HOW TO MAKE
AN EXPERIMENTER'S
SUPERSONIC HETERODYNE
RECEIVER
by
G. P. KENDALL, B.Sc.
The Balkite Battery Charger has no valves or moving parts

The Balkite Battery Charger enables one to charge accumulators from alternating current in the most convenient manner possible. It has no valves or moving parts and is absolutely noiseless in operation. There is nothing to adjust or get out of order. The Balkite Charger contains a small transformer and a special rectifying cell. When the alternating current passes through, both half cycles are converted into direct current for charging the accumulator. The cell contains a rare metal called Balkite, specially produced for use in the Charger. When this cell is filled with ordinary accumulator acid the Charger is ready for use and needs no further attention except the periodical addition of a little distilled water.

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## Contents

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>An Experimenter's Supersonic Receiver</td>
<td>291</td>
</tr>
<tr>
<td>By G. P. Kendall, B.Sc.</td>
<td></td>
</tr>
<tr>
<td>The Eclipse and Radio Reception</td>
<td>297</td>
</tr>
<tr>
<td>By G. A. B. Rowe</td>
<td></td>
</tr>
<tr>
<td>In Pursang</td>
<td>300</td>
</tr>
<tr>
<td>A Drawing-Room Two-Valve Receiver</td>
<td>302</td>
</tr>
<tr>
<td>By John Underdown</td>
<td></td>
</tr>
<tr>
<td>A Chat with the New Constructor</td>
<td>307</td>
</tr>
<tr>
<td>By Percy W. Harris, M.I.E.E.</td>
<td></td>
</tr>
<tr>
<td>A Split Secondary Tuner for the Experimenter</td>
<td>310</td>
</tr>
<tr>
<td>By John W. Barber</td>
<td></td>
</tr>
<tr>
<td>Regular Programmes from Continental Broadcasting Stations</td>
<td>317</td>
</tr>
<tr>
<td>By Captain L. F. Plavon, B.Sc., F.R.A.S., F.I.Met.S.</td>
<td></td>
</tr>
<tr>
<td>The &quot;General Purpose Three&quot;</td>
<td>330</td>
</tr>
<tr>
<td>By A. Johnson-Randall</td>
<td></td>
</tr>
<tr>
<td>Regular Programmes from American Broadcasting Stations</td>
<td>341</td>
</tr>
<tr>
<td>A Crystal Set for Comparative Tests</td>
<td>348</td>
</tr>
<tr>
<td>By A. S. Clark</td>
<td></td>
</tr>
<tr>
<td>Trouble Corner</td>
<td>364</td>
</tr>
<tr>
<td>Using the Potentiometer</td>
<td></td>
</tr>
<tr>
<td>By H. W. Hal lows, M.A.</td>
<td>370</td>
</tr>
<tr>
<td>A Simple Selective Set</td>
<td></td>
</tr>
<tr>
<td>By A. D. Cowper, M.Sc.</td>
<td></td>
</tr>
<tr>
<td>Tested by Ourselves</td>
<td>378</td>
</tr>
</tbody>
</table>

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- For making short wave coils with minimum dielectric losses. Former is 31 in. in diameter, 6 in. long, with holes and soldering lugs on each end and bracket for fixing. Constructed of grade "A" Ebonite and lacquered brass.
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- Minimum capacity theoretically zero. Low losses make high efficiency in tuning neutralizing circuits. One screw fixing with 1 hole for spindle.
- Price 2/7

VALVE WINDOWS.

- Heavily nickel plated, with rounded beard, back plate, gauze and all nuts and bolts.
- A handsome finish to any set.
- Price each 6d.
I have not been given as much space as I would like in order to tell you about the merits of Resistance-Capacity Coupling. There are, perhaps, two reasons for this—namely, because I must not weary you, and because space costs money. You must therefore excuse me if these notes lack literary style.

The meaning of distortion in relation to Broadcast is now understood by the time one leaves ones "prep." school. When we say that distortion is present, we mean that the reproduction differs from the original in some way—that is to say, some quality is lacking, or some undesired vibration has been added unintentionally.

How, then, can we ensure faithful reproduction? It is well worth striving after.

There are three main things which can influence "quality"; they are:
1. The valves you use.
2. The voltages you use.
3. The inter-valve coupling you use.

These are all important, but perhaps the last needs most care.

The purpose of any form of inter-valve coupling is to apply fluctuating voltages to the grid of one valve by virtue of the fluctuations of current in the anode circuit of the valve before it.

An inter-valve coupling is a good one, if, amongst other things—
1. The output voltage is truly proportional to the input current;
2. The output voltage for a given input current is the same whatever the audible frequency.

Now it happens that the only way of obtaining fluctuating voltages from fluctuations of current is by passing the latter through something which impedes its flow.

We call such a thing an "impedance."

There are three things which have "impedance"—namely, an inductance, a capacity, and a resistance.

The impedance of an inductance is proportional to the frequency—it is therefore unwise to use a choke or transformer for inter-valve coupling.

The impedance of a condenser is inversely proportional to the frequency; therefore it would be unwise to use the voltage drop across a condenser, even if a practical arrangement of this kind existed.

The impedance of a resistance is constant for all frequencies, and therefore it is pre-eminent the thing to use for valve coupling.

The impedance of the wire resistance in an R.C.C. unit has a variation of less than 1 per cent. over the frequency range of 100-10,000 cycles per second.

R.C.C. units therefore fulfill in a remarkably efficient way conditions (1) and (2) above.
An Experimenter's Supersonic Receiver

By G. P. KENDALL, B.Sc., Staff Editor.

Although this installation is primarily designed to permit experimental work to be performed upon the super-heterodyne circuit, it gives all the extraordinary results characteristic of a good supersonic receiver. The article, the first section of which appears in this issue, will be found of value to all interested in these circuits, since it deals in a general manner with the practical side of their design and operation.

The title of this article is intended to convey that the instrument which we shall be considering is not to be regarded as a receiving set specially designed to enable one to switch on, adjust a few dials, and enjoy the programme from certain stations. Actually, the set is intended to provide an extremely flexible super-heterodyne equipment, so arranged as to permit of the carrying out of a great deal of experimental work upon the super-heterodyne circuit, with the minimum of actual reconstruction at each change. I have therefore proceeded upon very different lines from those which would have been followed by the designer of an instrument which was to form a receiving set with a more or less fixed arrangement, as the reader will observe when we come to consider the various units of which the equipment is composed, in detail.

The Need for Experiment

Now, experiment is certainly much needed in the super-heterodyne field, since although the circuits are in quite common use in America, and they appear to be of fairly satisfactory design in that country, it by no means follows that these designs can be copied by the British experimenter with any reasonable chance of success, since they almost all of them call for special components which are not available in this country, and many are designed to suit special types of valves with characteristics which cannot be matched among those on the British market. The first experimental work may be largely a repetition of that which has already been done in the United States, but it must not be considered a waste of time for that reason, since success with the super-heterodyne depends to quite a considerable extent upon a choice of suitable components, in providing suitable means of overcoming practical difficulties, and so on.

The Crucial Points

Some of the most important points on which experiment is called for in the supersonic circuit are these: there is first the question of the method to be adopted in converting our short wave signals to their long wave equivalent; and a variety of methods offer themselves here, such as the original method, using a completely separate oscillator valve to provide the local high-frequency current to heterodyne the incoming signals, while numerous attempts have been made to combine the functions of the oscillator and first detector valve. This latter is a somewhat difficult undertaking, but quite good results have been obtained, and, of course, one eliminates in this way one of the valves of the receiver. The next important point to which attention should be devoted is the appliance commonly called "the intermediate frequency filter, which constitutes the coupling between the "frequency converting" part of the circuit and the intermediate frequency or long wave amplifier.

The intermediate frequency amplifier itself presents a number of problems, the actual choice of intervalve coupling having the most important bearing upon the quality of the results which you will obtain, and there is here a most fruitful
field for experiment. At the present moment, no doubt, it may be argued that there are no suitable intervalve couplings on the market, but one of reasonable effectiveness can be improvised with little trouble, and provided that it is possible to make easy comparison, there is no very great difficulty in persuading the intermediate frequency amplifier to give the desired degree of selectivity and amplification. An extremely vexed question is involved in the use of a stage of high frequency amplification at the fundamental signal frequency, that is to say, in front of the first detector valve, and it is desirable to be able to remove this valve from circuit at will, since in my own experience this valve is desirable or not very largely according to the arrangements of aerial and earth which are in use at the time, and according to the particular leanings of the user.

The Circuit

A simplified form of the circuit of the apparatus under consideration is given in Fig. 3, and it will be seen that it gives a form of the "Tropadyn" arrangement, which I have found reasonably successful, and apparently very suitable for general experiments in superheterodyne reception. It is advisable to go through this circuit in some detail.

It will be seen that we have first a tuned aerial circuit consisting of the condenser $C_1$ and coil $L_1$, to which is attached an earth connection and a small aerial of some sort. Across this circuit is connected in the ordinary way a high-frequency amplifying valve $V_1$, whose grid potential is controlled by means of a potentiometer, and in whose anode circuit is the primary of the high-frequency transformer $T_1$, tuned by the condenser $C_2$. This transformer is of the ordinary plug-in variety, any of the standard

Fig. 3.—A simplified diagram of the apparatus, omitting various details. A full diagram will accompany a later section of this article.
makes being suitable, and the amplified output from its secondary is applied to the first detector valve, which also performs the function of the local oscillator, so that in its anode circuit beats are produced corresponding to the desired long wavelength which is to be handed on to the intermediate frequency amplifier, which consists of the valves $V_3$, $V_4$, $V_5$, and the second detector $V_6$.

The combined detector and oscillator valve $V_5$ has a tuned grid circuit $L_5C_5$, which is kept in a state of continuous oscillation by the reaction coil $L_4$, which is coupled to it in the ordinary manner, and these local oscillations are tuned to such a frequency as will produce the desired high-frequency beats which may correspond to a long wavelength of the order of from 3,000 to 10,000 metres, according to the requirements of the moment. The connections to this tuned grid circuit should be noted with care, since they constitute the important feature of the "Tropodyne" arrangement, which enables one to use a grid circuit tuned in to some wavelength quite close to that being received, without upsetting the tuning of the preceding circuits, and without any appreciable back transference of this energy to those circuits.

**Use of Centre Tapping**

This is achieved by taking the lead from the secondary of the transformer $T_1$ to the centre point of the winding $L_5$, it being claimed by the originator of this circuit that a nodal point is easily located, such that no potential differences between this point and the filament circuit are set up by the continuous oscillations, so that
Fig. 6.—This view shows how the sub-panel is arranged. The connections to the left hand vernier are optional.

there is no tendency for energy to be transferred back to the preceding circuit. Certainly, with the aid of a few tappings, and the variable gridleak $R_5$, a balance can be obtained which enables the circuit to function quite successfully. The inductance $L_5$ will, of course, consist of a coil which would normally be of the correct size for a tuned anode circuit to cover the broadcast band, while the condenser $C_5$ and the leak $R_5$ may have fairly conventional values.

The Filter
In the anode circuit of this first detector valve $V_1$, we have the long wave filter, which consists of the fixed condenser $C_5$ and the coil $L_5$, which together give the wavelength, to which we desire to alter the frequency of the incoming signals, and coupled to this coil is a secondary winding $L_4$ which transfers the long wave signals which are built up in the primary winding to the grid and filament of the first of the intermediate frequency amplifying valves, this being designated $V_2$ upon the diagram. The long wave signals thus transferred to the intermediate frequency amplifier pass through the three successive stages of amplification, and are finally rectified by the valve $V_3$, in whose anode circuit the telephones are shown. This completes the actual equipment now under description, but, of course, a suitable low-frequency amplifier can be added to enable a loud-speaker to be worked.

Turning now to the actual apparatus employed, it will be observed from the photographs that there are three distinct sections and these are, upon the left, a standard type of tuner, this being the instrument which I described in the September issue, then a two-valve unit which contains the first high-frequency valve (which operates at the frequency of the incoming signal), and the "Tropadyn frequency converting" valve, and then in the next unit the three intermediate frequency amplifiers and the second detector. This third unit is the "Experimenter's High-frequency Amplifier" which I described in the February issue.

The Tuner
The tuner employed may be of any good standard type, and it is not necessary to use the somewhat complicated instrument shown, and anyone who desires to try this complete receiver without going to the trouble of making up such a tuner is well advised to use a separate panel containing merely a two-coil holder and a single variable condenser, with terminals upon the left for aerial and earth, and upon the right for the leads to the grid and filament of the first high-frequency valve, and above these a pair which may go to the moving coil socket for reaction purposes under certain special conditions which we shall consider later.

The components which will be required are as follows:
1 Cabinet (Scientific Appliances).
1 Ebonite panel, 7½ in. by 9 in. by 1 in.

Fig. 7.—The drilling and wiring of the coil-holder panel.
Referring back to the photograph, Fig. 1, it will be seen that this centre unit contains the first high-frequency valve and the first detector with the necessary filament rheostats for those valves, and also a potentiometer to control the grid potential of the first high-frequency valve, with the necessary plug-in high-frequency transformer and its primary around the edges of the panel for cross connections between the tuner upon the left, and the intermediate frequency amplifier on the right, and the coil holder upon the top.

The coil holder itself is mounted upon a small separate panel of ebonite, whose dimensions are given in another diagram, this little panel being let into the top of the cabinet, a suitable piece of wood being cut out beneath by means of a keyhole saw. The connections from the coil holder are brought out to four Clix which

![Diagram](image_url)

**Fig. 8.—The connections on the under-side of the sub-panel next to the back of the main panel are shown dotted. The connections to the potentiometer should be made before the sub-panel is attached. Those of the jack are similar to those given on page 8 of the February issue.**

Blue Print No.108b.

1. "Single filament" jack (Burne-Jones).
2. 19 Clix sockets.
4. 1 -0.005 µF fixed condenser (Dubilier).
5. 1 -0.005 µF fixed condenser (Edison Bell).
6. 2 Pairs of coil pin and socket mountings.
7. 2 Pairs of clips for McMichael clip-in condensers.

The connections being made between these four Clix and those upon the upper edge of the oscillator unit panel by means of flexible links with Clix upon their ends.

Along the upper edge of the oscillator unit will be seen a row of five Clix sockets, and of these the right-hand pair are for the connections to the grid coil of the oscillator circuit, namely L₂; while the left-hand pair are for the reaction coil L₄. The centre one is for the connection which goes

1 or more McMichael clip-in condensers (see text).

One set Radio Press Panel Transfers.

...
to the centre tapping upon the grid coil \( L_4 \), as will perhaps be seen after inspection of Fig. 1. The right-hand variable condenser controls the tuning of the circuit \( L_5 C_6 \), that is to say, it governs the frequency of the locally generated oscillations, and it is by its means that one adjusts the frequency of the beats produced, that is to say, the wavelength to which the short-wave signals are converted so that they may be transferred by the filter circuit to the intermediate frequency amplifier. In parallel with this condenser \( C_6 \) is a small vernier condenser, whose handle may be seen immediately above, and this I have found most necessary.

The Second Vernier

Immediately above the other condenser will be seen the handle of a similar vernier condenser, and the use of this is optional. The tuning of the primary circuit of the high-frequency transformer \( T_2 \) is usually by no means critical, but a vernier across the condenser \( C_5 \) may be found useful in some cases. Alternatively, it may be used to produce reaction by being connected directly between the plate and grid of the valve \( V_2 \), as shown in dotted lines upon the wiring diagram. Whether it is necessary in this position or not will depend to a considerable extent upon the aerial used, and upon the very small aerals which are commonly employed, it is quite unnecessary, since the valve \( V_2 \) oscillates freely when the potentiometer is turned towards the negative end, a convenient control of reaction being obtained in this way.

The Sub-panel

Upon turning to the photograph showing the inside of this unit, it will be seen that besides the components whose controlling knobs or dials were seen on the face of the panel there is the filter circuit, already referred to, and this is mounted upon a small sub-panel whose dimensions and drilling points are indicated in a further small diagram. Upon this sub-panel there are two pairs of plug and socket mountings for a couple of plug-in coils, these being lettered to indicate that they are to carry the inductances \( L_s \) and \( L_7 \), and also two pairs of clips for McMichael clip-in fixed condensers. These are the condensers \( C_5 \) and \( C_6 \), and their position in the circuit will be seen by referring to Fig. 3. \( C_6 \) it will be observed, is merely in parallel with the primary inductance \( L_7 \), to adjust this circuit to the desired wavelength, the power to select any given wavelength, within certain limits, by inserting a suitable condenser being most valuable.

A Coupling Condenser

The other condenser \( C_7 \) is not always necessary, and when it is used it occupies the position shown dotted in Fig. 3, that is to say, between the plate end of the coil \( L_7 \), and the grid end of the coil \( L_6 \). Its chief effect is to tighten the coupling between the two windings, and whether it will be necessary or not appears to depend largely upon the type of coil used for the coupling, and this matter should be decided by experiment. Since some of the wiring of this dummy panel is below and some of it above the surface of the panel itself, I found it convenient to insert four brass screws, a, b, c, d, through the panel, locking them with nuts above the panel, and certain of the connections are soldered to the heads of these screws, while the leads from the panel to other parts of the circuit are taken from their upper ends.

Upon the wiring diagram it will be observed that the wires beneath this dummy panel are shown dotted, while the full lines denote that the wires are carried above the panel. To take an example, it will be seen that the first wire from the screw which secures the upper clip for the condenser \( C_7 \) is taken across and soldered to the head of the screw \( a \), and then further to the pin of the mounting for the coil \( L_7 \). This wire runs beneath the sub-panel, while the connection from the screw \( a \) to the Clix socket \( G \) is taken above the sub-panel. This, no doubt, will be quite clear when the actual wiring is undertaken, although it may appear a little complicated upon the diagram itself.

The Filter Coils

The actual pair of coils which I commonly employ for the long wave filter are a couple of Gambrell H coils which, with a fixed condenser of 0.001 microfarad in parallel with the primary coil, give a wavelength which I find to be extremely convenient in practice. This wavelength I believe to be in the neighbourhood of 2,500 metres, and I use it merely because it is one which is singularly free from long wave morse signals, so that the intermediate frequency amplifier can even be made to oscillate without giving any audible interference, a most valuable state of affairs when it is desired to receive continuous wave signals on the short waves.

The remainder of the construction of the unit itself appears to be quite straightforward, the only point which perhaps calls for mention being the method of mounting the condenser \( C_9 \), this being held in mid-air, as it were, by the two stiff connections which are soldered to its tags from the upper socket of the H.F. transformer \( T_2 \), and from the Clix socket No. 3, respectively.

The reaction coil \( L_4 \) may be any standard plug-in type of coil of moderate size, such as a No. 35 of the numbered types, a Burndeat S3, or a Gambrell A. The coil with the centre tapping is obviously the most critical component in this part of the circuit, and I have tried a variety of arrangements here with varying success. A decidedly good effect can be obtained by locating a centre tapping upon one of the standard Burndeat Concert coils, the \( S_4 \) being suitable for covering the lower part of the 300-500 metre band, the \( S_5 \) covering the whole band fairly comfortably with the -000314F variable condenser \( C_5 \) which is provided. The making of a centre tapping upon these coils, it must be confessed, is by no means an easy task for the average constructor, and for myself I nearly developed a permanent squint when trying to count accurately the turns of the enamelled wire employed for the \( S_5 \) coil in order to locate the centre, and I strongly advise anyone else to wind a special coil. This is the more desirable, in view of the fact that the electrical centre may not necessarily be the numerical centre turn, and several tappings are desirable in order that the electrical centre may be found by experiment.

The remainder of this article will appear in our next issue, and will contain details of the centertapped coil, instructions for operating the set, etc.
A graphical record of the variations in reception due to the eclipse. The top curve was taken on a wavelength of 380 metres and the bottom one on 75 metres.

The Eclipse and Radio Reception

By G. A. B. Rowe.

Some data concerning the effect of the recent eclipse upon the reception of wireless signals.

The 24th day of January, 1925, was a date anxiously awaited by scientists in the northern portion of the United States. Formerly the passage of the moon across the sun had been of interest only to astronomers, but this year it was determined to ascertain what effect the sudden darkness would have upon wireless waves.

It was known that wireless broadcast signals generally became much stronger at nightfall. It was possible to get some idea of how wireless waves travelled by noticing how much stronger they became by night and the extent to which the signals "faded" in and out. It was also possible from such observations to get information as to whether wireless waves travelled along the ground exclusively as "ground waves," or whether they also travelled in part far overhead (as "sky waves").

Some scientists think there is good reason to believe that the wave received during darkness for the most part travels at a height of 50 to 75 miles overhead, being reflected back to the ground eventually by a conducting layer of air at that height, known as the Heaviside layer.

To study this effect, both the transmitting stations and the receiving equipment should be in approximately the same straight line running perpendicular to the direction of the shadow of the eclipse. This is so that the degree of the eclipse will be the same at both places at the same time. Also suitable instruments for recording the atmospheric conditions, the power used in transmitting and the condition of the waves as they are received should be provided, in order that any changes in reception may be accounted for.

In New York City, where the
eclipse was total, exhaustive tests were conducted in the laboratory of the Radio Corporation of America. Instruments for recording the amount of "fading" or "swinging" were installed and observations were taken on two wave-lengths from 6:30 a.m. until 11 a.m. for two days before and after the eclipse. Two Super-Heterodyne sets were tuned to signals being broadcast by station WGY and experimental station 2XI, at Schenectady, N.Y., a distance of approximately 160 miles from New York City. Station WGY broadcast on a-wave-length of 380 metres and station 2XI sent out signals on a wave-length of 75 metres. The reason for recording a short wave was because this was expected to be reflected more strongly by the shadow wall.

Explanation of Terms Used

It is well known that at night particularly, and over certain distances of 100 miles or more, the received signals are not steady. They will be loud for one moment and then gradually diminish in strength, returning after a while to their original strength. This is called "swinging" or "fading" of the signal and, of course, produces unpleasant reception effects. The usual wave-lengths used in broadcasting—that is, from 220 to 550 metres—do not show much daylight fading effect, although in the early morning hours there is some fading even on these wave-lengths. The shorter waves, those below 100 metres, do show considerable fading effect over certain distances of transmission by daylight.

It is also well known to wireless listeners that there is a marked difference between daytime and night-time strength of signals. The average signal strength at night on the normal broadcasting waves is much greater than the day signals over any considerable distance. On some of the shorter wavelengths the reverse is the case.

Results of the Eclipse Tests

The following results are more or less preliminary and tentative. They are all subject to later modification, to careful checking of the transmitting and receiving equipment, to make sure that the operation of these devices was constant and correct throughout the tests. It was found during the five days of the observations that the 380-metre wave was swinging rather badly at sunrise and that the swinging gradually diminished, the signal becoming steady, as the sun rose higher. As a general rule, the signal became practically steady between 1 hour and 2 hours after sunrise. The more severe the fading at sunrise, the longer the fading lasted into the daylight hours. Furthermore, the more severe the swinging at sunrise, the more rapid the fading of the signal from loud signals to weak signals and back again.

During the totality of the eclipse it appeared to cause a reduction of swinging of the signals. However, the reduction of swinging apparently caused by the eclipse was not nearly so great a reduction as occurs between night-time conditions and full day-time conditions. That is, the eclipse did not change swinging nearly so much as does full sunlight. While the above effects were noted, the eclipse did not affect the average signal strength at all. This, during the period of the eclipse, was about the same as it would be in full daylight. During the period of totality it was noticed that atmospherics, which were present before this period, were lessened to a great extent.

Observations on the 75-metre wave during the five days when readings were taken showed that over the distance of 160 miles between Schenectady and New York, this wave had very marked swinging every day, and became weaker towards the middle of the
April, 1925

...day, although it never disappeared for more than a second or two, except during the eclipse period. During the entire period of partial and total eclipse, this wave disappeared altogether. In other words, this short wave is very sensitive to the sunlight conditions on the path over which it travels, and even the partial darkness of the eclipse was apparently sufficient to prevent it from travelling between the transmitting and receiving stations. It was heard loudly before and after the eclipse period.

Conclusions

So far as any general conclusions can be given at this time, it may be said that for transmission over this distance, the normal broadcasting waves were not affected in their average strength by the eclipse, but the swinging was somewhat reduced during the period, thus steadying the wave. The short wave of 75 metres was greatly reduced in intensity during the eclipse; these waves are much more sensitive to changes in illumination of their path than are the longer, normal broadcasting waves. The choice of wave-lengths between 220 and 550 metres for broadcasting appears to be a fortunate one, and these waves seem on the whole to be the most acceptable for broadcasting purposes. Broadcast listeners need not, therefore, be concerned about any more desirable range of wave-lengths being found for broadcasting than those to which their receivers can now tune, at least so far as the eclipse experiments indicate.

Other interesting effects were observed in the reception of signals transmitted from England on a wave-length of 12,500 metres. These signals were also observed for two days before and after the day of the eclipse. There were two stations in America that were taking readings on these long wave signals, one at Riverhead, Long Island, which was in the path of totality, and the other station was located at Belfast, Maine, which was not in the path of totality. The readings of signal strength that were taken were automatically recorded.

The signal behaviour up to a few minutes before totality was the same as on the previous two days. There was a sharp drop of strength just after dawn and then the usual day-time diminution. However, just before totality there was another sharp drop in strength which lasted until after the moon had begun its journey off the face of the sun. Then the conditions were approximately the same until the time that the sun was eclipsed to its maximum value in England. At that time there was again a dip in the signal strength curve.

The signals that were recorded at Belfast, Maine, were of a different character in that there was no sharp diminution of strength at the time that the sun was totally eclipsed at the same longitude as the receiving station. However, when the sun had been eclipsed at the transmitting station in England a drop in strength was noted.

Just what these sudden drops in strength mean is impossible to say at the present time, because there has not been sufficient time as yet to check all the data, conditions, etc. The only conclusions so far reached are that the sun has a definite effect on wireless waves. Just what wave-lengths are affected and in what degree is as yet undetermined. As we have mentioned above, these results are preliminary and are merely the effects observed.

Another view of the special apparatus used by Mr. T. Parkinson at the Bureau of Standards.
Unkind

I have been more than pained to read recently a great deal of unkind criticism levelled against the quality of the B.B.C. programmes which you and I pick up on those nights when Radiating Rupert and others of his kidney are kind enough to allow us to do so. I gather somehow that many people are dissatisfied particularly with the topical tales. Now this is the part of each evening programme which I love above all others. It fills me with the most intense joy to hear Sir Augustus Blandford drizzling about pigs, Mr. Elihu Spooner giving his little heart-to-heart talk on how cheese is made, or Professor Binkowski meandering on the subject of wool dyeing. Once the topical talker gets into his stride I close my eyes and lie back in my chair with a little happy sigh. I am happy because I can tell by his voice that he is infinitely more bored than I am. I picture him standing before the microphone with one eye upon his manuscript and the other upon the clock, praying to heaven that his allotted span of twenty minutes may pass quickly.

Reality

I know precisely what happens to him. When the idea of broadcasting was first mooted he was thrilled with the idea of speaking to a vast unseen audience. He probably felt goosey all over at the thought that his words would be heard not only in Wolverhampton and Wigan and Lerwick and Little Puddleton, but also in Brussels and Paris and possibly Puxtryvmsko. He saw himself scintillating before the microphone, he imagined the joy that he would bring into a myriad homes by his bright and pithy discourse. And then the poor fellow was brought down to earth for the first time with a resounding bump. He was asked to submit his paper typewritten for approval. It is one thing to let yourself go naturally and quite another to put down your most brilliant saffies in black and white upon paper. It is still another thing when your manuscript comes back with requests for the alteration of certain passages. By the time that the once enthusiastic broadcaster comes to take his stand before the microphone all the stuffing has been knocked out of him and he is very far indeed from scintillating.

One eye on the clock.

Wonderful

Personally I think that a testimonial signed by all wireless folk should be sent to the B.B.C. to compliment them upon their amazing skill in picking out the dullest subjects and the dreariest talkers that the world has ever known. Do not misunderstand me. I am not throwing bricks. I am handing out compliments as hard as I can. I delight in being bored via the wireless set, simply because I know that I can end the ordeal at any moment by a single flick of a switch. Also I like being talked to sleep, and I look forward with enormous pleasure to the little nap in which I indulge each evening thanks to the topical talker. But for him I might suffer agonies from insomnia between dinner-time and bedtime. As it is, I wake at the end of the talk thoroughly refreshed and quite ready to enjoy programmes from the Continent as soon as our own stations have closed down. Whenever I meet a friend who is looking tired and haggard I ask him, "Who's been missing his topical talk?" and once I have shown him the error of his ways he promises never again to omit the little nightly dose. If only the B.B.C. would engage topical talkers up to the present standard to broadcast nightly from one to two "akemma," I am sure that they would earn the undying gratitude of all confirmed insomniacs.

More Injustice

Then there is the question of the concert party. It appears that quite a number of people strongly object to the elegant form of humour which is broadcast whenever these people are in possession of the studio, largely on the grounds that their jokes are stale. This, I think, is a most reprehensible attitude. Being myself a Conservative to the marrow, I am all in favour of the preservation of ancient institutions. To me it seems that the concert party is doing great and noble work in keeping alive a tradition which might otherwise die. But for them all the fine old English jokes about kippers, mothers-in-law, seaside lodgings and Scotsmen might fall into oblivion. No, I would not have the concert party removed from the programmes for worlds. To me they are one of the most precious links with the past that I possess. I love the wobbly and rather strident voices of the sopranos, the nasal tenors and the grunting baritones, for they take one back to the days before the war when music halls were music halls and not palaces of revue. Hot-headed youth may complain that the humour lacks freshness, that the music is not
Musical, that the dialogue is rot; but to an old buffer of thirty something the wireless concert party comes like a fragrant breeze from an almost forgotten past. My own memories of pre-war days are still pretty distinct, and there is therefore no need for me to listen to the concert party. It is for this reason alone that I switch off when it comes along, but I trust that my younger friends listen earnestly to it, for as they would too morris dancers or old English ballads, for there is nothing quite like it for giving them an insight into the entertainments of many years ago.

More Carping

I am sorry to say there are those who complain that there is too much simultaneous broadcasting. "Why," they say, "should Glasgow or Belfast or Newcastle be compelled to listen willy-nilly to the London programmes? Are these stations incapable of producing something that is entirely their own? And why should London humbly compete? Why should not Birmingham be simultaneously broadcast two or three nights a week? Birmingham, after all, is somewhere near the middle of the country, whilst London is a mere dot somewhere near the south-east corner. My friends, my friends, do not let your local enthusiasm run away with you. It would never do to turn ZY on to S.B., for it is well known that what Manchester thinks to-day London thinks to-morrow, and one simply could not force the pace of thought in this way. The only way out of this difficulty would be for Manchester to S.B. its yesterday's programme the day after to-morrow. But this is only one side of the question. There is another which is far more important; you must not forget that the B.B.C. realises its enormous potentials as an educational factor. Thanks largely to the fact that London is responsible for the lion's share of simultaneous broadcasting, the country at large is beginning to speak Standard English. If we were to turn the Northern stations loose, goodness only knows what would happen. Glasgow, for example, would possibly lead us so far astray that before we knew where we were we might be talking "Stalnog," or English Local requires no words of mine to point out what the results might be.

In Praise of S.B.

As for me, I have nothing but praise for the system of simultaneous broadcasting. What I mean is this. Just as I am settling down to a peaceful evening after dinner there is a ring at the front-door bell and some fellow is shown in who at once expresses a desire to hear all the broadcasting stations one by one. Provided that it turns out to be an evening when S.B. is in progress I can do the trick without the slightest difficulty. So selective is my set on these occasions that I can separate Cardiff from London, London from Manchester, Manchester from Bournemouth, or Glasgow from Belfast. I simply say, "Oh, certainly, delighted," and twiddle the knobs. The tune that we were hearing before now comes in at rather smaller strength. "London S.B. from Manchester," I say with a smile. "Let us see if we can get him a little better." I improve the strength. "Not bad for Manchester," I say. I make a fresh adjustment. "London S.B. from Bournemouth. Perhaps we can get him rather more strongly." We do; and we get all the rest at splendid strength without any trouble at all. "Of course," I say, as the friend listens, usually very much impressed, but occasionally wobble, if alleged tenors sound as sopranos and contraltos bleat and nasal catarrh combined with an effort to swallow a large potato, you will cease to grouse even if you have heard "In a Monastery Garden" so often that even you pay your respects to it. You might even point to it as a pity that there was nothing but S.B. to-night. Still, you heard the other stations at the strength that they usually come in at on my set. It just shows what a sensitive and selective receiving set can do, does it not? Come round another evening when they are all doing different programmes and let us see what we can make of them then." If the said friend turns up on an evening when S.B. is not in progress it is a most extraordinary thing that my accumulator is invariably on its last legs.

Wireless concert parties.

"In a Monastery Garden."

Jazz

Others again are those who run down our admirable programmes by asserting that we have too much jazz. Here, I think, the criticism is most unjust. I welcome jazz for two reasons. In the first place, being without tunes and consisting mainly of a sustained cacophony, it assists enormously in testing out the low frequency part of the set for distortion. The set which will make this kind of thing sound melodious must be indeed as much above suspicion as was Caesar's wife. My second reason is that it is just as helpful as is other S.B. on those nights when a friend who wants too much pays you a visit. In the ordinary way when stations close down at half-past ten he might reasonably ask you to let him hear Bremen and Madrid and Rome and all kinds of other places like that. Provided that jazz is doing its worst you are perfectly safe, for you have merely to point out that as our own stations occupy the entire band between 303 and 495, there is quite impossible to tune in the foreigners. "If," you say, "it were a question of the main stations alone, matters would be quite easy; but with these innumerable relays on all kinds of odd wavelengths it is really a matter of impossibility to pick up Continental stations. Come round, my dear fellow, on some night when there is no jazz and you shall hear just what you like from abroad." If he does come you can either work the accumulator stout already described or so your one remaining battery with a little shrug of the shoulders and a despairing wave of the hands.

Just Praise

I think that I have said sufficient to show it is quite true that the B.C. programmes as we have them at present are in every way satisfactory, and I hope that in future you will cease to grouse even if sopranos and contraltos bleat and wobble, if alleged tenors sound as though they were suffering from nasal catarrh combined with an effort to swallow a large potato, if you have heard "In a Monastery Garden" so often that even you can play it with one finger, and if the organ at 2, Savoy Hill does sound like an asthmatic concertina. Before you start to grouse remember that good programmes cost money and that the Company's income is still well under half a million a year.

The Listener-In.
The receiver itself presents a distinguished appearance. On the right is seen the "on and off" switch.

Simplicity and reliability without any sacrifice in efficiency, and a handsome, unobtrusive appearance compatible with the surroundings of a home, are the dominant features of the family receiver about to be described. Coils and valves are enclosed and out of harm's way, whilst once tuned the mere movement of a switch will give the programme from a station—a desirable feature where the set is to be left for the members of the family who do not feel competent to tune even a simple set. Tuning is simplicity itself, one control alone serving to change the wavelength, whilst signal strength may be improved and tuning sharpened by the use of carefully applied reaction, if required. For finer tuning on distant stations a vernier condenser is included. Provision is made for the use of bright or dull emitter valves and separate high-tension and grid bias, so that valves may work under their best conditions for maximum signal strength combined with good reproduction.

The Circuit
The circuit is that of a detector valve using a direct coupled aerial circuit with reaction on it, followed by an efficient stage of transformer coupled low-frequency amplification. Although so simple an arrangement, it is one favoured both by the novice and the long distance worker alike, being frequently used by certain record breaking amateurs noted for their short wave reception. This arrangement is equally suitable for short and long wave working.

Theoretical Arrangement
Referring to the theoretical circuit of Fig. 1, it will be seen that either constant aerial tuning with its consequent advantages of improved selectivity and the fact that a given coil will cover a much greater range which can be predicted with a fair degree of accuracy on aerials of widely differing characteristics, or plain parallel tuning may be used by connecting the aerial to the terminal marked "Aerial" or A respectively. The aerial coil L1 is tuned by the parallel condenser C1 of 0.0005 µF, whilst the vernier condenser serves for fine tuning on distant stations. Rectification is effected by the usual leaky grid condenser method, the usual values of 0.003 µF and 2 megohms being used for the condenser and leak. In the plate circuit of the detector valve V1 are the reaction coil L2, coupled to the aerial coil to give magnetic reaction, and also the primary of the low-frequency transformer, from the O.P. of which a tapping is taken to the H.T. + terminal to provide a separate supply for this valve. The secondary of the L.F. transformer is connected in the grid circuit of V2, and provision is made for grid bias by the small battery G.B. The telephones are in the plate circuit of V2, and from one side of these the second tapping is taken to feed this second valve with the necessary high-tension supply. Anticipating a query here, the + telephone terminal is that from which the tapping is taken to the high-tension battery. This will hold good for any set. Two filament rheostats are used, and the switch S in the + filament lead serves to put the set in and out of action.

The Cabinet
From the photographs it will be seen that the set is enclosed in a type of cabinet very popular on account of its neat and convenient form. By lifting the lid either constant aerial tuning with its consequent advantages of improved selectivity and the fact that a given coil will cover a much greater range which can be predicted with a fair degree of accuracy on aerials of widely differing characteristics, or plain parallel tuning may be used by connecting the aerial to the terminal marked "Aerial" or A respectively. The aerial coil L1 is tuned by the parallel condenser C1 of 0.0005 µF, whilst the vernier condenser serves for fine tuning on distant stations. Rectification is effected by the usual leaky grid condenser method, the usual values of 0.003 µF and 2 megohms being used for the condenser and leak. In the plate circuit of the detector valve V1 are the reaction coil L2, coupled to the aerial coil to give magnetic reaction, and also the primary of the low-frequency transformer, from the O.P. of which a tapping is taken to the H.T. + terminal to provide a separate supply for this valve. The secondary of the L.F. transformer is connected in the grid circuit of V2, and provision is made for grid bias by the small battery G.B. The telephones are in the plate circuit of V2, and from one side of these the second tapping is taken to feed this second valve with the necessary high-tension supply. Anticipating a query here, the + telephone terminal is that from which the tapping is taken to the high-tension battery. This will hold good for any set. Two filament rheostats are used, and the switch S in the + filament lead serves to put the set in and out of action.

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A simple and reliable receiver utilising a circuit effective alike for loudspeaker work near a broadcasting station, and for telephone reception at greater distances.

There is ample clearance behind the panel for even the largest coils.

Panel Arrangement

The panel is of polished ebonite, and with nickelled terminals and valve windows, has a handsome appearance. All the controls are on the front of the panel, the aerial tuning condenser being on the left, and directly above it the associated vernier; the reaction control is in the centre of the panel, and the two filament rheostats are to either side of this latter. Only five terminals appear on the panel, these being the two aerial and earth terminals on the left, and those for telephones or loudspeaker to the right. These are the only terminals in the set; the expedient of taking the battery leads direct to their respective batteries being adopted, thus simplifying construction and wiring.

General Layout

At first reviewing the size of the panel, this seems rather large for a 2-valve set, but will be found necessary in order comfortably to accommodate the coils behind the panel. Sufficient room has been allowed to use the largest plug-in types of well-known makes and at the same time permit of easily interchanging these. Simplicity has been carefully studied in the behind-panel layout, and a minimum of constructional work will be required. The transformer, valve-holders, the grid condenser, and that of 0.002 μF used as the by-pass across the primary of the former are mounted direct on to the wooden sub-base, so that no valve platform is necessary. To allow of the use of dull emitter valves, some types of which are inclined to be microphonic "Antiphonic" valve-holders have been used. Where bright emitters or others proved not to have this drawback are used, these may of course be substituted for if desired.

Components Required

To build the set the following components are required. Makers' names are given so that if desired an exact copy of the set may be made. Although it is obviously not necessary to use the same makes, it should be borne in mind that the arrangement given is of proved success, and if you are in any doubt you will be well advised to adhere to the components used.

1. Radion black panel, 16 in. by 8 in. by 3/16 in. thick. (American Hard Rubber Co.)
2. Cabinet to take the above panel, with a wooden sub-base 16 in. by 7 in. by 3/4 in. thick. (Carrington Manufacturing Co.)
3. 0.005 μF Square Law condenser. (Bower-Lowe Co.)
4. Colvern vernier condenser. (Collinson's Precision Screw Co., Ltd.)
5. Behind-panel type of coil-holder. (Peto-Scott, Ltd.)
6. Dual filament rheostats and Anti-phonic valve-holders. (Burndy.)
7. Connecticut "On and Off" switch. (R. A. Rothermel, Ltd.)
8. 1st stage L.F. transformer. (Gambrell Bros., Ltd.)
9. Fixed condensers type 600 and of 0.002, 0.003 and 0.001 μF. (Dubilier.)
10. Grid leak of 2 megohms. (Dubilier.)
11. A length of heavy black and red-covered twin flex. (Any good electrician will supply this.)
12. Nickel-plated terminals. (Burne-Jones, Ltd.)
13. Nickel-plated valve windows. (Bower-Lowe Co., Ltd.)
14. Quantity of 6-gauge tinned copper wire and soldering tags.
15. Grid bias battery of suitable voltage for the valves used.
That shown is by the Ever-Ready Co., and has a value of 6 volts tapped at 1½ volt steps.

Packet of Radio Press panel transfers.

Drilling the Panel

The panel may be readily set out and drilled by consulting the front of panel diagram of Fig. 2. With the original set, the lines on which the various components have their centres were made by using an ordinary carpenter's gauge and a square. With the condenser and filament resistances templates are supplied, so that no difficulty should be experienced with these. The valve windows are the only problem which may present any difficulty, but if the centres are first drilled with a drill of about the size used for drilling the clearance holes for the terminals, the necessary holes may readily be made by using the ordinary 1 in. carpenter's bit and brace. Drilling should be effected in this case by first drilling from one side of the panel and finishing the hole from the other side, thus making a clean and finished job. With the polished panel mentioned previously the components may now be mounted, but should unguaranteed ebonite be used it will be necessary to remove the surface skin by rubbing with emery cloth.

Assembling

First fix the valve windows to the panel and then the rheostats and terminals, after which the most convenient step is to mount the .0005 condenser and the vernier, finally completing this part of the construction with the 2-coil holder. It now remains to screw the
Fig. 3.—The wiring diagram, Blue Print No. 106b. Note that no terminals are provided on the panel for battery leads. Flexible connections are used instead.

Wiring

Before screwing the panel to the baseboard a number of wires may be soldered into position on both sides of the panel, etc., should be carefully cleaned, preferably with a small smooth file, and carefully tinned, when no difficulty should be experienced in making good connections. A really hot iron should be used and then the connections may be made quickly before nuts become loosened, as usually happens if too cool an iron is employed. A minimum of flux should be used and care taken to remove any surplus which may have spluttered on to the panel. Where leads are taken under screws, such as on the rheostats, switch and coil-holder, a convenient method is to use some form of small soldering tags, which can be obtained from any good wireless shop. The panel and baseboard when wired as far as possible are fixed together by three ¼ in. wood screws, no bracket being necessary since when inserted into the cabinet the panel will be held rigidly in position by two further screws, one on each side of the panel, which go into the fillets on the side of the cabinet. For the sake of rigidity a conveniently sized piece of ½ in. wood may be placed under the side of the coil-holder furthest from the panel to give support to the coil-holder whilst the coils are being inserted. This should be secured in position during assembly. To hold the grid battery in position a clip can be made out of any convenient piece of thin metal, as seen in the photographs. This should not be fixed until the battery is obtained, but can then be placed to hold the battery against the case. The C.A.T. condenser is held in position by its leads, thus obviating marring the appearance of the panel by using two screws.

Leads to Batteries

To simplify construction the usual terminal strip for H.T. and L.T. leads has been omitted, and these taken direct from the appropriate parts of the circuit. Heavy red and black twin flex has been
used for the L.T. supply, the length of leads being determined by the position in which the battery is to be placed; the same holds for the H.T. leads, which are of V.I.R. flex ended by battery plugs or Clix. These are all brought out together through a convenient hole in the back of the cabinet. Before leaving the set these leads are taken un楼宇 a small strip of fibre or other insulating material held firmly in position by two small screws. Anticipating a further possible query here, the fact that these leads are bunched together is in no wise detrimental to efficiency, since these are all at earth potential as far as radio frequency currents are concerned, and any capacity introduced does not lead to instability.

Testing
On completion of the wiring the set should be tested. First connect the L.T. battery in circuit and insert a valve in the first valve socket with the switch in the "On" position, but the rheostats off. Now slowly rotate the rheostat, noting that the valve lights correctly. The same test should be carried out with the second valve. Satisfied that the filament leads are correctly wired, insert a No. 50 coil in the grid circuit, that is, in the fixed block, and a No. 50 in the moving or reaction socket, and connect the high-tension battery in circuit. For a preliminary test the same H.T. may be used for both valves by plugging H.T. plug into the minus of the H.T. battery, and the two + plugs into a + socket of a suitable voltage for the valves you are using. Generally a value of 60 volts will be satisfactory for bright emitter valves. Grid bias may be short-circuited during this test by plugging one G.B. Clix into the other. Now connect aerial to the "Aerial" terminal and earth to "Earth" and phones between the terminals TEL. With the coils well open rotate the aerial condenser till signals are heard, and then bring the reaction towards the aerial coil, returning slightly on the aerial condenser. Signal strength should improve and tuning become sharper as this is done till finally, it carned too far, the set oscillates. Previous to this a rushing noise will be heard in the "phones. Do not work the set up to this point or quality will suffer, and you will tend to spoil reception for your neighbours.

Coils and Valves to Use
For the 300 to 500 metre band a No. 50 will usually be satisfactory, using C.A.T., or with plain parallel tuning with the aerial connected to A, a No. 35 and 50 will be necessary. For reception a No. 50 or 75 is required. For 5XX and Radiola a 150, using the A₁, aerial connection, will be necessary for the aerial circuit, and a 100 for reaction.

Any general purpose valves of good make will be suitable for both positions, and the makers' instructions as to H.T. and grid bias should be observed. For loud-speaker work an excellent arrangement is that of a general purpose valve followed by a power valve of the dull emitter type now becoming so popular.

The above photograph shows the new wireless station which is being erected outside Tangier, Morocco. A single-wire aerial will be employed.

Results
Tested at 12 miles S.E. of 2LO on quite an average aerial, loud-speaker strength was obtained from that station, using a bright emitter as a detector with 60 volts H.T., followed by a B₄ with 100 volts H.T. and about 45 volts grid bias; reaction demands were but slight and excellent quality resulted. 5XX also gave excellent loud-speaker results. On "phones the majority of B.B.C. stations have all been well received. On the very short wavelengths of 100 metres and below, by twisting five turns round the aerial coil, giving an aperiodic aerial circuit, a number of stations were received at fair telephone strength, a concert in French coming in well, after 11 p.m. For this range a Gambrell "a" was used for the aerial coil and an "a" for reaction. Under favourable conditions several of the American broadcast stations have been received at fair phone strength, among those identified being WGY and WBZ. The set is easy to handle and can be well recommended for loud-speaker work within a radius of 10 miles from a main station, though under favourable conditions this may be considerably extended, and for telephone reception at much greater distances.

The May issue of the "Wireless Constructor" will contain full details of How to make an efficient Portable Three-Valve Receiver, by Percy W. Harris, M.I.R.E. Order your copy now.
This issue of Modern Wireless will fall into the hands of many people who, for some reason or other, are just contemplating building their own wireless apparatus, and are wondering just how to set about it. I know from experience just how these affairs start. A general and wide interest in broadcasting and a vague intention of "fixing up a set at home" is suddenly crystallised into a definite desire owing to a visit to a friend's house for some special event, such as the recent Tetrazzini broadcast from the London station. In such cases the programme is usually excellent, very well reproduced, and the host for the evening is naturally anxious to point out that the set is "home constructed" at a cost which, to the uninitiated, seems surprisingly low.

Home Construction
At first it seems a rather formidable task to set about building your own apparatus. Quite likely you belong to that numerous class of people which is quite willing to admit that it knows nothing of electricity, has never done any soldering, and is not "mechanically inclined." Yet there is such a big difference between the cost of a properly constructed commercial set and that of a home-built piece of apparatus that it does really seem worth while to try and build a set for oneself.

Labour Costs
In passing, it is only fair to point out that the big difference referred to does not by any means represent an exorbitant profit on the part of the commercial manufacturer of wireless sets. The amateur and experimenter are apt to overlook the fact that in estimating the cost of a home-built set no allowance whatever is generally made for the time of the home builder. I came across a case the other day which

Illustrated this point very well. A young man pointed out with justifiable pride that his excellent set had cost him but twelve pounds, whereas a similar set commercially cost more than twice that figure. The set was built entirely in his spare time in the evening, and it is probable that the equivalent of at least ten full evenings was spent at the work. These evenings did not run consecutively, for on the alternate nights he was working at his office. In a subsequent discussion regarding pay, he pointed out that for this "overtime" he was paid at the rate of time-and-a-half, and he thought that evening work after normal hours should be paid at a higher rate than this.

"If you had been working at the office on those evenings when you were making your set," I asked him, "how much would you have earned at the time-and-a-half rate?"

"About seven pounds ten shillings," he answered.

"If you had been making wireless sets for your firm," I said, "instead of doing clerical work, that seven pounds ten shillings would have to be added to the cost of the material, while a further sum, probably much more than you would imagine, would have had to be added for establishment charges."

How to Start
There is no need to labour this point. It should be evident to every thinking person that the saving of the labour costs is bound to reduce the cost of production very considerably, and as many people are quite willing to spend their spare time in assembling a set, the popularity of home
construction can be well understood.

It is not generally the cost which worries the beginner, but just how to set about building the apparatus. The purpose of this article is to indicate how to make this start, and, after all, a good start is half of the battle.

Commence with a Simple Set

First of all, you must make sure that you really know what you want. You can have anything from a crystal set to a elaborate multi-valve receiver capable of doing all kinds of wonderful things in skilled hands. Unfortunately many beginners, in an excess of zeal, launch out upon the construction of a set both expensive and difficult to manipulate, and when, on completion of the set, they fail to get satisfactory results—or even any results at all—they blame the set, the components, or the paper from which they have taken the design. The position is much the same with cameras. Often you must have noticed that the new photographer purchases a half-guinea camera and takes a number of excellent snapshots. After a few weeks he tires of the limitations of this type of camera and buys an elaborate instrument with a large aperture, anastigmat lens, high-speed focal plane shutter, and goodness knows what else besides. To his intense annoyance the family with one voice points out that the results are nothing like so good as he obtained with the cheaper camera, and whatever did he want to spend all that money for? With cameras, elaborate and simple, the position is the same as with wireless sets. An elaborate instrument needs skilled handling and more knowledge than the beginner possesses. If you are just embarking upon wireless as a hobby and are not acquainted with the handling of multi-valve sets, fight the temptation to build a five or six-valve receiver, and, at least for the time being, concentrate on something simpler.

The Humble Crystal Set

The simplest of all to build and by far the cheapest in maintenance costs, as well as in first costs, is the humble crystal set. Do not turn up your nose at the crystal receiver, if you have been accustomed to listening to valve sets. If you are content to listen to the nearest station, and this happens to be within a dozen miles of your home, and, furthermore, you have facilities to erect an average outdoor aerial, then the crystal receiver properly made, with good quality headphones, gives all the strength you want in two or three pairs of headphones. If you choose one of the modern, permanent or semipermanent crystal detectors, such as have been described recently in MODERN WIRELESS, Wireless Weekly and the Wireless Constructor, you will find that the bugbear of most crystal sets—the need of constant adjustment of the crystal—will be removed. There are no accumulators to buy, no high-tension batteries and no expensive valves. Tested designs for building crystal receivers are published from time to time in MODERN WIRELESS.

In addition to the detector, while distant stations are brought in clearer if one or more stages of high-frequency precede the detector. What the Radio Press sets will do is always clearly set out in the descriptions published with them, so I need not go into such details here.

Conclusion

A point which needs making perfectly clear to the beginner is that the man who is “always building wireless sets” is not necessarily extravagant. The hobby of wireless is so intensely fascinating that thousands of people are in the habit of building and re-building their receivers from time to time as new designs come out and new improvements are introduced. Fortunately, practically all of the component parts of a set built to one design can be used on further designs, the chief changes being in wiring and panel layout. Note, too, that there are certain expenses in connection with valve sets which only occur once. For example, whatever set you build the same telephones will do and the same loud-speaker. If your accumulator is of reasonable size for, say, a two-valve set, you will have no difficulty in working a four-valve set from the same accumulator, although, of course, if the valves are of the bright-emitter type, or of fairly high efficiency...
consumption, the charge in the accumulator will last for a much shorter period. A high-tension battery suitable for a single valve set will be equally suitable for anything up to a three-valve receiver, while if you build a four or five-valved set, the single receiver high-tension battery can be used in conjunction with others, and thus is not wasted. Similarly, the valve you use in a single set will be sure to find a place in the multi-valve, and as the same aerial and earth are used, the same telephones or loud-speaker, the same valves (with perhaps the addition of one or two more), and as probably nine-tenths of the components of your first set will find a place in the new design, it is not to be wondered at that embarking upon making of a new receiver is not the expensive business which it might at first appear to be. In fact, it frequently happens that quite a modern receiver can be made out of an old set with no more expense than the cost of a new battery panel.

Of course, it is hardly necessary to point out that until you are thoroughly experienced and really competent to design your own receiver, the only safe way is to pick a reliable design and make it as closely as possible to the author's instructions. All the sets described in Radio Press publications (Modern Wireless, Wireless Weekly, the Wireless Constructor, Radio Press books, Envelopes and Panel Cards) are designed by experts, and are tried and tested. Every one of them was built and tested out in practical working conditions before any description appeared.

Finally, and even at the risk of boring you, I must repeat the advice which has been so frequently given in these pages—do not try to economise by buying cheap components of unknown manufacture. In no other business is it so easy to make shoddy and worthless apparatus look presentable as in the wireless trade. Remember, too, that British components are unsurpassed in quality by any of foreign origin.

Some Readers' Results with Radio Press Sets

The Seven-Valve T.A.T.

Sir,—I have much pleasure in sending you a photograph of the seven valve T.A.T. (described by Mr. John Scott-Taggart in the January Modern Wireless) as promised. I am well satisfied with the circuit, and using four valves I get great volume. When I use more than that the set is more selective, but, like your correspondent who constructed the eight-valve set, I feel there is room for an improvement in selectivity. The special American transmission, two Sundays ago, came through very well, if you can make any use of photo I shall be very happy. Meanwhile, I remain an interested experimenter.

Wishing your circuits every success,—Yours truly, H. A. CASTLE.

High Wycombe.

The Single-Valve Receiver for KDKA

Sir,—I constructed the Single-Valve Receiver for KDKA, described by Mr. Stanley G. Rattee in the MODERN WIRELESS for March, during the week-end, and on Tuesday evening was able to receive KDKA from 11.15—12.12, at good phone strength and without the usual firework display which we get through the B.B.C. I heard the following items announced and played:—The Lotus Flower, "Springtime Serenade," and finally "Musical Melange," by special request. These items were relayed from the Pittsburgh Athletic Association dinner-room and played by Gregorio Calgo's Orchestra. The announcer then said, "That concludes the dinner hour programme from etc.

Mr. H. A. Castle's Seven-Valve T.A.T. Receiver.

Radio Press books, Envelopes and Panel Cards) are designed by experts, and are tried and tested. Every one of them was built and tested out in practical working conditions before any description appeared.

Some Readers' Results with Radio Press Sets

The "Transatlantic Four"

Sir,—I think it may interest you to know the results I have obtained from my Transatlantic four-valve set, described by Mr. Percy Harris in Modern Wireless, November, 1924. I can receive all B.B.C. main stations and several relay stations at full loud-speaker strength, also many of the Continental stations on loud-speaker. On February 4, 1925, from 1.30 a.m. till 3 a.m. I received three American stations on a small indoor cage aerial made by myself.

The stations were WBZ, KDKA and WGY.

With outside aerial I have received KDKA, WBZ and WGY on the loud-speaker, which could be heard in any room of the house. I think this set is wonderful for long-distance work.

—Yours truly,

CHAS. A. BAXTER.

Waterbeach, Cambs.
A Split-Secondary Tuner for the Experimenter

By JOHN W. BARBER.

An instrument which is designed for the experimenter who is constantly changing his circuits.

The completed tuner, showing the split-secondary circuit (Fig. 7) in use.

To the man who is engaged in trying out many different forms of circuits, whether as complete receivers or as board experiments, some standard form of tuning arrangement is a necessity. By this means experiments are considerably facilitated, and if the tuner employed is capable of modification, by means of switches, nothing need be sacrificed for the sake of convenience.

Conditions Necessary

The majority of receivers employed at the present time embody a conventional tuning system, whether directly or loosely coupled, and it would appear a waste of valuable time to rebuild this part of the set for each new circuit tried. Given, then, a well-designed tuner, experiments are greatly facilitated, for all that is necessary is to join up the necessary high-frequency amplifiers, detector, low-frequency valves, and so on.

The conditions such a tuner would have to comply with are quite simple; in most cases direct or loose coupling alone would suffice, with provisions for series or parallel connection of the aerial tuning condenser, for earthing the lower end of the secondary circuit, and for direct or reversed reaction. These provisions will, in general, suffice, but here we come up against a point which needs some modification, on the score of ease of operation. In a tuner such as that outlined above, it becomes obvious that the reaction coil may either be coupled to the aerial coil or the secondary or closed circuit inductance. In the latter case, it will be seen that, once the reaction coil has been coupled to the secondary coil in such a manner as to give the best results, any variation in coupling between the aerial and secondary coils will immediately render a resetting of the reaction coupling necessary. If the reaction coil is so adjusted that the set is just off the point of self-oscillation, the effect of loosening the coupling between the aerial and secondary coils will result in an immediate tendency, on the part of the set, to "flop" over into oscillation. Although these conditions may, by skilled handling, be avoided (by, for example, slackening coupling between reaction and secondary, etc.),...
With most receivers the tuner is incorporated in the set itself, and it is necessary to reconstruct when a change in circuits is desired. The tuner described in this article can, however, be attached to any receiver and enables a variety of circuits to be used by a simple arrangement of switches.

and aerial and secondary, coils simultaneously) they constitute an obstacle in the path of speedy work.

Split-Secondary

The method of overcoming this difficulty is by employing a circuit known as the "split-secondary," in which the secondary coil is, as the name implies, divided into two portions, one of which is coupled to the aerial coil, the other forming the inductance to which the reaction coil is coupled. In this way the settings of aerial and reaction coils are independent of one another, while a marked increase in selectivity is obtainable.

Several points in the design of such a tuner face one when considering the construction. Firstly, the change-over from one circuit to another must be simple, no complicated evolutions of changing wires and so on being permitted.

A full-face view of the tuner with the coils removed.

Coupling between coils must be easily varied, some form of long operating handle being preferable. The coupling between the coils must be capable of being reduced to the fullest extent, in order that the full benefits of loose-coupling may be obtained.

Again, important leads must be kept short, those in the aerial and grid circuits demanding most careful attention. Leads on the earth side may, without detriment to the efficiency of the tuner, be left longer, especially if a greater spacing be thereby obtained. It is also essential that insulation should be of a high standard of quality, indicating careful choice of the ebonite panel. It is also desirable that the tuning condensers be in such a position that they may be adjusted without capacity effects being produced, due to the proximity of the operator's hands.

The instrument to be described, was designed to fulfil these requirements, and has been in use at the writer's station for some six months, having given satisfactory service during that period.

Constructional Details

For the benefit of those desiring to construct a standard instrument along the lines of that described, a list of the necessary components is given, together with makers' names, which latter are, however, only intended to serve as a guide, there being no obligation to adhere strictly to the specification.

Firstly, we shall require an ebonite panel of good quality, 10 in. by 9 in. by ¾ in. being a suitable size. Great care should be taken over the ebonite, to ensure freedom from surface leakage, and thus the best only should be used. It is highly desirable to take great
Fig. 3.—The simplest circuit. care of the minute currents flowing in this part of the receiver, any leakage here being detrimental to the operation of the remainder of the set. Some suitable form of cabinet will be necessary, that used being of the sloping front type made by the Carrington Manufacturing Co.

Components
2 Two-way coil holders (Magnum).
2 Square Law condensers, 0,0005 \(\mu\)F (Bowyer-Lowe).
2 Double - pole double - throw switches.

Layout of the Panel
The panel layout is very simple, a dimensioned drawing being given to assist in the construction. If desired, change-over switches of the "Utility" or similar design may be used, in which case holes will be drilled to suit the needs of the particular component employed. Drilling templates are supplied with the variable condensers, so that nothing further need be said regarding this section of the work. Wiring is carried out with square-section tinned copper wire, and should be carefully soldered at the necessary places. The wiring diagram given makes all connections perfectly clear, and when used in conjunction with the back - of - panel photograph, no difficulty should be experienced. When completed, the tuner may be placed in the cabinet and secured by screws if necessary, when the instrument will be ready for use.

Switching
The circuit diagram of the tuner itself is given in Fig. 2, which clearly shows the operation of the various switches. The left-hand change-over switch on the front of the panel serves to place the aerial tuning condenser \(C_1\) in series or parallel with the aerial coil. The other change-over switch effects the change from direct to loose coupling, and is, in effect, a "tune-stand-by" switch. On the "tune" side, i.e., employing loose coupling, \(L_1\) is the aerial coil, \(L_2\) the part of the secondary coupled to it, while \(L_3\) is the other part of the secondary coupled to the reaction coil \(L_4\). The single-pole switch \(S_1\) enables the lower end of the secondary circuit to be earthed.

On longer waves a variable condenser, somewhat larger than that provided in the aerial circuit, may be desirable, in which case switch \(S_2\) is moved to the "on" position.

Fig. 4.—Useful for long waves.

"Stand-by"
On the "stand-by" side, \(L_4\) is cut out of circuit, the erstwhile secondary coils now becoming the aerial coils. Switch \(S_1\) shorts-circuits the part \(L_1\) of the "secondary," leaving \(L_2\) alone in the aerial circuit now, with \(L_4\) coupled to it for reaction effects. In this case, switch \(S_2\) will throw the variable condenser \(C_2\) out of circuit, as the coil \(L_3\) is already in series or parallel, as the case may be, with the condenser \(C_1\). This particular form of switching is rendered necessary in order that reaction may be used on a direct-coupled circuit, the only disadvantage, a small one, being that it is necessary, when changing over from tune to stand-by, or vice versa, to change the coil \(L_3\).

A Simple Circuit
Fig. 3 shows the simplest circuit possible, being a direct-coupled circuit with parallel condenser, and reaction. The necessary combination of switches is: Series-parallel switch to the right, other switch to the right. \(S_1\) "on," i.e., shorting \(L_1\); \(S_2\) "off"; \(S_3\) may be ignored for obvious reasons.

On longer waves a variable condenser, somewhat larger than that provided in the aerial circuit, may be desirable, in which case switch \(S_4\) is moved to the "on" position.
Fig. 9.—A useful aperiodic circuit.

position, thus placing $C_2$ in parallel with the coil $L_1$. We now have the two 0.0005 μF condensers in parallel with this coil, giving a maximum capacity of 0.001 μF. This is shown in Fig. 4.

Series Tuning

Still using direct coupling, the aerial condenser may be placed in series with $L_1$, by simply changing over the "S.P." switch to the left, $S_2$ being off, and the other switches as above. This circuit is suitable for short-wave reception, and is shown in Fig. 5.

By simply placing the switch $S_2$ in the "on" position, we now obtain the circuit shown in Fig. 6, which may be considered as a circuit employing constant aerial tuning, if the series condenser is set at a low value.

Coupled Circuits

Coming now to the loosely-coupled circuits, Fig. 7 shows the simple split-secondary circuit, $C_1$ being in parallel with $L_1$, the aerial coil, coupled to which is $L_2$, while $L_3$, now in the secondary circuit, is coupled to $L_1$. To obtain this circuit, the S.P. switch is placed to the right, the tune-stand-by switch being to the left. $S_4$ is off, $S_2$ being on. The lower end of the secondary winding may be earthed by placing $S_3$ in the on position, plugged into socket $L_4$, reaction being obtained as before. Aerial and earth leads are joined to appropriate terminals on, or leads from, the special coil. If desired to earth the now secondary coil $L_2$, place $S_2$ in the on position and take a wire from terminal E of the tuner to earth.

A Specially Selective Circuit

By using an aperiodic coil such as mentioned above, a very selective circuit may be obtained, and is shown in Fig. 10. Switching arrangements are parallel, tune, $S_2$ off, $S_4$ on, $S_3$ on. The special aperiodic coil is plugged into the aerial socket $L_4$, suitable coils being placed in the other sockets, as described later. In Fig. 10 L represents the small winding on the aerial coil $L_1$. The ends of the coil $L$ are joined to aerial and earth respectively, while the earth is also joined to the E terminal of the tuner, terminal A being left free. We thus have the aerial aperiodically coupled to a tuned circuit $L_1$, $C_1$, which, in turn, is coupled to the tuned circuit $L_2$, $L_3$, reaction being introduced by coupling $L_4$ to $L_5$. This circuit should certainly be tried by all who desire extreme selectivity, as it is truly remarkable in this respect.

Coils Needed

Some guidance as to the coils necessary for the split-secondary circuits will be needed, and a few details are given here.

For the broadcast band of wavelengths up to 500 metres the aerial coil may be a Gambrell A or B, coupled to a Gambrell B or C. The other half of the secondary may be a Gambrell "a" coil, while a reaction coil of suitable size may be chosen. In the numbered series of coils, $L_1$ may be a No. 35 or 50, $L_2$ a No. 50, $L_3$ a No. 25, a suitable reaction coil being again chosen.

In Burndept's range of coils, $S_2$, $S_3$, $S_4$, and $S_5$ may be used in the positions $L_5$, $L_5$, $L_5$, $L_5$, respectively. For reception of the long wave station, and as a rough guide for
Fig. 11.—If this wiring diagram be used in conjunction with the back-of-panel photograph given on the previous page, no difficulty will be encountered in wiring up the instrument. Full size Blue Print No. 105b may be obtained.

Elimination of High-Frequency Losses

With the extremely rapid growth of popularity of the short waves has come the necessity for the further reduction of high-frequency losses in apparatus such as variable condensers, valves and switches. Although the properties of these ultra short waves are as yet little known, much experimental work is being carried out in an endeavour to determine exactly the losses that are occasioned by stray capacities and the use of different dielectrics in coils and condensers.

The Wireless Weekly, in its usual manner of getting at the root of things, publishes the views of some well-known investigators upon this matter, and in the issue dated February 18th, Mr. Philip R. Coursey, B.Sc., F.Inst.P., A.M.I.E.E., contributed a particularly interesting and illuminating article on "Low-Loss Condensers," in which he discussed the use of small insulating bushes and metal ended variable condensers, and also gave some very practical information about the electric stress in the dielectric for rods of various substances, separated by various thicknesses of dielectric. In the issue dated February 25th, an American contributor, Mr. Sylvan Harris, expressed some further opinions which in view of Mr. Coursey's article makes very interesting reading when compared with the previous issue.

Another article of outstanding interest that has appeared recently in Wireless Weekly (March 11th) is one by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., entitled "Grid-Choke Rectification." In this Mr. Scott-Taggart describes a method of rectification whereby the usual gridleak is replaced by a choke, and his remarks open a new field of experiment for those who have not previously considered the possibility of such methods of detection.

For those who are interested in Reflex Circuits, there is an article of interest in Wireless Weekly, dated February 25th, written by Mr. John Scott-Taggart, in which he discusses upon the advantages and disadvantages of reflex working, besides making a prophecy as to the ultimate end to which dual receivers will come.

By far one of the most commendable new features incorporated in Wireless Weekly for some time is The Foreign Radio Times, which, besides giving the usual list of Continental and American stations whose wave-lengths are closest to that of London while the latter station is working, this principle has been very little used in this country, and quite deserves more attention, and I feel sure that once any prejudice is overcome, and a tuner built upon these lines, the advantages of "split-secondary" tuning will be realized and fully appreciated.

In conclusion, those requiring extremely flexible tuning arrangements are recommended to read the article on "Split Secondary Tuning" by Mr. Sylvan Harris, M.I.R.E., appearing in the issue dated February 18th.
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<td>Amsterdam</td>
<td>Stocks, Shares and News</td>
<td>10 mins.</td>
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<td>Market Prices</td>
<td>10 mins.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>6</td>
<td>9.55</td>
<td>Persbureau</td>
<td>PCFF 2125 m.</td>
<td>Amsterdam</td>
<td>Stocks, Shares and News</td>
<td>10 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>7</td>
<td>10.23</td>
<td>Vaz Dias</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>10.30</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>3 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>9</td>
<td>10.39</td>
<td>Lyons</td>
<td>YN 350 m.</td>
<td>France</td>
<td>Gramophone Records</td>
<td>30 mins.</td>
<td>700 Watts,</td>
</tr>
<tr>
<td>10</td>
<td>11.00</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in C.E.T. and Exc.</td>
<td>5 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>11</td>
<td>11.15</td>
<td>Radio Wien</td>
<td>—— 530 m.</td>
<td>Austria</td>
<td>Concert</td>
<td>12.50 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>12</td>
<td>11.30</td>
<td>Kiel</td>
<td>—— 555 m.</td>
<td>Silesia</td>
<td>Weather Report—Exchange Quotations</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>13</td>
<td>11.45</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>3 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>14</td>
<td>11.55</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Fish Market Quotations—Cotton Exchange</td>
<td>10 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>15</td>
<td>11.55</td>
<td>Frankfurt</td>
<td>—— 470 m.</td>
<td>Frankfurt</td>
<td>Time Signals in C.E.T. (spoken) followed by News</td>
<td>5 mins.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>noon</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>12.00</td>
<td>Leipzig</td>
<td>—— 451 m.</td>
<td>Germany</td>
<td>Concert</td>
<td>12.50 p.m.</td>
<td>700 Watts.</td>
</tr>
<tr>
<td>17</td>
<td>12.00</td>
<td>Zurich</td>
<td>—— 515 m.</td>
<td>Switzerland</td>
<td>Weather Report</td>
<td>5 mins.</td>
<td>300 Watts,</td>
</tr>
<tr>
<td>18</td>
<td>12.15</td>
<td>Persbureau</td>
<td>PCFF 2125 m.</td>
<td>Amsterdam</td>
<td>Stocks and Shares</td>
<td>8 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>19</td>
<td>12.15</td>
<td>Vaz Dias</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>12.30</td>
<td>Stockholm</td>
<td>—— 430 m.</td>
<td>Sweden</td>
<td>Exchange Opening Prices</td>
<td>5 mins.</td>
<td>300 Watts.</td>
</tr>
<tr>
<td>21</td>
<td>12.30</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clichy</td>
<td>Concert followed by News</td>
<td>2 p.m.</td>
<td>8 Kw.</td>
</tr>
<tr>
<td>22</td>
<td>12.45</td>
<td>Persbureau</td>
<td>PCFF 2125 m.</td>
<td>Amsterdam</td>
<td>Stocks and Shares</td>
<td>10 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>23</td>
<td>12.45</td>
<td>Vaz Dias</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>12.57</td>
<td>Nauan</td>
<td>POZ 3000 m.</td>
<td>Berlin</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>8 mins.</td>
<td>50 Kw.</td>
</tr>
<tr>
<td>25</td>
<td>13.00</td>
<td>Zurich</td>
<td>—— 515 m.</td>
<td>Switzerland</td>
<td>Weather Forecast, Shares, News</td>
<td>5 mins.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>26</td>
<td>13.00</td>
<td>Haaren</td>
<td>BAV 1100 m.</td>
<td>Brussel</td>
<td>Weather Forecast in French and English</td>
<td>8 mins.</td>
<td>150 Watts.</td>
</tr>
<tr>
<td>27</td>
<td>13.00</td>
<td>Geneva</td>
<td>HB 1100 m.</td>
<td>Switzerland</td>
<td>Lecture</td>
<td>1.45 p.m.</td>
<td>300 Watts.</td>
</tr>
<tr>
<td>28</td>
<td>13.00</td>
<td>Koln</td>
<td>—— 555 m.</td>
<td>Prague</td>
<td>Exchange Quotations</td>
<td>10 mins.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>30</td>
<td>13.00</td>
<td>Munch</td>
<td>—— 485 m.</td>
<td>Bavaria</td>
<td>News and Weather Report</td>
<td>10 mins.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>31</td>
<td>13.00</td>
<td>Komorow</td>
<td>—— 1800 m.</td>
<td>Czechoslovakia</td>
<td>Stock Exchange and Late News</td>
<td>10 mins.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>32</td>
<td>13.00</td>
<td>Vozdus</td>
<td>—— 430 m.</td>
<td>Berlin</td>
<td>Stock Exchange News</td>
<td>5 mins.</td>
<td>200 Watts.</td>
</tr>
<tr>
<td>33</td>
<td>13.00</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Exchange Opening Prices (Sat. excepted)</td>
<td>8 mins.</td>
<td>5 Kw.</td>
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</table>

**WEEK DAYS.**
<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>B.S.T.</th>
<th>Name of Station</th>
<th>Call Sign and Wave-length</th>
<th>Situation</th>
<th>Nature of Transmission</th>
<th>Closing Time or Approx. Duration</th>
<th>Approx. Power used</th>
</tr>
</thead>
<tbody>
<tr>
<td>181</td>
<td>3.00</td>
<td>Breslau</td>
<td>418 m.</td>
<td>Silesia</td>
<td>News &amp; Exchange Quotations</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>40</td>
<td>3.30</td>
<td>Munster</td>
<td>410 m.</td>
<td>Westphalia</td>
<td>Stocks, Shares and News</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>47</td>
<td>3.35</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Exchange Quotations (Sat. excepted)</td>
<td>5 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>38</td>
<td>3.40</td>
<td>Pershoreau Vaz Dias.</td>
<td>FCFF 2135 m.</td>
<td>Amsterdam</td>
<td>Stocks, Shares and News</td>
<td>10 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>48</td>
<td>3.55</td>
<td>Pershoreau Vaz Dias.</td>
<td>FCFF 2135 m.</td>
<td>Amsterdam</td>
<td>Stock Exchange and News</td>
<td>10 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>158</td>
<td>4.00</td>
<td>Zurich</td>
<td>515 m.</td>
<td>Switzerland</td>
<td>Hotel Baur au Lac Concert, Relayed.</td>
<td>6 p.m.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>202</td>
<td>4.00</td>
<td>Munster</td>
<td>410 m.</td>
<td>Westphalia</td>
<td>Concert</td>
<td>5 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>159</td>
<td>4.00</td>
<td>Radio-Wien</td>
<td>530 m.</td>
<td>Vienna</td>
<td>News followed by Concert</td>
<td>6 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>42</td>
<td>4.30</td>
<td>Frankfurt</td>
<td>470 m.</td>
<td>Germany</td>
<td>Light Orchestra</td>
<td>6 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>43</td>
<td>4.30</td>
<td>Konigsberg</td>
<td>463 m.</td>
<td>East Prussia</td>
<td>Light Orchestra (Wed. &amp; Sat., Children’s Hour)</td>
<td>6 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>44</td>
<td>4.30</td>
<td>Voxhaus</td>
<td>505 &amp; 430 m.</td>
<td>Berlin</td>
<td>Concert, followed by News</td>
<td>6 p.m.</td>
<td>700 Watts.</td>
</tr>
<tr>
<td>46</td>
<td>4.30</td>
<td>Leipzig</td>
<td>454 m.</td>
<td>Germany</td>
<td>Concert</td>
<td>6 p.m.</td>
<td>700 Watts.</td>
</tr>
<tr>
<td>51</td>
<td>4.30</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clechy</td>
<td>Concert preceded and followed by News</td>
<td>5.45 p.m.</td>
<td>8 Kw.</td>
</tr>
<tr>
<td>52</td>
<td>4.30</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Exchange Closing Prices (except Saturday)</td>
<td>8 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>160</td>
<td>5.00</td>
<td>Breslau</td>
<td>418 m.</td>
<td>Silesia</td>
<td>Light Orchestra</td>
<td>6 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>226</td>
<td>5.00</td>
<td>Stuttgart</td>
<td>443 m.</td>
<td>Wurttemberg</td>
<td>Concert</td>
<td>6.30 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>54</td>
<td>5.00</td>
<td>Radio-Belg.</td>
<td>SBR 265 m.</td>
<td>Brussels</td>
<td>Concert followed by News</td>
<td>5 p.m.</td>
<td>2.5 Kw.</td>
</tr>
<tr>
<td>186</td>
<td>6.00</td>
<td>Frankfurt</td>
<td>470 m.</td>
<td>Germany</td>
<td>Lectures</td>
<td>7.30 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>187</td>
<td>6.00</td>
<td>Hamburg</td>
<td>365 m.</td>
<td>Germany</td>
<td>Music or Lecture</td>
<td>7.30 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>162</td>
<td>6.00</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Concert followed by News Bulletin</td>
<td>6.35 p.m.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>177</td>
<td>6.00</td>
<td>Radio-Barcelona</td>
<td>EAJF 325 m.</td>
<td>Barcelona</td>
<td>Concert</td>
<td>7.00 p.m.</td>
<td>650 Watts.</td>
</tr>
<tr>
<td>161</td>
<td>6.30</td>
<td>Munich</td>
<td>485 m.</td>
<td>Bavaria</td>
<td>Light Orchestra or Lecture</td>
<td>7.30 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>230</td>
<td>7.00</td>
<td>Komarov</td>
<td>1890 m.</td>
<td>Czechoslovakia</td>
<td>Lecture or Concert</td>
<td>8 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>57</td>
<td>7.15</td>
<td>Kiel</td>
<td>555 m.</td>
<td>Prague</td>
<td>Lecture</td>
<td>20 min.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>63</td>
<td>7.30</td>
<td>Stuttgart</td>
<td>443 m.</td>
<td>Wurttemberg</td>
<td>Lecture followed by Evening Programme</td>
<td>11 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>164</td>
<td>7.30</td>
<td>Radiofonica</td>
<td>425 m.</td>
<td>Rome</td>
<td>Concert followed by News (Interval between 8.20 and 8.30)</td>
<td>6.30 p.m.</td>
<td>4 Kw.</td>
</tr>
<tr>
<td>58</td>
<td>8.00</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>General Weather Forecast</td>
<td>8 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>188</td>
<td>8.00</td>
<td>Frankfurt</td>
<td>470 m.</td>
<td>Germany</td>
<td>Lecture</td>
<td>8.30 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>61</td>
<td>8.00</td>
<td>Konigsberg</td>
<td>463 m.</td>
<td>East Prussia</td>
<td>Concert and News</td>
<td>10 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>62</td>
<td>8.00</td>
<td>Hamburg</td>
<td>395 m.</td>
<td>Germany</td>
<td>Concert and Late News and Dance Music</td>
<td>11 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>127</td>
<td>8.00</td>
<td>Kiel</td>
<td>555 m.</td>
<td>Prague</td>
<td>Evening Concert</td>
<td>10.30 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>74</td>
<td>8.15</td>
<td>Radio-Belg.</td>
<td>SBR 265 m.</td>
<td>Brussels</td>
<td>Concert preceded and followed by News</td>
<td>10.10 p.m.</td>
<td>2.5 Kw.</td>
</tr>
<tr>
<td>66</td>
<td>8.15</td>
<td>Lausanne</td>
<td>HB2 850 m.</td>
<td>Switzerland</td>
<td>Concert (Monday excepted)</td>
<td>10.30 p.m.</td>
<td>300 Watts.</td>
</tr>
<tr>
<td>64</td>
<td>8.15</td>
<td>Zurich</td>
<td>515 m.</td>
<td>Switzerland</td>
<td>Concert followed by Late News (3 days a week till 11.30 p.m.)</td>
<td>10 p.m.</td>
<td>300 Watts.</td>
</tr>
<tr>
<td>65</td>
<td>8.15</td>
<td>Leipzig</td>
<td>454 m.</td>
<td>Germany</td>
<td>Concert and News</td>
<td>10 p.m.</td>
<td>700 Watts.</td>
</tr>
<tr>
<td>67</td>
<td>8.30</td>
<td>Frankfurt</td>
<td>470 m.</td>
<td>Germany</td>
<td>Concert and News</td>
<td>11 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>59</td>
<td>8.30</td>
<td>Munster</td>
<td>410 m.</td>
<td>Westphalia</td>
<td>Concert followed by News</td>
<td>11 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>72</td>
<td>8.30</td>
<td>Voxhaus</td>
<td>430 m.</td>
<td>Berlin</td>
<td>Concert followed by News</td>
<td>10.45 p.m.</td>
<td>0.7 and 1.5 Kw.</td>
</tr>
<tr>
<td>73</td>
<td>8.30</td>
<td>Manich</td>
<td>485 m.</td>
<td>Bavaria</td>
<td>Concert and News</td>
<td>10 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>69</td>
<td>8.30</td>
<td>Breslau</td>
<td>416 m.</td>
<td>Silesia</td>
<td>Concert</td>
<td>10 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>75</td>
<td>8.30</td>
<td>Ecole Sup. des P. &amp; Tg.</td>
<td>PFTT 450 m.</td>
<td>Paris</td>
<td>Concert, sometimes preceded by Lecture, usually outside broadcast</td>
<td>9 p.m.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>60</td>
<td>8.30</td>
<td>Radio-Wien</td>
<td>530 m.</td>
<td>Vienna</td>
<td>Evening Programme</td>
<td>10 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>76</td>
<td>8.30</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clichy</td>
<td>Detailed News Bulletin</td>
<td>9 p.m.</td>
<td>8 Kw.</td>
</tr>
<tr>
<td>77</td>
<td>8.30</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clichy</td>
<td>Time Signal followed by Concert</td>
<td>5.30 p.m.</td>
<td>8 Kw.</td>
</tr>
<tr>
<td>78</td>
<td>9.00</td>
<td>Radio-Iberica</td>
<td>RI 392 m.</td>
<td>Madrid</td>
<td>Concert and Advertisements</td>
<td>Midnignt</td>
<td>3 Kw.</td>
</tr>
<tr>
<td>189</td>
<td>9.00</td>
<td>Radio-Barcelona</td>
<td>EAJF 325 m.</td>
<td>Barcelona</td>
<td>Concert</td>
<td>7.30 p.m.</td>
<td>650 Watts.</td>
</tr>
<tr>
<td>79</td>
<td>11.00</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Time Signal in Greenwich Sidereal Time (Spark)</td>
<td>5 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>80</td>
<td>11.10</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>General Weather Forecast</td>
<td>5 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>81</td>
<td>11.44</td>
<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>5 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>82</td>
<td>12.57</td>
<td>Nauen</td>
<td>POZ 3000 m.</td>
<td>Berlin</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>8 mins.</td>
<td>50 Kw.</td>
</tr>
</tbody>
</table>
Don’t cramp your tuning

With an ordinary condenser you can often get three stations with a degree of scale movement. Think of the pains-taking care necessary which short-wave work calls for with such a condenser, and how easy it is to miss those distant stations altogether.

The first time you use the LISSEN MARK 2 MICA VARIABLE CONDENSER you will appreciate its delightful control of tuning. In it you have a condenser which covers every capacity from a negligible minimum up to its conservatively rated maximum of .001. The economy and convenience of this condenser is worth noting therefore.

If you want to try a perfect CONDENSER, try the LISSEN MARK 2 MICA VARIABLE (patents pending).

LISSEN ONE HOLE FIXING, OF COURSE, Table or panel mounting, without alteration — 17/6

LISSENAGON “X” Coils

In addition to the well-known and standard Lissenagon Coils we have now introduced the Lissenagon “X” Coils. They are similar to standard Lissenagon Coils but have the addition of two tapping points brought out to easily accessible terminals on the coil mount. Used for aperiodic aerial tuning Lissenagon “X” Coils give very great selectivity, whilst reaction control is exceptionally smooth and much finer than is usually obtainable. Used in Neutrodyne Circuits, the high frequency amplification obtained, when using Lissenagon “X” Coils, is remarkably stable, the use of one or other of the tapping points having the effect of neutralising the grid-plate capacity of the valve.

Lissenagon “X” Coils are very highly efficient when used in the “Neutral Grid” Circuits described by Mr. Cowper.

The No. 60 Lissenagon “X” Coil is now available and covers all broadcast wavelengths whether used for aerial or anode circuit.

Price — — — 6/4

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<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>B. S. T.</th>
<th>Name of Station</th>
<th>Call Sign and Wave-length</th>
<th>Situation</th>
<th>Nature of Transmission</th>
<th>Closing Time or Approx. Duration</th>
<th>Approx. Power used.</th>
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<td>a.m.</td>
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<tr>
<td>83</td>
<td>8.30</td>
<td>Frankfurt</td>
<td>SF 650 m.</td>
<td>Germany</td>
<td>Morning Prayer</td>
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<td>85</td>
<td>9.00</td>
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<td>-</td>
<td>Germany</td>
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<td>Konigsberg</td>
<td>-</td>
<td>E. Prussia</td>
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<td>9.45 a.m.</td>
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<tr>
<td>213</td>
<td>9.00</td>
<td>Voxhaus</td>
<td>-</td>
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<tr>
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<td>9.40</td>
<td>Bloemendael</td>
<td>-</td>
<td>Holland</td>
<td>Divine Service</td>
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<td>1 Kw.</td>
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<tr>
<td>86</td>
<td>10.00</td>
<td>Komarow</td>
<td>-</td>
<td>Czechoslovakia</td>
<td>Sacred Concert</td>
<td>1 hour</td>
<td>1 Kw.</td>
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<tr>
<td>87</td>
<td>10.23</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in G.M.T.</td>
<td>3 mins.</td>
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<tr>
<td>93</td>
<td>10.30</td>
<td>Lyons</td>
<td>YN 550 m.</td>
<td>Paris</td>
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<td>5 mins.</td>
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<td>11.15</td>
<td>Hamburg</td>
<td>-</td>
<td>Vienna</td>
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<td>12.50 p.m.</td>
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<td>94</td>
<td>11.30</td>
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<td>-</td>
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<td>-</td>
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<td>1 Kw.</td>
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<td>Koningswusterhausen</td>
<td>-</td>
<td>Bavaria</td>
<td>Sacred Concert</td>
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<td>95</td>
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<td>Concert</td>
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<td>97</td>
<td>11.55</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Fish Market Quotations, followed by Weather Report</td>
<td>12 mns.</td>
<td>5 Kw.</td>
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<tr>
<td>214</td>
<td>12.00</td>
<td>Munster</td>
<td>-</td>
<td>Westphalia</td>
<td>Morning Prayer</td>
<td>1.30 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>98</td>
<td>12.00</td>
<td>Stockholm</td>
<td>-</td>
<td>Sweden</td>
<td>Service</td>
<td>1.15 p.m.</td>
<td>500 Watts</td>
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<td>102</td>
<td>12.45</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clichy</td>
<td>Concert followed by News</td>
<td>2.00 p.m.</td>
<td>8 Kw.</td>
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<tr>
<td>103</td>
<td>12.37</td>
<td>Nauen</td>
<td>POZ 3000 m.</td>
<td>Berlin</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>3 mins.</td>
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<tr>
<td>106</td>
<td>3.00</td>
<td>Lyngby</td>
<td>-</td>
<td>Germany</td>
<td>News</td>
<td>10 mns.</td>
<td>1 Kw.</td>
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<tr>
<td>108</td>
<td>4.00</td>
<td>Munich</td>
<td>-</td>
<td>Munich</td>
<td>Concert</td>
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<tr>
<td>214</td>
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<td>Munster</td>
<td>-</td>
<td>Munich</td>
<td>Concert</td>
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<td>1.5 Kw.</td>
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<tr>
<td>104</td>
<td>4.00</td>
<td>Breslau</td>
<td>-</td>
<td>Westphalia</td>
<td>Concert</td>
<td>5.00 p.m.</td>
<td>1 Kw.</td>
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<tr>
<td>104</td>
<td>4.00</td>
<td>Breslau</td>
<td>-</td>
<td>Silesia</td>
<td>Children's Stories</td>
<td>4.30 p.m.</td>
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<tr>
<td>104</td>
<td>4.00</td>
<td>Koningswusterhausen</td>
<td>-</td>
<td>Wurtemburg</td>
<td>Light Orchestra</td>
<td>6.00 p.m.</td>
<td>1 Kw.</td>
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<tr>
<td>107</td>
<td>4.00</td>
<td>Frankfurt</td>
<td>-</td>
<td>Germany</td>
<td>Concert</td>
<td>6.00 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>107</td>
<td>4.00</td>
<td>Frankfurt</td>
<td>-</td>
<td>Switzerland</td>
<td>Local Hotel Concert</td>
<td>6.00 p.m.</td>
<td>500 Watts</td>
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<tr>
<td>107</td>
<td>4.00</td>
<td>Zurich</td>
<td>-</td>
<td>Switzerland</td>
<td>Afternoon Concert, preceded by News</td>
<td>6.00 p.m.</td>
<td>1.5 Kw.</td>
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<td>4.30</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>E. Prussia</td>
<td>Light Orchestra</td>
<td>6.00 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>110</td>
<td>4.45</td>
<td>Leipzig</td>
<td>-</td>
<td>Germany</td>
<td>Light Orchestra</td>
<td>6.00 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>110</td>
<td>4.45</td>
<td>Bloemendael</td>
<td>-</td>
<td>Holland</td>
<td>Divine Service</td>
<td>6.00 p.m.</td>
<td>700 Watts</td>
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<tr>
<td>110</td>
<td>4.45</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clichy</td>
<td>Concert, followed by News</td>
<td>6.00 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>117</td>
<td>5.00</td>
<td>Frankfurt</td>
<td>-</td>
<td>Germany</td>
<td>Light Orchestra</td>
<td>6.00 p.m.</td>
<td>1 Kw.</td>
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<tr>
<td>111</td>
<td>5.00</td>
<td>Radio-Brigel</td>
<td>SFR 265 m.</td>
<td>Brussels</td>
<td>Concert</td>
<td>1 hour</td>
<td>2.5 Kw.</td>
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<tr>
<td>115</td>
<td>5.30</td>
<td>Barcelona</td>
<td>EAJ 125 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>8.30 p.m.</td>
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<tr>
<td>113</td>
<td>6.00</td>
<td>Frankfurt</td>
<td>-</td>
<td>Germany</td>
<td>Lecture, followed by Evening Programme</td>
<td>10.00 p.m.</td>
<td>1 Kw.</td>
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<tr>
<td>112</td>
<td>6.00</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Concert, followed by News</td>
<td>1 hour</td>
<td>5 Kw.</td>
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<tr>
<td>219</td>
<td>6.00</td>
<td>Malmo</td>
<td>SAC 270 m.</td>
<td>Sweden</td>
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<td>8 p.m.</td>
<td>3 Kw.</td>
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<tr>
<td>170</td>
<td>6.45</td>
<td>Copenhagen</td>
<td>-</td>
<td>Denmark</td>
<td>Concert, followed by News</td>
<td>7.15 p.m.</td>
<td>2 Kw.</td>
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<tr>
<td>228</td>
<td>7.00</td>
<td>Komarow</td>
<td>-</td>
<td>Greece</td>
<td>Lecture or Concert</td>
<td>8 p.m.</td>
<td>1 Kw.</td>
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<tr>
<td>175</td>
<td>7.35</td>
<td>Radiofonica</td>
<td>-</td>
<td>Rome</td>
<td>Concert, followed by Late News</td>
<td>9.30 p.m.</td>
<td>4 Kw.</td>
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<tr>
<td>126</td>
<td>7.40</td>
<td>Ned. Saintes</td>
<td>NSF 1060 m.</td>
<td>Hilversum</td>
<td>Concert</td>
<td>10.10 p.m.</td>
<td>3 Kw.</td>
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<td>114</td>
<td>8.00</td>
<td>Radio-Wien</td>
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<td>Vienna</td>
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<td>1 Kw.</td>
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<tr>
<td>114</td>
<td>8.00</td>
<td>Konigsberg</td>
<td>-</td>
<td>E. Prussia</td>
<td>Concert</td>
<td>10.00 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>115</td>
<td>8.00</td>
<td>Hamburg</td>
<td>-</td>
<td>Germany</td>
<td>Concert, followed by News</td>
<td>8 mins.</td>
<td>5 Kw.</td>
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<td>120</td>
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<td>Eiffel Tower</td>
<td>FL 2600 m.</td>
<td>Paris</td>
<td>General Weather Forecast</td>
<td>8 mins.</td>
<td>5 Kw.</td>
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<td>125</td>
<td>8.00</td>
<td>Stuttgart</td>
<td>-</td>
<td>Wurtemberg</td>
<td>Concert, Dance Music from 10 p.m.</td>
<td>Midnight</td>
<td>1 Kw.</td>
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<td>124</td>
<td>8.00</td>
<td>Breslau</td>
<td>-</td>
<td>Silesia</td>
<td>Light Orchestra, Dance Music at 10 p.m.</td>
<td>10.30 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>231</td>
<td>8.00</td>
<td>Kbel</td>
<td>-</td>
<td>Prague</td>
<td>Evening Concert</td>
<td>10.0 p.m.</td>
<td>1 Kw.</td>
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<td>127</td>
<td>8.15</td>
<td>Radio-Belg</td>
<td>SFR 265 m.</td>
<td>Brussels</td>
<td>Concert, followed by News</td>
<td>10.10 p.m.</td>
<td>2.5 Kw.</td>
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<td>127</td>
<td>8.15</td>
<td>Baslaine</td>
<td>HB 95 350 m.</td>
<td>Switzerland</td>
<td>Concert</td>
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<td>300 Watts</td>
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<td>-</td>
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<td>300 Watts</td>
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<td>123</td>
<td>8.15</td>
<td>Leipzig</td>
<td>-</td>
<td>Germany</td>
<td>Symphony Concert</td>
<td>9.49 p.m.</td>
<td>700 Watts</td>
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<td>116</td>
<td>8.30</td>
<td>Munster</td>
<td>-</td>
<td>Westphalia</td>
<td>Classical Concert</td>
<td>10.00 p.m.</td>
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<tr>
<td>220</td>
<td>8.30</td>
<td>Voxhaus</td>
<td>-</td>
<td>Berlin</td>
<td>Evening Programme, Dance Music from 10.30 p.m</td>
<td>Midnight</td>
<td>1 Kw.</td>
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<td>174</td>
<td>8.30</td>
<td>Munich</td>
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<td>Bavaria</td>
<td>Concert</td>
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<td>1 Kw.</td>
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<td>128</td>
<td>8.30</td>
<td>Radio-Paris</td>
<td>SFR 1780 m.</td>
<td>Clichy</td>
<td>Detailed News Bulletin</td>
<td>9.00 p.m.</td>
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**SUNDAYS.**
### SPECIAL DAYS

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<th>Closing Time or Approx. Duration</th>
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<tr>
<td>129 8.30</td>
<td>Ecole Sup. des Pet Tgs.</td>
<td>FPTT 450 m.</td>
<td>Paris</td>
<td>Concert or Lecture. May begin 15 mins. earlier or later.</td>
<td>10.30 to 12 p.m.</td>
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<td>130 9.00</td>
<td>Radio-Iberica</td>
<td>RI 302 m.</td>
<td>Spain</td>
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<td>3 Kw.</td>
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<tr>
<td>131 9.30</td>
<td>Petit Parisien</td>
<td>— 345 m.</td>
<td>Paris</td>
<td>Concert, followed by Dance Music.</td>
<td>11.00 p.m.</td>
<td>8 Kw.</td>
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<tr>
<td>133 11.00</td>
<td>Eiffel Tower</td>
<td>FL 2550 m.</td>
<td>Paris</td>
<td>Concert (Items announced in English as well as French).</td>
<td>11.30 p.m.</td>
<td>500 Watts.</td>
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<td>Time Signal in Greenwich Sidereal Time (Spark).</td>
<td>3 mins.</td>
<td>60 Kw.</td>
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**SUNDAYS (Contd.)**

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<tr>
<td>132 9.00</td>
<td>Radio-Paris</td>
<td>SPR 1780 m.</td>
<td>Clichy</td>
<td>Concert.</td>
<td>11.00 p.m.</td>
<td>8 Kw.</td>
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<td>133 11.00</td>
<td>Eiffel Tower</td>
<td>FL 2550 m.</td>
<td>Paris</td>
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<td>500 Watts.</td>
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<td>Eiffel Tower</td>
<td>FL 2550 m.</td>
<td>Paris</td>
<td>Time Signal in G.M.T. (Spark).</td>
<td>3 mins.</td>
<td>60 Kw.</td>
<td></td>
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</tbody>
</table>

### SPECIAL NOTICE

The next issue of "Modern Wireless" will contain a full "How to Make" description of a

**NINE VALVE CABINET SUPERHETERODYNE RECEIVER**

By JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

The Receiver is the outcome of many months' experiment on this type of instrument, and gives remarkable results on the smallest frame aerial.
April, 1925.

A wonderful time of the tear—

Spring! The promise of sunshine, the promise of flowers and the promise of the great outdoors. Let our hopes include music; song, dance and romances—through Sterling radio—this Spring!

For you and yours!

Here is a radio receiver that pleases like the flowers of Spring, but the pleasure it brings lasts longer! With the Sterling “Anodion One” all the joys of broadcasting are for you and yours indoors and outdoors, through the Spring, through the Summer, and for the years to come.

These claims are no idle phantasy of the season, for Sterling have never made anything in radio that did not keep its promise. There is no one, whether radio expert or amateur, who has ever failed to receive through Sterling products the wonder and charm of music, song and interest with an efficiency that is without equal.

The truth of this claim is in your hands to test by inquiry where you will. Dealers are always happy to demonstrate Sterling products.

The “Anodion One” is a highly efficient one-valve receiver giving splendid results often at considerable distances under favourable conditions. Tuning is effected by means of a Sterling Square Law Condenser in conjunction with Sterling Tuning Units, the complete range available covering a wave-band of 275-7600 metres. The instrument is mounted upon a highly finished desk-type hinged cabinet. With B.B.C. coil, but without accessores.

PRICE £7:7:0

At your radio dealer

A good time to buy

STERLING "ANODION ONE"

VALVE RECEIVER

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Works: Dagenham, Essex.
The secret of their fine performance—is in the windings

In the case of both the Igranic High Frequency Transformer and the Igranic Unitune Aperiodic Fixed Coupler the world famous De Forest method of Honeycomb Duolateral winding is employed. In the transformer this results in a highly inductive coupling being obtained and self-capacity is kept at a minimum—and so the maximum transfer of anode potential fluctuations to the grid of the succeeding valve is assured with the minimum of distortion. The Igranic H.F. Transformer is made in four sizes: 250 to 500 metres, 8s.; 450 to 880 metres, 9s. 6d.; 800 to 1,700 metres, 11s.; and 1,500 to 3,000 metres, 12s. 6d.

The De Forest method is of particular advantage in the Unitune Coupler—a device specially designed for transatlantic and short wave reception—because minimum self-capacity in the coupler is so essential when high-frequencies, such as occur in short wavelengths, are involved. The Igranic Unitune Coupler combines the advantages of both direct and loosely coupled methods of tuning without their attendant disadvantages. Made in two sizes—minor for 75-150 metres, 7s. 6d., and major for 300-600 metres, 9s. The Igranic E. Type Audio-frequency Transformer has a coil wound by a patent cotton interweave process, and the primary and secondary windings are so disposed with relation to the iron circuit that distortion is avoided. Windings are of ample cross-section and have a current carrying capacity of 20 milliamperes. Each transformer is subjected to a flash test of 2,500 volts alternating potential between windings and between windings and frame, and is suitable for anode potentials up to 150 volts. This audio-frequency transformer is obtainable in 1-5 ratio for first stage of amplification, 21s., and 1-3 ratio for second and subsequent stages, 19s. 6d.

Only the finest material can stand the tests to which Igranic Components are put before leaving the works and it is therefore not to be wondered at that you will build a better set with Igranic Radio Devices.

Write for list No. Z 448.

These are the foundations of a BETTER set
The Zurich Broadcasting Station.
By CAPT. L. F. PLUGGE, B.Sc., F.R.Met.S., F.R.Ae.S.

In this article our Continental Broadcasting Correspondent describes in an interesting manner another of his visits to a celebrated Continental station.

ZURICH is a very pretty town situated on the German side of Switzerland, and on the northern apex of the great Zurich Lake. It is not more than 25 miles as the crow flies from the German frontier.

Although broadcasting stations exist both at Lausanne and Geneva, the Zurich station is the only Swiss broadcasting station which may consistently be heard in Great Britain at present. There are several interesting features about the Zurich Broadcasting Station which are noteworthy. In designing the station, which is run by the Radio Genossenschaft Co., it was borne in mind that the inhabitants of the town of Zurich would most likely want to listen to foreign stations as well as their local one, and for this reason, among others, it was decided to place the transmitting station some five miles out of the town, although the studio is located in the centre of Zurich.

Transmitting Equipment

This procedure has done away with the trouble of interference from the near station sending out on full power when the amateur is trying to tune in a distant station on a similar waveband. This difficulty is much experienced and complained about by the inhabitants of our great cities, where in most cases, and in particular London, the transmitting station is placed in the centre of the town. In the case of Zurich there was another distinct advantage in placing the station outside the town and near the little village of Hongg, where it is situated, as the site chosen is some 500 feet above the level of the town and consequently about 1,800 feet above sea level. It is unnecessary to dwell upon the value of such a vantage point with regard to distant reception, and no doubt this goes much towards assisting this station in being heard over such great distances although using so small a power. There is another reason, however, for this, and that is, undoubtedly, the transmitting gear used. This gear is the standard Western Electric 500 watt transmitting equipment. Those who are used to tuning in Continental stations will have heard several stations which are equipped with this gear, and among these is the "Petit Parisien,"
which has often been received in this country on sets which are sometimes not able to receive more than one or two B.B.C. stations.

The Aerial
When the Zurich station began transmitting it used a wavelength of 800 metres, but this was subsequently reduced to 650 metres. The jamming from shipping on this wave, however, decided the Chief Engineer to reduce the wavelength again, and 515 metres is now used.

The aerial, which is supported by two lattice steel towers 63 metres high and 150 metres apart, consists of a six wire cage, six feet in diameter, the horizontal part being approximately 130 feet above the counterpoise. The total length of the aerial is 240 feet and the wires consist of seven strand 18 S.W.G., the overall diameter of the stranded wire being approximately 4 millimetres. As mentioned, a counterpoise is used instead of the usual earth connection. This counterpoise consists of a fan-shaped network of wires radiating from the transmitting equipment and consisting of single conductors of about two millimetres diameter. They are supported by wooden poles and steel supporting wires and form a sheet at about 15 feet above the ground level. The counterpoise is insulated from the supporting wires by small egg-type insulators, and the supporting wires are fastened to the wooden poles by heavy porcelain insulators.

The Station
The transmitting gear is installed in a small concrete building situated at the foot of one of the towers. It only contains two rooms on the ground floor, in one of which the transmitting gear is installed, together with the speech amplifier and power panel. In the second room, the motor generator set, line switches, battery charging gear, etc., are housed. There is also a small upper story in the building which contains the storage battery for the speech input equipment and also a bedroom for the station operator.

Aerial Lead-in
The high frequency connections from the aerial and the counterpoise to the transmitting gear are made of 3 inch copper tube. No lead-in insulator is employed, the copper tube being taken direct through a hole in a glass window. The lead down from the aerial is 130 feet long and consists of six wires of the same diameter as those used for the 90 feet of the horizontal portion of the aerial. The upper part of the lead down is arranged in the form of a small cage about 10 centimetres diameter, and in the lower half the wires forming this cage are bound together in a compact cable with a view to reducing the capacity of this lower portion, which joins on to the copper lead-in tube previously mentioned. The natural wavelength of the aerial system is approximately 500 metres.

The Studio
The Zurich studio is on the fourth floor of a large building in the Lindenofstrasse, and is connected to the transmitting station by means of a cable in the city itself, by overhead wire to within some 20 yards of the station, whence it is again brought underground by means of a second cable to the speech input amplifier in the transmitting room.

Some considerable changes are at present under consideration with regard to the studio arrangement, but when I visited the station a couple of months ago arrangements were quite satisfactory. The control room was, as usual, adjoining the studio. An interesting device, which I have not seen in use at 2LO, and which I found very helpful whilst broadcasting, would warrant description. It consists of a large panel containing eight small compartments which could be separately lit up. On the glass panel of each of these compartments indications such as "Speak up," "Stand further away from the microphone," "Speak slower," etc., could be flashed from the control room.

Afternoon Transmissions
All those who have visited Zurich, and many travellers do this on their
**Sharp Tuning**

Provided you are using good coils, your receiver should tune sharply. If your coils are low loss then flat tuning is caused by using inefficient condensers. Good condensers make tuning a pleasure. Sharp—razor sharp tuning—requires a tuning condenser which is designed with an almost zero minimum capacity and a guaranteed maximum; very low dielectric losses and negligible resistance to H.F. currents. Experimenters continually express their high appreciation of J.B. Variable Condensers. Among the popularly-priced, no better instrument can be procured. Zero minimum, guaranteed a maximum, low loss, and mechanically perfect summarise the J.B. A more precise instrument cannot be obtained. Square Law or Standard as you may desire.

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The nickel-plated extended handles, fittings and ebonite, are assembled with minute care; the finished holder being an efficient and worthy fitment for any set, whilst the very low price at which it is marketed will appeal to all. Here you are offered both quality and price advantage.

Let distortion be in the other fellow's set

With the passing of such phases as the "itch for distance," comes the more tangible pleasure of attaining good loud-speaker reproduction. With the provision of the scientifically and accurately designed Success Choke it would be interesting to conduct experiments to prove if any other method of audio-frequency amplification could give greater purity. There is no secret in the performance of the Success Choke. That music and speech are faithfully reproduced, with an absolute dead silent background, that there is a complete absence of rasping penetrating ruts and curious distorting noises conspicuous in many receivers, comes not by accident. The scientific facts which have guided the design of the Success Choke in conjunction with an intense criticism that it should reproduce with greater fidelity than any component then available, indicates to some measure, that in the Success Choke you have a remarkable instrument.

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The use of a "Square Law" Condenser renders the tuning of a Receiver a very simple matter indeed. A calibration chart may be made by the following simple means:

Tune in a station of known wavelength on the lower part of the condenser scale and plot it on the chart. Repeat this process with another station of known wavelength which is received on the upper part of the condenser scale. Draw a straight line through the two points and the chart is complete.

Owing to details of its design, this type of Variable Condenser possesses a negligible minimum capacity, and the specially shaped vanes give an ease of control which is entirely unknown to users of the ordinary type.

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way to St. Moritz, know the beautiful hotel, situated at the foot of the Zurich Lake, called Hotel Baur-au-Lac, and its well-known orchestra. This orchestra is broadcast regularly every afternoon by the Zurich station, and in the hotel lounge the standard push pull carbon microphone can be seen. The four-valve speech amplifier is housed in the cloakroom. In regard to these afternoon concerts, I would like to point out a serious fault, and that is the very long intervals which take place between items and during which no announcements are made. This worries the listener and makes it exceedingly difficult for the distant listener to know with certainty the station he has tuned in. I would suggest that the intervals might be made shorter and the intervals as well, and, if possible, an occasional call given out, either at the hotel or from the transmitting station, for the benefit of listeners in this country and other distant listeners.

Conclusion
For some time the programmes, although of a classical nature, have been rather short, and some great improvements have been made of late in this direction, for which all thanks are due to Mr. Speorri. Mr. Speorri, secretary of the Radio Genossenschaft, who has the welfare of Zurich listeners at heart, spares no effort in providing them with the very best programmes available. Apart from transmissions from theatres, he has also arranged some re-broadcasts of Chelmsford, which he receives on a three-valve set with very good results. Several performances of the Zurich State Opera have been relayed by the Zurich station, including one on the 9th of last month, when the opera "Tannhauser" was broadcast. This performance I received in London without any interference, at about normal crystal strength of 2LO, on my Supersonic heterodyne, using a 15 -" frame aerial and only two stages of intermediate amplification. The London station, only half a mile away, was entirely eliminated. The Zurich station is remarkable for the purity of its modulation and the absence of any noises in the carrier wave. This is so much so that, using a crystal receiver in the transmitting room itself, it was found impossible to detect if the carrier wave was being transmitted or not.

The author seated before the microphone on the occasion of his talk from the Zurich station.

A Fair Reader's Success

Str.—This letter is long overdue, as I have been using the "All-Wave Receiver" described by Mr. John Scott-Taggart, ever since March, 1924, and yet I can only give a partial report, as I have not yet managed to get a third valve. As detector and L.F., I think the set is very good, especially as, in a way, it is only a makeshift not to use all three valves. I get 2ZY (15 miles) at very good strength. I can make it too loud for comfort. 6LV (15 miles) is hardly any different, and neither station interferes with the other. I have had, at different times, every main B.B.C. station on the two valves. Leeds and Nottingham, also 5XK and 'Radio-Paris, come in, using Mr. Harris' special coil at good one valve strength. I also get several European stations, but never manage to work out who they are, except Petit Parisien, L'Ecole Superieure, Madrid, and, I think Zurich on Sunday. I have used a Peto-Scott low frequency transformer, Peto-Scott condensers, Lissen gridleale, Lissen valve, home-made basket coils wound with 20 S.W.G., and C.A.T. The selectivity is excellent, but having used it for a year, I have got so used to it that I want a change, so I am now making the "Twin-Valve" set. Just before Christmas I made the single-valve cabinet and coils, December Wireless Constructor, for a friend, and he is delighted with it, as he seems to get in St. Helens anything he wants, and it is very selective.

The author seated before the microphone on the occasion of his talk from the Zurich station.
The "General Purpose Three"

By A. JOHNSON-RANDALL.

A three-valve receiver, eminently suitable for all-round work, capable of working a loud-speaker up to a distance of 20-30 miles from the local station. Good telephone reception of all the B.B.C. main stations and most of the Continental is obtainable in favourable conditions.

If I were asked, "What is the most popular type of receiver for all-round work?" I would most certainly reply: "A straight three-valve set consisting of a detector valve preceded by one stage of high frequency and followed by a single stage of low-frequency amplification."

This arrangement is probably the most useful combination utilising three valves that it is possible to obtain.

Considerations in Design

To commence with, what are the main points which govern the design of a general purpose receiver? They are, first, the set must be simple to understand, to construct, and to operate; second, it should be economical both in first cost and in maintenance; third, it must be suitable for general long-distance work on the telephones, and it must be also capable of operating a loud-speaker efficiently on the local station. For long-distance work we need a stage of high-frequency amplification, and for loud-speaker work it is essential that we employ at least one stage of low-frequency amplification; hence three valves is the smallest number we can use.

Fig. 1.—The theoretical circuit diagram. To cut out the low-frequency stage it is only necessary to insert the telephone plug in Jack No. 1.
For your H.F. work

The H.F. Unit to use in T.A.T. circuits

The semi-aperiodic stages of H.F. in the T.A.T. circuits should be the LISSEN REACTANCE (patent).

With its Reactance and capacity values on each tapping point arranged to give just that degree of damping which keeps the set stable without any sacrifice of efficiency, with its windings and whole design balanced, the degree of amplification obtained is surprisingly high for H.F. work.

The purity of reception—the convenience in use (for it covers an extremely wide wavelength range, despite its compact form)—with its internally connected switch, making it easy to cover each wavelength band quickly—it is highly recommended for these circuits.

The receiver fitted with LISSEN REACTANCE will pick up distant signals, and build them up, passing them powerfully on to the next valve. Simplicity itself to fit, connect and use. It will make your T.A.T. receiver powerful.

It is self-tuned, but a separate condenser may be fitted if desired (preferably use the LISSEN VERNIER, price 12/6, specially designed for fine tuning in H.F. circuits).

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**LISSEN Neutrodyne Condenser**

The action of the LISSEN NEUTRODYNE CONDENSER is particularly smooth and regular without any looseness or backlash, but is sufficiently firm to ensure that the condenser will remain indefinitely at any capacity to which it is set.

A long control knob is fitted in order to overcome the risk of hand capacity effects when making adjustments.

Mounted by the Lissen One Hole Fixing Method, it occupies a space of less than 1 in. diameter, and is only 1½ in. long under panel.

The LISSEN NEUTRODYNE CONDENSER is a high class component, totally enclosed, with nothing to get out of order. **PRICE 4/6**

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Switching

To increase the sphere of usefulness of the receiver it is desirable that some form of switching device be incorporated so that the number of valves in use can be varied. But, unfortunately, switching on the H.F. side is not usually very effective, on account of the instability caused by its use. On the L.F. side, however, the problem is more simple, and it is therefore wise to arrange some method whereby the set may either be used as a two-valve receiver consisting of a high-frequency stage and a detector, or as a three-valve set utilising the low-frequency stage. If separate H.T. tappings are employed it is often a difficult matter to arrange the usual form of "lever" switching successfully, but the difficulty may be easily surmounted by the employment of jacks and telephone plugs. There seems to be a certain dislike for the use of jacks in this country, but I feel sure that once the sceptic tries this method he will never return to the more common forms of L.F. switching. It is a receiver of the general purpose type embodying the above points that I am about to describe.

Self-Capacity

Readers should bear in mind that in cases where they are situated within a short distance of the local station, it is unnecessary to use the H.F. valve in a conventional straight circuit, as the filament may be turned out and signals still be received, in some circumstances with but small decrease in volume. The reason for this is that the incoming oscillations are by-passed by the small condenser formed by the internal capacity of the H.F. valve itself and its attendant casual capacities. This may clear up a matter which so frequently mystifies readers who state that they still receive perfectly good signals even when the filament of the H.F. valve is turned off.

The Circuit

The circuit chosen consists of an A.T.I. tuned by a 0.0005 µF. square law pattern variable condenser connected in parallel. Constant aerial tuning is provided for those who prefer this method, and may be brought into use by connecting the aerial lead to the terminal marked C.A.T. on the panel instead of to that marked "Aerial."

The method of H.F. coupling used is the tuned anode, as it is almost an undisputed fact that this method gives greater amplification.

There is sufficient clearance for the largest types of plug-in coils.

Fig. 2.-The lay-out of the front of the panel. Blue Print No. 107a, may be obtained from the Sales Dept. The aerial coil L1 is immediately below the reaction coil L3.
than any other; although if more than one stage is used the receiver tends to become uncontrollable unless special precautions are taken. Two or three valves may be used as desired, as by means of two jacks the transformer-coupled stage of L.F. amplification may be cut out by the simple expedient of withdrawing the plug connected to the telephone leads from one jack and inserting it in the other. Two H.T. positive tappings are provided, one of which is common to the first two valves, the other permitting the use of a higher H.T. voltage on the plate of the last valve.

**Grid Bias**

In order to ensure efficient operation on the L.F. side, provision is made for negative grid bias; and it cannot be too strongly emphasised that full advantage should be taken of this. It should be remembered that it is useless to expect good reproduction unless the H.T. and grid bias for the last valve are adjusted so that the operating point lies upon the correct portion of the characteristic curve for distortionless amplification. Of course, allowance must be made for the fact that the filament rheostats are connected in the negative L.T. lead. This automatically ensures a small negative bias on the grid of the L.F. valve, the magnitude of which is determined by the type of valve in use and the terminal voltage of the L.T. battery.

**Drop across Rheostat**

For example, in the case where an ordinary "R" type valve rated at 4 volts is used in conjunction with a 6-volt accumulator the drop across the filament resistance which is applied to the grid is 2 volts. If, therefore, our total grid bias should be 3½ volts, it is only necessary to plug in at the first tapping, which is 1½ volts, on the grid battery.

**Components Required**

The following components are required, and if any departure is made from this list, the constructor should assure himself that those he chooses are of reputable make:

- 1 Cabinet, sloping front to take a panel 18 in. by 10 in. by 1 in. (W. H. Agar).
- 1 Ebonite panel, 18 in. by 10 in. by ½ in. (Peter Curtis).
- 3 Dual rheostats (Burndept).
- 1 Two-coil holder (Polar Universal).
- 1 Plug (telephone) (R. A. Rothermel).
- 1 .0005 µF fixed condenser (Dubilier).
- 1 .0003 µF fixed condenser (Dubilier).
- 1 2-meg. ohm grid leak (Dubilier).
- 1 .0001 µF fixed condenser (Edison Bell).
- 10 Terminals. Those used are Burndept and have 2 B.A. shanks.
- 1 Set of Radio Press panel transfers.
- A quantity of square-section tinned copper wire and a few 4 B.A. and 6 B.A. screws and nuts.

**Marking Out the Panel**

Now take the panel, which should be guaranteed free from surface leakage, and mark out by means of a 12-inch steel rule and scriber to the dimensions given in blue print No. 1074 or to those shown in Fig. 2. Having done this, drill the holes according to the instructions given by the makers of the components on the paper templates supplied. The single-hole fixing condensers require a ½ in. hole, and the "Royal" transformer is secured by means of four No. 4 B.A. countersunk screws and nuts. Two ½ in. holes will also serve for the jacks, although this is larger than is necessary.

The terminals will have either No. 2 or No. 4 B.A. shanks, according to make and quantity. Next commence the wiring, using No. 16 gauge square-section tinned wire and a hot iron of not less than 8 ozs. weight. A big iron is a distinct advantage, as it retains an even
Music all round the dial

"...With an indoor aerial on my Duodyne III, I receive all B.B.C., most Continental, and four American stations nightly, whether London is on or not... Tuning is absurdly simple, as there is 'music all round the dial'..."

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The DUODYNE PORTABLE IV LOUD SPEAKER MODEL Complete with D.E. Valves, all Batteries, Headphones, etc. £21

Guaranteed delivery at specified dates. Guaranteed range on self-contained aerial, 30 miles on 7½ K.W. (An earth connection will double this distance.)

THE MOST EFFICIENT AND POWERFUL PORTABLE RECEIVER ON THE MARKET NOW ON DEMONSTRATION.

PARAGON CURTIS ONE PIECE MICA CONDENSER

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Patents and Manufacurers: The Paragon Rubber Mfg. Co., Ltd.

UNCONDITIONAL GUARANTEE.

To replace free of all charge any Paragon Curtis One Piece Mica Condenser, which may break down or otherwise be defective from any cause whatsoever other than mechanical fracture for a period of five years from date of purchase. We have decided to extend to all users of Paragon Curtis One Piece Mica Condensers our maintenance guarantee given to users of the Paragon Curtis Submarine Cable Telegraph Condensers.

-.0008 to .006... 2/6 each.

Grid Condenser with clips...

Grid Leak...

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Never mind the aerial—
Add a stage of H.F.

Have you been trying unsuccessfully to pick up a distant station, or having got it the reception is so faint as to render it a mere buzzing in the phones? This trouble is most often due to a mediocre aerial or inefficient components making long-distance reception an irritation rather than a personal radio achievement.

It can be cured by adding a stage of H.F. Amplification, if the right components are used. The range of your receiver will then be increased considerably, selectivity assured, and for local reception the use of an aerial possibly dispensed with altogether.

To obtain one or all of these results it is absolutely imperative that reliable high efficiency components be used. H.F. Transformers of M.H. manufacture are the first essential. These transformers are universally acknowledged to be the best.

Made of specially manufactured non-loss ebonite, precision machined and polished to the usual high finish of all M.H. products and with the windings carried in staggered slots, ensuring low self-capacity and high efficiency, they are of a well-balanced and pleasing appearance.

To ensure perfect matching they are subjected to a rigorous system of testing before being offered to the public and any not coming within extremely narrow limits are rejected. Matching is guaranteed, where specified.

Supplied in six ranges of wavelengths covering from 80 to 7,000 metres.

No. 0... 80 to 150 metres... 10/-
No. 0... 150 " 300 "... 10/-
No. 1... 300 " 600 "... 10/-
No. 2... 550 to 1,200 metres... 10/-
No. 3... 1,100 " 3,000 "... 10/-
No. 4... 2,500 " 7,000 "... 10/-

A. 6, Neutrodyne Unit (Broadcast Wavelength) ... ... each 10/-
The Complete Set in handsome case, Nos. 00-4 ... ... 55/-

Any number of each Transformer can be supplied matched at 10/- extra charge if requested at the time of ordering.

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MODERN WIRELESS

afterwards with methylated spirit. Temperature so much longer than the wiring up, except perhaps to work of this description.

There are no special difficulties in the wiring up, except perhaps to dull-emitter, will be suitable; but if a loud-speaker is going to be used and good distortionless reproduction is required, I recommend that a small power valve be used in the last socket. For use with a 6-volt accumulator a power valve of the B.T.H. B4, D.E.5, or Mullard D.F.A. is capable of handling all the energy required for ordinary loud-speaker work in the house, and specially for H.F. amplification will give excellent results; but, as stated above, a good general purpose valve will also give good results here.

Further Details

Having placed the valves in the sockets, turn the knobs of the rheostats and note whether the valves light up. All being well, connect up the H.T. battery, placing the positive plug connected to H.T. + 1 in, say, the 50-volt tapping, and that connected to H.T. + 2 in the 100-volt tapping if a small power valve is being used, otherwise from 70-80 volts will be suitable for ordinary valves. No hard-and-fast rules can be given respecting grid bias, as the type of valve and the H.T. are the two deciding factors, and here the maker’s instructions should be followed. In no case should the voltage applied to the plates of any of the valves exceed that specified by the makers as the maximum. Place the telephone plug in the desired jack, according as to whether two or three valves are required, and place a No. 25 or 35 coil in the aerial socket and a No. 35 or 50 in the moving socket of the two-coil holder. For the upper band of B.B.C. wavelengths a No. 50 may give better results in the aerial socket. Place a No. 50, 60 or 75 in the anode socket, according to wavelength, and, keeping the moving coil well away from the aerial coil, rotate both condenser dials slowly until signals are heard. Now bring the moving coil nearer to the aerial coil. Signals should increase in volume on retuning slightly, and if this does not occur, rotate the moving coil through 180 degs., thus reversing the reaction. Signals should now increase in strength as the moving coil approaches the aerial coil, thus denoting that the reaction leads are now correct.

Constant Aerial Tuning

The form of coil holder used is particularly useful for work with different types of coils, as it is not necessary to reverse the soldered leads on the back of the panel when desiring to reverse the direction of reaction. Experiment with the size of reaction coil until the best results are obtained. For 5XX and Radio Paris use a No. 150 coil in the aerial socket, a No. 100 for reaction, and a No. 200 or 250 in the tuned anode. For those who wish to use constant aerial tuning a No. 50 and 75 will cover the B.B.C. wave band, but as the use of this form of tuning makes the set very prone to oscillate, care should be taken and a small reaction coil...
This photograph should be used in conjunction with the wiring diagram.

should be used. No condenser is shown in the theoretical diagram across either of the H.T. tapings, nor is one included in the set. I recommend that these condensers should be treated as part of the H.T. battery unit itself. No condenser is connected across the last jack, as one is not really necessary for use with telephones; but for loud-speaker work some experiments should certainly be made with different sized shunt condensers, and the tone can be vastly improved if a suitable value is chosen. So much depends on the type of loud-speaker used, that no real information as to the proper value can be given here. Three good values to try are .004, .006, and .01 µF.

Results

Results with any receiver are largely dependent upon local conditions, such as the type of aerial which can be erected and whether the district in which the constructor is situated is good or bad for reception generally. The results with this receiver were obtained at a distance of 15 miles S.E. of 2LO, using first, a single wire 100 ft. long aerial with an average height of 35 ft., well insulated and unscreened, and in conjunction with a low resistance earth. Second, an indoor aerial consisting of three 20 S.W.G. wires, each 15 ft. long, suspended 2 ft. below the ceiling of the drawing-room and unscreened.

On the outdoor aerial 2LO is received at full loud-speaker strength without difficulty. At night Newcastle has been fairly consistently received at fair loud-speaker strength with London entirely eliminated. It is in fact generally audible on the loud-speaker on two valves only. Aberdeen and Birmingham have also been received at quite good strength on the loud-speaker at night, although not so consistently as Newcastle. Bournemouth at times comes in at quite amazing strength, but it is difficult to eliminate 2LO, and fading is also very noticeable. A number of Continental stations are always audible at night on the loud-speaker, but generally speaking they are difficult to identify. No difficulty is, however, experienced in the case of Petit Parisien, as this station announces in English as well as in French, and it usually comes through at about the same strength as Newcastle.

The remaining B.B.C. stations are received at good telephone strength.

In daylight B.B.C. stations are received at consistently fair loud-speaker strength, but unfortunately the London interference usually associated with this station when reception is carried out in the South of England is very troublesome.

On the indoor aerial 2LO is received at good strength on the loud-speaker; in fact there is not a big difference between the results on the indoor and outdoor aerial on this near station. The small aerial gives a very quiet background, and is at this distance preferable for general family use in an ordinary sized room. On Sunday morning, March 15, it was thought desirable to give the receiver a final test on real DX reception, and an attempt was made to receive America immediately after 5XX had finished his Transatlantic transmission, at about 1 a.m.

Transatlantic Reception

Previously it had been very amusing to hear the shrill scream of the local oscillators as they attempted to tune in Chelmsford’s harmonic on the broadcast band, evidently under the impression that they were receiving some distant transmission, probably America. At about 1.10 a.m. a piano was heard and a minute later the announcement that WBBZ, the Westinghouse station, New England, would continue its programme from the Springfield studio, with another song. Reception was quite easily intelligible on the ‘phones on two valves, and was audible on the loud-speaker using three. The coils used for all these tests were as follows: A Gambrell A or B in the aerial, a C for the tuned anode, and an “a” for reaction. Of the numbered coils a No. 35 or 50 in the aerial, a 50 or 75 in the tuned anode with a No. 35 or 50 for reaction. The reaction coil is, of course, a matter for experiment, and with some aerials a slightly larger one may be desirable. It is well to point out that should full oscillation be experienced upon bringing the two tuned circuits into tune this may quite easily be controlled by using a small coil in the reaction socket and potting the moving coil so as to apply a little reverse reaction. The valves actually used were a Cossor P2 in the first socket, a P1 as detector and a B4 in the last socket with 120 volts H.T., and 6 to 7½ volts negative bias. 50 volts will be found sufficient for the first two valves. In conclusion I should be pleased to know the results obtained by readers who construct this receiver.

The “Transatlantic Four”

Sir,—Just a line to let you know my remarkable results with the “Transatlantic Four,” described by Mr. Percy W. Harris in Modern Wireless, November, 1924. Using 30 ft. of covered wire in the bedroom, all B.B.C. stations are received at good phone strength, also London, Bournemouth and Birmingham on loud-speaker. On a good outdoor aerial 55 ft. by 40 ft. high all stations except Manchester are at good loud-speaker strength. I might say that I had several friends in to hear my last set before I had given it a trial run, so that shows the confidence I had in a Modern Wireless set of giving a good show. Wishing all Radio Press journals every success, not forgetting Mr. Percy Harris.—Yours truly,

Aldershot, Hants.

J. Gedge.
Cosmos Components
for Efficient Radio Sets

"COSMOS" STRIP PLUG-IN
INDUCTANCE COILS
are made in the following sizes:

<table>
<thead>
<tr>
<th>Coil No.</th>
<th>Inductance Microhens.</th>
<th>Price s.d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>125</td>
<td>4/9</td>
</tr>
<tr>
<td>25</td>
<td>25</td>
<td>4/6</td>
</tr>
<tr>
<td>35</td>
<td>50</td>
<td>4/6</td>
</tr>
<tr>
<td>40</td>
<td>100</td>
<td>4/6</td>
</tr>
<tr>
<td>50</td>
<td>150</td>
<td>4/9</td>
</tr>
<tr>
<td>75</td>
<td>300</td>
<td>5/9</td>
</tr>
<tr>
<td>100</td>
<td>700</td>
<td>6/6</td>
</tr>
<tr>
<td>150</td>
<td>1000</td>
<td>6/6</td>
</tr>
<tr>
<td>175</td>
<td>1200</td>
<td>7/6</td>
</tr>
<tr>
<td>200</td>
<td>2500</td>
<td>8/6</td>
</tr>
<tr>
<td>300</td>
<td>5000</td>
<td>9/9</td>
</tr>
</tbody>
</table>

"COSMOS" STRIP INDUCTANCE COILS are constructed on a new principle which results in Low Resistance, Low H.F. Resistance, Robust Constructions and Low Self-Capacity. With regard to the last feature, a report on an independent test conducted by "The Wireless Trader" (issue March 4th) reads as follows:

"Our tests proved satisfactory, for the coil (tested on 377 metres) was found to have quite exceptionally low self-capacity. It was tested at the same time as a well-known and favourite type of plug-in coil, and the decrease in self-capacity was phenomenal; the other coil having approximately thirteen times the amount of self-capacity found in the 'Cosmos.'"

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Regular Programmes from American Broadcasting Stations

Hours of transmission given in British Summer Time and in local time prevailing.

Edited by Captain L. F. PLUGGE, B.Sc., F.R.Ae.S., F.R.Met.S. Copyright.

Until British Summer Time comes into force, note that one hour should be subtracted from time given.

WEEKDAYS.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>British Summer Time</th>
<th>Local Time prevailing</th>
<th>Name of Company owning station</th>
<th>Call Sign and Wave-length</th>
<th>Situation</th>
<th>Nature of Transmission</th>
<th>Approx. duration of Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 1</td>
<td>midnight</td>
<td>6.0 p.m.</td>
<td>Willard-Storage Battery Co.</td>
<td>WTAM 390 m.</td>
<td>Cleveland, Ohio.</td>
<td>Dance Music, Concert, Orchestra.</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 2</td>
<td>midnight</td>
<td>6.0 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBZ 377 m.</td>
<td>Springfield, Mass.</td>
<td>Dinner Concert.</td>
<td>-</td>
</tr>
<tr>
<td>A. 65</td>
<td>midnight</td>
<td>6.0 p.m.</td>
<td>American Tel. &amp; Tel. Co.</td>
<td>WEAF 402 m.</td>
<td>New York.</td>
<td>Musical Programme.</td>
<td>-</td>
</tr>
<tr>
<td>A. 61</td>
<td>midnight</td>
<td>6.0 p.m.</td>
<td>The Detroit News.</td>
<td>WWJ 337 m.</td>
<td>Detroit Mich.</td>
<td>Dinner Concert.</td>
<td>-</td>
</tr>
<tr>
<td>A. 3</td>
<td>12.15 a.m.</td>
<td>6.15 p.m.</td>
<td>L. 'Bamberger &amp; Co.</td>
<td>WOR 405 m.</td>
<td>Newark, New Jersey.</td>
<td>Orchestra.</td>
<td>-</td>
</tr>
<tr>
<td>A. 4</td>
<td>12.15 a.m.</td>
<td>6.15 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 356 m. &amp; 68 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Dinner Concert or Organ Recital.</td>
<td>-</td>
</tr>
<tr>
<td>A. 5</td>
<td>12.50 a.m.</td>
<td>5.50 p.m.</td>
<td>“Kansas City Star”</td>
<td>WDAF 411 m.</td>
<td>Kansas City, Mo.</td>
<td>Market, Weather Report, Time Signal.</td>
<td>-</td>
</tr>
<tr>
<td>A. 6</td>
<td>1.0 a.m.</td>
<td>6.0 p.m.</td>
<td>“Kansas City Star”.</td>
<td>WDAF 411 m.</td>
<td>Kansas City, Mo.</td>
<td>Concert (except Saturdays).</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 9</td>
<td>1.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Goodyear Tyre &amp; Rubber Co.</td>
<td>WEAR 390 m.</td>
<td>Cleveland, Ohio.</td>
<td>Market Report.</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 7</td>
<td>1.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBB 337 m.</td>
<td>Springfield, Mass.</td>
<td>News, Financial Markets.</td>
<td>15 min.</td>
</tr>
<tr>
<td>A. 8</td>
<td>1.0 a.m.</td>
<td>6.0 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KYW 356 m.</td>
<td>Chicago, Ill.</td>
<td>News, Talks.</td>
<td>16 min.</td>
</tr>
<tr>
<td>A. 13</td>
<td>7.15 a.m.</td>
<td>7.15 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 356 m. &amp; 68 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Market Reports.</td>
<td>-</td>
</tr>
<tr>
<td>A. 11</td>
<td>1.15 a.m.</td>
<td>7.15 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBB 337 m.</td>
<td>Springfield, Mass.</td>
<td>Talks followed by Concert or other Musical Programme.</td>
<td>-</td>
</tr>
<tr>
<td>A. 66</td>
<td>1.30 a.m.</td>
<td>6.30 p.m.</td>
<td>Chicago Tribune Broadcasting Co.</td>
<td>WGN 370 m.</td>
<td>Chicago, Ill.</td>
<td>Concert (Except Mondays).</td>
<td>30 min.</td>
</tr>
<tr>
<td>A. 10</td>
<td>1.30 a.m.</td>
<td>7.30 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 326 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Children’s Period. (not on 68 m.)</td>
<td>-</td>
</tr>
<tr>
<td>A. 12</td>
<td>1.30 a.m.</td>
<td>6.30 p.m.</td>
<td>Woodmen of the World</td>
<td>WOAW 326 m.</td>
<td>Omaha, Nebraska.</td>
<td>Concert or Orchestra.</td>
<td>-</td>
</tr>
<tr>
<td>A. 62</td>
<td>1.30 a.m.</td>
<td>7.30 p.m.</td>
<td>State College, Washington</td>
<td>KFAE 256 m.</td>
<td>Pullman, Washington</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>A. 14</td>
<td>1.35 a.m.</td>
<td>6.35 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KYW 356 m.</td>
<td>Chicago, Ill.</td>
<td>Children's Period.</td>
<td>25 min.</td>
</tr>
<tr>
<td>A. 15</td>
<td>1.45 a.m.</td>
<td>7.45 p.m.</td>
<td>General Electric Co.</td>
<td>WGY 380 m.</td>
<td>Schenectady, New York.</td>
<td>Musical Programme and, or talks (except Wed. and Sat.).</td>
<td>-</td>
</tr>
<tr>
<td>A. 16</td>
<td>2.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KYW 356 m.</td>
<td>Chicago, Ill.</td>
<td>Talks, Dinner Concerts, Musical Programmes (Mondays excepted).</td>
<td>2½ hrs.</td>
</tr>
<tr>
<td>A. 17</td>
<td>2.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Sears-Roebuck &amp; Co.</td>
<td>WLS 345 m.</td>
<td>Chicago, Ill.</td>
<td>Children’s Period (Mondays excepted)</td>
<td>20 min.</td>
</tr>
<tr>
<td>A. 63</td>
<td>2.15 a.m.</td>
<td>8.15 p.m.</td>
<td>The Radio Light-house</td>
<td>WEMC 266 m.</td>
<td>Berrion Springs, Michigan.</td>
<td>Concert.</td>
<td>-</td>
</tr>
<tr>
<td>A. 18</td>
<td>2.30 a.m.</td>
<td>8.30 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 326 m. &amp; 68 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Concert and Musical Programme.</td>
<td>-</td>
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### WEEKDAYS—continued.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>British Summer Time</th>
<th>Local Time prevailing</th>
<th>Name of Company owning Station</th>
<th>Call Sign and Wave-length</th>
<th>Situation</th>
<th>Nature of Transmission</th>
<th>Approx. duration of Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 19</td>
<td>2.30 a.m.</td>
<td>7.30 p.m.</td>
<td>&quot;Fort Worth Star Telegram.&quot;</td>
<td>WBAP</td>
<td>Fort Worth, Texas.</td>
<td>Musical Programme (except Saturdays). Concert (except Mondays).</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 24</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WOAW</td>
<td>Omaha, Neb.</td>
<td>Musical Programme (except Mondays).</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 26</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WGOB</td>
<td>U.S. Naval Observatorv Time Signal followed by U.S. Weather forecast.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 27</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WNOF</td>
<td>Concert (except Thursdays).</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 28</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WNAC</td>
<td>Concert.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 29</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WOOG</td>
<td>Concert.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 30</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WOOG</td>
<td>Concert.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 31</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WOOG</td>
<td>Concert.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 32</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WOOG</td>
<td>Concert.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 33</td>
<td>3.55 a.m.</td>
<td>9.55 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>337 m.</td>
<td>WOOG</td>
<td>Concert.</td>
<td>2 hrs.</td>
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</tbody>
</table>

### SUNDAYS.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>British Summer Time</th>
<th>Local Time prevailing</th>
<th>Name of Company owning Station</th>
<th>Call Sign and Wave-length</th>
<th>Situation</th>
<th>Nature of Transmission</th>
<th>Approx. duration of Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 30</td>
<td>12.30 a.m.</td>
<td>6.15 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA</td>
<td>Pittsburgh, Pa.</td>
<td>Dinner Concert.</td>
<td>—</td>
</tr>
<tr>
<td>A. 77</td>
<td>1.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Sears-Roebuck &amp; Co.</td>
<td>WRS</td>
<td>Chicago, Ill.</td>
<td>Orchestra.</td>
<td>—</td>
</tr>
<tr>
<td>A. 31</td>
<td>1.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Woodmen of the World.</td>
<td>WOAW</td>
<td>Omaha, Neb.</td>
<td>Bible Study Hour.</td>
<td>—</td>
</tr>
<tr>
<td>A. 79</td>
<td>1.20 a.m.</td>
<td>7.20 p.m.</td>
<td>Chesapeake and Potomac Telephone Co.</td>
<td>WCAE</td>
<td>Washington, D.C.</td>
<td>Musical Programme and Organ Recital.</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>A. 66</td>
<td>1.20 a.m.</td>
<td>7.20 p.m.</td>
<td>American Tel. &amp; Tel. Co.</td>
<td>WEAF</td>
<td>New York.</td>
<td>Musical Programme.</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>A. 32</td>
<td>1.30 a.m.</td>
<td>7.30 p.m.</td>
<td>Strawbridge and Clothier.</td>
<td>WFI</td>
<td>Philadelphia, Pa.</td>
<td>Church Service.</td>
<td>—</td>
</tr>
<tr>
<td>A. 33</td>
<td>1.30 a.m.</td>
<td>7.30 p.m.</td>
<td>General Electric Co.</td>
<td>WGY</td>
<td>Schenectady, New York.</td>
<td>Church Service.</td>
<td>—</td>
</tr>
</tbody>
</table>
CASTOR and POLLUX, twin sons of Zeus, were regarded as aiders of men, patrons of travellers and guardians of hospitality.

A more familiar conjunction of names, because they belong to our everyday life, is that of MARCONI and OSRAM—the names of the two famous organisations which have combined to produce wireless valves of unparalleled excellence—"The Valve in the Purple Box."

Names famous in combination.
No. 2. Castor and Pollux.

---

NEW REDUCED PRICES.

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Type</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-volt Accumulators</td>
<td>G.P.</td>
<td>D.E.R.</td>
</tr>
<tr>
<td></td>
<td>H.S.</td>
<td>D.E.R.</td>
</tr>
<tr>
<td>4-volt Accumulators</td>
<td>G.P.</td>
<td>R</td>
</tr>
<tr>
<td></td>
<td>G.P.</td>
<td>D.E.R.</td>
</tr>
<tr>
<td></td>
<td>L.S.</td>
<td>D.E.R.</td>
</tr>
<tr>
<td>6-volt Accumulators</td>
<td>G.P.</td>
<td>R.S.</td>
</tr>
<tr>
<td></td>
<td>L.S.</td>
<td>D.E.R.</td>
</tr>
<tr>
<td></td>
<td>L.S.</td>
<td>D.E.R.</td>
</tr>
<tr>
<td></td>
<td>L.S.</td>
<td>L.S.</td>
</tr>
</tbody>
</table>

G.P. = General Purpose.
H.S. = Specially suitable for low frequency amplification for Loud Speakers.
L.S. = Can be used with Dry Batteries.
R.S. = For Resistance - Capacity Amplification.

---

MODERN WIRELESS
April, 1925

The Ramo Unit

A new type of Dull Emitter Valves
Experts declare new Wuncell Dull Emitter likely to revolutionise Valves design

To produce a Dull Emitter Valve which operates with a glow that is almost invisible in daylight is a feat that has just been accomplished by the London firm of A. C. Cossor Ltd. This new Valve—called the Wuncell—because it requires only one cell to operate—is certainly the most recent approach to the ideal of a "cold" valve that we have yet seen. Work under working conditions the filament could just be seen glowing in daylight, in which it could readily be likened to the embers of a dying match.

To give some approximate idea of the actual temperature, a representative of the firm stated that according to pyrometer tests, the reading was 800 degrees as against the 2,000 degrees required for a Bright Emitter and even some types of Dull Emitters.

For our benefit actual tests were made and in the presence of one of us a filament was heated to 2,000 degrees, and demonstrated to the lay mind in a very striking manner that such a low temperature must mean a vastly increased life for the Valve.

The British Valve still the best
But it was on actual Broadcasting tests that this new Valve showed its real worth; everywhere in the country is concerned, we have nothing to fear from Continental Valve manufacturers. For the purpose of illustration a good four-Valve set was used. For the first Valve—which acted as a high-frequency amplifier—the Wuncell Type W.1 was used, while for the last stage one of the new Wuncell Loud Speaker Valves was used as a power amplifier. For the second Valve we used two of the standard W.1 Wuncells, while for the last stage one of the new Wuncell Loud Speaker Valves was used as a high-frequency valve.

Wuncells just as sensitive as Bright Emitter Valves
The result of these tests certainly demonstrates that the new Wuncell Valves are not one with less sensitive than standard Bright Emitter valves. Another remarkable feature of these Wuncell Valves was the complete freedom from microphonic action. It has likewise always been an inherent disadvantage of dull emitter diodes that even from the room or other slight vibrations are communicated to the Valves and, in the case of loud speakers, are noticeable in the headphones or loud speakers.

All the usual tests, such as the table m-while, were placed, adjustments of the receiver were made, and the slightest suggestion of a microphonic action was noted.

We understand the reason for this improvement in to be found in the special Wuncan method of mounting the filament. Instead of being supported between two electrodes, spring apart, to counteract expansion and contraction, the filament is unsupported and supported as the centre of a third electrode. No doubt, this is the greatest contribution to this result.

Use Wuncells along with Bright Emitter in the same Set
We were most impressed, not only by the very slight appearance of the Wuncell, but with the vast amount of forethought and research work that must obviously have been put into its construction. For instance, it was noted that the design was used on high-grade components and was a very fine transformer for the Wuncell tube. It had a large filament area, and the use of the filament was a matter of considerable importance, since the slight delay in the circuit had been found to exist in the country without such a delay in the transmission.

In this connection, Mr. S. G. B. L. Stenhouse, the well-known Glasgow experimenter, writes as follows:

"Some time ago I wrote you concerning my recent experiment of improving the reception of my P.I. Valve. I have now determined the efficiency of the P.I. Valve, which has been the first step in the construction of a new type of valve. I have found that the P.I. Valve is capable of giving better results than any other Valve.

"To me it would be impossible to live without a Valve, and I have been using a Valve in my P.I. set for several weeks. I have found that the use of the P.I. Valve in my set has been greatly improved, and I am glad to say that I am now getting the same results with the P.I. Valve as I have been getting with my normal Valve.

"I have been using the P.I. Valve in my P.I. set for several weeks, and I am now getting the same results with the P.I. Valve as I have been getting with my normal Valve.

Have you got down to the short waves yet?

Get ready for the new Broadcasting Stations operating on 100 metres or less

There's lots of enjoyment to be obtained from the new V.R. B.S.S. stations when they come into operation. You should certainly alter your set to suit the new wave lengths, as any evening you will find some British stations corresponding with these new wave lengths.

A most extraordinary thing about these new sets is that the fielldistance can be altered at will. Using the low power, you can get in a station a couple of miles away, but by increasing the power, you can get in a station 100 miles away. Considering the contrast in use and potential of the present and the future, it is almost unbelievable that the use of such a Valve might be supposed to take place only when the 6 -volt accumulator is in use.

In replying to advertisers, use Form Order enclosed.
### SUNDAYS—(continued)

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>British Summer Time</th>
<th>Local Time prevailing</th>
<th>Name of Company owning station</th>
<th>Call Sign and Wavelength</th>
<th>Situation</th>
<th>Nature of Transmission</th>
<th>Approx. duration of Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 34</td>
<td>1.30 a.m.</td>
<td>7.45 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 326 m. &amp; 58 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Church Service</td>
<td>—</td>
</tr>
<tr>
<td>A. 37</td>
<td>1.30 a.m.</td>
<td>7.30 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBZ 337 m.</td>
<td>Springfield, Mass.</td>
<td>Concert or Music, etc.</td>
<td>—</td>
</tr>
<tr>
<td>A. 36</td>
<td>2.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WGR 319 m.</td>
<td>Hotel Statler, Buffalo, N.Y.</td>
<td>Church Service</td>
<td>—</td>
</tr>
<tr>
<td>A. 35</td>
<td>1.45 a.m.</td>
<td>7.45 p.m.</td>
<td>John Wanamaker</td>
<td>WOO 509 m.</td>
<td>Philadelphia, Pa.</td>
<td>Church Service (occasionally at 11.45 p.m. instead)</td>
<td>—</td>
</tr>
<tr>
<td>A. 39</td>
<td>3.0 a.m.</td>
<td>9.0 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WGY 380 m.</td>
<td>New York</td>
<td>Hotel Orchestra, relayed.</td>
<td>—</td>
</tr>
<tr>
<td>A. 40</td>
<td>3.30 a.m.</td>
<td>9.30 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBZ 492 m.</td>
<td>Portland, Oregon</td>
<td>Hotel Orchestra, relayed.</td>
<td>—</td>
</tr>
<tr>
<td>A. 41</td>
<td>4.0 a.m.</td>
<td>10.0 p.m.</td>
<td>KFI Radio Central</td>
<td>KFI 492 m.</td>
<td>Los Angeles, Calif.</td>
<td>Musical programme.</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>A. 42</td>
<td>4.0 a.m.</td>
<td>10.0 p.m.</td>
<td>Chicago Tribune Broadcasting Co.</td>
<td>WGN 370 m.</td>
<td>Omaha, Nebraska</td>
<td>Church Service.</td>
<td>—</td>
</tr>
<tr>
<td>A. 43</td>
<td>8.0 a.m.</td>
<td>11.0 p.m.</td>
<td>Fort Worth Star Telegram</td>
<td>WABP 470 m.</td>
<td>Fort Worth, Texas</td>
<td>Dance Orchestra.</td>
<td>1 hr.</td>
</tr>
</tbody>
</table>

### SPECIAL DAYS

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>British Summer Time</th>
<th>Local Time prevailing</th>
<th>Name of Company owning station</th>
<th>Call Sign and Wavelength</th>
<th>Situation</th>
<th>Nature of Transmission &amp; day of week on which occurring</th>
<th>Approx. duration of Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 44</td>
<td>12.30 a.m.</td>
<td>6.30 p.m.</td>
<td>General Electric Co.</td>
<td>WGY 380 m.</td>
<td>Schenectady, New York</td>
<td>Tues. &amp; Thurs.— Hotel Music relayed.</td>
<td>—</td>
</tr>
<tr>
<td>A. 45</td>
<td>12.30 a.m.</td>
<td>6.30 p.m.</td>
<td>Strawbridge &amp; Clothier</td>
<td>WFI 395 m.</td>
<td>Philadelphia, Pa.</td>
<td>Mon. &amp; Sat.— Hotel Concert Orchestra followed by Children's period at 7.0 p.m.</td>
<td>—</td>
</tr>
<tr>
<td>A. 46</td>
<td>1.0 a.m.</td>
<td>7.0 p.m.</td>
<td>Chesapeake and Potomac Telephone Co.</td>
<td>WGAP 450 m.</td>
<td>Washington, D.C.</td>
<td>Mon., Wed., Fri.— Musical Programme &amp; Talks.</td>
<td>4 hrs.</td>
</tr>
<tr>
<td>A. 47</td>
<td>1.30 a.m.</td>
<td>7.30 p.m.</td>
<td>John Wanamaker</td>
<td>WOO 509 m.</td>
<td>Philadelphia, Pa.</td>
<td>Mon. &amp; Wed., Fri.— Organ or Orchestral Concerts, Talks.</td>
<td>—</td>
</tr>
<tr>
<td>A. 48</td>
<td>2.0 a.m.</td>
<td>8.0 p.m.</td>
<td>Strawbridge and Clothier</td>
<td>WFI 395 m.</td>
<td>Philadelphia, Pa.</td>
<td>Thurs.—Boy Scout Programme, followed by Concert at 8.30 p.m.</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>A. 49</td>
<td>2.0 a.m.</td>
<td>8.0 p.m.</td>
<td>L. Bamberger &amp; Co.</td>
<td>WOR 495 m.</td>
<td>Newark, New Jersey</td>
<td>Tues., and Sat.— Concert.</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 50</td>
<td>2.0 a.m.</td>
<td>8.0 p.m.</td>
<td>Willard Storage Battery Co.</td>
<td>WTAM 390 m. or 361 m.</td>
<td>Cleveland, Ohio</td>
<td>Mon., Wed., Sat.— Musical Programme, Talks.</td>
<td>3 hrs.</td>
</tr>
<tr>
<td>A. 51</td>
<td>3.0 a.m.</td>
<td>9.0 p.m.</td>
<td>Willard Storage Battery Co.</td>
<td>WTAM 390 m. or 361 m.</td>
<td>Cleveland, Ohio</td>
<td>Mon. &amp; Wed.— Concert.</td>
<td>3 hrs.</td>
</tr>
</tbody>
</table>

345
## Results with a T.A.T. Circuit

_Sir,—I fear I have been very remiss in not letting you know before the results I obtained with a 2 H.F. T.A.T. (as described by Mr. John Scott-Taggart in the November issue) on my experimental board early in November at Buxton._

_Aerial used was a Vertex, about 10 feet above a chimney stack, and 40 feet from the ground._

_Earth, double—One 7 ft. to Climax buried tube; one 20 ft. to main water pipe._

**Results.—** On good nights, using one L.F. only, *every* main B.B.C. station good loud-speaker strength; also the following relays—Stoke, Sheffield, Nottingham, Leeds, Bradford, Hull, Liverpool.

With two stages L.F. comfortable loud-speaker strength from Plymouth (230 miles), provided that Hull was not transmitting, and from Dundee (215 miles).

I found no trouble in separating Madrid from Newcastle, but found that Hamburg and Madrid heterodyned each other.

Amongst the German stations Eberswalde and Nuremberg were nearly always loud-speaker strength.

On bad nights, Bournemouth, London and Cardiff were difficult to pick up, but Aberdeen (260 miles) always came in at great strength.

I have been using the original circuit published, _i.e._, with a 250 choke coil, and no grid bias, except on the L.F. stages.

The great beauty of the circuit is that it enables one to get the distant stations without distortion on the loud-speaker.

I also use reaction on the tuned anode coil.

Otherwise, I have worked along the same lines as you have suggested in your more recent articles on the T.A.T.

Wishing you success to all your various publications.—Yours truly,

_M. G. FERGUSON._

Pampstead, N.W. 3.

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### SPECIAL DAYS—(Continued.)

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>British Summer Time</th>
<th>Local Time prevailing</th>
<th>Name of Company owning station</th>
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<th>Situation</th>
<th>Nature of Transmission and day of week on which occurring</th>
<th>Approx. duration of Transmission</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 71</td>
<td>3:00 a.m.</td>
<td>9:00 p.m.</td>
<td>Federal Telephone Manufacturing Corporation</td>
<td>WGR 319 m.</td>
<td>Hotel Statler, Buffalo, N.Y.</td>
<td>Concert &amp; Supper Music (Mondays, Wednesdays and Fridays)</td>
<td>24 hrs.</td>
</tr>
<tr>
<td>A. 52</td>
<td>3:30 a.m.</td>
<td>9:30 p.m.</td>
<td>General Electric Co.</td>
<td>WGY 380 m.</td>
<td>Schenectady, New York</td>
<td>Mon. &amp; Wed.</td>
<td>Concert.</td>
</tr>
<tr>
<td>A. 53</td>
<td>4:00 a.m.</td>
<td>7:00 p.m.</td>
<td>&quot;Morning Oregonian.&quot;</td>
<td>KGW 492 m.</td>
<td>Portland, Oregon</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. 54</td>
<td>4:30 a.m.</td>
<td>10:30 p.m.</td>
<td>Willard Storage Battery Co.</td>
<td>WTAM 300 m.</td>
<td>Cleveland, Ohio</td>
<td>Mon.—Dance Programme.</td>
<td>2 1/2 hrs.</td>
</tr>
<tr>
<td>A. 55</td>
<td>4:30 a.m.</td>
<td>10:30 p.m.</td>
<td>General Electric Co.</td>
<td>WGY 380 m.</td>
<td>Schenectady, New York</td>
<td>Fri.—Musical Programme.</td>
<td>—</td>
</tr>
<tr>
<td>A. 56</td>
<td>5:30 a.m.</td>
<td>11:30 p.m.</td>
<td>General Electric Co.</td>
<td>WGY 380 m.</td>
<td>Schenectady, New York</td>
<td>Tues. &amp; Thurs. Organ Recital.</td>
<td>—</td>
</tr>
<tr>
<td>A. 57</td>
<td>5:30 a.m.</td>
<td>11:30 p.m.</td>
<td>Woodmen of the World</td>
<td>WOAW 526 m.</td>
<td>Omaha, Nebraska</td>
<td>Tues. or Thurs. Entertainment Programme.</td>
<td>—</td>
</tr>
<tr>
<td>A. 58</td>
<td>5:30 a.m.</td>
<td>11:30 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBZ 337 m.</td>
<td>Springfield, Mass.</td>
<td>Fri.—Relayed Orchestra.</td>
<td>—</td>
</tr>
<tr>
<td>A. 59</td>
<td>6:15 a.m.</td>
<td>11:15 p.m.</td>
<td>Woodmen of the World</td>
<td>WOAW 526 m.</td>
<td>Omaha, Nebraska</td>
<td>Sat.—Entertainment Programme.</td>
<td>—</td>
</tr>
<tr>
<td>A. 59a</td>
<td>7:00 a.m.</td>
<td>1:00 p.m.</td>
<td>&quot;Morning Oregonian.&quot;</td>
<td>KGW 492 m.</td>
<td>Portland, Oregon</td>
<td>Mon., Tues. and Sat.—Dance Music</td>
<td>—</td>
</tr>
<tr>
<td>A. 60</td>
<td>7:00 a.m. midnight</td>
<td></td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KYW 536 m.</td>
<td>Chicago, Ill.</td>
<td>Sat.—Hotel Band Relayed.</td>
<td>2 hrs.</td>
</tr>
</tbody>
</table>

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The four-valve receiver presented by H.M. the King and Viscount Lascelles to the stable lads at Egerton House.
THE REASON WHY Gambrell Coils surpass all others in efficiency is owing to their unique patented construction which enables a series of coils to be produced having extremely small H.F. resistance and almost negligible self capacity.

Gambrell Coils are known by letters instead of numbers, such as 35, 50, 75, etc., which refer to the number of turns in an ordinary coil, for the simple reason that giving the number of turns in Gambrell Coils gives no true comparison with other makes. (See table below.)

Very full information about the above and other features which result in Gambrell Coils being more efficient than ordinary coils will be found in the pamphlet “Efficiency Inductances” which will be sent to you on application.

If your Retailer has not Gambrell Coils in stock—he can quickly obtain them to your order.

Members of the Trade who have not yet received our literature are particularly requested to write for same.

GAMBRELL BROS. LTD.
76, Victoria St., London, S.W.1

Works: Merton Road, Southfields, S.W.18.

*Phones: VICTORIA 9938 PUTNEY 3647-2

GAMBRELL COILS

<table>
<thead>
<tr>
<th>No. of Turns on Ordinary Coils</th>
<th>Series</th>
<th>Parallel</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>a/2 70</td>
<td>105</td>
<td>1.30</td>
<td>210</td>
</tr>
<tr>
<td>25 A 110</td>
<td>200</td>
<td>315</td>
<td>5/0</td>
</tr>
<tr>
<td>35 B 175</td>
<td>260</td>
<td>325</td>
<td>5/0</td>
</tr>
<tr>
<td>50 C 275</td>
<td>415</td>
<td>495</td>
<td>825</td>
</tr>
<tr>
<td>75 D 380</td>
<td>530</td>
<td>690</td>
<td>1150</td>
</tr>
<tr>
<td>100 E 530</td>
<td>750</td>
<td>975</td>
<td>1625</td>
</tr>
<tr>
<td>150 F 830</td>
<td>1200</td>
<td>1600</td>
<td>2700</td>
</tr>
<tr>
<td>200 G 1350</td>
<td>1600</td>
<td>2700</td>
<td>2700</td>
</tr>
<tr>
<td>300 H 2000</td>
<td>2250</td>
<td>4300</td>
<td>10/3</td>
</tr>
<tr>
<td>500 I 3500</td>
<td>3500</td>
<td>6200</td>
<td>12/3</td>
</tr>
<tr>
<td>600 J 5800</td>
<td>5800</td>
<td>10,000</td>
<td>14/-</td>
</tr>
<tr>
<td>700 K 8000</td>
<td>8000</td>
<td>14,500</td>
<td>18/-</td>
</tr>
<tr>
<td>1,000 L 14,000</td>
<td>14,000</td>
<td>24,000</td>
<td>19/-</td>
</tr>
</tbody>
</table>

This is the Sign of the Most Efficient Coil

Insist on having the Coil contained in the Red Carton bearing the above sign.

You will then be certain of obtaining the coil which gives the best results.

In replying to advertisers, use Order Form enclosed.
The small door on which the detector is mounted allows it to be shut away from the dust.

The crystal set about to be described is so arranged that comparative tests of different crystals and plug-in coils may be easily made. But while having these advantages, it does not, as many experimental crystal sets do, look large and complicated with many detectors, switches and terminals on it. On the contrary, it has a very neat and compact appearance, and may very well take the place of the ordinary drawing-room set, and have the aforementioned advantages in flexibility.

General Description

The detector, which is of the multiple crystal type, is completely protected from dust by being shut right into the cabinet by means of the small door in the front of the cabinet. The tuner for the lower range of broadcasting wavelengths consists of a highly efficient type of tapped basket coil wound on a permanent former and tuned by means of a variable condenser. It is possible to use a loading coil in series with this for the high-powered station; the plug for such a coil is seen to the right of the panel. By means of the lower switch on the left-hand side it is possible to short this plug when it is not in use, or to short the fixed basket coil so that the condenser may be shunted across the plug-in coil alone, thus making it possible roughly to test the comparative wavelength band and efficiency of various commercial coils and also home-made ones.

Components

Before going on with the construction of this receiver, it may be as well to give a list of the component parts required. The coil former is not obtainable commercially, and must therefore be made at home; but this will not be found very difficult if the instructions given further on are followed. The components required, other than the material for the former, which will probably be found in the junk box, are as given in the following list:

![Diagram of the circuit used.](image)

- A Crystal Set for Comparative Tests

By

A. S. CLARK

List of Parts Required

1 Ebonite panel, 6 in. by 8 in. by \( \frac{3}{4} \) in. (Peter Curtis).
2 0005 mfd. variable condenser (Jackson Bros. square-law).
3 Loading coil plug (Woodhall flush mounting).
4 Stud switches with 3 contacts and 2 stops each (Bowyer-Lowe).
5 Terminals (Arthur Butler spring type).
6 Decko dial indicator.
7 Multi Crystal detector (Service Radio Co.).
8 Packet Radio Press panel transformers.
9 lb. No. 20 d.c.c. copper wire.
10 Quantity square wire, wire, etc.
11 Cabinet for horizontal panel with door, dimensions given in Fig. 4. (W. H. Agar).

Use of other Components

The particular make of component is given for those who desire to follow the actual receiver in every detail. But any other similar components of good make will do just as well. There will probably be found plenty of room for them on the panel.

The Construction

The first thing to do in the construction is to make the former for the coil. The materials required for this are: some odd pieces of ebonite, one \( \frac{4}{8} \) B.A. nut and bolt, and two or three bone knitting needles. These latter should be about \( \frac{1}{8} \) in. to \( \frac{3}{8} \) in. in diameter and long enough so that seven pieces \( \frac{3}{4} \) in. long may be cut from them. First cut the seven pieces of knitting needle; a hack-saw will do the job quite well. Now cut out a seven-sided piece of \( \frac{1}{4} \) in. ebonite to the dimensions given in Fig. 3; the length of the sides is best found by trial. Each corner is flattened off a little with a file and a hole drilled at each one about \( \frac{1}{4} \) in. deep and a little smaller than.
This neat little crystal receiver includes a new method of detector mounting, and it allows interesting experiments to be conducted, whilst always remaining ready for broadcast reception.

The simple layout is seen in this photograph. Note that the telephone terminals are on the left.

The underside of the panel, clearly illustrating the basket coil and its tappings.

Winding the Coil

The glue on the spokes must first be left to harden properly before winding is commenced, which is carried out in the following manner. Take one end of the d.c.c. wire and give it a twist round one of the spokes, leaving a length of about 6 in., for connecting purposes. Now wind on 45 turns of wire. It is not possible with this thick wire to make a very neat coil, but the efficiency of a coil wound with it is worth the slight loss in neatness. After winding on 45 turns give the wire a twist round the same spoke it was started on, and after making a loop about 6 ins. long, again twist it round this spoke and continue to wind in the same direction as before. After another ten turns have been added, a further tap is taken in the same manner as the first. All the taps and the two ends should be brought out at the same side of the coil. Place another ten turns on, and then finish the coil off by giving the wire a twist round the spoke and threading it through the coil at about six turns from the outside. If it does not seem as if all the turns will go on, it is because the coil is not being wound tightly enough. Fig. 3 makes the coil construction clear.

The Coil Holder

A piece of ebonite to hold the coil to the panel is cut to the dimensions given in Fig. 6, and the coil is clamped to it as shown, a small ebonite washer of $\frac{1}{2}$ in. thickness being interposed between the coil and its holder. Two holes for 4 or 6 B.A. screws must be tapped in the bottom of this piece of ebonite where shown, or if no taps are available it is possible to force the screws into holes a little too small for them. The tappings should be placed so that they are to the right side of the coil when it is looked at with its support at the back; this will make the connections from the tappings short and neat. Before connections are made to the coil, the loops must be cut in the middle and the wire on both the resulting ends bared right up to the coil; now twist the ends together once or twice. Cut one of them off short to about $\frac{3}{4}$ in., and solder it to the other, which is used for making the actual joint.

Drilling the Panel

We must next drill the panel to the dimensions given in Fig. 2. With the particular type of coil plug and switches used, a template is supplied on their containing boxes.
and this greatly simplifies fitting them. Before drilling the holes for the screws to fix the panel to its cabinet it is best to fit it in the cabinet, noticing the thickness of the beading which supports it; it will then be an easy matter to drill these the right distance from the edge of the panel. Although the telephone terminals come rather near to the switch studs, there is quite enough clearance here. If a different type of condenser is used it may be necessary to drill the hole for the Decko indicator in a slightly different place.

Fixing the Components

Having completed the drilling of the panel, we must now fit the terminals and components. Fit the small ones first, leaving the coil till the very last. The reader may have noticed by now that the aerial and earth terminals are opposite to their usual end. This was done so that when adjusting the crystal detector with the right hand the telephone cords will not get in the way. The detector may at this point be screwed to the door in the front of the cabinet.

Wiring

The wiring is fairly simple, and may be followed from the wiring diagram, which is Fig. 5, and with the help of the photographs of the back of the panel. The crystal detector is connected by means of two pieces of flexible wire connected where indicated. In the case of the telephone terminal which goes to the detector, it was found as well to solder the flex to a short piece of square wire about 1 in. long, which is soldered to the terminal shank. This makes a neater job of this connection, as there are no other wires which are soldered to this terminal. The connections to the tappings on the coil are made all the way with the actual wire of which the coil is wound, and they are very conveniently placed, as shown in the photographs of the back of the panel. The connection from the aerial to the left-hand stud of Sr was made in order to keep the tappings neat, and is shown in the theoretical circuit for consistency.

Comparing Crystals

When comparing different types of crystals it is best to leave the set tuned in this manner to the local station. By means of the detector used it is a simple matter to change from one crystal to another by simply twisting the cupholder round. Also if more than five specimens of crystals are to be tried, it is an easy matter to change any of the crystals by means of the spring fixing cups. Two-crystal combinations may be tried by means of the spare crystal cup which is seen screwed on to the base.

Types of Crystals

The particular specimens of crystal which are used in the detector are left to the choice of the constructor. But a note of what they are should be made on a piece of paper for future reference, a crystal which is easily recognised being taken as a starting point. A shorting plug for the loading coil socket is unnecessary, as this is shorted with the lower switch. This is an advantage, as it obviates the necessity of removing the loading coil when it is not in use.

How to Use the Set

For whatever purpose the set is used, the aerial and earth are always connected to the terminals marked for them, also the telephones remain on the two left-hand terminals, so it is not necessary to alter the external connections at any time. When using the set purely for listening to the programme from the local station, no external coil is necessary. Place the lower switch right over to the right and try the
April, 1925

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In consequence of the reductions in the prices of B.T.H. Headphones and B.T.H. Radio Valves, coupled with the increased demand for Radiola Receivers, the following revised schedule of prices is current as from February 17th.

<table>
<thead>
<tr>
<th>Apparatus</th>
<th>Complete with</th>
<th>Headphones</th>
<th>Valves</th>
<th>Dry Batteries</th>
<th>Old Price £</th>
<th>New Price £</th>
</tr>
</thead>
<tbody>
<tr>
<td>Radiola &quot;Bijou&quot; Crystal Receiver</td>
<td>1 set 4000 ohm.</td>
<td>1 B5</td>
<td>H.T.</td>
<td></td>
<td>3 5 0</td>
<td>2 15 0</td>
</tr>
<tr>
<td>Radiola &quot;Model A&quot; Crystal Receiver</td>
<td>1 set 4000 ohm.</td>
<td>1 B5</td>
<td>H.T.</td>
<td></td>
<td>4 15 0</td>
<td>4 5 0</td>
</tr>
<tr>
<td>Loading Device, 1,600 Metres, for above</td>
<td>1 set 4000 ohm.</td>
<td>1 B5</td>
<td>H.T.</td>
<td></td>
<td>8 6</td>
<td>8 0</td>
</tr>
<tr>
<td>Radiola I. Valve-Crystal Receiver</td>
<td>1 set 4000 ohm.</td>
<td>1 B5</td>
<td>H.T.</td>
<td></td>
<td>11 0 0</td>
<td>10 0 0</td>
</tr>
<tr>
<td>Loading Coils 1,600 Metres, for above</td>
<td>1 set 4000 ohm.</td>
<td>1 B5</td>
<td>H.T.</td>
<td></td>
<td>17 0</td>
<td>16 0</td>
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<tr>
<td>Radiola II, 2-Valve Receiver</td>
<td>1 set 4000 ohm.</td>
<td>2 B5</td>
<td>H.T. and L.T.</td>
<td></td>
<td>21 0 0</td>
<td>19 0 0</td>
</tr>
<tr>
<td>Radiola III, 3-Valve Cabinet Receiver, with enclosed Loud Speaker</td>
<td>1 set 4000 ohm.</td>
<td>3 B5</td>
<td>H.T. and L.T.</td>
<td></td>
<td>50 0 0</td>
<td>49 0 0</td>
</tr>
<tr>
<td>Radiola VI, 6-Valve Cabinet Receiver, with enclosed Loud Speaker</td>
<td>1 set 4000 ohm.</td>
<td>4 B5</td>
<td>H.T. and L.T.</td>
<td></td>
<td>137 0 0</td>
<td>135 0 0</td>
</tr>
<tr>
<td>Radiola Portable 3-Valve Receiver, Leather finish</td>
<td>1 set 4000 ohm.</td>
<td>3 B5</td>
<td>H.T. and L.T.</td>
<td></td>
<td>28 0 0</td>
<td>27 0 0</td>
</tr>
<tr>
<td>Ditto Mahogany finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>30 10 0</td>
<td>29 10 0</td>
</tr>
<tr>
<td>Power Amplifier, 2-Valve</td>
<td></td>
<td>2B4 or 2B6</td>
<td></td>
<td></td>
<td>12 10 0</td>
<td>12 0 0</td>
</tr>
<tr>
<td>Unit Amplifier, 1-Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 15 0</td>
<td>2 15 0</td>
</tr>
<tr>
<td>Portable Loud Speaker &amp; Amplifier, Leather finish</td>
<td></td>
<td>2 B6</td>
<td>H.T. and L.T.</td>
<td></td>
<td>24 0 0</td>
<td>23 10 0</td>
</tr>
<tr>
<td>Ditto Mahogany finish</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>26 0 0</td>
<td>25 10 0</td>
</tr>
<tr>
<td>Headphones 4,000 ohms</td>
<td></td>
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<td>1 5 0</td>
<td>1 0 0</td>
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<td>Headphones 120 ohms</td>
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<td></td>
<td></td>
<td></td>
<td>1 2 6</td>
<td>1 0 0</td>
</tr>
<tr>
<td>R Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>12 6</td>
<td>11 0</td>
</tr>
<tr>
<td>B3 Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 1 0</td>
<td>18 0</td>
</tr>
<tr>
<td>B4 Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 15 0</td>
<td>110 0</td>
</tr>
<tr>
<td>B5 Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 5 0</td>
<td>1 1 0</td>
</tr>
<tr>
<td>B6 Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 15 0</td>
<td>110 0</td>
</tr>
<tr>
<td>B7 Valve</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1 17 0</td>
<td>112 0</td>
</tr>
</tbody>
</table>

The new price of the Radiola, II 2-valve Receiver includes Loading Coils (1600 metres) for the High Powered Station.

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when wiring up the receiver this diagram should be followed carefully.

between the two crystal detector terminals. This cup will screw on in place of the catwhisker and the tightening nut which holds it, and is only fixed to the base as a secure place for keeping it.

Longwave Reception
When it is desired to receive Chelmsford or the spark time signals sent out from the Eiffel Tower, a plug-in coil is inserted in the loading coil socket to the right end of the panel, and the lower switch placed on the middle stud. The top switch should be placed on the left-hand stud.

If it is desired to find the comparative efficiency of a number of plug-in coils on either the short or long wavelengths, the lower switch is placed on its left-hand stud, and tuning done by means of the condenser. It is possible to get a rough idea of the comparative maximum or minimum to which two plug-in coils will tune by observing at which adjustment of the variable condenser the local station is tuned in. The lower the reading at which it comes in loudest, the higher the wavelength to which the particular coil will tune.

Test Report
In testing this receiver, its greatest advantage was found to be the ease with which it was possible to change over from the local station, which is 2LO, to Chelmsford. With a 150 or 200 coil in the loading coil socket, 5XX was received almost as loud as 2LO in S.W. London. The strength of the London station was remarkably loud for a crystal set, it being possible to just hear the programme at any point in a fair size room out of a small loud speaker.

When using an aperiodic aerial coil the signal strength was not reduced. The best tuning position for the local station was with the tapping switch on the middle stud and with the condenser at about 80 degrees, thus indicating that the coil would tune easily over the whole B.B.C. wavelengths. Ship stations and Eiffel Tower time signals were received at good strength, and it was very easy to compare different coils as already indicated. Listening after the B.B.C. stations had closed down on Sunday, 15th March, a station of French origin was heard loud enough to distinguish the speech. Indications point to this station being Petit Parisian.
O f the new Radio Press books and other publications just in the press, probably the one with the widest appeal is a particularly original and helpful little volume by R. W. Hallows, M.A., Staff Editor, whose articles in our journals are so well known for their wide scope and thorough grasp of detail. This new book is entitled “Wireless Faults and How to Find Them” (R.P. Series, No. 24, price 1s. 6d., post free 1s. 8d.), and the very title should make it plain that this is a book which no wireless man can afford to miss, for the subject is one in which we all take an extreme interest at certain times, when we welcome any aid, however small.

The assistance given by this most interesting little book, however, is far from small, and it is difficult to see how even the most stubborn of concealed faults can evade for long anyone who has read it and who carries out the ingenious methods of trouble tracing which the author has devised, so searching are the tests which he describes.

The Contents

The book opens with a chapter giving the necessary details for the construction of an extremely cheap and simple but effective little appliance which is used in conjunction with a pair of telephones for the greater part of the testing of the set and its constituent parts. The author then proceeds to deal thoroughly with the testing of all those of the principal components of a set which are commonly responsible for faults, such as condensers, fixed and variable, transformers, coils, detectors, and so on, passing from components actually forming a part of the set to such accessories as valves, batteries and aerial and earth.

These sections of the book are to be regarded as preliminary to the chapters on actual set testing, and a very useful and time-saving method has been adopted here. The author gives (and explains fully) a complete series of tests for the set under consideration, which are designed to narrow down gradually the possible area of the trouble until it is finally tracked down in a particular circuit, say the anode circuit of a low-frequency amplifying valve, and then finally in a particular component, perhaps the L.F. transformer. The reader then refers back to the section on the testing of L.F. transformers, and proceeds to find out exactly what is wrong with his defective specimen.

A complete separate chapter is provided to explain the testing of crystal sets, and another for single-valve sets, while general tests for the common types of multi-valve sets form the subject of another section. The last chapter deals in full detail with the subject of fault-tracing in reflex circuits, which demands somewhat special treatment, as most readers are no doubt aware. The symptoms which they display and the particular types of faults which may occur are naturally somewhat different from those of “straight” circuits, but the whole matter is treated most lucidly, and anyone who has had the misfortune to incorporate unknowingly a dud component in a reflex set will be able to set about its location with entire confidence with the aid of this book.

A Valuable Feature

A specially valuable and time-saving feature will be found in the summaries appended to each chapter, which take the form of clearly arranged tables with headings for “Symptoms,” “Possible Causes,” etc., so that the whole provides a brief summary upon a single page of the preceding chapter. One can therefore use it as an aid to memory and run through the whole series of systematic tests for any given set very rapidly, having previously read the whole chapter. The arrangement, of course, is rather like that of the analysis tables used by chemists.

The book has been so written and arranged that it can be understood and used with perfect ease by even the absolute beginner, who will particularly appreciate the very full and comprehensive way in which our popularity is expressed at the time of its publication. Sales are proving extremely rapid, and form a gratifying testimony to the faith which our readers place in the soundness of the designs of Radio Press authors in general, and of those of Mr. Rattee in particular.

Radio Press News

A NEW PUBLICATION.

“Six Simple Sets,” by Stanley G. Rattee, M.I.R.E., Staff Editor (R.P. Series, No. 21, price 1s. 6d., post free 1s. 8d.), has now been on sale for some weeks, and has exceeded even the expectations of its popularity expressed at the time of publication. Sales are proving extremely rapid, and form a gratifying testimony to the faith which our readers place in the soundness of the designs of Radio Press authors in general, and of those of Mr. Rattee in particular.

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An Amusing Case

RECENTLY I came across a fault of quite a novel kind. A friend, who is more or less a beginner at wireless, had made a two-valve set consisting of a rectifier followed by a transformer-coupled note magnifier. Instead of the ordinary four-pin valve he had used a pair of the anti-capacity or "test tube" type. He brought the set round to me one evening complaining that it would not work. The symptoms were that no signals of any sort or kind could be brought in. As an examination of the wiring disclosed nothing amiss, the set was attached to the aerial for a practical test. It was obvious that something was seriously wrong, for not a sound could be heard when a buzzer wavemeter was placed quite close to the A.F.I., and tuned through a band of wavelengths which must have been covered by the particular coil in use. When a milliammeter was inserted into the high-tension circuit it disclosed such a terrific plate current that the set was hastily switched off. A reading of some 20 milliamperes was obviously excessive for two valves!

The Result

On looking at the valves themselves I saw at once what had happened. They had been placed wrongly in their-clip holders, with the result that the plates were in contact with the grid connections and vice versa. The result of doing this is to produce the amazing circuit shown in Fig. 1, and it was hardly surprising to find that the set refused to work. When the valves were turned round it functioned excellently. It is quite easy to make a mistake when placing anti-capacity valves in their holders if one is careless about it, since they will go in just as easily either way. In fact, I must confess that I have done it myself in an absent-minded moment on more than one occasion. In these valves the little metal cap which forms the plate contact is coloured red or green to distinguish it from the grid contact on the opposite side. My beginner friend took it that the special colouring indicated that it belonged to the grid. But there is another way of distinguishing the contacts from one another which is useful, partly because it makes a strong appeal to the eye and partly because this indication is always there, though the red or green colouring of the plate contact may be rubbed off in course of long service. If you look at Fig. 2 you will see that the "pip" of the valve is upon the same side as the grid contact. This seems the rule in test tube valves, and it is a handy thing to remember. If you happen to change a valve always look at it to see that its "pip" is pointing in the same direction as those of the others.

A "Test Tube" Valve Tip

Even if they are correctly placed in their holders anti-capacity valves may occasionally be a little troublesome. The other day, when trying out a newly-made four-valve set fitted with two D.E.V's and two D.E.Q's, I was unable to get any signals at all at the first attempt. As I was quite sure that there was nothing wrong with the components, all of which had been tested before the set was put together, or with the connections, I suspected the valves. I therefore resorted to the substitution method, replacing first of all each of the D.E.Q's with another valve of the same type. This produced no result, but when I changed the first D.E.V for another signals came in as they should have done. The valve was put aside to be tested later. When it was tried out subsequently in another holder it was found to be functioning though not very well. What had happened was that the plate contact had become rather dirty and when this was brightened up with a small piece of the finest emery cloth the valve was restored to its normal excellence. Those who use anti-capacity valves should bear in mind that a bad contact between either a plate or a grid boss and its clip is much more likely to occur than it is between the corresponding pins and legs of a valve of the ordinary type in its holder.

Poor Contact

The clips do not exert at any time a particularly firm pressure upon the little caps of test tube valves, so that a very thin film of dirt or grease may be sufficient to throw them out of action, or, at any event, to give curious results. It is as well to give both plate and
grid clips a good head inwards from time to time so as to make them grip the valve as firmly as possible. Further, each of the metal caps should receive an occasional rub with fine emery and the same treatment should be given to the contact faces of the clips so as to keep them bright and clean. Contacts can also be kept fairly clean if the following simple method is used fairly frequently. Leaving the valve in its holder, grasp it with the forefinger and thumb of one hand and turn it slightly from side to side half-a-dozen times. In this way the caps are rubbed against the faces of the clips with the result that both surfaces are cleaned.

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  - 0.002-0.004 mfd., 2/6 each.
  - Type M.B.
  - 0.005-0.01 mfd., 2/6 each.

**Fluxes and Leaks**

Does a deposit of greasy flux upon the surface of an ebonite panel spoil its insulating properties? I have always felt quite sure that it does, in view of practical experience of various troubles which occurred with panels in a messy state and disappeared when the deposit of flux upon them was removed. However, if two terminals are placed quite close together and flux is deliberately run on to the panel between them, the "megger" fails to disclose any leakage. I have tried this several times and have always obtained a reading of "infinity." In last month's Modern Wireless a confirmation of my belief that messy panels are leaky was given from two different sources. The Test Department states that one of the main sources of trouble in defective sets is to be found in a layer of flux upon the panel, due to bad soldering. Again, Mr. A D. Cowper, in writing on the "Super Negadyne," states that the least trace of flux left upon the panel between valve sockets is sufficient to make it impossible to produce a "gridleak howl." Those who find that their sets are unduly noisy when no signals are coming in, that tuning is flat, and that there is difficulty in producing oscillation, should bear these facts in mind.

**Preventing Flux Deposit**

The trouble is very likely due to any defect in the ebonite but to the presence of a film of flux between contacts, especially valve legs, on its under side. I have known any number of cases of flatness, deadness and noisiness which were cured at once by washing the panels over carefully with absolute alcohol. But for the best method is to prevent the occurrence of leakage and not to be forced to find a cure for it. My own tip when soldering is simply this. When the panel is ready for its connections to be made I press a piece of blotting paper about 2 in. square on to the shank of each terminal, pushing it down until it lies on the ebonite. Valve legs are treated in the same way. If the smallest amount of flux is then used any splutterings are caught by the blotting paper, which is removed by tearing it away when the job is done. This simple tip enables one to turn out a set with panels that are absolutely clean, and if it is used there need be no fear provided that the ebonite is of good quality, that there will be high resistance leaks sufficient to cause a variety of unpleasant results.

**Crystal Troubles**

Quite often I have brought round for examination a crystal set which is either not working at all or is doing extremely badly. Sometimes the fault is one of the usual ones, such as a broken lead, a faulty coil or a bad contact with the moving plates of the variable condenser. But in the great majority of cases none of the components are at fault. If ever you come across a crystal set which has shown a gradual decline in value, and when finally signals are either very weak indeed or absent altogether, look to the crystal itself in the first instance. Very often the trouble is due to the way in which it has been mounted in its cup. The average galena crystal is a fairly delicate thing which will not stand much heat without losing its sensitiveness. Many amateurs
ruin their crystals by embedding them in Wood's metal which has been made too hot, or, worse still, in common solder. In such cases a crystal sometimes loses its sensitivity at once, and the set never works satisfactorily. But sometimes again the application of excessive heat produces not an immediate loss of sensitivity but rather a progressive and fairly rapid decline. Solder should never be used for mounting any type of crystal, and personally I would never recommend even Wood's metal with its much lower melting point for the use of a beginner. If you use the latter, heat it up in the cup until it runs and then allow it to cool until it has almost set before embedding the crystal in it. Some amalgam pastes, again, are not satisfactory, since they are made embedding the crystal in it. Some amalgam pastes, again, are not satisfactory, since they are made with mercury which has an action, not only on the crystal itself, but also upon the brass of the cup in which it rests, producing as a rule a slow falling off in signal strength.

Switching Troubles

The temptation to fit switches to the wireless set is a strong one, for they enable so many circuit changes to be made in the easiest way in the world. It is, however, a temptation which should be resisted, upon the high-frequency side of the set at any rate. Not long ago I built a receiving set with two stages of high-frequency amplification which gave excellent results when it was first used. It was as sensitive, as selective, and as stable as one could wish for. Later I succumbed to the temptation and fitted very small switches, unfortunately rather a risky thing to do in a receiver of this type. The switches used were the tune-standby and the series-parallel seen in Figs. 3 and 4. The result of this "improvement" was utterly to spoil the set's performance. These very small switches introduce a comparatively large amount of unwanted capacity on the high-frequency side of the set, quite sufficient at any rate to account for a variety of undesirable symptoms. If tune-standby or series-parallel switches are used, or if there is a switching arrangement enabling a high-frequency valve to be thrown in or out of circuit as desired, miniature switches of an unsuitable design should not be employed. Instead, anti-capacity switches should be mounted. These are specially designed so as to reduce to the smallest possible limits the amount of added capacity, and where they are employed no ill results should be anticipated. When later I removed the switches originally fitted and replaced them with others of low capacity design the set returned once more to its former good working. If you find

![Diagram](image-url)

**Fig. 3.**—Two common forms of switching. A series-parallel arrangement is shown at (a) and tune-standby at (b).
the high-frequency side of your set unsatisfactory and have switches of the midget kind, you will probably obtain very much better results either by doing away with them altogether or by substituting others of a type more suited for the purpose.

**Gassing High-Tension Batteries**

High-tension batteries provided with a covering of wax have as a rule no vent holes for the cells. When the battery is in action a certain amount of hydrogen gas is given off by each cell, and if there is no vent for this, something must give way when the pressure becomes excessive. The wax surface of one battery that I had in use last year became covered in a week or two with bulges caused by gas which could find no means of escape. In such batteries the ill effects of gassing are not as a rule noticed unless the amount given off is rather large. The gas produced by ordinary work while no very great amount of current is drawn from the battery may be so small that it does not give rise to any great amount of bulging. But if a battery is allowed to stand in the sun or near a fire, the increased pressure caused by the heat may be sufficient to do it considerable damage. It is therefore desirable to see that high-tension batteries, especially those not provided with vent holes, are kept in cool places. When bulging does occur it is as difficult to remove as in the case of gassing high-tension batteries.

**Note Swivel Mounting.**

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**Note Swivel Mounting.**

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LONDON'S LARGEST 'Stock of
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Using the Potentiometer

By R. W. HALLOWS, M.A., Staff Editor.

An interesting description of a few of the many ways in which that much neglected little instrument, the potentiometer, may improve the working of your set.

Do you use a potentiometer? If you do not you may be failing to make use of one of the greatest aids to obtaining efficiency for there is hardly a set, crystal, single-valve or mult-valve, whose performance is not sometimes improved by the proper employment of this little instrument. If you do already make use of a potentiometer, are you quite sure that you make the most of its help? In this short article I want to point out some of the ways in which the potentiometer may be employed to give those very fine adjustments of important potentials which make so much difference to the quality of reception and to the sensitivity of the set.

How it Functions

First of all, what is the potentiometer? In spite of its rather forbidding name it consists of nothing more than a resistance of wire, carbon provided with a moving contact of some kind. A glance at Fig. 1 will show readily how it works. In the drawing we see that a resistance of 300 ohms is connected directly across a six-volt battery. You need not be afraid that by doing this you are short-circuiting the battery. By Ohm's Law the current flowing, volts divided by resistance, will be

\[
\text{current} = \frac{\text{volts}}{\text{ohms}} = \frac{6}{300} = 0.02 \text{ ampere.}
\]

The coil will have a value of +6 volts, whilst the bottom will be at zero potential. Across the windings the drop in voltage will be perfectly regular—that is to say, half way down them the potential will be +3 volts, three-quarters of the way down it will be +1.5 volts, and so on. By moving the slider, represented

![Diagram of a simple potentiometer circuit for applying positive potential](image)

Fig. 1. - A simple potentiometer circuit for applying positive potential.

in the drawing by an arrow, up and down the coil we can tap off any potential that we like between 6 volts positive and zero.

Obtaining Positive or Negative Potential

The potentiometer arranged as shown in Fig. 1 enables us only to obtain a varying amount of positive potential. We can, however, arrange the potentiometer so that either positive or negative potentials may be obtained. Fig. 2 shows how this is done. The two dry cell batteries A and B, each having a value of 3 volts, are wired in series and a connection, C, is taken from the junction between them. If the slider X is placed at the left hand end C of the resistance coil, the easiest path for current will be from Y through battery A to C and thence to X. In this case X will be 3 volts more positive than Y.

If we move the slider right across to the other end D, the position of affairs will be reversed. The easiest path will now be from Y through battery B to D, and X will be 3 volts more negative than Y. When X is placed in the middle position E between C and D, the batteries are working against each other, their potentials cancel out and X and Y are at the same potential. By moving X from E towards C we can obtain any potential between 0 and +3 volts, whilst if it is moved from E towards D the value will vary from zero to -3 volts.

Another Method

Exactly the same result can be obtained as shown in Fig. 3 with a potentiometer whose windings are provided with a central tapping. Here two dry cells are shown in use and the end C is 3 volts positive to D. Since the voltage drop across the resistance is regular, the centre point E is 1.5 volts more negative than C and 1.5 volts more positive than D. If the slider X is placed opposite E, X and Y will be at the same potential. When it is moved from E towards C, X may be made anything from 0 to 1.5 volts more positive than Y, and if it is moved from E in the direction of D, the potential of X can be varied between nothing and 1.5 volts more negative than Y.

Improving Crystal Sets

Fig. 4 shows how reception with a crystal set can sometimes be improved by means of a potentiometer such as that seen in Figs. 2 and 3. In the early days of wireless, when carborundum was fairly extensively used a potentiometer

![Diagram of a potentiometer with centre tap](image)

Fig. 2. - By means of this arrangement, positive or negative potential is obtainable.

Fig. 3. - Using a potentiometer with centre tap, potential may be varied as in Fig. 2 with the use of only one battery.

was seen on every receiving set. To-day, however, owing to the use of various forms of galena crystal, it is hardly ever seen, since quite satisfactory results are obtainable without it. But as a matter of fact there is hardly a crystal on the
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Users of H.F. Receivers appreciate how extremely difficult it is to bring circuits into resonance. The large tuning condenser which permits only a comparatively large variation of capacity tends to make the accurate balancing a matter of chance. It is quite simple when searching for Distant Signals to pass over the correct dial reading. But if you use a low maximum capacity condenser which gives you very fine tuning it will come as a pleasant surprise just how easily you can tune in weak signals.

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**On Building an H.F. Receiver**

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A casual glance at the H.T.C. low capacity valve holder shows that a reduction of capacity is effected to a much greater degree. That segment a reduction introduces very high efficiency into your receiver goes without question; and the better results you will obtain by utilizing the H.T.C. low capacity valve holder is so marked that for H.F. work they are absolutely essential. H.F. amplification may be considerably hampered by high capacity at the valve. In fact, capacity effects at the heart of your receiver may completely deprive your valves of the power to oscillate on the short wavelengths. It may shorten effective receiving range and in many instances—especially where embedded sockets are used—introduce distortion.

You can only get the best from your set if you employ H.T.C. Low Capacity Valve Holders. Remember also that when you are using the popular Plug-in Type H.F. Transformer make no mistake about them in conjunction with the H.T.C. low capacity Valve Holders.

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**WARNING!**

Purchasers of Low Capacity Valve Holders are notified to beware of imitations. It is very necessary when buying to look for the name H.T.C. on the template, without which no Valve-Holder is the genuine and original H.T.C. It may be taken that colourable imitations—simply because they are imitations—are not nor cannot give efficiency which is inherent to the H.T.C.
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**TYPE AR.**

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<table>
<thead>
<tr>
<th>Characteristic</th>
<th>L.F.</th>
<th>H.F.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Filament Volts</td>
<td>1.8-2.0</td>
<td>1.8-2.0</td>
</tr>
<tr>
<td>Filament Current</td>
<td>0.3 amp</td>
<td>0.3 amp</td>
</tr>
<tr>
<td>Anode Volts</td>
<td>20-100</td>
<td>20-100</td>
</tr>
<tr>
<td>Total Emission</td>
<td>16 m.a.</td>
<td>16 m.a.</td>
</tr>
<tr>
<td>Amplification Factor</td>
<td>5.0</td>
<td>9.5</td>
</tr>
<tr>
<td>Approx. Impedance</td>
<td>15,000</td>
<td>40,000</td>
</tr>
<tr>
<td>Normal working slope</td>
<td>0.10</td>
<td>0.30</td>
</tr>
</tbody>
</table>

The distinguishing marks are a green line for L.F. and a red line for H.F. on the side of the bulb. This line will also indicate the Anode pin of the cap. *Price 18.— each.*

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market whose working is not occasionally improved by the application of either a positive or a negative potential across it. Most galena crystals become more sensitive under the influence of a positive potential of a fraction of a volt. It will therefore be sufficient to use a single cell from a large flashlamp refill with a centre connection—potentiometer, or two cells in series if the arrangement shown in Fig. 2 is employed. The efficacy of the potentiometer is best tested in the following way. Rig up the circuit shown in Fig. 4 and cut the potentiometer out of action by short circuiting the points A and B. Now tune in a very weak signal. When this has been done remove the short circuiting lead and try the effect of moving the slider of the potentiometer very gradually first in one direction and then in another. Very often an adjustment will be found which brings up the weak signal to a greater strength than they were without the potentiometer. Upon strong signals the difference will not be so marked.

Controlling Oscillation

Let us see next what the potentiometer can be made to do in the valve set. Fig. 5 shows the way in which the instrument is most commonly used—and in many cases abused. A high frequency valve, such as that seen in the drawing, whose plate and grid circuits can be sharply tuned will tend to oscillate when the two are brought into resonance, provided that there is not an undue amount of resistance in the coils and their connections, and that the variable condensers are efficient. Oscillation can be prevented by making the grid of the valve rather positive. The effect of this is to produce a flow of grid current which damps the oscillations. If, however, the positive potential upon the grid is too large, distortion may result. It is a sound working rule that a stabilising potential of two volts positive is the maximum that should ever be used and that one should aim at never employing a positive potential exceeding 1 volt. If the set cannot be held down in this way steps must be taken to produce stability by other means, and not by excessive use of the potentiometer. It is advisable, by the way, that where the potentiometer is used for regulating the grid potential of a high frequency valve a condenser should be fitted in the position shown by the dotted lines in the drawing that is, between the slider and low tension negative. This condenser acts as a bypass for high frequency oscillations, which would otherwise have to pass through a number of turns of the resistance coil.

Adjusting Grid Potential in a Detector Circuit

But the use of the potentiometer is by no means limited in the valve set to produce stability on the high frequency side. In Fig. 6 it is seen a way in which it can be employed to advantage in either single-valve sets or multi-valvers. The usual practice is to connect the gridleak of the rectifying valve direct to low tension positive.

The grid potential can be varied by altering the resistance of the leak, that is, either by using a variable gridleak or by fitting fixed leaks of different values. Very much finer adjustments are made possible by the arrangement shown in Fig. 6, where, instead of being connected directly to low tension positive, the lower end of the leak is taken to the slider of a potentiometer. This arrangement will be found particularly useful for short wave work, where the grid potential of the rectifying valve is apt to be somewhat critical. When the potentiometer is used a suitable value for the leak is about 1 megohm.

Controlling Negative Bias

Another position where the potentiometer can be employed
Fig. 7.—A very convenient means of controlling negative grid bias in a low-frequency amplifier.

The Double Circuit Neutrodyne Receiver

SIR,—It may interest you to know that I have recently completed the Double Circuit Neutrodyne Receiver, described by Mr. John Underdown, in November issue of MODERN WIRELESS. I am situated within 3 miles of the Cardiff station, but can get all the B.B.C. stations except 2LO without interference from 5 WA, as well as Hamburg, Frankfurt, Zurich, Madrid and Petit Parisien. In the latter case there was a faint undercurrent of 5 WA, but this was not strong enough to interfere much. I have also had several amateur stations. Later I hope to get the H.F. transformers and coils to include the higher wavelengths and thus include other stations. Reaction control is so wonderfully smooth, and my wireless friends are many of them anxious to make a similar circuit. This is the first valve set I have made, and was chosen for its selective qualities. I would like to take this opportunity of expressing my appreciation of MODERN WIRELESS and the Wireless Constructor, both of which are responsible for many happy and instructive hours.—Yours truly,

OLWEN PROGER (Miss).
St. Fagans, Glamorgan.

The Aristocrat of Receiving Sets

THIS Supersonic Heterodyne Receiving Set is the aristocrat of the Western Electric Economy Series of Radio Instruments.

It contains seven Wecovalves, and operates with a Frame Aerial which together with a Battery Box and head-receivers, forms the complete equipment.

Broadcast telephony can be received from all British and Continental Stations operating on 300 to 3,000 metres, the distance range usually being limited only by atmospheric conditions.

It should be noted that being a Frame Aerial Set, the whole equipment is portable and can be taken from room to room.

The No. 41002 Set is designed for head-receiver reception, but can be used in conjunction with a power amplifier for operating Loud Speakers. The Supersonic Heterodyne principle, as used in this instrument, results in a wonderful degree of selectivity and sensitiveness.

Price (complete) £75.

Western Electric Company Limited,
CONNAUGHT HOUSE, ALDWYCH,
LONDON W.C.2.
CENTRAL 1745 (9 lines).
Branches: Birmingham, Leeds, Manchester, Newcastle, Glasgow, Cardiff, Southampton, Liverpool, Dublin.
From a Reader
in the United States.

Sir,—Through the kindness of an English friend, I have recently received a copy of the January issue of Modern Wireless. It is a most interesting publication, and I wish to express my appreciation of it at this time. Here, in the States, the conditions are very different from those in England and on the Continent, and I find your publication very enlightening as regards English methods of transmitting and receiving.

Simultaneous Broadcasting

During the recent International Transatlantic tests a great amount of interest was shown on this side, and a number of your stations were received. One reason that the stations were not verified more generally lies in the fact that the call letters were not given frequently enough.

The B.B.C.'s chain broadcasting would not be so very popular here, where everyone is looking for distance. The American Telephone and Telegraph do link up stations quite frequently, but only when there is something very important to broadcast, such as the National Conventions. Prize-fights once called for chain broadcasting, but it caused so many people to stay at home that Tex Rickard refuses to allow any further broadcasting of events which he promotes.

The Growth of Radio

Here it is not possible to operate a small crystal or one-valve outfit with any degree of satisfaction. These sets do function in a satisfactory manner when they are near a broadcasting station, but when one lives several hundred miles away from any station, then such a set is of little use.

Clayton is a good illustration of what a small rural town is like. It might interest you to know Clayton's radio history, as I believe that most other towns have very similar ones, and hence it is almost the radio history of the whole of rural America.

There were the usual number of boys who were interested in wireless, and these with their spark coil and crystal receivers made up the group of local wireless experts. Then came the Westinghouse Company with their broadcasting stations KDKA and WJZ, which at that time were very crude when compared with what they are to-day.

Rapid Progress

It was decided to give a concert in the Town Hall, and a receiver was installed, but the concert failed. Station WJZ played special music, and everything was done to make it a success, but failure came swiftly, and in this case silently. This was a decided setback to local enthusiasm, but the few who believed continued to talk radio night and day.

Finally they met with success. A local church was without a pastor, and it was finally arranged that a former pastor would speak from station WHAM in Rochester, New York. A receiver made by the General Electric Co. and an amplifier of Western Electric make were installed, and a loud-speaker set in the pulpit. The church was packed with people from miles around assembled to hear "The Radio." The reception of the hour and a quarter sermon was perfect; every word was understood, and the voice of the speaker recognised by old friends. After that, receivers were installed by many, and to-day finds this little town well equipped with radio receiving apparatus. Most of the sets incorporate five or six valves, and there are two eight-valve super-heterodynes which received English broadcasting every night of the recent tests. The story will give you a good idea of how radio came to the average country community.

Popular Receivers

The squeals of radiating receivers are the greatest pest of the present-day radio fan. No longer do the amateurs cause trouble. In some localities spark stations owned by the Government do cause trouble, but these are being eliminated and will soon be done away with.

Neutrodyne receivers seem to lead in popularity to-day. With a five-valve set it is easily possible to hear the stations on the Pacific Coast while living on the Atlantic seaboard. The majority of valve sets are equipped with loud speakers and the sets are no longer playthings. They have a place in every home, and in country places are the chief means of enjoyment.

Advertising by Wireless

Most of our stations are used for advertising mediums, and a great amount of bunk is poured nightly into the air. Every day the quality of transmission is improving, and with it come better programmes. Recently the Victor Talking Machine Company started broadcasting, and now every two weeks the broadcasters may hear some of the finest artists of to-day.

There are, in cities which have broadcasting stations, a great number of small crystal sets; but I rather agree with your Captain Eckersley, who said: "You must at least own a six-valve set in America if you don't wish to be looked down upon like a man who wears an india-rubber collar." It is a fact that here we go in for multi-valve sets, and this seems to show that the radio public has accepted radio, and it is no longer a plaything, but rather one of the necessary luxuries of modern life.

Radio has ceased to be merely interesting; it has become as important as the movies and the newspaper, and the American people are taking it into their homes, not as a wonder, but as a matter of course.

With sincerest best wishes for the year.—Yours truly,

"Jack" P. Ross.
Clayton, New York.
A Simple Selective Set
By A. D. COWPER, M.Sc.,
Staff Editor.

A simple and efficient single-valve receiver, employing Aperiodic Aerial Coupling and Reinartz Reaction, which can also be used as an ordinary direct-coupled receiver on long waves.

The set to be described here has been designed so that those without much experience of constructional work, and who do not like to undertake the winding and adjustment of the necessary inductances, may still have available the extremely selective device of so-called "semi-aperiodic" coupling, or aerial-tap auto-transformer coupling with but a few turns actually included in the aerial circuit proper, so long and so warmly advocated by the writer for reception of telephony on the short broadcast waves. Combined with this is the Reinartz type of reaction, with a fixed reaction coil fed via a small variable condenser from the plate, a suitable radio-choke being connected in the plate circuit above the 'phones. This device gives a smoothness and ease of reaction control which is a revelation to those who have struggled with the conventional device of a swinging reaction coil coupled with a fine wire inductance, itself coupled, in turn, directly to a heavily damped aerial.

For reception of the high-powered station and long-wave Continental stations (when a good outside aerial is available) ordinary plug-in coils can be substituted for the short-wave coils, and the receiver is then used as an ordinary direct-coupled receiver, but with the Reinartz type of reaction still in use. With the aerial load in addition, the reaction control is not then so refined, and there is noticeable the usual effect of reaction coupling on primary tuning; this is much less troublesome on the flatter-tuned long-wave stations. When a very small inside aerial is being used, this arrangement is also to be preferred to the "aperiodic" arrangement, as the latter then involves quite a serious loss of signal-strength on distant stations.

General Design

The components are all mounted on the back of a panel 6 in. by 8 in. The instrument illustrated was contained in a neat imitation leather covered box with hinged lid, supplied at an extremely moderate price by Messrs. Scientific Supply Stores. The "aperiodic"
Build "Bretwood" Guaranteed Components into your set. They are 100 per cent efficient—that's why they are successfully used and recommended everywhere.

The "Bretwood" Anode Resistance.
Price 3/- Postage 3d.

The "Bretwood" Patent Valve Holder.
Price 1/9 Postage 3d.

The "Bretwood" Anti-Capacity Switch
Price 5/- Postage 3d.

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12-18, London Mews, Maple Street, London, W.

Accuracy

The purchase of an L.F. Transformer upon the wellmeaning and appreciative recommendation of a friend is only wise when performance is uniformly and consistently good. The production of L.F. Transformers, with the confidence that these will perform identically, requires scientific manufacturing of the highest order. Any two chronometers—intimate as these instruments are—register the passage of time identically. What an example of uniform accuracy!

The very close matching of Royal Transformers is an achievement equally scientific. The inductance, resistance, reactance and impedance are as nearly alike as scientific manufacturing methods can produce them. Thus the incorporation of Royal Transformers into your set is not an enterprise, but rather a confident act; the results you must obtain will equal in volume, purity and richness of tone those which are the pride of many thousands of set builders who build Royal Transformers into every successive receiver they build.

Price £1 0 0

Special Notice.
We have opened a special department handling Highclass American Apparatus. We shall be pleased to forward lists describing the following—
Sonotone Kits, Haynes Griffin Products, Bremer Tubby Low Loss Tuners, Godfrey Coils, Apex Veneri Controls, Bradleystats, Leads and Ohms, and Bradleytubes.

More Items Later.

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**ELECTRON WIRE**

**THE PERFECT AERIAL**

Not an ordinary Coil of Wire—but an extraordinary Coil of Wire—a special Coil of Wire; a Wire which, known as Electron, the World's Wonder Aerial, has brought immeasurable pleasure to countless wireless enthusiasts. Gone is the trouble of erecting an outside mast with its unsightliness and uncertainty. To-day, the clean gate-proof Aerial can be laid over anything, fixed anywhere—in sight or out of sight—with surcease of perfect reception.

**A special box**

For such a special Aerial it was necessary to have a special Box. For public protection we created a distinctive Box printed in blue, which cannot be mistaken. Thus, if you insist upon Electron, insist also upon genuine Electron in the special Electron Box. The price is 1/8 for 100 feet.

**TWENTY pennyworth of SHEER HAPPINESS.**

**A wonderful result**

A wonderful result will be obtained even from the most mediocre set, if you use Electron. A wonderful result will be obtained even from the most mediocre set, if you use Electron.

Extract from a letter March 4th, 1925.

"I erected a number of indoor aerials (of different wires) all exactly the same length, including Electron Wire. An independent observer sat with his back to the set, and I changed the aerials about while the observer noted the difference in signal strength. Every time he voted for the Electron Aerial."

"This was quite a conclusive test and I can recommend this wire to anyone who wants to fix up an aerial with the minimum of trouble."

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Laid double for loud-speaker and phone extensions.

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NEW LONDON ELECTRON WORKS, LTD.

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EAST HAM, LONDON, E.6.

Telephone: 1409 East Ham (3 lines).

Telegram: "Distortionless reproduction with volume and sweetness of tone are assured, as long as your set lasts, if you fit Powquip Low Frequency Transformers. Every Transformer has each part thoroughly tested before assembly, and the complete instrument is guaranteed by us to give perfect satisfaction for twelve months. (See our guarantee form in every box)

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The Twelve Prize Winners are:

- M. STIG JOHANSSON, Morgatan, Haga, Sweden.
- S. PARKINSON, 103, Lloyd Street South, Moss-side, Manchester.
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- E. A. DRAY, 37, Kingsley Road, Wimborne, S.W.19.
terminal is actually on the tapped plug-in coil itself, the new No. 60 Lissenagon "X" coil of Messrs. Lissen, Ltd., with twoappings at the sixth and tenth turns respectively, being used. These tapings are brought out to small terminals on bosses arranged on each side of the base or plug-in mount; so that the aerial lead-in wire can be connected directly to either. The A.T.I. coil and the fixed reaction-coil are plugged into fixed holders at the rear of the panel; the two tuning-condenser handles, for A.T.C. and reaction-condenser respectively, are at the front, and the filament resistance control is towards one side of the panel.

Valve Mounting
The valve is carried where it should be in any but a purely experimental receiver—outr of harm's way behind the panel. Sufficient clearance is made for the D.E. 5b type of valve, with a large bulb, since wherever possible the writer prefers to use a detector valve of high amplifying power (the D.E. 5b has an M of 20) and generous electron emission. A carbon compression type of filament resistance is suggested, to provide for the use of more than one type of valve, when desired. The small radio-choke used here, which is of a type which will be available from several of the advertisers in this journal, is a very narrow slab-coil of a large number of turns of fine wire, and is mounted directly on the centre terminal of the reaction-condenser in a compact manner.

Radio-Choke
In case this terminal is too short, a small piece of No. 2 or 4 B.A. screwed brass rod can be arranged to carry it in approximately the same position as shown in the figures, the column being secured by back nuts through the ebonite end of the condenser or through the panel itself. A No. 250 or larger plug-in coil can be used in place of the special choke-coil, but is cumbersome. The actual choke shown was that supplied by Messrs. Lissen, Ltd.; it has two terminals and is thin enough to mount directly on the condenser terminal.

Tuning
The A.T.C. must be both of low minimum capacity and of the actual maximum capacity, 0.003 pF, specified, as there is not the large margin which results from the use of excessively large tuning-condensers with several plug-in coils to cover the broadcast belt. Some types, especially the low-priced metal-ended type with absurdly small insulating bushes, may have so high a minimum capacity that the receiver will not tune down to the relay stations; and a 0.005 " nominal " would be required to reach Aberdeen's wavelength. Those actually incorporated in the receiver shown were the J.B. ebonite-end type and give the desired range. The wavelength scale is almost linear. It is suggested that the usual meaningless degree scales be abandoned, for the short-wave range at least, and replaced by " stations " scales, or at least " wavelength " scales. Pointers and short ebonite handles are accordingly used in place of bevel scales; the stations or wavelengths are then marked directly on the panel with a pen and Chinese white, or with black ink on a plain semicircle of ivoryne (the reverse side of an ordinary 180 degree scale) secured on the panel with Chatterton's compound.

Components Required
Box or cabinet (to take panel 6 in. by 8 in.).
Panel, 6 in. by 8 in. of % in. thickness preferably. (That used was the handsome wood-grain finish Trolite panel."
Lissenagon "X" No. 60 double-tapped plug-in coil; a No. 35 plug-in coil, preferably of same make; for 280-500 metres. For higher waves, a set of plug-in coils of any good make.
A 0.003 μF variable condenser (Jackson Bros.).

There is sufficient clearance for all types of valves.
Valve window (Grafton Electric Co.).
Grid condenser and leak, '0003 F and 2 megohms, of Dubilier or other reliable make.
6 W.O. terminals.
3 Telephone terminals (Gerrard Radio), 4 volt.
Short extension handles, and pointers.
No. 4 B.A. screws and nuts; No. 16 gauge or square bus-bar wire, tinned.
A set of Radio Press Panel Transfers.

Value of H.T.
With the D.E. 5b valve, a 6 volt accumulator and the full 60 volts or so of the H.T. battery may be required, but with a soft Dutch valve a 4 volt accumulator is generally required, and the H.T. value is very critical. One experimented with gave excellent results with just 19 volts H.T. - Ordinary R valves require usually a 4 or 6 volt accumulator and 50 volts H.T.; for other types the makers' instructions should be followed, and the H.T. adjusted at the smallest value which will give easy, steady oscillation over the whole scale when trying for distant stations. The principal point to notice is the necessity for careful adjustment of filament and H.T. in order to eliminate all "oscillation hysteresis" or backlash: these should be adjusted, by trial, so that the valve glides imperceptibly into and out of oscillation without any "plop." It is possible to accomplish this with a lightly coupled aerial and Reinartz reaction, and it is the whole secret of efficient reception with a valve. On the loud local station this does not apply so much; a bright filament and maximum H.T. may be necessary then to avoid harshness due to overloading the valve together with minimum reaction.

Constructional Details
These are mainly given in the figures and wiring diagram. Those components which are not of the one hole fixing variety are secured by No. 4 B.A. screws with back-nuts through the panel. The coil holder will require four large clearing holes. The window is cut out by drilling a circle of small holes, breaking out the piece thus isolated, and finishing with a round file or small key-hole saw. All wiring is done with bare tinned wire, though actually there are only three soldered joints in the receiver, of which one at least could be avoided, if desired, by putting the wire in question, directly on the coil-plug. If any alterations are introduced in the actual arrangement, the point to bear in mind is that the length of the grid-lead in particular, and of any high-frequency leads in general, should be kept to a minimum; and they should be well isolated from other leads and one another.

The wiring of the coil-plugs should be followed carefully, as otherwise reverse reaction will ensue, and negative results will be obtained. In a few cases the reaction-coil itself may have been wired up internally so that it will give reverse reaction even if the other wiring has been done correctly. Hence it is preferable to use the same make of coil for reaction and A.T.I.

The writer believes that the
In replying to advertisers, use Order Form enclosed.
Out of the welter of exaggerated claims and mis-statements comes the new Gravity Detector—

If the 1925 Radio Season is famous for nothing else it will be noteworthy for the heavy crop of new crystal detectors. Large and small—cheap and expensive—permanent, semi-permanent or with cat-whisker—every type is represented. But one stands out from the crowd. One is so unique in its principles that it cannot fail to attract attention. The Gravity Detector.

The Eureka Gravity utilises all the sensitiveness of the catwhisker Detector but with none of its disadvantages. Its principle is just this: The crystal is held in a cup within the centre of the cartridge. Around the periphery of the case is placed a row of catwhisker points, each one of which is weighted at the head. When the Gravity is rotated these points are caused to drop, one by one, to make contact with the Crystal. Thus it is only necessary to give the Detector a twist until the loudest signals are heard.

No factory-sealed permanent Detector can ever hope to compare with the Eureka Gravity because the user can utilise any favourite piece of crystal known to be absolutely sensitive.

Besides, no crystal lasts for ever—its sensitiveness is bound to fall off in time. In any case, the present immense popularity of catwhisker contact is proof positive that any double-crystal combination is of little value under present-day conditions.

To change the crystal in the Gravity is but a moment’s work. Just lift it from the spring clips, separate the two halves, lift out the old crystal and drop in a new piece, and the job is done. Quicker in fact than describing it. And the crystal is protected against dust, fingering and light.

No matter what type of Set you are using the Gravity will improve it. If it is a Reflex it will stabilise it and yield wonderful tone. Experience has proved that half the trouble in Reflex Sets is due to the incorrect pressure of the catwhisker. In the Gravity this is done for you automatically. We have calculated the pressure at which the contact should be made—no more, no less.

Get your Dealer to show you one of these handsome Gravity Detectors to-day—the fact that it is a product of the manufacturers of the Eureka Transformer is a sure guarantee of its excellence.

Portable Utilities Co., Ltd.,
Makers of the Eureka Transformer

And from all Dealers

Six advantages you get with no other Detector.

1. The Crystal is firmly held in a spring cup and the moving points fall to make contact with it as the holder is rotated.
2. When the Gravity Detector is in use the Crystal is fully enclosed and protected from dirt.
3. The Gravity Detector can be reloaded with a new crystal in a moment. Nothing to unscrew or solder.
4. The slightest turn of the Detector automatically brings into use a new spot on the crystal and a new contact point.
5. Nothing to wear out—the Gravity Detector will last a lifetime.
6. Stout plated spring clips are supplied and the base can be removed for fitting the Detector direct to the panel.

Complete with Crystal 6/6

In replying to advertisers, use Order Form enclosed.
Lissenagon tapped coil is made with the tappings towards the end connected to the male plug connection; the "earth" end is thus the socket side of the coil base, and the receiver is wired accordingly, with a "plug" of the A.T.I. mount connected to earth. The reaction-coil mount is arranged the same way round, but the connection is crossed as shown.

**Operation**

Beginners are advised to insert the valve first with the H.T. battery wholly disconnected, and should be slowly moved in the range where your station might be expected. With a coil of definite inductance, and a tuning-condenser of known size and range, the element of uncertainty is largely eliminated from the tuning with this type of coupling. By slowly increasing the reaction, the station should finally be heard, below the "plop" point, which indicates oscillation when oscillation hysteresis is still present. The tuning should be left at this point, and the reception adjusted to give maximum clear signals, without the hoarse speech and jangled out-of-tune effect with music which spells oscillation. There should be no wait when the tuning is slightly altered. Finally, by small adjustments of tuning, reaction, filament and H.T., the best result for that station is obtained.

**Reception of Chelmsford**

With the larger coils, as direct coupling is used, less precise information is available, and the tuning points must be found by trial, different aerials implying either the No. 150 or the 200 coil for 5XX, with the smallest reaction coil which will give oscillation with this in use. Both sizes should be tried. On a small indoor aerial the No. 200 coil and nearly all the tuning capacity were required, but a No. 60 reaction sufficed. On a large outdoor aerial with long lead-in the No. 150 with 200 reaction coil in every case. The writer has tried a large number of valves of all types in this receiver, ranging from the 05 to small power valves, except for this point no trouble was experienced, with proper H.T. and filament temperature. Excellent results were obtained on a small indoor aerial with the Dextraudion (filament 0.5 ampere, 1 volt) D.E. valve run from a single small bell-battery with some 50-60 volts H.T. The ordinary "pea-nut" type and the 2 volt 0.5 ampere type of D.E. also operated well, with the usual reaction coils.

**Test Report**

In this connection the very pertinent remarks of Mr. P. W. Harris in recent issues of the Wireless Constructor and Wireless Weekly might well be quoted as indicating the different range, etc., to be expected from a given receiver under different operating conditions. This set was designed for home construction rather than for extreme D.X. work in the hands of experts. Actually, on a moderate outdoor country aerial in a good position for reception, and under favourable conditions, all the B.B.C. main stations and relays, mutual heterodyne excepting, have been read repeatedly on this set; a dozen Continental stations at least; and one or two American stations (KDKA and WHZ) whilst the local stations, 2L0 and 5XX, each at 35 miles, came in at moderate loud-speaker strength, with proper adjustment of reaction to give good signals without oscillation, within one minute and with no previous experience. In this condition the application of the moistened fingers across aerial and earth terminals did not silence 2L0 in the loud-speaker. A D.E. 5b valve was used with about 2 volts H.T. On the earth-lead alone, or on a short length of No. 20 as indoor aerial, beneath a corrugated iron roof, London was still clear on the 'phones. With a temporary aerial consisting of a short length of Electron aerial wire thrown into the leaves of a small apple tree, away from other aerials, and with the instrument and its batteries standing on wet grass but with no direct earth connection, London (35 miles) was readily tuned in on the 'phones, and at least one other wave was heard, probably that of Birmingham.

The effective range of the receiver will be greatly increased by the addition of a stage of E.F amplification, since the limiting factor is the ratio of casual local noises to signals.
"Macondo" Pneumatic Ear Pads

We have received from Messrs. McLeod and McLeod samples of the "Macondo" pneumatic ear pads for use on the ear-pieces of existing head-sets. At the present stage of advancement of the radio art, when very many listeners are still compelled to wear head-phones for considerable periods in order to listen to the programmes, any device is welcome which will in some manner reduce the extreme discomfort, amounting at times, after continuous wear for an hour or more to little short of torture, experienced by many when their heads are clamped closely in the jaws of the average head-set, particularly when the ear-pieces are of the small type. These pneumatic ear-pads proved, on extended trial, to alleviate this discomfort to a large extent, and made possible the wearing of the head-phones for longer periods without the unpleasant after-effects often experienced. They consist of a small annular inflated rubber cushion, about 2 1/2" in. diameter, with a corrugated surface of thin rubber and with a rubber flange at the back to fit over the ear-piece. They could be fitted, on trial, over even the very large type of ear-piece used on certain types of head-phones. Incidentally, these close-fitting pneumatic pads excluded external noises to an unusual degree, so that for crystal reception considerable improvement may be noticed from this point alone; but for extreme D.X. work the slight rustle noticed in the rubber from movements of

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the head, etc., might nullify this advantage. A point that should be noticed in practical use is that the perspiration cannot escape when these are worn, and therefore condenses in quite a noticeable degree on the diaphragm and in the receiver. Particularly with a valve receiver this should receive attention, on account of possible insulation deterioration, and with diaphragms which are liable to rust, the ear-pieces should be removed at intervals and dried out.

With this proviso, we can certainly recommend these aids to comfort in reception.

"Goltone" Coil-Holder

Messrs. Ward and Goldstone, Ltd., have sent for test a sample of their three-coil holder, the "Goltone" Micrometer Regulating Holder. This is for mounting either on the front of a panel or on the side of a cabinet, and is built up on a moulded base which is in one piece with the sides of the instrument, between which the coil-plugs are arranged. The base is to be secured by small screws through the rim of it; an open space is left through which the ordinary flex connections can be carried to small terminal screws on the coil holder itself. The fine adjustment device consists of a long spindle with a longitudinal micrometer adjustment, a knob at the end of which bears against a contact piece attached to the moving coil holder. The latter is held up by a spring, which eliminates backlash. On trial the mechanism operated smoothly, and gave close control over coupling.

"Goltone" three coil holder.

It was found that the springs were strong enough to handle the usual sizes of coils, but the holder should be used in a vertical position if very large coils are in use. The insulation resistance was excellent.

"Radix" High-Frequency Couplings

Messrs. Radix, Ltd., have sent samples of various devices for use in H.F. amplification coupling. The insulated units, consisting of a very similar small mushroom type of fitting, but with two legs only, to fit in an ordinary 4-pin holder, showed similar tuning range and characteristics on test. A larger tapped inductance for tuned anode reactance capacity coupling was mounted on the usual 4-pin base, and had incorporated the valve-panel used.

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Any Receiving Set that is worth attaching to an aerial is worth treating fairly—is worthy of the best headphones—is worthy of "General Radiophones."

Try them and see!
in it the necessary anode-grid connection. A small 6-point selector switch (with short-circuiting arrangement to reduce effects of dead-end turns) gave an effective range of about 100 to 1,500 kilocycles (200 to 3,000 metres wavelength) on test.

In each case no trouble was experienced with instability, using ordinary parallel tuning on a direct-coupled aerial. Amplification, as compared with a single-valve with properly controlled reaction, was not conspicuous; and the selectivity, when using critical reaction, was notably less than with the single detector-valve alone.

Reaction units were also submitted for use with these devices. One type had a small coil pivoted on a fitting which plugs into a central hole in the transformer or anode coil, being controlled by a short insulated handle. On trial, with good and bad R valves and 30 volts H.T., this sufficed to give oscillation over the whole range. The higher range coil gave, on trial, good results with the tuned-anode unit, but produced uncontrollable self-oscillation with the corresponding transformer even when quite isolated. Unfortunately, one terminal on the short-wave reaction unit was so tightly screwed up that the whole twisted out and broke one wire connection when attempt was made to unscrew it, so that this could not be tested.

The insulation resistance in the transformer units proved excellent on trial.

A robust coil, the "Tangent."

"Tangent" Coils

A set of tuning inductances, Nos. 25 to 75, covering the usual short broadcast wavelength range, has been submitted for test by Messrs. Gent and Co., Ltd. These are extremely robust coils wound as simple short solenoids on a ring former, 3 in. diameter, and secured by a crossed lacing of fine cord. The Nos. 25 and 35 are single-layer, of fairly fine wire and ½ in. to ½ in. wide; the other two had a double layer, separated by the fine cord mesh. The usual plug-in fitting is provided, very securely fastened on by a brass strap.

Measured on a basic capacity of 0.0003 µF plus casual panel capacities, corresponding to a P.M.G. aerial under working conditions, the wavelength range was from 240 to 370 metres for the No. 25, and from 300 to 460 metres for the No. 35, with a 0.0005 µF (actual) tuning condenser. The No. 50 gave 480 to 740 metres, and the No. 75, 660 to 980 metres tuning range under the same conditions. With a 0.001 µF (actual) tuning capacity the No. 35 gave up to 575 metres, the No. 50 to 900, and the No. 75 to 1,250 metres, thus covering the range from 240 to 1,250 metres with adequate overlap. Free oscillation was obtained over this range under normal working conditions, the reaction-coupling required being noticeably less than with some plug-in coils, indicating a moderate H.F. resistance and comparatively small dielectric losses. Signal strength and selectivity were about what one would expect with an average fairly fine-wire plug-in coil.

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PUT A LARGE “OCTOPUS” Mansbridge Condenser
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The Best By Test

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<th>.05</th>
<th>.25</th>
<th>.5</th>
<th>1 MF.</th>
<th>2 MF.</th>
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<td>A GOOD CONDENSER CAN BE.</td>
<td>2 4</td>
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<td>3 10</td>
<td>4 8</td>
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The Postcard, reproduced here, reads as follows:

"I bought one of your Crystals here on Saturday last, and would like to tell you of my results. Frankfort of all, one-and-a-half miles off, on the L. Speaker, Radio-Paris, 5 XX land on one pair of ‘phones, and still easily readable on two pairs. Sunday morning I got the concert from Koenigsmeisterhausen on 2,800, and after dinner 2.3 W.E. time Radio-Paris, Monday evening I tuned in Bournemouth, 5 XX, R-Paris, some other stations, which I did not wait to identify, and finally I got Aberdeen perfectly clear. I think for pure Crystal reception, without any amplification, this is nearly a record, the distance being over 1,200 km. 5 XX and R-Paris I can tune in while Frankfort is transmitting (with a wave-catcher). My aerial is non plus ultra. With hearty congratulations on the excellence of your fabric, I am

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Used units replaced easily.

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A "Micrometer" Filament Resistance

Messrs. Enterprise Manufacturing Co. Ltd., have sent for test a sample of their "Micrometer Filament Dimmer," a one-hole fixing compression type of filament resistance of a design familiar by now, but with a novel element in the shape of replaceable resistance cartridges which are inserted in it to give different resistance ranges. Thus the same external mechanism suffices for several different working ranges, for bright or dull-emitter valves; and the change can be made from one to the other range with considerable ease, only one connection having to be disturbed.

The instrument has the customary one hole fixing device of metal bush and lock-nut, and is provided with a substantial knob. The body is about 2 in. long by ½ in. diameter, and carries a milled head brass screwed stopper at the farther end. This is removed in order to insert or change the resistance cartridge, and has a terminal screw with soldering tag on one side of it. The other terminal screw and tag are affixed to the side of the bush fitting. The cartridges take the form of small thick rubber tubes with brass plug ends, ½ in. long and some ¼ in. diameter, and contain a carbonaceous resistance powder.

With the plug marked "5," the range, as measured, was from 90 to 5 ohms with 4½ turns of the knob; with the "10," from 2 to 80 ohms with 4½ turns; with the "20," from 24 ohms to 20 ohms with 1½ turns; and with the "30," from 2 to 1,000 ohms with ¾ turn of the knob. The "10" gave a resistance of 20 ohms with but a fraction of a turn of the knob. The values were roughly reproducible after the resistance element had been "aged" by repeated compression and decompression. In actual trial in reception with the No. "5" cartridge good silent control was obtained with an ordinary R valve and a s-six-volt battery, though it was noticed that the lighting-up of the filament was rather sudden, so that the valve might easily be over-run momentarily if great care was not taken.

Evidently there is not a very close relationship between the numbers on the cartridges and the available range, and a considerably greater uniformity of operation, together with a more gradual change of resistance, would be desirable. The principle is evidently very sound and offers great convenience to those who possess many valve sets and wish to use a variety of valves in them, and for renewal of the resistance element if this should happen to "pack" or otherwise deteriorate in use.

"Jix" Terminals

Many amateur constructors meet their Waterloo when they attempt the new fashion of wiring up radio-receivers exclusively with bare stranded wire of large gauge, with right-angled bends, in making the soldered joints between the ends of the wires and the back-studs of the terminals, etc., on the back of the panel. The "Jix" terminals, samples of which have been submitted to us by W. E. Bowling, are designed to dispel this difficulty, since these a panel can be wired up completely without any soldered end-joints of this type at all. The device consists essentially of an elongated back-nut, about ½ in. in length, with the end drilled and split in a manner which makes it an easy matter to obtain a firm and good electrical contact with the end of a large-gauge bare wire inserted in the small hole in the end, by pinching the latter with a pair of pliers. It would actually be possible to alter the wiring, though for such a purpose a new "Jix" terminal would be preferable, applied on the same stud.

On trial these terminals were found to hold large square wire securely, and were easy to apply on a No. 4 B.A. back-stud. It is evident that the connection could be readily made permanent by the use of solder, when preliminary adjustments and trials were completed; for this purpose alone these terminals would effect a great saving of time and temper even for the experienced.

"Shipton" Variable Grid-Leak

A type of variable grid-leak which departs somewhat from the usual form is that submitted by Messrs. E. Shipton and Co., Ltd. This is of the familiar black-lead pencil line variety, but the means adopted to obtain good contact with the pencil line and to mount the resulting instrument in a practicable one hole fixing form are novel and ingenious.

Externally, the instrument recalls the usual circular type of filament resistance, and has the customary one hole fixing sleeve and collar, and large controlling knob on a central spindle. A case of black insulating material 1½ in. diameter replaces the usual resistance-spiral and its former, however. Within this moves, through an angle of nearly 300 degrees, an arm, carrying in a small holder a short piece of graphite pencil. An external spring causes this pencil to bear down on the end of the case, and to make thus on a circular track the pencil line which provides the leak, this being actually widened out to give a convenient resistance range. Accessible and reasonably large terminals on the end and side of the case provide convenient connection; an indicating pointer is provided which at the same time acts as a locking device for the knob, in a manner reminiscent of the device used on motor valve springs, and is exceedingly neat and effective here.

To remove the knob in mounting the instrument, the spring is eased down, the pointer withdrawn, and the knob then slides off easily; but when in place is locked firmly.

On trial, the resistance range was from about ½ to 40 megohms maximum, and a useful fine adjustment was given over the more usual range employed. A little
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The PAD that relieves the pressure

Without doubt, the "Kumfi” DeLuxe Ear Pad marks a new era in wireless. Instead of the discomfort caused by pressure from the hard surface of the headphones, we now have a soft, resilient, velvety ear pad which relieves the pressure and enables us to listen in comfort. The services of the "Kumfi” Ear Pad do not end there. It eliminates exterior noises, absorbs all moisture, and, being antiseptic, keeps the ear-pieces hygienic and clean. The pad is self-adhesive and only needs pressing against the ear-piece of the headphone. It is equally simple to remove.

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EAR-PAD

If your Wireless Dealer cannot supply, send 1/3d to the makers.
The pads will be sent POST FREE.
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A view of the interior of the wireless cabin on the s.s. "Maloja." The direction-finding apparatus may be seen on the left of the photograph.

The services of the "Kumfi” Ear Pad do not end there. It eliminates exterior noises, absorbs all moisture, and, being antiseptic, keeps the ear-pieces hygienic and clean. The pad is self-adhesive and only needs pressing against the ear-piece of the headphone. It is equally simple to remove.

Push-Pull Switch

A compact and very neat form of single hole fixing panel switch, giving a plain "on" and "off" action, has been sent for test by Messrs. Lissen, Ltd.

With the addition of two washers supplied with the instrument, this will accommodate itself to panels from about 3-16 to 5-16 in. in thickness. It occupies less than a square inch on the panel and an inch below it. Two small but accessible terminals are provided for connections, and the device is operated by a small knob on the central spindle, with a sliding action and "snap" effect. For simple switching in L.T. and in H.T. circuits which do not carry high-frequency currents this switch appears to be eminently suitable, and it is marketed at a very modest price.

"Vernier" Rheostat

A fine adjustment filament rheostat has been submitted for test by Messrs. Economic Electric, Ltd., in which the one controlling knob serves to operate both the main adjustment and also a fine regulating device. A flat spiral resistance of normal type is enclosed in a circular insulating casing, and a contact finger serves to make the coarse adjustment of resistance in conjunction with this. The finger is not, however, secured rigidly to the controlling spindle, but has a play of some 100 degrees. The spindle carries, rigidly attached, a segment of insulating material of corresponding length, over the edge of which is stretched a short length of resistance wire. A spring contact at the back of the main contact on the loose finger slides along the wire, thus putting more or less of this short piece of resistance wire in series with the portion of the main resistance already in circuit. Thus by a small motion of the controlling knob backwards and forwards over the range of play of the loose arm a fine adjustment of the resistance is made.

The instrument submitted had a maximum resistance of about 18 ohms, the fine adjustment being a fraction over 1 ohm. The general finish and workmanship were of a high order; some trouble was experienced with the adjustment, on trial, as the spindle tended to move the main contact-finger from its position of approximate adjustment when moved to and fro to give the fine adjustment, thereby upsetting the whole adjustment. Some pains were taken to set this in order, without much success. When this matter is rectified it is evident that the instrument will have useful applications—e.g., in the "Nega-dyne” circuit, where extremely critical filament adjustment is called for.
One trouble less — to puzzle you

It is the little things that escape detection. A faulty connection here, and bad contact there—all play their damaging part in robbing you receiver of its fullest power and range.

Those experimenters who favour the use of the variable grid leak appreciate how it gives the final touch—clearing reception to make it rich, pure and round in tonal quality.

The WATMEL is well known as the first variable grid leak which became available to the home constructor, and its consistent record for reliability to get the best out of the detector valve is without peer.

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If you are troubled with poor results pay particular attention to the working of the Detector Valve. Reduce the H.T. voltage consistent with good volume, and incorporate THE WATMEL VARIABLE GRID LEAK.

WARNING!

The WATMEL Wireless Co. wish to notify the trade and public that their Variable Grid Leak Application No. 2s6o98 was contested in the Comptroller’s Court, and on appeal; in both instances the Patent Grant was upheld and costs awarded.

It is the aim of this Company to protect traders, customers, and also its own interests by securing Patent Protection for the novelties in its specialities, as it is these novelties, invented by experts and exhaustively tested, which are the Hall Mark of all WATMEL Products.

Here, at last, is the real Wireless Tool Set that every Wireless Constructor has been waiting for. No more spoiling a good panel by using the family screwdriver, hammer, and gimlet; no more trying to tighten nuts with an adjustable car spanner or a pair of pliers.

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2. Broad Screwdriver for turning all ordinary screws.
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7. Reamer, for enlarging holes to any diameter. Replaces numerous and costly drills.
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All these tools fit into the Universal Holder provided. If you cannot get the tool-set from your local dealer send direct to us, kindly mentioning the dealer’s name.
BRETWOOD VARIABLE MERCURY CONDENSER

Hand capacity is entirely abolished. This feature renders usable many excellent circuits which are difficult to control. At the same time the use of the Breetwood Condenser in an ordinary circuit will vastly improve results obtained and with its conspicuous enable better methods of working to be adopted, thus leading to still better reception.

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The wonderful new Dial-o denser has astonished every wireless engineer who has had the opportunity of testing it. For the first time there is available a square law condenser with a minimum capacity of 3 micro-microfarads—a capacity so low as to be utterly negligible. And owing to its unique construction, its movable and fixed vanes are not subjected to losses due to bad contact and oxidation. The Dial-o denser is thus true low-loss condenser. Wherever you are using ordinary variable condenser—expensive and bulky—remember that you can replace it with a Dial-o denser and get vastly superior results.

Only the Dial-o denser gives you these advantages

1. A true square law reading.
2. A minimum capacity of 3 micro-microfarads—the lowest of any variable condenser on the market.
3. A genuine low-loss Condenser through the elimination of oxidation losses.
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Fitted with screwed front plate for Panel Mounting. Compact Easy setting. Sweet action.
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For improved results see that your fixed Condensers carry the mark

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as good as new, ask to the firm that repairs them PROPERLY

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We guarantee:

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<table>
<thead>
<tr>
<th>Size</th>
<th>Black</th>
<th>Mahoganite</th>
</tr>
</thead>
<tbody>
<tr>
<td>6&quot; x 7&quot;</td>
<td>3/6</td>
<td>4/3</td>
</tr>
<tr>
<td>6&quot; x 10&quot;</td>
<td>5/6</td>
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</tr>
<tr>
<td>6&quot; x 14&quot;</td>
<td>7/6</td>
<td>8/6</td>
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<tr>
<td>6&quot; x 18&quot;</td>
<td>9/6</td>
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<tr>
<td>7&quot; x 14&quot;</td>
<td>10/6</td>
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<td>7&quot; x 18&quot;</td>
<td>11/6</td>
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<tr>
<td>7&quot; x 22&quot;</td>
<td>12/6</td>
<td>18/6</td>
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<tr>
<td>7&quot; x 26&quot;</td>
<td>13/6</td>
<td>22/6</td>
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In the Foreground

—as is customary

The "Wireless Weekly" again fully maintains its reputation as the leading organ in wireless by the introduction and regular publication of Continental and American Broadcasting Programmes—in advance. This new feature, which first appeared in our issue of March 4th, will be regularly included in the form of a supplement, and elaborate arrangements have been concluded whereby accurate and detailed times of Continental and American Broadcasting Programmes for the coming week will be given, together with names of artists, the songs and music rendered and other fascinating particulars. The inclusion of this novel and attractive feature will still further enhance the vast popularity of this great weekly wireless journal. Start reading it yourself.
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<thead>
<tr>
<th>Company Name</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Agar (W. H.)</td>
<td>389</td>
</tr>
<tr>
<td>American Hard Rubber Co., Ltd.</td>
<td>396</td>
</tr>
<tr>
<td>Arrigoni (C. &amp; J.)</td>
<td>407</td>
</tr>
<tr>
<td>Athol Engineering Co.</td>
<td>405</td>
</tr>
<tr>
<td>Auto Sundries, Ltd.</td>
<td>403</td>
</tr>
<tr>
<td>Autoveyors, Ltd.</td>
<td>327</td>
</tr>
<tr>
<td>Beard and Pitch.</td>
<td>382</td>
</tr>
<tr>
<td>Bennett College</td>
<td>391</td>
</tr>
<tr>
<td>Bayley-Lowe Co.</td>
<td>316</td>
</tr>
<tr>
<td>Brandis, Ltd.</td>
<td>371</td>
</tr>
<tr>
<td>British Battery Co., Ltd. (Th)e</td>
<td>382</td>
</tr>
<tr>
<td>British &amp; Colonial Industries, Ltd.</td>
<td>335</td>
</tr>
<tr>
<td>British Thomson-Houston Co.</td>
<td>332</td>
</tr>
<tr>
<td>Brown Brothers, Ltd.</td>
<td>327</td>
</tr>
<tr>
<td>Brown (S. C.), Ltd.</td>
<td>392</td>
</tr>
<tr>
<td>Burndent, Ltd.</td>
<td>Cover ii</td>
</tr>
<tr>
<td>Byrne-Jones &amp; Co., Ltd.</td>
<td>402</td>
</tr>
<tr>
<td>Bus (T. O.)</td>
<td>401</td>
</tr>
<tr>
<td>Carrington Manufacturing Bros.</td>
<td>408</td>
</tr>
<tr>
<td>Cattermole Bros.</td>
<td>389</td>
</tr>
<tr>
<td>C.A.V. Small Tools</td>
<td>385</td>
</tr>
<tr>
<td>Chase Electrical Co.</td>
<td>386</td>
</tr>
<tr>
<td>Clarke (H.) &amp; Co.</td>
<td>401</td>
</tr>
<tr>
<td>Collinson’s Precision Screw Co., Ltd.</td>
<td>344</td>
</tr>
<tr>
<td>Corsor Valve Co.</td>
<td>347</td>
</tr>
<tr>
<td>Craik &amp; Smith</td>
<td>397</td>
</tr>
<tr>
<td>Curtis (Peter), Ltd.</td>
<td>335</td>
</tr>
<tr>
<td>Diamond Wireless, Ltd.</td>
<td>379</td>
</tr>
<tr>
<td>Dixon (L.) &amp; Co.</td>
<td>398</td>
</tr>
<tr>
<td>Drummond Bros.</td>
<td>378</td>
</tr>
<tr>
<td>Dubover Condenser Co. (1921), Ltd.</td>
<td>335</td>
</tr>
<tr>
<td>Eagle Elec. Manufacturing Co.</td>
<td>375</td>
</tr>
<tr>
<td>Edison Swan Elec. Co.</td>
<td>366</td>
</tr>
<tr>
<td>Fall, Stadil &amp; Co.</td>
<td>398</td>
</tr>
<tr>
<td>Fellows Magneto Co., Ltd.</td>
<td>351</td>
</tr>
<tr>
<td>Finchett (C. A.)</td>
<td>398</td>
</tr>
<tr>
<td>Forman Co.</td>
<td>331</td>
</tr>
<tr>
<td>Fuller’s United Elec. Works, Ltd.</td>
<td>407</td>
</tr>
<tr>
<td>Gambrell Bros., Ltd.</td>
<td>347</td>
</tr>
<tr>
<td>General Electric Co., Ltd.</td>
<td>315</td>
</tr>
<tr>
<td>General Radio Co.</td>
<td>379</td>
</tr>
<tr>
<td>Gent &amp; Co.</td>
<td>363</td>
</tr>
<tr>
<td>Gilroy Radio Co.</td>
<td>403</td>
</tr>
<tr>
<td>Goswell Engineering Co.</td>
<td>359</td>
</tr>
<tr>
<td>Graham (A.) &amp; Co.</td>
<td>320</td>
</tr>
<tr>
<td>Harlic Bros.</td>
<td>407</td>
</tr>
<tr>
<td>H. T. C. Electric Co.</td>
<td>355</td>
</tr>
<tr>
<td>Huggins (F. B.) &amp; Co.</td>
<td>331</td>
</tr>
<tr>
<td>Hunt (A. H.), Ltd.</td>
<td>317</td>
</tr>
<tr>
<td>Igranic Elective Co., Ltd.</td>
<td>324</td>
</tr>
<tr>
<td>International Correspondence School</td>
<td>397</td>
</tr>
<tr>
<td>Jackson Bros.</td>
<td>384</td>
</tr>
<tr>
<td>Kunihi-de-Luxe Ear Pad Co.</td>
<td>384</td>
</tr>
<tr>
<td>Lante Laboratories</td>
<td>385</td>
</tr>
<tr>
<td>Lighting Supplies Co.</td>
<td>395</td>
</tr>
<tr>
<td>Lissot Co.</td>
<td>319</td>
</tr>
<tr>
<td>London Electric Wire Co.</td>
<td>305</td>
</tr>
<tr>
<td>London Valves</td>
<td>301</td>
</tr>
<tr>
<td>McMichael (L.), Ltd.</td>
<td>336</td>
</tr>
<tr>
<td>Mellish (Ltd.) &amp; Co.</td>
<td>405</td>
</tr>
<tr>
<td>Metro-Vick Supplies</td>
<td>339</td>
</tr>
<tr>
<td>M. O. Valve Co., Ltd.</td>
<td>343</td>
</tr>
<tr>
<td>Mulhall</td>
<td>395</td>
</tr>
<tr>
<td>Multiflux Radio Valve Co., Ltd.</td>
<td>332</td>
</tr>
<tr>
<td>Naylor (J. H.)</td>
<td>381</td>
</tr>
<tr>
<td>Neumon, Ltd.</td>
<td>381</td>
</tr>
<tr>
<td>New London Electron Works</td>
<td>372</td>
</tr>
<tr>
<td>Oldham Accumulators</td>
<td>304</td>
</tr>
<tr>
<td>Ormond Engineering Co.</td>
<td>328</td>
</tr>
<tr>
<td>Pickett Bros.</td>
<td>389</td>
</tr>
<tr>
<td>Pitman (Sir Isaac) &amp; Sons.</td>
<td>408</td>
</tr>
<tr>
<td>Peto-Scott Co.</td>
<td>340</td>
</tr>
<tr>
<td>P. &amp; M., Ltd.</td>
<td>401</td>
</tr>
<tr>
<td>Portable Utilities Co., Ltd.</td>
<td>346</td>
</tr>
<tr>
<td>Power Equipment Co.</td>
<td>372</td>
</tr>
<tr>
<td>Pressland Elec. Supplies</td>
<td>401</td>
</tr>
<tr>
<td>Radios, Ltd.</td>
<td>405</td>
</tr>
<tr>
<td>Radio Communication Co., Ltd.</td>
<td>209</td>
</tr>
<tr>
<td>Radio Instruments, Ltd.</td>
<td>Cover iv</td>
</tr>
<tr>
<td>Radio Stocks</td>
<td>380</td>
</tr>
<tr>
<td>Radians, Ltd.</td>
<td>128</td>
</tr>
<tr>
<td>Raymond (K.)</td>
<td>228</td>
</tr>
<tr>
<td>Robinson (Lionel) &amp; Co.</td>
<td>351</td>
</tr>
<tr>
<td>Rothermel (R. A.), Ltd.</td>
<td>371</td>
</tr>
<tr>
<td>&quot;Sel Eny&quot; Wireless Co.</td>
<td>365</td>
</tr>
<tr>
<td>Shipton (F.) &amp; Co.</td>
<td>374</td>
</tr>
<tr>
<td>Siemens Bros. &amp; Co., Ltd.</td>
<td>365</td>
</tr>
<tr>
<td>Simpson &amp; Blythe</td>
<td>352</td>
</tr>
<tr>
<td>Smith &amp; Ellis</td>
<td>388</td>
</tr>
<tr>
<td>Stringing Telephone Co., Ltd.</td>
<td>328</td>
</tr>
<tr>
<td>Stevens (A. J.) &amp; Co. (1914), Ltd.</td>
<td>356</td>
</tr>
<tr>
<td>Stirings</td>
<td>306</td>
</tr>
<tr>
<td>Stockall, Marples &amp; Co.</td>
<td>397</td>
</tr>
<tr>
<td>Telegraph Condenser Co.</td>
<td>387</td>
</tr>
<tr>
<td>Telephone Mfg. Co.</td>
<td>389</td>
</tr>
<tr>
<td>&quot;U.S.&quot; Radio Co.</td>
<td>390</td>
</tr>
<tr>
<td>Vanderwell (C. A.)</td>
<td>388</td>
</tr>
<tr>
<td>Varley Magnet Co.</td>
<td>389</td>
</tr>
<tr>
<td>Verstreten (M.)</td>
<td>308</td>
</tr>
<tr>
<td>Vokes (G. J.) &amp; Co.</td>
<td>407</td>
</tr>
<tr>
<td>Ward &amp; Goldstone, Ltd.</td>
<td>387</td>
</tr>
<tr>
<td>Wates Bros.</td>
<td>363</td>
</tr>
<tr>
<td>Watson Wireless Co.</td>
<td>385</td>
</tr>
<tr>
<td>Western Electric Co., Ltd.</td>
<td>368</td>
</tr>
<tr>
<td>Wilkins &amp; Wright, Ltd.</td>
<td>393</td>
</tr>
<tr>
<td>Wilkinson’s Wireless Stores</td>
<td>389</td>
</tr>
<tr>
<td>Wireless Distributing Co.</td>
<td>386</td>
</tr>
</tbody>
</table>

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16 How to Make an Efficient Single-Valve Receiver

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17 How to Build an Efficient Single-Valve Receiver

By Herbert K. Simpson

18 Switches in Wireless Circuits

By E. Redpath

19 How to Build a 2-Valve Amplifier de Luxe

By Herbert K. Simpson

20 How to Build a 2-Valve Amplifier de Luxe

By G. P. Kendall, B.Sc.

21 Switches in Wireless Circuits

By E. Redpath

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