it. G. M. DARLING.

MY ideal set would be an all-wave receiver covering amateur as well as broadcast wavelengths. Consequently, longish spells of listening would be entailed, and a really comfortable operating position, restful for the arms and with ample leg room, would be appreciated.

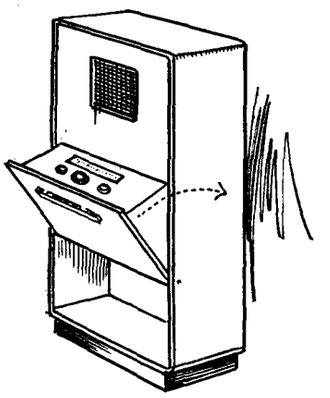
I visualise a cabinet built on the lines of the knee-hole writing desk containing the receiver proper, with gramophone equipment as a separate unit, capable of being operated from a fireside armchair.

H. B. GLOVER.



An all-wave receiver in conjunction with a "low-boy" gramophone playing unit.

THE recent article "Housing the Wireless Set" has led me to submit an idea of mine for overcoming the awkwardness of the ordinary tuning system. As my sketch shows, I propose that the radio chassis should be mounted on a pull-out flap, which, when closed, conceals all the controls except perhaps a combined volume control and on-off switch. When the flap is in an open position the panel is at an angle and height suitable for



The chassis unit is mounted on a drop-flap to give a convenient operating position.

operating either in a standing or sitting position, and at the same time a rest for the wrists is provided. The tuning scale would be easily readable.

W. J. ABBOTT.

UNBIASED
BY FREE GRID

Radiagnosis

CITIZENS of the United States are very fond of reiterating that their country is top dog where new ideas are concerned, but in the case of the latest brain-wave the palm must be handed to one of the smaller Latin-American republics.

A friend who has just arrived from that part of the world tells me that a radio periodical there has evolved an entirely new idea of diagnosing the set troubles of its readers. In most cases lists of symptoms sent in by readers include the statement that when switching-on the set gives vent to an unearthly howl. This is not of very great help, since this symptom may be due to half a dozen different causes.

To a layman one howl is very much like another, and the same remark applies to other types of noise emitted by sets in distress, but to the skilled engineer it is quite different. Just as a doctor, listening-in with his stethoscope, can say at once whether we are suffering from smallpox or housemaid's knee, so a skilled radio engineer can, by merely listening, say forthwith whether a howl is being set up by a broken grid connection or too much acid in the accumulator. He can, in fact, discriminate between the different kinds of howl just as a woman is supposed to do in the case of the emanations of a baby.

The technical staff of the South American journal in question, fully realising the truth of the above-mentioned statements, has evolved a remarkably ingenious scheme to get over the difficulty. Each

As indicated in the book of instructions.

set owner who writes in for help is supplied with a blank gramophone record to use with the home recorder with which, apparently, every self-respecting wireless listener in that country provides himself. It then becomes a simple matter for him to connect up the actual recorder in place of the loud speaker and make a faithful record of all the cries of anguish emitted by the faulty receiver and forward it to the journal concerned for diagnosis.

I am told that this new system of diagnostic records has caught on to such an extent that the medical profession of that country are making use of it by supplying blank records to dwellers in the back blocks. In this case the input to the recorder is made *via* a special stethoscope. The sufferer places this instrument on various parts of his body as indicated in the book of instructions supplied him, and then drops the record into the nearest pillar box.

Spurious Spooks

IT is with much trepidation that I butt into dramatic criticism of any type, but I do think that a strong protest should be made about the futile practical joke which the programme staff of a certain "sponsored programme" station put over the other night when they broadcast an English play which was supposed to make our flesh creep.

After solemnly warning us not to listen if we suffered from weak hearts or were "highly strung" they gave us what was, I think, the feeblest "thriller" I have ever heard. As for being highly strung, if I had my way, the producer of the wretched thing would soon be put into that condition, but in a hempen rather than a neurotic sense.

Instead of the good old-fashioned murder which I expected when, in obedience to the announcer, I turned out the lights and eagerly awaited the shrieks and gurgles of the victim, we were treated to a play which would, I feel sure, have acted as a soporific to the most neurotic of persons. There was not even a solitary groan, and as for making our flesh creep, a talk on parasitic insects would have left it miles behind in this respect.

Perhaps I am getting old and crotchety and unable to take a joke, as one of the female grid leaks has gratuitously informed me, but I feel incensed that an hour and a quarter of my time should have been wasted in this manner. If brevity be the soul of wit, as a *W.W.* writer once asserted, then a swift *dénouement* should certainly be the essence of a practical joke.

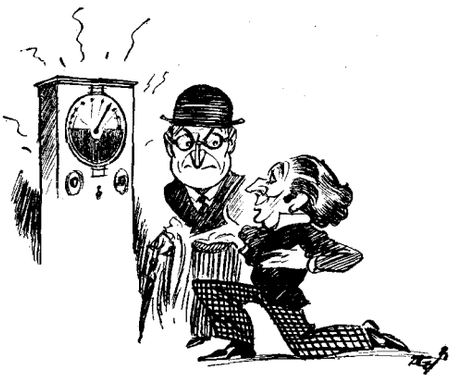
Watching the Needle

IT is astonishing how bigoted adherents of one particular school of music will become. One musician of my acquaintance becomes so enraged at the sound of light music of any description that some time ago his doctor warned him that, owing to the danger of apoplexy, he must take some special measures to prevent his ever hearing it from his loud speaker.

He thought to solve the problem by fitting his set with a visual tuning indicator so that he would merely have to look up a station which was churning out a classical programme, and then tune it in in silence, thus keeping out the sounds of revelry from other stations in the course of the tuning process.

Unfortunately, he had reckoned without such things as stations wandering off their wavelengths, last-minute changes in programmes, and similar annoyances, and at last, in desperation, he consulted me.

It was perhaps fortunate that he is a musician of very great ability. He is, in fact, the same man who, as I have mentioned previously in these notes (February 3rd, 1933), often plays an organ solo from a record by propping up a small portable gramophone on the music stand and watching the rotating sound grooves through a magnifying glass. It was this ability of his which gave me my idea, which, I think you will agree, is very simple.



Succeeded beyond my wildest dreams.

I connected in parallel with the output valve of his set another valve of very limited power-handling capabilities, and shoved a milliammeter in its plate circuit. I then tuned in a station which was transmitting a particularly offensive piece of chamber music, and disconnected the loud speaker. Calling my friend in, I bade him glance at the kicking needle associated with the overloaded valve, and, to my delight, an enraptured look spread over his face.

I had indeed succeeded beyond my wildest dreams, for he was able not only to name the work being played but to follow the melody (?) so perfectly that his æsthetic enjoyment was almost as great as when the loud speaker was switched on. My final test was to switch off the loud speaker and tune to London Regional, when, to my delight, he gave a howl of dismay and rushed out of the room. Quickly connecting up the loud speaker I found that, as I had expected, I had caught Henry Hall in one of his most inspired moments.

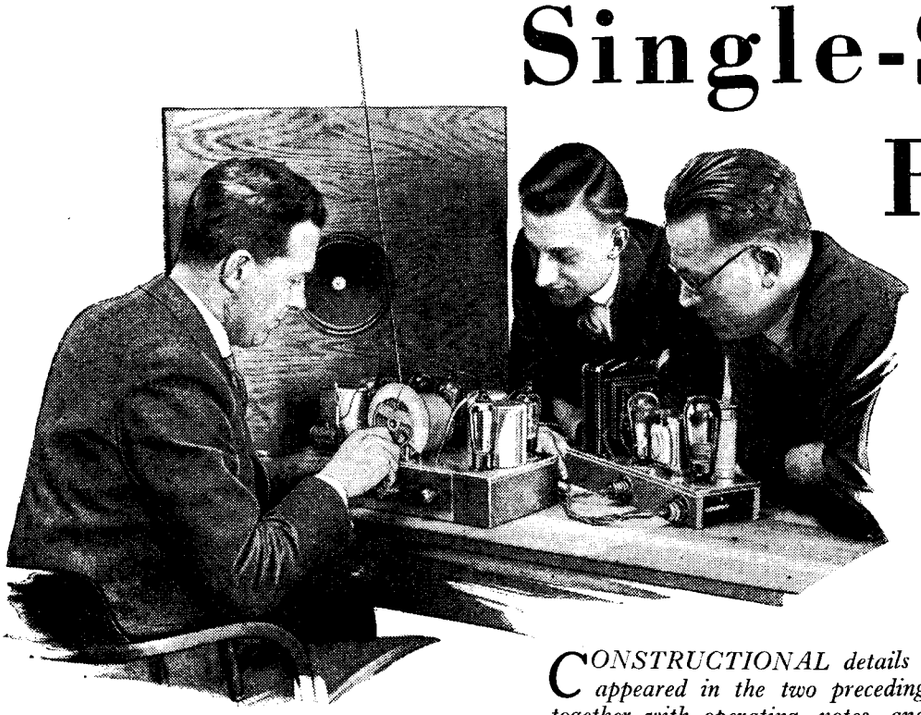
Alas, the very perfection of my invention is bringing trouble in its train! My friend has become so skilful at sight-reading from the milliammeter needle that he suffers acute anguish each time he accidentally lights on a jazz transmission.

The Wireless World

Single-Span Receiver

Constructing the Coils

By
W. T. COCKING



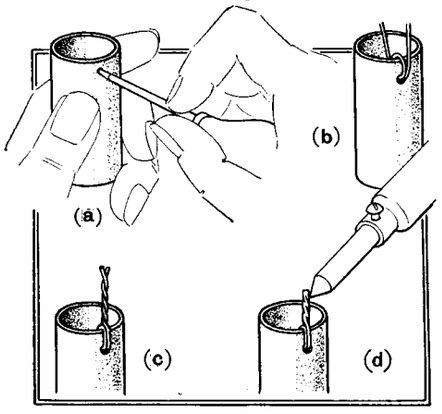
CONSTRUCTIONAL details of the Single-Span Receiver have appeared in the two preceding issues of "The Wireless World," together with operating notes and a description of its performance under test. In this article full details are given of the coils used, for these may readily be made without special tools or matching apparatus

THE two coils L1 and L2 which form a part of the aerial coupling of the Single-Span Receiver are very readily constructed. The former for each consists of a 2in. length of 1in. diameter Paxolin tube provided with one terminating lug at each end. These terminating lugs are easily fitted to the formers in the manner shown in one of the illustrations accompanying this article. The coil L1, which has an inductance of 326 μH, consists of 158 turns of No. 36 D.S.C. wire close-wound as a single layer; the total winding length is 1$\frac{9}{16}$in. L2 has an inductance of 346 μH and is wound with 169 turns of the same wire, the winding length for this coil being 1$\frac{11}{16}$in.

The oscillator coil L3 should next be constructed, and for this a 2$\frac{1}{2}$in. length of $\frac{3}{4}$in. diameter Paxolin tube is required. This former should be fitted with two lugs at each end, and two holes for the mounting bolts should be drilled in the side, as shown in the drawings. The reaction coil should start $\frac{9}{16}$in. from the end of the former farthest from the mounting, and consists of 20 turns of No. 36 D.S.C. wire. A gap of $\frac{5}{32}$in. should be left, and the tuned winding with an inductance of 41 μH commenced. This coil is wound with the same wire, but consists of 46 turns. Both coils must be wound in the same direction, and care should be taken in the matter of the connections since if one coil be reversed oscillation will not be secured. The two ends of the two coils which come nearest together are taken to lugs 2 and 3 for the tuned and reaction windings respectively.

The four I.F. coil assemblies are next in order, and the basis for each of these is the same. In every case the former is 1in. diameter by 1$\frac{7}{8}$in. long and is supported by a small bracket from one of the condenser terminals. The high potential end of the coil comes nearest the mounting bracket and only one connection is made to this end, so that only one terminating lug should be fitted. The "earthy" end of the coil is the top end physically, and for L4, L5 and L6 three lugs each must be fitted; L7, however, requires five lugs at the top end.

The main tuned winding should next be placed on each former. It is the same in every case, with an inductance of 98 μH, and is terminated at lugs 1 and 2; it consists of 80 turns of No. 32 D.S.C. wire close-wound and started $\frac{1}{16}$in. from the upper end of the former. Of these I.F. coils, L5 is the simplest and is completed by the addition of the reaction winding of 15 turns of No. 38 D.S.C. wire at the top end of the former and spaced $\frac{1}{8}$in. from the main winding. Both coils should be wound in the same direction; the upper end of the main winding is taken to lug 2, the lower end of the reaction coil to lug 3, and the upper end to lug 4.



Terminating lugs for the windings are easily attached to the formers. The first step is to make a small hole about $\frac{1}{8}$in. from the end of the former as at (a). Two turns of No. 22 tinned copper wire should then be threaded through (b), pulled tight and flattened with a pair of pliers, taking care not to break the former. The two ends are then twisted together (c) to form a projecting lug, and the metal is then run solid with solder (d).

In the case of the other coils, the additional windings are all overwound on the main winding so that suitable insulation must be provided. Start with L4 and cut a strip of paper of width rather less than that of the main winding which is already in place. Cream wove paper is suitable and may be obtained at any stationers in the form of ruled foolscap. Put two complete turns of paper over the main winding, and secure the outer end by two tiny blobs of sealing wax at the two corners. Next commence the winding of the primary on the smooth surface thus prepared. No. 38 D.S.C. wire is used and the bared end should be soldered to lug 3. The wire is then led down loosely on to the paper covering the main coil and fixed to it by a small blob of sealing wax. The winding proper can now proceed and 80 turns should be run on closely. At the end of the winding, another blob of sealing wax secures the last turn, and the end can be loosely run back to lug 4. This completes the coil, and L6 is identical save that the primary is given only 40 turns.

The last coil L7 is similar in its con-

The Wireless World Single-Span Receiver—

struction, but slightly more complicated. After the tuned winding has been wound, two layers of paper are wrapped round the coil and the primary of 60 turns of No. 38 D.S.C. is wound, exactly as described above, and terminated at lugs 3 and 4. The tertiary must now be wound. Two layers of paper are wrapped over the primary and secured with sealing wax, and then the tertiary is wound with 60 turns of No. 38 D.S.C. and terminated in lugs 5 and 6. This coil assembly thus consists of the main winding covered by two layers of paper; then the primary, again covered by two layers of paper, and lastly the tertiary.

When the coils are mounted, the lug 1 should be joined to the nearest terminal for the fixed plates of the trimming condenser by a stout wire, and this will assist the bracket in maintaining the whole assembly rigidly. The lugs at the top end of the former should be bent so that they project at right angles to the axis of the coil, otherwise they will probably foul the top of the coil screen when this is placed in position.

It should be noted that the anode leads of the two I.F. valves are brought out through the tops of the cans of L6 and L7. A small hole should be drilled in the centre of each of these two cans, therefore. The leads themselves can consist of short lengths of rubber-covered flex, from which any silk or cotton braiding has been removed. In order to push the wire through the hole in the top of the can, it will be necessary to make it much longer than it need be to reach only the valve anode. When the can is in position, however, the excess of wire can be tucked back inside it. If it is not desired to remove the can at any future time, of course, the excess may be cut off.

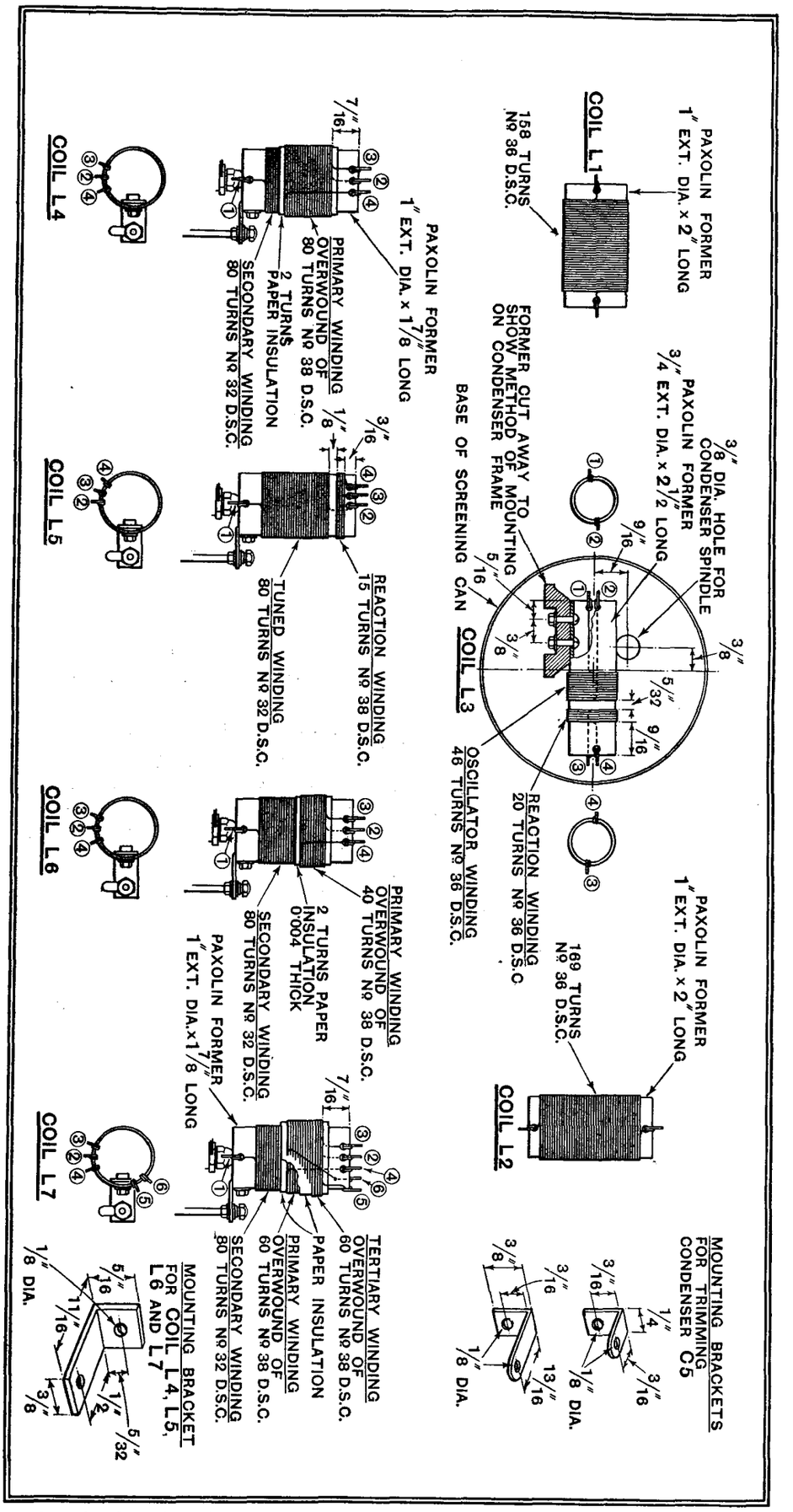
Gramophone Equipment

Although the operation of the Single-Span Receiver has already been briefly dealt with, some further notes on associated equipment may be of interest. The loud speaker should be of good quality, and if it be of the energised type its field must have a resistance of 2,500 ohms and be adequately excited by a current of some 40 mA. If a non-energised speaker be used or one which is separately excited, it will be necessary to fit a speaker field replacement type choke. This should have an inductance of over 50 H. at 40mA. and a D.C. resistance of 2,500 ohms, and its two terminals should be joined to the two points on the output socket to which a speaker field is normally connected.

The only equipment necessary for the reproduction of records, apart from the turntable and motor, is the pick-up. Since the low-frequency amplification included in this receiver is somewhat below the average, a sensitive pick-up is necessary if full volume is to be obtained. The pick-up, therefore, should be rated for an average output of at least 1 volt R.M.S.

The aerial and earth are also matters which should not be overlooked. A good earth should be used in order to reduce

HOW TO MAKE YOUR OWN COILS



These drawings show the constructional details of the various coils, and it should be noted that all windings must be in the same direction.

The Wireless World Single-Span Receiver—

any risk of hum and instability to a minimum and to secure maximum signal strength. Except in regions near a transmitter, the aerial should be as efficient as possible if the best performance is to be secured. In districts close to a broadcasting station, however, too good an aerial may lead to difficulty unless special precautions are taken. It must be remembered that in the neighbourhood of a powerful station quite a large voltage from this station may be applied to the grid of the first valve when a good aerial is used. This voltage, moreover, is applied all the time, irrespective of the station to which the receiver is tuned, for there is no tuning in the aerial system. As a result, if the input voltage be too great, the frequency-changer will be overloaded, and cross-modulation will occur.

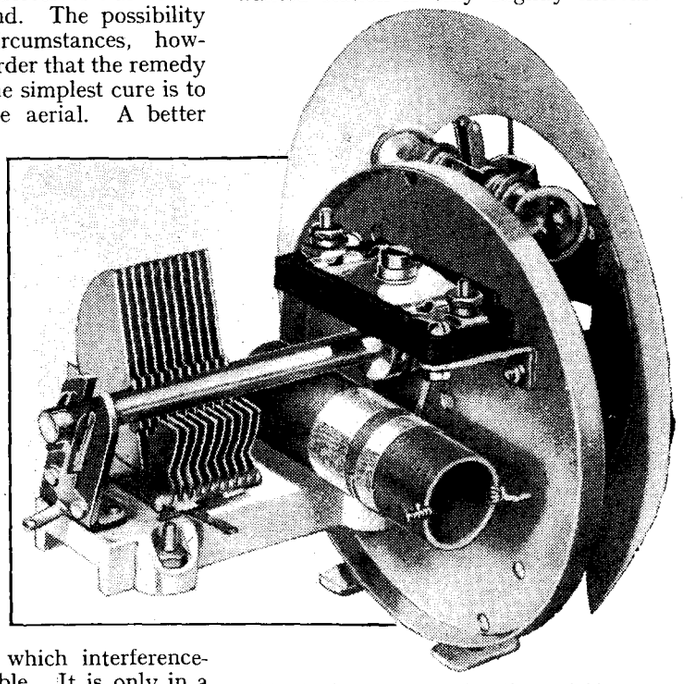
The Performance of the Receiver

It should be pointed out that in none of the tests which have been carried out with the Single-Span Receiver has cross-modulation been found. The possibility under exceptional circumstances, however, is mentioned in order that the remedy may be indicated. The simplest cure is to reduce the size of the aerial. A better remedy, however, is to use the double wavetrap unit described in *The Wireless World* for January 26th, 1934, under the title of "Eliminating Second Channel Interference." Not only will this unit effectively prevent cross-modulation in those few cases where local conditions are so bad that it occurs, but it will also reduce the spread of the local stations and so increase the number of channels over which interference-free reception is possible. It is only in a very few special cases that the use of such a unit will be advisable.

If the set is used near a local station, it may at first appear unselective, particularly if one is accustomed to the ordinary superheterodyne. The true selectivity, however, is much greater than the apparent selectivity. This is due partly to the action of A.V.C. in keeping the sensitivity at its maximum, and partly to the fact that much of the freedom from interference is secured through the use of reaction.

Suppose it be desired to receive a station on a frequency 50 kc/s different from that of the local, and the set be tuned to this frequency with reaction at minimum and at a time when the wanted station is not working. The programme of the local station will probably be distinctly audible. The natural response to this will be to increase reaction in order to obtain better selectivity. If this be done, there will be no change in the strength at which the local is reproduced, yet the selectivity will be much higher! Increasing reaction has greatly increased the sensitivity of the set at the frequency of the wanted station, which is, however, not yet working, but it leaves the amplification for the frequency of the local unaffected.

Under this condition with reaction at minimum, if the desired station starts working, it is probable that programmes from both this station and the local will be heard because the selectivity is then only moderate. If reaction now be increased, however, the interference from the local will gradually disappear. What happens is that the application of reaction increases the amplification of the set at the frequency of the wanted station, with the result that an increased voltage is applied to the detector. The A.V.C. system consequently applies a larger bias to the controlled valves, and reduces their amplification *for all frequencies equally*. The net result is that the total amplification at the frequency of the wanted station is only slightly increased by the application of reaction, but that the amplification at all other frequencies is reduced.



The tuning unit, showing the variable condenser C4, the trimmer C5 and the coil L3.

When the set is tuned to a signal, therefore, the combination of reaction and A.V.C. functions as a true selectivity control, and an increase in reaction audibly reduces interference. When the set is not tuned to a signal, however, A.V.C. does not function, and the application of reaction does nothing to reduce the sound output from a station to which the set is not tuned. As a result, it will be found that the spread of the local station seems very wide when operating the set in daylight when distant stations are very weak or are not working at all. At night, however, many stations which are within the daylight spread of the local will be found receivable without interference, although when the set is tuned midway between two distant stations the local may become audible.

Automatic volume control will be found to counteract the volume variations of normal fading, although it will naturally not affect any distortion which may accompany such fading. It will not usually give sufficient control to keep the local station at the same level as distant programmes, for the delay voltage is quite small. The control afforded, even on the local, however, is sufficient to keep signals within the range of the manual volume control without any necessity for a "Local-Distance" switch.

A noise-suppressor for distant reception is also unnecessary, owing to the shape of the overall resonance curve. This is essentially flat-topped when only a moderate degree of reaction is used, with the result that when the set is tuned midway between two adjacent stations the carriers of both stations can reach the A.V.C. diode, and the sensitivity of the set does not rise excessively between stations as it would with a very peaked resonance curve. This makes the set unusually pleasant to handle, for, as the tuning control is rotated, the stations slide in and out sweetly without interstation noise.

Constant Selectivity with Wavelength

Although the selectivity is variable, it is constant with respect to wavelength, unlike all other sets. The selectivity is dependent entirely upon the I.F. circuits, so that for a constant setting of the reaction condenser it is the same at all points within the tuning range. In all other receivers the selectivity increases somewhat with wavelength, and usually greatly at the upper end of the long waveband. As a result, the selectivity of the Single-Span Receiver appears to be lower on the long waveband than at shorter wavelengths, although it is actually exactly the same.

One important result of this constant selectivity is that sideband cutting also remains constant, and the quality of reproduction from the longer wavelength stations is of just as high a standard as that from stations operating on lower wavelengths. Of course, this assumes that the transmitters are all equally good, which is not always the case.

The performance obtainable naturally depends upon the excellence of the parts from which the receiver is built and it is unwise to depart widely from the specification. This applies particularly to valves, for the usual published characteristics do not completely specify a valve since the inter-electrode capacities are by no means unimportant. A table showing suitable types of valve for this receiver is included in this article, and every valve listed therein has been proved by practical test to be entirely satisfactory.

Before concluding, it may be as well to summarise the chief characteristics of the Single-Span Receiver. It gives a tuning range of rather more than 200-2,000 metres without the usual gap between 550

The Wireless World Single-Span Receiver—

and 900 metres, within which band operate a few broadcasting stations, civil aviation telephony transmitters, Heston Aerodrome, and many morse transmitters both ship and shore. This wide waveband is covered without any coil changing or switching, and the use of gang condensers and matched coils is completely avoided. As a natural consequence of this there are no ganging adjustments, and tuning is carried out by a single small condenser.

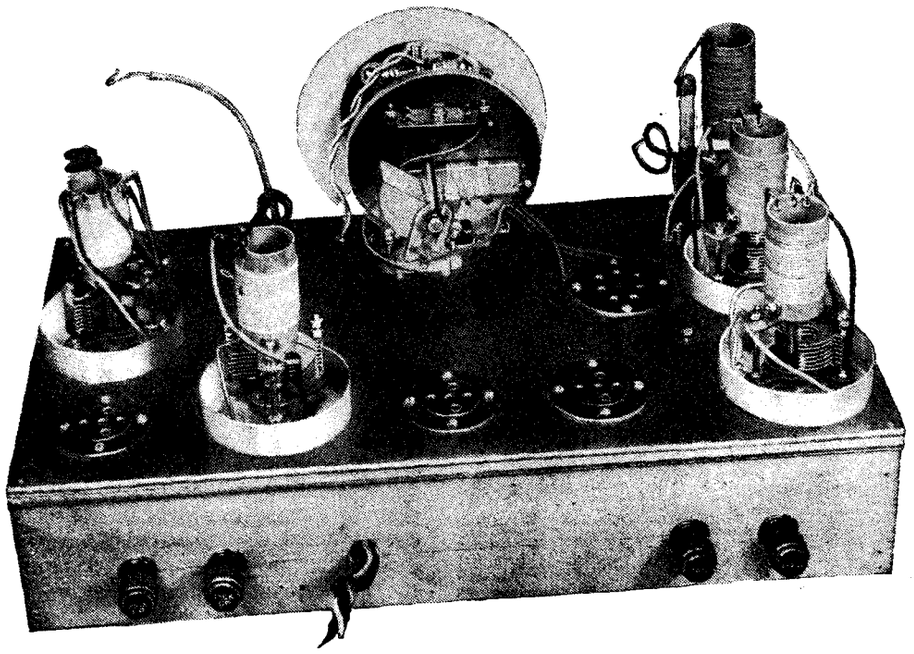
Owing to the use of a high intermediate frequency and a specially designed aerial coupling system, second-channel interference is entirely absent; moreover, complete freedom is obtained from the whistles so often found when an ordinary super-heterodyne is operated in the vicinity of a powerful transmitter.

The introduction of variable selectivity through the combination of reaction and automatic volume control leads to a striking improvement in the quality of reproduction obtainable on those stations which are sufficiently free from interference to render maximum selectivity unnecessary. It will thus be quite clear that the Single-Span Receiver is unusual, and that it sets a new standard in receiver design.

VALVES FOR THE SINGLE-SPAN RECEIVER.

Position.	Cossor.	Ferranti.	Mazda.	Marconi and Osram.	Micromesh.	Mullard.
Frequency-Changer.	—	VHT 4	—	MX 40	—	FC4
Buffer	41 MP	—	AC/P	ML 4	PA 1	104v.
1st I.F.	MVSG	VPT 4	AC/SGVM	VMS 4	9A 1	MM 4v
2nd I.F.	MVS-PEN	VPT 4	—	VMP 4*	9A 1	VP 4
Detector	DDT	H4D	AC/HL/DD	MHD 4	11A 2	TDD 4
Output	—	LP 4'	PP 3/250	PX 4	—	AC 044
Rectifier	—	—	—	MU 12	R 2	IW 3

* Requires a 7-pin valve-holder.



A view of the receiver unit with coil screens removed.

"The Short-wave World"

RECENT requests for collaboration from readers possessing logs extending back for seven or eight years brought forth offers of assistance from a few quarters. Owing, however, to the complete impossibility of comparing logs day by day and station by station over such a period, readers who can do so are asked to help in the following way:—

Starting as far back as possible, search the log for outstandingly good periods of reception of any particular part of the world. Taking the United States as a basis, suppose the usual weekly average of broadcast stations heard is in the region of ten.

Plot a rough curve showing variations in this level from one season to another, and see whether there is any evidence of a regular or irregular cycle.

Naturally, this is hardly a scientific method, as the number of listening-hours per week will have a considerable bearing on the matter. But if two or three readers only were to do this it would probably be possible to identify periods that were undoubtedly abnormal, either on the good or bad side, and compare one log with another.

Conditions since the beginning of April have been rather dull, with no sign of the improvement that is so long overdue. Possibly by the time this appears in print "spring" conditions will have arrived. Meanwhile, the late spring seems to be having a marked effect upon radio.

A most remarkable feature of short-wave reception during the past three or four months has been the consistency of the 16- and 19-metre stations. When conditions *do* show any sign of being unreliable, these shorter wavelengths are usually the most unreliable of all. This year, however, they have continued to produce good reception week in and week out, with only a bad day now and then to spoil the picture.

The recent note about W2GOQ—the broadcast station W2XE in "amateur" guise on 21 metres—has called forth an interesting note from a reader. This is to the effect that W2GOQ on 21 metres is often three or four times as strong as W2XE on 19 metres. If the writer's information is correct, all that the operator of the station does is to change the crystal and readjust all his tuned circuits for the new wavelength. Possibly, the aerial is better suited to 21 metres than to 19?

Ever since the U.S. regulations have permitted the use of telephony on the 21-metre amateur band there have been some outstandingly good transmissions to be heard. W9BHT is quoted by many as being the strongest American amateur using "phone," although the station is in Illinois, several hundred miles more distant than many of the "1's" and "2's."

There seems to be a dearth of high-power amateur telephony in this country. This is probably due, unfortunately, to the comparatively large number of out-of-date, unselective broadcast receivers that are still in use. The average amateur, though he may be within his rights to put out 250 watts of telephony on 21 metres, hates unpleasantness with neighbours. He therefore confines himself to C.W., which probably causes less interference if a good keying system is used.

The writer can use between 100 and 200 watts of telephony without interfering with his own (commercial) broadcast receiver in the same house; but complaints are assuredly received from listeners a quarter of a mile away, and for that reason C.W. is generally employed. MEGACYCLE.

THE RADIO INDUSTRY

WE have received from Postlethwaite Bros., of Kinver, Worcs, a leaflet describing the uses and performance of the Kinva dual-impedance tone-correcting device.

A subsidiary H.M.V. Company, known as H.M.V. Household Appliances, Ltd., has been formed to manufacture household electrical appliances.

The Lissen 5-valve Portable is now reduced in price from 11 guineas to £9.

Our recent review of the Dubilier reversible electrolytic condenser may have given the impression that "raw" A.C. may be applied to it. This, of course, is not the case, though the condenser is quite suitable for "universal" A.C.-D.C. sets.

A new Philco set, known as the Universal A.D.C. model, is for use on A.C. or D.C. mains interchangeably, and embodies a superheterodyne circuit with several interesting features.

The General Inductance Co., of 28-34, Fortess Road, London, N.W.5, have sent us a leaflet describing the properties of various types of bakelised paper tubes manufactured for use as coil formers.

NEWS of the WEEK

Current Events in Brief Review

World's Longest Aerial

MR. AL HYNES, of Clarenville, Newfoundland, claims to have the world's longest aerial. Originally it was 1,100 feet, but has now been extended to 2,000 feet, the open end being secured to the top of a neighbouring mountain. According to the *Globe Circler*, the organ of the International DX'ers Alliance, Mr. Hynes is getting remarkable reception.

Amateur D.F. in Herts

READERS of *The Wireless World* are invited to attend the annual direction-finding competition of the Golders Green and Hendon Radio Scientific Society which is to be held on Sunday, May 27th next, in the neighbourhood of St. Albans, Rickmansworth and King's Langley. Transmissions will be on a wavelength of 150 metres. Six prizes will be competed for by direction-finding groups. Full particulars of the scheme are obtainable from the Hon. Secretary, Mr. J. Hillier, 8, Denehurst Gardens, Hendon.

"But it Won't Lie Down"

LISTENERS who have questioned the intention of the Eiffel Tower station to close down in conformity with the Lucerne Plan, will have their doubts finally removed by the news that the "National Broadcasting Federation of the Eiffel Tower" has issued a manifesto reminding the public that its collaboration with the State radio system is not only friendly but necessary.

The Federation is now demanding that the Eiffel Tower should be allowed to continue to broadcast and suggests a wavelength of 514 metres. This happens to coincide with that of Riga and is perilously close to that of Mühlacker. It remains to be seen what Latvia and Germany think of the proposal.

Car Radio in U.S.

ACCORDING to our Washington correspondent, 724,000 car radio sets were sold in the United States in 1933, as compared with 143,000 in 1932

Television in Colour

"TRICHROMATIC Reproduction in Television" is the title of a paper to be given by Mr. J. C. Wilson before the Royal Society of Arts, Adelphi, London, W.C.2, on Wednesday next, May 2nd, at 8 p.m. Mr. J. L. Baird will preside. The paper will be illustrated by lantern slides.

Eight-hour Day

B.B.C. officials and staff will be interested in the regulations now in preparation by the French Ministry of Labour restricting all workers in broadcasting and wireless generally to an eight-hour day.

The B.B.C. staff work on the nominal basis of a seven-and-a-half hour day, but are liable to work for longer periods at the discretion of the departmental chiefs.

Big Public Address System

NO fewer than 200 British-made loud speakers are to be shipped to Buenos Aires in preparation for the forthcoming Eucharistic Congress. The speakers will form part of the public address system to be installed by Standard Telephones and Cables, Ltd. It is expected that over one million persons will participate in the Congress.

500-kilowatt Anomaly

THE special transmission by the new 500-kW. station at Cincinnati on February 18th was very poorly heard in this country. However, we learn that seventy reports were received from New Zealand.

THE ANNOUNCER OBLIGES. The station manager and the announcer at Lyons la Doua broadcasting station. During a recent visit of a *Wireless World* correspondent, the announcer brought the famous interval signal bell into the sunlight to help the photographer.

DELAY OVER IRISH BROADCASTING. The site at Lisburn, near Belfast, to which our Broadcasting Correspondent refers on another page. So far the only indication of progress towards the completion of North Ireland Regional is the survey peg shown in the picture.

One Over the Eight

INTERVAL signals are unnecessary in America. Starting on June 1st, says an official statement of the National Broadcasting Company, station "breaks" or intervals will not exceed nine seconds. Hitherto these station "breaks" occurring between the various network programmes have occasionally lasted as long as twenty seconds. The new order represents another effort to quicken the pace and maintain the listener's interest.

A Radiogram Concert

AS the result of their radiogramophone concert on April 11th in the City Hall, the Newcastle-upon-Tyne Radio Society has been able to hand £26 to the *Chronicle* Sunshine Fund. Nearly 1,700 visitors attended, and obviously enjoyed the reproduction provided by the moving coil speakers with special cones and flat baffles. The Society has decided that, if another concert is given, exponential baffles will be employed.

Amplifiers for Deaf Children

SPECIAL amplifiers and sensitive headphones are being used in experiments by Manchester University in teaching deaf and dumb children at the Royal Schools for the Deaf, Old Trafford.

The children's hearing is first tested to determine the degree of aural insensibility to different notes in the scale. Each child is then provided with a separate output from the amplifier, adjusted to meet the particular case.

Marconi's Surprise

MARCHESE MARCONI, who has just celebrated his sixtieth birthday, is now in Rome after his world tour in his yacht "The Elettra," conducting experiments with micro waves.

In a recent interview he expressed himself as highly satisfied with the results so far achieved. "I hope," he added, "to give the world as big a surprise within the next year or two as I did when discovering the principles of radio in 1896."

Fly Power Transmission

ALTHOUGH low-power records are continually being made on the short waves by amateur transmitters, the feat of Mr. E. F. Baker, of Tunbridge Wells, is exceptionally unusual. Mr. Baker has made consistent contact with Scotland from his station, G5OQ, when he was using only 5 volts on the plate of a crystal-controlled oscillator. This is equivalent to 30,000 miles per watt.

Belgian Amateur's Feat

A FOREIGN amateur transmitter has won a coveted British honour. The initials "W.B.E." and "W.A.C." stand for "worked British Empire" and "worked all Continents." While it is an easy matter to "W.A.C.," it is much more difficult to "W.B.E.," as many parts of the Empire possess very few amateurs. All the more credit, therefore, goes to Mr. J. Mahieu, of Peruwelz, Belgium, who from his station, ON4AU, has secured both the coveted initials and repeated them on telephony. He is the first foreign amateur to do so.

Really the Youngest

ALL records seem to have gone by the board for the claim to be the youngest British amateur transmitter. Mr. G. A. Bryan, of Littleover, Derby, is only thirteen years of age! He is the licensed operator of station 2AFV. In America—that land of extremes—there are actually amateurs who are not yet in their teens—but are there any in Europe?

Lifeboats and Amateur Radio

THREE Kent amateurs, Messrs. Elmer (G2GD), Chapman (G2IC), and Mainprise (G5MP) have rendered invaluable service to the Hythe lifeboat service by supplying it with a special receiver tuning to the coastguard and aircraft distress wavelengths. The set, which was subject to a 24-hour under-water test, is installed on the Hythe lifeboat, and it has already proved its worth; it picked up an urgent call resulting in the saving of six lives.

HINTS and TIPS

Practical Aids to Better Reception

IT may seem reprehensible to advocate the provoking of incipient L.F. instability, but nevertheless it is an expedient that is sometimes resorted to in order to accentuate bass response. Although the idea may at first sight sound unattractive, it is a fact that it often has the desired result, and it is easy to give it a trial.

Accentuating Low Notes

The scheme may be put into operation by reducing the amount of decoupling normally included in the detector anode circuit, but in order to provoke L.F. reaction, it may be necessary to reverse the connections of the L.F. transformer primary. To reduce the effectiveness of the decoupling system, one can either use a smaller by-pass condenser, a smaller resistance, or a combination of both.

IT is not the purpose of this paragraph to revive the old controversy with regard to the comparative merits of the various methods of H.F. coupling—transformer, tuned-grid, or tuned-anode. It is now realised that under modern conditions there is little difference between their effectiveness, and one's choice may be largely governed by convenience without running much risk.

Tuned Anode Shortcomings

In one respect, however, the tuned anode method differs radically from its competitors. This difference lies in the fact that it allows any L.F. voltages that may be built up across the inevitable resistance or impedance of the H.T. supply system to be fed back to the detector grid. This point is clearly shown in Fig. 1. Now the detector is the first valve in

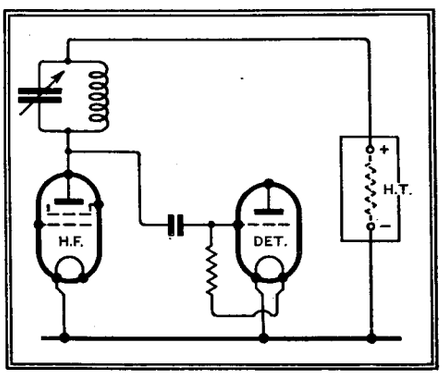


Fig. 1.— Illustrating the possibilities of L.F. reaction through a tuned-anode H.F. coupling.

the chain of L.F. amplification, and any unwanted signal-frequency voltages applied to its grid will receive full magnification; it is therefore not difficult to understand that the tuned-anode method of H.F. coupling, although a part of the "H.F." section of the set, may actually be responsible for "L.F." troubles.

To be on the safe side, it is a good plan to use a tuned-anode system only when sufficient surplus H.T. voltage exists to make it possible to employ anode circuit decoupling with sufficiently generous values to be effective in stopping feedback of low-frequency impulses. Where one cannot afford to use a decoupling resistance of as high a value as 10,000 or 20,000 ohms in the H.F. anode circuit, it is safer to employ another method.

A COMMON defect of short-wave sets —especially those of the simpler sort which depend on reaction for their sensitivity—is the production of a loud and unpleasant howl, which occurs just before the point of self-oscillation is reached. It is obvious that the presence of this howl limits the sensitivity of the set, for the reason that full use cannot be made of reaction.

Threshold Howling

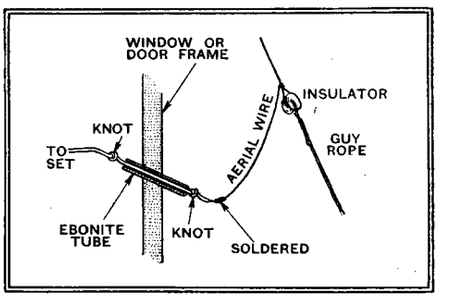
In view of the present interest in short-wave reception, it is worth while to remind beginners at the game that this howling is almost always traceable to interaction between the aerial and output ends of the receiver, and indirectly to imperfect filtering in the detector stage. It can generally be stopped by a liberal use of by-pass condensers, although occasionally the addition of an H.F. choke in the output valve anode circuit affords the simplest cure.

NO apology is needed for returning to a subject that is older than broadcasting; reference is here made to the aerial lead-in, a collective term generally applied to the connecting wire and its insulator by means of which an external aerial is connected to a receiver inside the building. The ordinary lead-in insulator of commerce, consisting of an ebonite tube and a central metal rod fitted with terminals at each end, would seem to be far from satisfactory; at any rate, without more attention than it usually receives. Poor connections, especially at the outside end, have often been proved to be responsible for an effect that is mistaken for fading.

The Aerial Lead-in

A strong case can be made out for maintaining a continuous and unjointed metallic circuit from the end of the aerial to the receiver terminal. But it is usually inconvenient to lead the bare aerial wire right up to the set, and so at least one soldered connection becomes necessary; whatever one may think of the desirability or otherwise of soldering, this is certainly a case where it is to be preferred to any other kind of joint.

In the accompanying sketch is shown a form of lead-in that is reasonably workmanlike, and which has the obvious merit of simplicity. It avoids the difficulty of corroded terminals, and necessitates but



A trouble-free aerial lead-in system. The ebonite tube should be inclined, to prevent the ingress of rain water.

one soldered joint. An insulated guy rope, as shown, is to be advocated, both on the score of neatness and because it relieves the lead-in of mechanical strain. For the connecting wire to the receiver, a length of heavily rubbered flexible wire is probably best.

EXPERIENCED amateurs do not need to be reminded that the adjustment of a trimming condenser is by no means "straight line frequency"—or, for the matter of that, "straight line anything." At the position of the adjusting screw corresponding to roughly minimum capacity, a full turn has little effect in varying the frequency of the circuit which it controls, but at nearly maximum position a small fraction of a turn makes a clearly perceptible difference.

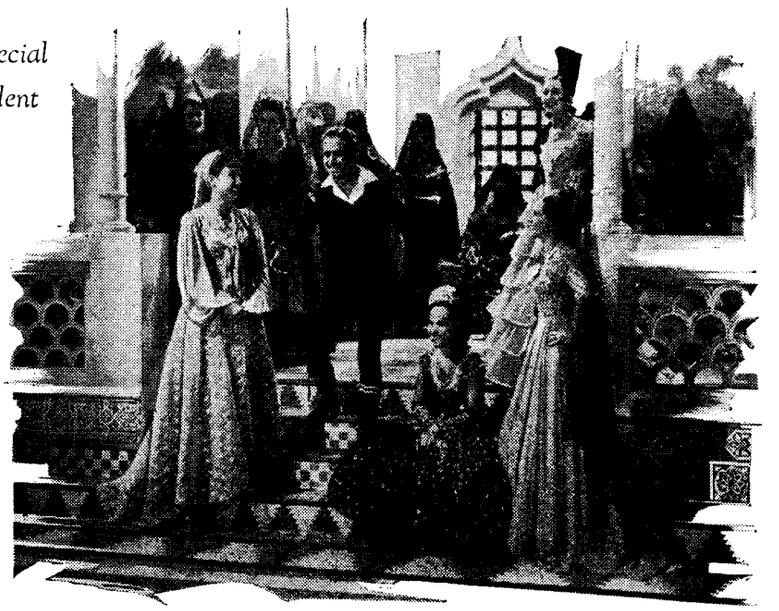
Initial Setting of Trimmers

This explains partly why the practice of starting the operation of trimming at random is often productive of disappointment, or at any rate of an unnecessary waste of time. It is generally worth while going to the trouble of seeing that the trimmers are set initially to roughly the middle of their useful working range. This condition can generally be achieved by screwing each control to the "all-in" position (right-handed), and then slacking back each screw by a couple of turns, or even slightly less.

It may be that by following this plan an unnecessarily large amount of trimming capacity is included in each circuit. But even if it is, after having found a good adjustment it is easy to make progressive reductions of capacity until one can go no farther without impairing the alignment of the circuits.

BROADCAST BREVITIES

By Our Special Correspondent



SECRETS OF THE STUDIOS. The B.B.C microphone will visit the Imperial Film Studios, Boreham Wood, on May 5th, to give listeners an impression of how "The Private Life of Don Juan" is being filmed. In addition to the director, Alexander Korda, listeners will meet such personalities as those in the photograph (left to right) Joan Gardner, Douglas Fairbanks, Merle Oberon and Benita Hume.

Storm Over the Teacups

I MAY not tell you which member of the B.B.C. National Symphony Orchestra disclosed the truth about Dr. Boult's fight for a free tea. Not that it matters, for a piccolo player can be as truthful as a double bass. (Anyway, it was not a piccolo player.)

Musical Director's Triumph

Dr. Boult considered that the Corporation should entertain members of a visiting orchestra. The meal was tea and the cost to the B.B.C. was to be something like £5.

The administrators said "No." Dr. Boult, feeling the affront, took the matter higher, and won.

Perpetual Conflict

No one listening to the bright and sparkling B.B.C. programmes would guess that this strife between the creative and administrative sides goes on from day to day. What material for a radio drama!

Not Even for the I.E.E.

IT seems a pity that members of the Institution of Electrical Engineers will not see the Droitwich transmitter working when they visit the new station on Saturday, May 26th.

The occasion is a "summer meeting," and it had been hoped that the visitors would see some signs of activity, but the engineers cannot hope to begin tests before the end of June.

It would be a happy scheme if the first national test could be radiated on July 27th, the ninth anniversary of the opening of Daventry 5XX.

B.B.C. Plans Five Years Ahead

SO confident is the B.B.C. that its Charter will be renewed in 1937 that programmes have been planned as far ahead as 1939. It has actually been arranged that during May, 1939, we are to have an Empire programme featuring life as it is lived in South and East Africa.

In the meantime, the B.B.C. is more immediately concerned with a special programme on May 24th next—Australia Day—which will mark the first of a series of annual broadcasts in which different parts of the Empire will talk to the world.

Laughing Jackass to Contribute

At 7 p.m. B.S.T. the programme will begin with clock chimes from the G.P.O. Building, Sydney, and there will follow dramatic cameos depicting the discovery of gold in Australia and the birth of the sheep and wheat industries. And then a very temperamental artiste, the Kooka Burra, or Laughing Jackass, will be asked to perform in the Sydney studio.

This programme will be radiated Nationally in Great Britain and will also be broadcast both directly over the Empire short-wave system and later in electrically recorded versions.

And So On . . .

Next year's Empire programme will be concerned with Canada and Newfoundland. India and Ceylon will provide the fare in 1936, the Irish Free State in 1937, and New Zealand in 1938. The programme for 1939 I have already mentioned.

On the Spot in Northern Ireland

A FRIEND of mine has just returned from a sleuthing expedition to Belfast. Anxious to know just how Northern Ireland stood in regard to its much trumpeted new Regional station, my friend traversed the Belfast-Hillsboro' road some fifteen miles till he came to the site for "North Ireland Regional." There were no notices against trespassers, no menacing B.B.C. monograms, but only a few survey pegs dotted around the field.

Since Belfast listeners are hoping for full-blooded transmissions in January next, it is not surprising that they are expressing concern over the delay in commencing building operations.

Another Mystery

The question of new studios also figures in the drama. When and where will an Ulster "Broadcasting House" be built? The present offices of the Corporation are in a shabby building behind the Ulster Hall. There are only three studios, and Belfast folk are asking why their fine city has so far been excluded from the scheme of Regional reorganisation and studio modernisation.

The existing small transmitter situated near the Albert Bridge has a poor output, and reception is sometimes impossible in Londonderry, where staunch Ulstermen have to depend upon Athlone for comfort and consolation.

Programmes for the Blind

THE current issue of the *Braille Radio Times* ends the seventh year of publication. Published weekly for blind listeners by the National Institute for the Blind, this periodical has never looked back since its first issue, which numbered a thousand copies. Now the circulation runs to 2,740 a week. Each copy, which is sold to the blind at 1d., costs 3d. to produce.

Tied to the Manuscript

LANCE SIEVEKING'S notion of overcoming microphone-consciousness by putting the actors in one studio and the "mike" in another was tried out in Lord Dunsany's "Bureau de Change" last week, but only added to the air of unreality which clothed the whole play.

Instead of trying to forget the microphone, broadcast actors would be better advised to learn their lines and thereby become more natural. No one can live a part while strutting around with a manuscript in his hand.

Learning Their Lines

The trouble is that star actors do not feel disposed to memorise lengthy parts for the sake of one or two performances, even though they are paid at least £25 for two broadcasts and attendance at rehearsals.

Those taking lesser parts must often be satisfied with a "fiver." Plays usually cost £200, but the administrators are trying to bring down the cost to £150.

If actors decline to learn their parts, Lance Sieveking and his colleagues might revert to the old idea of a lantern screen on which the words could be projected.

Who Would be an Announcer?

IT is idle to talk of the possibility of more women announcers. No woman would undertake the latest task which falls to the hard-worked announcer, namely, the memorisation of the pronunciation of 800 Welsh place-names.

Perhaps, however, the wily woman announcer of the future, confronted with "Llanfair-Pwll-Gwyngyll," or some such tongue-twister, would point to the sub-title of the little booklet just issued: "Recommendations to Announcers regarding the Pronunciation of some Welsh Place-names." No woman bothers herself seriously with *recommendations*.

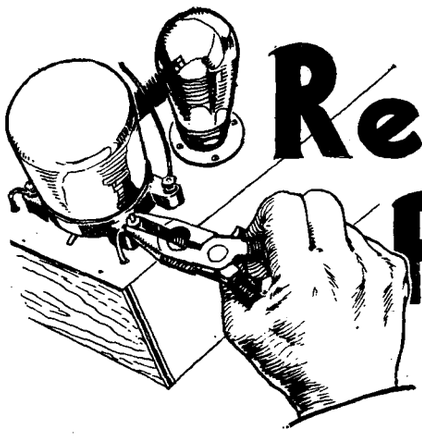
Heard in the Concert Hall

THEY tell me that the B.B.C. governors are *au fait* with all that goes on in the broadcasting world. Yet this was heard in the Concert Hall a few days ago:—

Governor: "Oh, *that's* the new organ? Behind that grille, isn't it?"

Nonentity: "Yes, sir."

Governor: "And is it a success?"



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

Automatic Coupling Change-Over

A READER who is in process of designing an experimental receiver finds that "top-end" capacity coupling between the component circuits of his input band-pass filter is extremely satisfactory on the medium waveband, but that extra coupling capacity is needed on changing over to the long waves. A switch or plug-and-socket arrangement could obviously be employed for making the necessary changes, but this would necessitate an extra control, as it would be difficult to link up this change-over system with the wave-range switch. We are asked to suggest a solution of this little problem.

The extra capacity needed for long-wave coupling may be connected between the junction points of each coil assembly in the manner shown in Fig. 1, in which C1 and C2 represent respectively the medium- and long-wave coupling capacities. Consideration of the diagram will show that with the wave-range switches closed for medium-wave reception, C2 is short-circuited and so entirely inoperative. But when the switches are opened for long-range working it acts as an extra link between the circuits, and the fact that it is not connected to the extreme high-potential end of the coils does not prejudice results. This arrangement is extremely simple and effective.

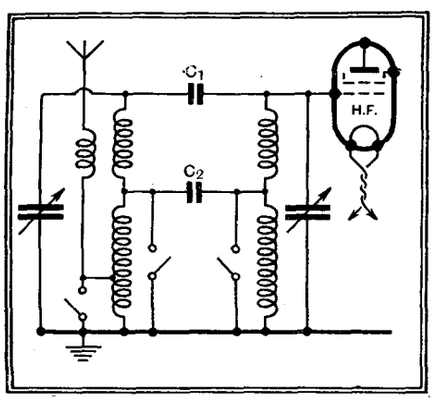


Fig. 1.—Effective on both wavebands without extra switching: arrangement of coupling condensers in a band-pass filter.

"Single-Span" with a Frame

SEVERAL questions have been received with regard to the application of Single-Span tuning to receivers operating with a frame aerial. So far as can be seen at present, it would appear that it would be necessary to make provision for separate tuning of the frame—which from some points of view, of course, rather detracts from the advantages of the system. It is possible, however, that an aperiodic frame arrangement might be devised, the frame taking the place of one inductance element of the input filter described in last week's issue. It is feared, however, that an aperiodic frame would not be highly satisfactory.

A tuned frame would naturally be connected in place of the special filter.

Automatic Bias Rules

IT is asked whether there is any simple formula for estimating the value of bias resistor required (in a self-biased circuit) when the valve concerned is to be operated at something less than the maximum rated anode voltage. It is pointed out that published data usually deals only with the bias voltage required when a valve is operated at full anode voltage.

There is no simple rule dealing with this subject, and fortunately the need for one is seldom felt. Within reasonable limits the bias resistor required for maximum voltage will be suitable for lower anode voltages. Admittedly, the valve will need less bias, but it will automatically receive it, due to the fact that anode current (and thus the current passing through the resistor will be less.

A possible exception exists in the case of certain large output valves, but here data is usually available from the manufacturers, and in any case the alteration in the value of the bias resistor is usually quite small.

"Hot" Leads

IT is continually being stressed that the grid and anode connections of an H.F. amplifier should be made as short as possible, and in particular that they should be spaced as far as possible from each other. A correspondent, who has apparently taken this advice to heart, is nevertheless somewhat uncertain as to the connections which require special attention; he submits a circuit diagram of the H.F. section of his receiver, and asks us to mark those connections which should be regarded as danger points.

His circuit diagram in skeleton form is reproduced in Fig. 2. To make matters as clear as possible, leads at high oscillating potential, and those forming part of closed oscillatory circuits, are shown in full lines as they represent wires through which energy may be transferred from one circuit to another.

It must not be imagined that all the connections indicated as "live" are equally likely to provoke instability, but to be on the safe side it is as well to exercise care in their disposition. The general rule to remember is that leads at the high-potential ends—the grid and anode ends—of the various circuits are always more likely to provoke trouble, but inductive coupling can and does take place from connections at the low-potential end of oscillatory circuits.

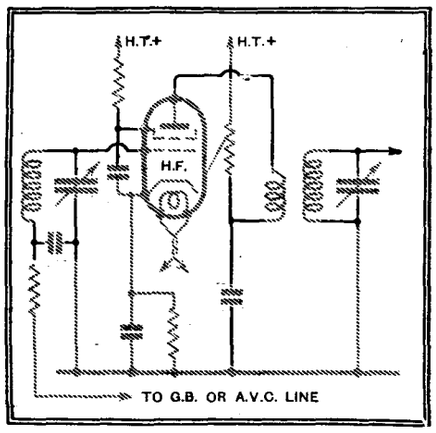


Fig. 2.—The connections shown in full lines are, to a varying extent, likely to be responsible for unwanted inter-circuit couplings.

Superheterodyne Tracking

IT is usual nowadays to employ for tuning a superheterodyne a special type of ganged condenser, in which the section which controls the oscillator circuit has a specially shaped set of vanes. By suitable design, matters are so arranged that the necessary frequency difference between the oscillator circuit and the signal-frequency circuits is maintained over the whole tuning range. It should be borne in mind that such a condenser can only be used with coils (signal-frequency and oscillator) of the correct inductance and with an I.F. amplifier adjusted to operate at a predetermined frequency.

It is possible, however, to obtain good results with an ordinary ganged condenser, and we think that a querist who applies for information on this subject would be well advised to read an article which appeared in *The Wireless World* of March 30th, 1932. Here it was shown that the maximum misalignment need not exceed one-fifth of one per cent., which is less than the ordinary ganging error.

The Wireless World INFORMATION BUREAU

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

Communications should be by letter to *The Wireless World* Information Bureau, Dorset House, Stamford Street, London, S.E.1, and must be accompanied by a remittance of 5s. to cover the cost of the service.

Personal interviews are not given by the technical staff, nor can technical enquiries be dealt with by telephone.

Eldeco Stenode Superhet

High Selectivity Combined with Tone Correction

FEATURES: ***Type.***—*Table-model superheterodyne receiver for A.C. mains.* ***Circuit.***—*Var.-mu H.F. amplifier—S.G. first det.—triode oscillator—var.-mu I.F. amplifier—single-diode-tetrode second det.—triode output valve. Full-wave valve rectifier.* ***Controls.***—*(1) Tuning with wavelength-calibrated scale. (2) Volume control and on-off switch. (3) Tone control. (4) Wave-range switch.* ***Price.***—*£25.* ***Makers.***—*Eldeco Radio Ltd., 62, Conduit Street, London, W.1.*

FROM a brief examination of the circuit diagram one would be inclined to classify this receiver as a straightforward six-valve superheterodyne of modern design. A closer examination, however, reveals that it is something more than this, and its claim to the inclusion of the word "Stenode" in the title lies in the use which has been made of Litz wire in the I.F. circuits to give an unusually high degree of selectivity, and the subsequent use of tone correction in the amplifying portion of the second detector valve to compensate for the loss of side-bands carrying the high audio frequencies.

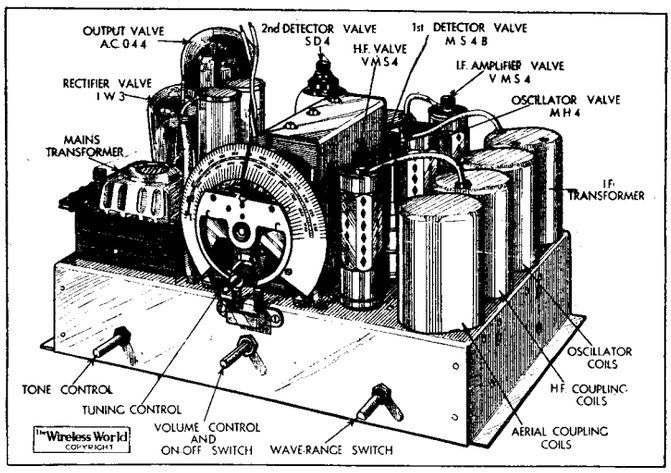
The first stage amplifies the incoming signals at radio frequency, and is coupled to the aerial through a tuned loose-coupled transformer. A filter circuit tuned to the intermediate frequency is included in the aerial lead. The second valve performs the sole function of frequency changing, a separate triode being employed to generate the local oscillations, which are injected in the cathode circuit of the frequency changer valve. The third stage is the I.F. amplifier with which four tuned circuits of high selectivity are associated. Both the I.F. valve and the first H.F. amplifier are of the variable-mu type, and are controlled by the A.V.C. circuit. A single-diode-tetrode valve is used in the second detector stage, and the tone corrector circuit is connected in the anode circuit of the screen-grid amplifying portion of that valve. In addition, there is a variable tone control, consisting of a condenser and variable resistance in series, which may be used to curtail high-note response when background noises are troublesome.

The last stage makes use of a high-powered triode valve capable of an undistorted output of 3 watts.

The H.T. current is supplied by a full-wave valve rectifier and is smoothed by the loud speaker field, which is connected in the negative lead. The volt-drop across this winding is utilised for the bias of the output valve and the first L.F. amplifier.

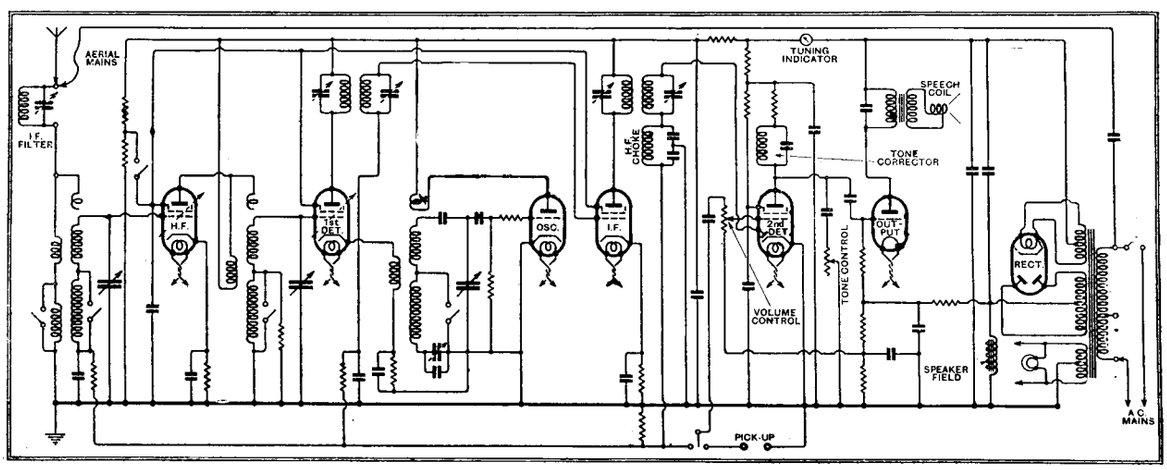
The walnut cabinet is of rather larger dimensions than is usual in a table model and measures 24in. × 16in. × 13½in. The chassis is completely isolated from vibration by rubber blocks, and is mounted above the moving-coil loud speaker, which is of the large Magnavox "Magna" type. A four-pin plug connects the loud speaker with the set, and braided screened leads are employed. A visual tuning indicator is conveniently mounted just over the tuning scale. The cabinet is well ventilated and the top is readily detachable by removing a single screw. A mains aerial connection is provided, and the mains leads are fitted with a reversible plug of unusually neat design.

The range and sensitivity are as high as in any receiver we have tested with an equivalent number of stages, and at least eight medium-wave Continental stations were received at good programme strength in daylight. As might be expected, the selectivity is of a very high order, and in Central London all trace of the London Regional transmitter is lost outside a band of 14 kc/s or 1½ channels on either side of its maximum setting. On long waves Königswusterhausen can be tuned in clear of direct interference from Daventry, but there was an occasional sideband "splash" on loud passages.



General view of the chassis. Plug and socket connections are provided at the back of the base-plate for the loud speaker leads.

With the set accurately tuned to the local station the quality of reproduction gave the impression that a slightly higher degree of tone correction might have been employed. With the tone control set to give the maximum brilliance, there was, perhaps, a shade too much bass in relation to the high note response. The quality of the low-note reproduction, however, was exceptionally good, and probably approaches 50 cycles without showing any noticeable signs of diaphragm or cabinet resonance. At the risk of incurring the wrath of technical purists, it may be mentioned that we succeeded in getting an entirely satisfactory balance of tone by careful mistuning with the aid of the visual tuning indicator.



Highly selective Litz-wound coils are used in the I.F. circuits, and tone correction is applied after the second detector stage.

Quiet, Amplified, and Delayed A.V.C. with a Single Valve

How the New Triple-Diode-Triode Works

THE chief drawback of A.V.C. is the high level of noise found during the process of tuning a sensitive and selective receiver, for when the set is not tuned to a carrier the sensitivity rises to its maximum. In this article a system of quiet A.V.C. is described which does not involve the use of an additional valve owing to the introduction of a new type—the triple-diode-triode—which can simultaneously perform the functions of signal rectification, first stage L.F. amplification, and quiet delayed amplified automatic volume control.

THE sensitive long-range superhet with A.V.C. has come as a great boon to the listening public, who can now enjoy entertainment from their radio sets from one station at a time. Neither are the benefits of this type of receiver confined to selectivity and sensitivity alone. Quality of reproduction can be as good as that of the most ambitious straight set, and the ease with which "blasting" and the effects of fading can be overcome is a virtue among many others which is leading the superhet to a position of supremacy in this country.

There is one shortcoming, however, which becomes more irritating as the selectivity increases. It is the background noise between stations, the automatic elimination of which has hitherto been expensive and has generally been found only on the most elaborate receivers. When an A.V.C. set is tuned to a carrier wave the early valves are biased back and the sensitivity is reduced, but in the inter-carrier spaces each valve is working at its maximum sensitivity and we are treated to the full amplification of atmospherics, man-made static, valve noise and general mush.

It is no use cutting down permanently the absolute sensitivity of the receiver, as there are times when it may be wanted, but, as a compromise, a variable sensitivity control (in addition to the usual volume control) can be embodied and set to suit the prevailing noise conditions.

Such a control is a little cumbersome as it must perforce be an auxiliary to the main volume control and very seldom can be left unaltered during an evening's listening. A form of A.V.C. is required in which all inter-channel noise, together with those programmes which are so weak as to be useless from an entertainment point of view, are completely silenced. Such a system is called quiet A.V.C. and can be effected in either of two ways.

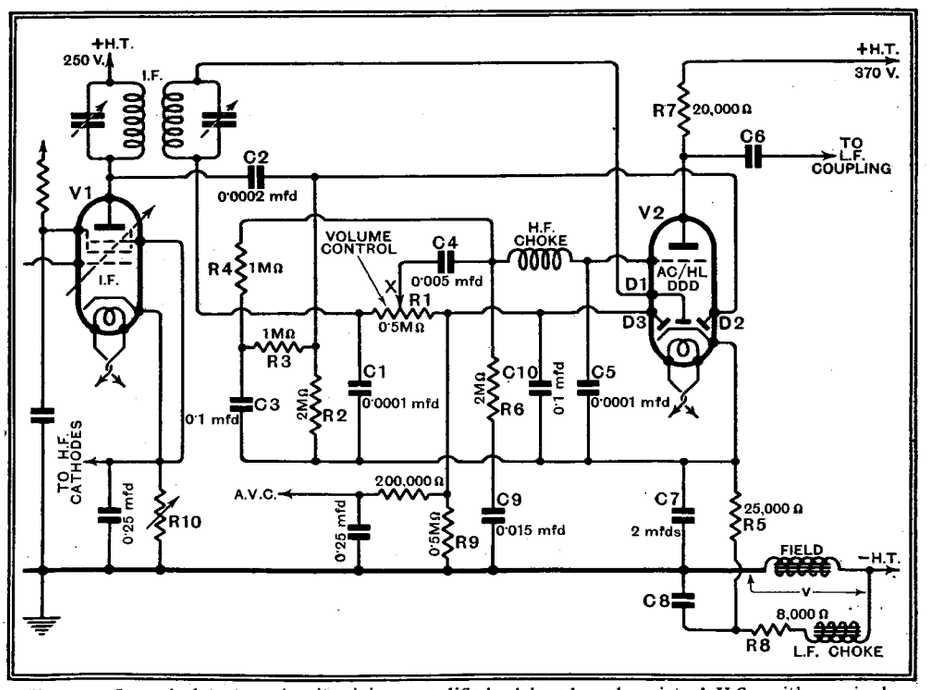
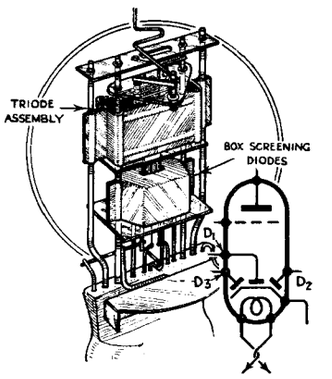


Fig. 1.—Second detector circuit giving amplified, delayed and quiet A.V.C. with a single Mazda triple-diode-triode valve. The components C8, R8 and L.F.C. act as smoothing and the 8,000 ohms shown in the diagram is the sum of R8 and the D.C. resistance of L.F.C.



The three diodes are mounted within a screening box below the triode electrode assembly, as will be seen in this sketch, which also shows the diagrammatic symbol for the new valve.

MAZDA AC/HLDDD.

Heater volts	4.0
Filament current (amps.) ..	1.0
Anode voltage (max.)	250
Heater-cathode voltage (max.) ..	150
*Mutual conductance (mA/volt)	2.7
*Amplification factor	35
*Anode A.C. resistance (ohms) ..	13,000

* *Taken at anode voltage = 100; grid voltage zero.*

Interelectrode Capacities.

Grid to anode	2.0 mmfds.
Grid to cathode	3.75 mmfds.
Anode to cathode	6.25 mmfds.
D1 to cathode	3.25 mmfds.
D2 to cathode	3.75 mmfds.
D1 to D2	0.5 mmfds.
D1 or D2 to grid	0.09 mmfds.

D3 at cathode potential in above measurements.

A mechanical relay can be provided which shunts the L.F. output when no carrier is present but which is actuated when the incoming signal reaches a predetermined level. The system works best when there is an additional valve to operate the relay, but the disadvantages are the liability to mechanical derangement and the fact that it requires a rather larger carrier to bring the set out of noise suppression than is required for suppression. The other method is to overbias considerably the L.F. or detector valves and so reduce the amplification and to remove the extra bias when the incoming carrier exceeds the suppression voltage.

The latter system is entirely successful but has hitherto entailed the use of an extra valve, and so is to be found only in receivers where expense is not of paramount importance.

By the introduction of the new Mazda triple-diode-triode—styled the AC/HLDDD—it is possible to arrange a circuit in which amplified, delayed and quiet A.V.C. can each play their rôle, using only a single valve. This brings Q.A.V.C. to the more popular type of superhet, and it would seem safe to prophesy its inclusion in a large number of next season's receivers.

The characteristics of the new valve are

Quiet, Amplified, and Delayed A.V.C.—

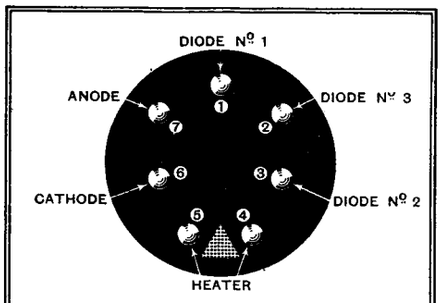
given in the table, from which it will be seen that care must be exercised in connecting up the three diodes as they are not interchangeable. The heater has been specially designed to give a high insulation to the cathode so that amplified A.V.C. can be used with impunity. In operation the three diodes and the triode are entirely independent of one another, each section being completely screened.

The circuit advocated (see Fig. 1) is ingenious, for amplified A.V.C. is obtained in the normal way except that the diode D2 which supplies the bias to the triode does not supply the L.F. The detector diode D1 is returned to the delay diode D3 and both are negatively biased in the absence of a signal by the amount of the delay voltage so that no rectification occurs. When a strong enough signal is tuned in the cathode potential falls until it is negative with respect to the earth line, whereupon the delay diode-cathode path becomes conductive and the A.V.C. starts to function. The signal diode being returned to the delay diode is now at cathode potential and rectification starts.

How Q.A.V.C. is obtained

The foregoing gives a brief summary of the fundamental processes involved, but to understand the precise mechanism the circuit must be examined in greater detail.

Let us take the diode D2 first. When a signal voltage is received from V1 it passes via C2 to the diode D2, which has a load resistance R2 returned to cathode, and is therefore always conductive. There are developed across R2 in accordance with the ordinary process of simple rectification, H.F., L.F. and D.C. components, the former two being shunted away by R3 and C3 leaving a rectified



The arrangement of the pins looking at the base of the new Mazda AC/HLDDD valve. The top-cap is connected to the control grid. Care must be taken to join the diodes as shown in the circuit diagram.

D.C. voltage of about $0.8 \times$ signal peak volts[1] to be applied as bias through R4 and the H.F. choke to the control grid of V2. The increased negative bias reduces the anode current of V2, which in turn reduces the voltage drop along the cathode circuit (R5, R8 and L.F.C.).

[1] The efficiency of the diode detector with the load shown is such that the D.C. output is about 0.8 times the peak H.F. input.

Assuming the effective D.C. amplification of the valve to be 15, it will be seen that a signal of 3.3 peak volts at the I.F. transformer primary will depress the cathode potential by 40 volts approximately, since $3.3 \times 0.8 \times 15 = 39.6$. Should the A.V.C. delay voltage be fixed at 40 then a signal of the amplitude just referred to will about neutralise it. A signal of 5 volts peak, for instance, will cause the cathode potential to drop by 60 volts (for $5 \times 0.8 \times 15 = 60$) and the delay voltage of 40 would not only be neutralised but a negative bias of 20 volts would be applied along the A.V.C. line to the early valves in the receiver. This explains the amplified A.V.C. process.

Taking the signal diode D1 next, it will be seen that it receives its signal from the secondary of the I.F. transformer and has the usual load resistance R1 in the return circuit. The latter is connected not to cathode but to the delay diode D3, which has the conventional A.V.C. decoupling circuit and a load R9 joined to earth. The L.F. speech component developed across R1 is fed through the slider of the volume control X to the grid of V2, is amplified, and appears across R7—the anode load—so that parallel-feed L.F. coupling can be carried out in the ordinary way through C6. A filter (H.F. Choke and C5) prevents the application of residual H.F. to the grid of the AC/HLDDD.

It has been found that a delay voltage of about 40 is the most satisfactory for this circuit, a figure which is obtained by passing the anode current of all the valves preceding V2 through the loud speaker field, and the anode current of V2 through R5, R8, and L.F.C. The field should be of such a value that the volts dropped are about 80, and the total cathode resistance must be 33,000 ohms, the voltage absorbed being about 120. The difference between these two, which is the delay voltage, will thus be $120 - 80 = 40$. As the diodes D3 and D1 are both effectively biased negatively by 40 volts, neither A.V.C. nor signal rectification begins until the incoming carrier produces a cathode voltage depression large enough to neutralise this. This explains the suppression of inputs below a certain predetermined minimum value, or Q.A.V.C.

The components R6, C9, are included to stop all signs of motor-boating which are liable to occur when a sensitive set with amplified A.V.C. is tuned to the fringe of a carrier wave. The capacity C9 must be kept as low as possible, otherwise the time constant of the A.V.C. noise-suppression circuit may be excessive, and weak stations will be lost while "searching."

It may be desirable in different localities, or at different periods of the year, to provide varying degrees of noise-suppression; that is, the actual amplitude of aerial input which will bring the set out of noise-suppression should be adjustable at will. To effect this, a control of the maximum sensitivity of the valves preceding V2 is necessary, and is provided by a variable common cathode resistance R10.

In Fig. 2 are given curves for the performance of a five-valve superhet with three controlled stages, using a Mazda AC/HLDDD as a second detector. Curve ABCD represents the A.V.C. characteristic without noise-suppression. From A to C there is no A.V.C. Near C the delay voltage is neutralised and the A.V.C. action starts. From 100 to 1,000,000 microvolts absolute

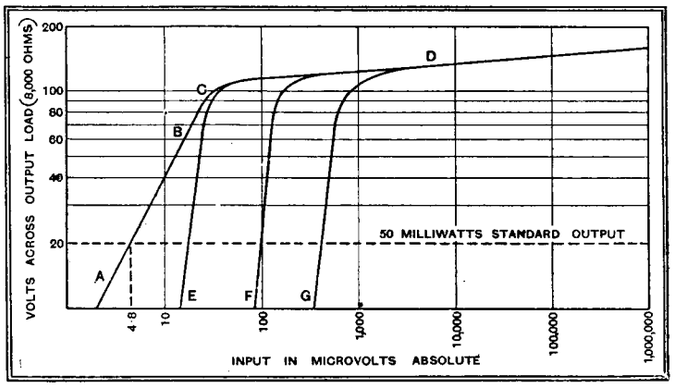


Fig. 2.—Showing the A.V.C. characteristics of a 5-valve superhet having three controlled stages and employing a Mazda AC/HLDDD valve in an amplified, delayed and Q.A.V.C. circuit.

input, representing a change of 10,000 to 1, the output power change is only 2 to 1—a very creditable performance. By making use of the noise suppression control R10 we may silence all noise, or stations whose aerial amplitude is less than E, or if more drastic suppression is needed all inputs below F or G.

Letters to the Editor :—

The Electronic Organ

Single-Span Receiver : Disc Records : Long-wave Records

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

The Electronic Organ

THE Electronic Organ described recently in *The Wireless World* is very interesting. I listened to the first and other broadcasts of this instrument from Poste Parisien. My interest is the greater having experimented with similar methods of tone production for five years. Conclusions drawn from this experimental experience I uphold since hearing this Electronic instrument.

I consider that while many new tones may be produced with methods such as are used in the instrument made by Messrs. Coupleux Frères (not necessarily *organ* tones), it is impossible to *reproduce* in this manner pipe organ tone. My reasoning brings forth arguments which may well be called psychical, being far removed from things mechanical and electrical.

The difference between this Electronic instrument and the organ at Notre Dame, or any other organ large or small, has to be heard to be appreciated. Major Raven-Hart states that the quality of the Electronic stops is produced by the rich harmonics present. If the tone of the Electronic instrument is so enriched, how many of these harmonics reach our ears through a broadcast receiver, and what is left of the tone having been so maltreated? The reason for the introduction of mutation stops in the *ensemble* of any large organ provides food for thought. Listen to full organ from Poste Parisien with the rich harmonics, and to full organ from, say, the Concert Hall at Broadcasting House.

The possibility of an infinite variety of so-called new organ tones is not very heartening. Any organ of dimensions will ever be beyond the keenest of organists, there being thousands of possible combinations never to be explored.

Now why should the removal of certain harmonics by filter necessarily affect the tone colours and timbres? In each case is it not the fundamentals, together with definite structures in harmonics and transients, which make up organ tones?

The "attack" desired by Major Raven-Hart is due to time periods (alterable with every different type of organ action) in the various tones peculiar to a pipe organ. The voicer provides these differences in time or attack, smooth or otherwise, thereby characterising the different stops. I agree that the faked effects in the Electronic instrument do not provide these peculiarities of organ tone.

To say that the notes may be repeated in a manner not possible with pipes is true. But with present-day Electro-actions it is found that pipes will speak more rapidly than even the expert player demands. The repetition in the lower notes is no doubt improved in the Electronic instrument, but who wants to hear notes of slow vibration, attempting to function with a speed which may be equal almost to the vibration itself?

The instrument at Poste Parisien is a remarkable achievement, but why call it an organ? Compare it with other of the world's famous organs. The foundation of good organ tone is the Diapason family, and the cost of an organ depends entirely on the amount and character of tone.

The writer appends that the Electronic instrument may veritably be perfect from the "action" point of view, but not a little lacking in tonal appointment in organ practice.

Organ tone has been developing since the days of Nebuchadnezzar, and will not be reproduced, no not even by Herr Pfenniger.

Stoke-on-Trent. HARRY B. ROGERS

The Single-Span Receiver

I TAKE this opportunity to express my congratulations on your "Single Span" Receiving System. I have been a regular reader of your periodical since 1927, and I likewise study other foreign and German wireless papers, but I have to state that I never found a wireless periodical being of such interest like your *Wireless World*.

I specialise in superhets., and I am, therefore, of opinion that the new "Single Span Tuning System" will modify the whole receiving technique.

Awaiting with greatest interest future articles on the above matter.

ROBERT KAUBLER.

Düsseldorf, Germany.

Alternatives to the Disc Record

THE correspondence regarding the respective merits of films and discs as the medium of sound reproduction does not show much knowledge of the problems involved.

As a technician who has recorded many hundreds of discs and a considerable number of sound films, I can fairly assess the respective merits of each system without bias.

There is no question that the cost of a film reproducer to give equivalent quality to that obtainable from a good disc reproducer would be prohibitive. A good optical system, extreme accuracy in manufacture and great mechanical robustness are not features that lend themselves to low-priced production.

Constant cleaning and focusing, expensive replacements, dirt and abrasions on the sound track, and the difficulties connected with rewinding and storing all combine to outweigh any possible advantage of the film.

Your correspondent, Mr. E. Hurran, raises a number of points in his letter. Granted that a film reproducer can be made silent running, it would still be essential to have a feed sprocket; but that is not the principal cause of noise in a picture projector. The motor could be as silent as a gramophone motor, but it would have to be much more powerful and consequently expensive to run. A mechanical filter is absolutely indispensable.

A good camera, Mr. Hurran states, can be made quite cheaply; but a good gramophone motor and pick-up costs much less than a good camera. The expense of aligning the components of a good optical system alone would exceed the cost of the motor and pick-up.

There are other disadvantages of the sound film reproducer, and from a domestic point of view there is nothing in its favour excepting that it will give a continuous playing time of ten minutes.

But what of the disc record made by the hill and dale process?

A twelve-inch disc can be made to play for eight minutes at an average track speed of a hundred feet per minute. Recording can be carried out over a range of 30/15,000 cycles. Owing to the carefully calculated contour of the groove, reproduction is obtained with practically no surface sound. The actual modulations are sunk deep in the groove, well protected, and the walls carry no weight. The output can be greater than from a lateral cut record. No lead screw is necessary, records can be played on any machine, and no new needle or playing point is ever required.

Nevertheless, the reproduction from an ordinary lateral cut record can be made adequate if recording is carried out from the centre to the outside. The mutilation of high frequencies which occurs in the ordinary method of playing due to the needle point having worn until the area of the point is greater than the space available in the groove for, say, a 3,000 cycle wave is thus avoided. By careful adjustment, the rate of wear of the needle point and the length of track available for the wave can be made almost proportionate.

In any event, the principal demand of the listener is for fidelity of reproduction; and this does not so much imply an extremely wide frequency response as a correct proportion of harmonics to fundamental sounds, so that these shall appear natural. This condition is satisfactorily fulfilled in the latest disc recordings.

London. A. L. M. DOUGLAS.

The AC/DC3

I HAVE just completed building your Universal AC/DC3, and put it into operation.

From the very moderate description given of its performance, I was led to expect quite mediocre results, and I am pleased to say that its actual performance is far in advance of anything I looked for.

Edinburgh. G. H. CLARKE.

Long-wave Records

I WAS very interested in the account of long-distance reception of Luxembourg under "News of the Week" in current *Wireless World*.

In India, before the "hot weather" of 1927, I received nightly concerts from Radio Paris (long wave) at strength R. 7 to 9, on an old det.-2-L.F. receiver and phones. My temporary station was situated a few miles from Benares. The distance from Paris I won't guess at, but considering the power then used by Radio Paris, and my receiver—an R.A.F. "T.F."—probably well known to many of your readers—it indicated "good going." V. NOLLER.

Thorpe, Norwich.

New Musical Instruments for Wireless

WITH reference to M. Sarnette's new instruments for broadcast transmissions, described in *The Wireless World* of March 16th, perhaps I may be allowed to quote from an article by Mr. Berkeley and myself, in *The Nineteenth Century* for May, 1930, nearly four years ago: "Another possibility . . . is the replacement of certain instruments which reproduce badly by others more adapted to wireless. The outstanding examples of such instruments are the double-bass. . . . Possibly alternatives . . . some special instrument to be developed, somewhat on the lines of the bass saxophone, but coarser in tone."

R. RAVEN-HART.

La Ciotat (B.-du-Rhone), France.

H.T. from the L.T. Battery

MANY other readers besides myself would probably be interested to learn whether any amateur has succeeded in making a vibratory H.T. generator, to

Miss Grethe Otto, the lady announcer in the Copenhagen-Kalundborg programmes. The microphone is a moving coil.

operate from a two-volt accumulator (or, for car radio work, a six- or twelve-volt battery).

My own attempts with a high-note buzzer interrupter, step-up transformer, and metal rectifier have not been entirely successful, but results are promising enough to lead one to believe that it would not be impossible to improvise a workable and fairly simple arrangement with an output of some two or three watts at 150 volts.

Manchester. A. B. EVERARD.

Interval Signal

AMONG the abundance of news paragraphs in your recent issues, I noticed particularly one of the smaller items which suggested an Interval Signal to succeed the pealing of Bow Bells. Although I know opinions expressing a six-to-one on liking for the present signal, there are no doubt adequate reasons afloat or attributary to any other policy adopted.

I suggest a pleasant signal would be a recording of the nightingale—essentially no accompaniment. This would seem to give general compliance, to be free from religious, political, or any rebellious sentiments, and to have technical advantages at one end, namely, no shortcomings at unnatural volume, and, with developed imagination, the bird would on accidental occasions not sing.

It should not disgust by familiarity, in any case, for the nightingale singing properly over a period has a great variety of tunes, probably as unheard to the microphone as to thousands, and its popularity could be safeguarded by the tantalisation in letting us only occasionally hear the sweetest notes.

C. TOMPSETT.

Kent.

ON THE SPOT

Visits to Foreign Broadcast Stations

XVI. Copenhagen
255.1 metres, 1,176kc/s 10kW and Kalundborg 1,261 metres, 238kc/s 75kW

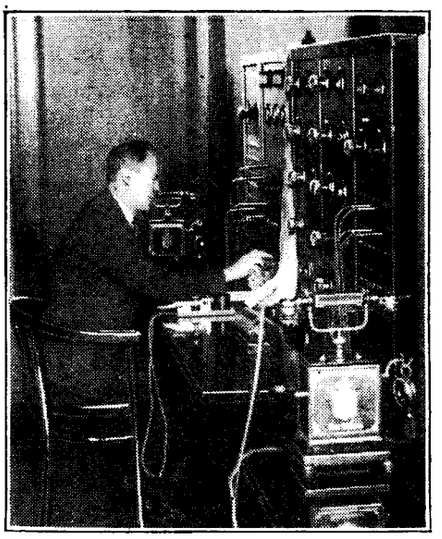
BROADCASTING in Denmark belongs to the State, and there are three transmitting stations; one (10 kW.) at Herstedvester, near Copenhagen, using an anti-fading aerial; a second one of high power at Kalundborg on the west coast of Seeland; and a third, a short-wave station at Skamlebeck, not far from Kalundborg. Danish listeners largely rely on the Kalundborg long-wave transmitter.

The Danish Broadcasting House at Copenhagen, which was completed some years ago, is a theatre and a broadcasting studio combined, and is conveniently near to the Royal Opera House.

The Kalundborg transmitter, which was recently described in *The Wireless World*, is built on a small peninsular close by the harbour of an old-world fishing town. In winter it is surrounded by ice.

British listeners will have noticed that until 4 p.m. each day a lady announcer officiates. This is Miss Grethe Otto, whose chief cause for complaint, it seems, is that she hardly ever gets any letters from Britain.

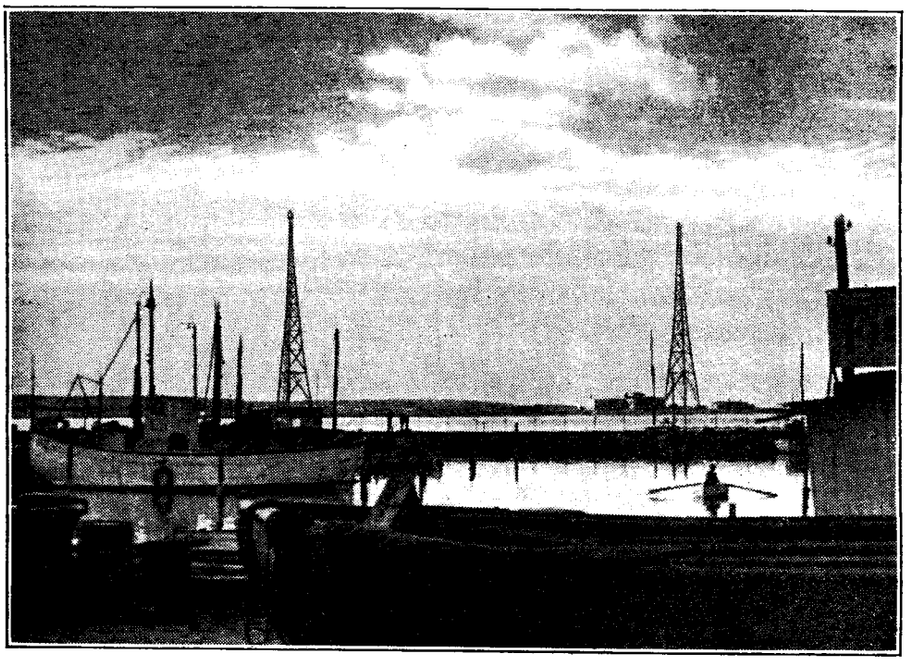
The mechanism of the Danish interval



A corner of the Copenhagen control room.

signal has been illustrated in *The Wireless World*, but I do not think the story has been told of the tune itself. This is the oldest known musical tune set to Danish words. It was discovered in an old manuscript, and provides the ideally simple air which accompanies the words, "I dreamt a dream about silk and costly cloth."

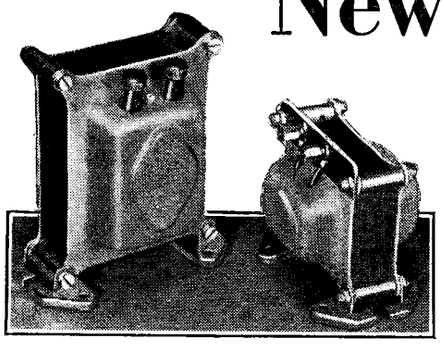
WANDERING WAVE.



An interesting glimpse of the Kalundborg masts on the small peninsula near the harbour.

New Apparatus Reviewed

Latest Products of the Manufacturers



Wearite smoothing chokes, H.T.14 and H.T.25.

WEARITE H.T. SMOOTHING CHOKES

THE Wearite range of L.F. chokes, made by Wright and Weaire, Ltd., 740, High Road, Tottenham, London, N.17, is particularly extensive, and covers most present-day requirements. There are several models described as constant-inductance types, and the H.T.12 and the H.T.14 come within this category.

Rated at 20 henrys and to carry 75 mA., the model H.T.12 was found on test to have an inductance of 19.5 henrys with no D.C. flowing; at 40 mA. the inductance was 19 henrys, and at 80 mA. 18.2 henrys. The variation is quite small considering the magnitude of the change in the D.C. Its resistance is 380 ohms, and the price 12s. 6d.

The H.T.14 is a high-inductance model—120 henrys nominal—and rated to handle 30 mA. of D.C. It was found by test that currents up to 60 mA. did not reduce the inductance appreciably, but this may be due to some change in the air gap length, as the inductance is a shade low throughout. With no D.C. flowing our specimen showed 103 henrys, which fell to 101 henrys with 40 mA. and to 94 henrys with 60 mA.

The resistance of the winding is 2,700 ohms, and this model could be employed as a loud speaker field replacement choke, as the inductance and resistance are both of the right order. Its price is 12s. 6d.

Although the H.T.25 model is not listed as a constant-inductance style, the specimen tested by us could quite well be included in this class, for its inductance remained sensibly constant at 18 henrys with D.C. currents up to 50 mA. flowing through it. With 60 mA. its value had fallen to 17.9 henrys. It has a resistance of 840 ohms, is rated at 20 henrys 50 mA., and costs 9s.

NEW FERRANTI COMPONENTS

TO the Ferranti range of components has been added recently a number of new and interesting items. There is now a range of half-watt resistances, a style which should prove very popular, since this rating will suffice for many of the resistances used in present-day sets, and they have the advantage of being small and light. They consist of small tubes, resembling porcelain in appearance and measuring only 1¼in. long × ⅛in. diameter, with the resistance material deposited on the surface. Metal-end caps are fitted, also wire ends 2in. long. This type is known as the manufacturers' style, and they cost 6d. each; the sizes available when tested ranged from 300 to 250,000 ohms, and the standard colour-code is adopted. Other sizes will follow later.

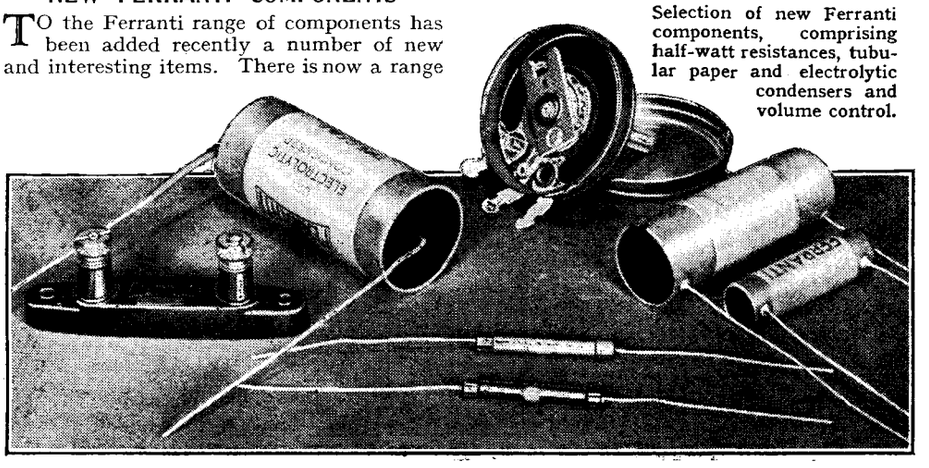
An alternative style embodying the same resistance element assembled in a neat bakelite holder with terminals is available at 1s. each. Several specimens of each pattern have been tested and found entirely satisfactory; the resistance was in every case within the maker's tolerance of ±5 per cent., and very little change in value occurs when loaded to the permissible maximum.

Very good agreement with marked values was found with the new tubular paper condensers. These are assembled in Pertinax tubes varying in dimensions from 1½in. × ⅞in. to 2⅛in. × 1in., the former housing the 0.01 mfd. size and the latter the 0.5 mfd. model. Many intermediate values are available, and prices range from 1s. 2d. each to 1s. 9d., according to capacity. Up to 0.02 mfd. the working voltage is 750 D.C., and above this 375 volts D.C., the test voltage being double these figures.

There is a series of dry electrolytic condensers in small Pertinax tubes fitted with wire ends. They are made in 25 and 50 mfds. sizes and for 25 and 50 volts peak working, the prices ranging from 2s. 6d. to 3s. each.

We were able to test, also, some specimens of the new Ferranti volume control, which has a graded composition-type resistance element and is housed in a metal case measuring 1⅝in. in diameter and only ½in. deep. The resistance is carefully adjusted, and it is perfectly silent in operation.

The element and the sliding contact are insulated from the case, and potentiometers from 50,000 ohms to one megohm are obtainable at 3s. 9d. each. They can be obtained fitted with a mains switch at 4s. 6d. each for all values. The makers are Ferranti, Ltd., Hollinwood, Lancs.

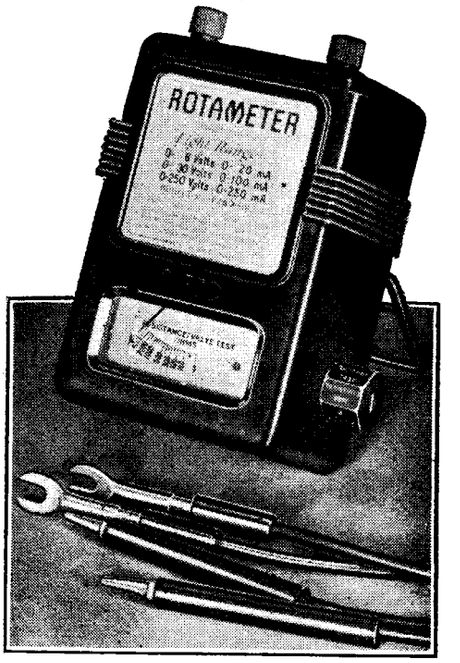


Selection of new Ferranti components, comprising half-watt resistances, tubular paper and electrolytic condensers and volume control.

PIFCO ROTAMETER

THIS instrument doubtlessly derives its description of Rotameter from the ingenious combined range switch and scale. The arrangement adopted certainly avoids confusion, as only the scale it is desired to use is visible.

The Rotameter is for D.C. measurements of voltage, current and resistance; it has eight ranges in all, three for voltage, three for current, one for resistance and provision for measuring the voltage of the internal battery. This is used for the resistance readings also when the instrument is employed for continuity testing and checking valve filaments, for which purpose a five-pin valve socket is let into the top.



Pifco eight-range Rotameter for D.C. measurements.

A barrel switch operated by a hexagonal knob on the side of the case selects the various ranges, and in its rotation it carries round the separate scales, bringing into view the one applying to the range in use.

The voltage ranges are 0-8, 0-30 and 0-250, while for current measurement the scales read 0-20 mA., 0-100 mA. and 0-250 mA. The resistance scale is calibrated up to 4,000 ohms, and this range is used for all continuity measurements.

A well-damped moving-iron movement is fitted, and the accuracy of the calibrations is as good as can be expected in view of the length of the scales, for these are only a shade over one inch long.

A reasonably close approximation to true values is, however, possible with this meter, but when measuring the voltage of dry batteries "snap" readings should be taken, as a current of 20 mA. is required for a full scale deflection. On the voltage ranges the resistance is, therefore, 50 ohms per volt.

It is made by Provincial Incandescent Fittings Co., Ltd., Pifco House, High Street, Manchester, and the price is 29s. 6d.