A FRAME AERIAL CABINET RECEIVER

By G.P. Kendall, B.Sc.
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The season of good resolutions is upon us.

We are all promising faithfully to go to bed early, except on very special occasions (about two nights in five, say), never to oscillate, not to growl about the loud-speaker next door, and, in fact, generally to be well behaved—as long as our courage lasts. We wish you all, and ourselves, good luck.

Many of our readers must have desired to build a family set which was a really artistic piece of furniture, and which was, as far as possible, self-contained. Our principal set this month is one by Mr. Kendall, employing a built-in frame aerial, and having provision for all batteries inside the cabinet. The set is primarily intended for the local station, but aerial and earth terminals are provided so that the more distant stations can be obtained if required.

**Real Purity with Volume**

Mr. Clark describes a three-valve receiver employing a type of trigger circuit which is capable of giving considerable volume with excellent purity of reproduction. This receiver will probably appeal to many who have been looking for really good loud-speaker working.

A novel form of receiver is that described by the Laboratory staff, on which it is possible to receive both the local and high-power station simultaneously. By a simple switching arrangement it is possible to utilise one of the valves as a note magnifier when only one station is being received.

The quest for selectivity has resulted in the production of two simple yet selective receivers. One of these, which was designed by Mr. John Scott-Taggart, employs two tuned filters, followed by a detector valve and note magnifier. By using this arrangement, oscillation troubles are minimised, and a very stable form of selective circuit results.

**Simplification of Tuning**

The use of two tuned circuits introduces an additional complication in that two tuning controls are usually necessary. In order to simplify the operation of such a circuit, Mr. Reyner describes an ingenious method, by which a variable condenser is made to serve the dual purpose of coupling two circuits together and tuning them, an interesting principle which will probably bear following up.

Another form of selectivity is that obtainable by the use of wavetraps to cut out the interference from the local station. By this means it is often possible to obtain adequate selectivity with a receiver of ordinary construction only. The article on the subject of "Wavetraps and Their Uses," therefore, will be of interest to those readers who are already in possession of receiving sets.

**Foreign Programmes**

In response to several requests we are again publishing our list of Continental and American transmissions, which will facilitate the identification of the ever-increasing galaxy of foreign stations. We are also giving constructional details of the transformers used in "The Special Five," recently described by Mr. Harris.

We desire to thank our readers for the replies which were sent in the questionnaire. There are many points on which the criticism received has been of assistance and we appreciate the trouble taken by those who responded to our request.

**Future Features**

We hope in our next issue to give some authentic details of the new Dublin broadcasting station, and also the results of some interesting research which is now taking place on the relative merits of various types of well-known circuits, both as regards selectivity and efficiency. For the present—a Happy New Year to our readers—may it exceed their expectations.
A FRAME AERIAL CABINET SET

By G.P. Kendall, B.Sc.

An interesting receiver for local work which employs an enclosed frame aerial for short ranges

There must be few experimenters of more than a few months' standing who have not realised that it is a most desirable thing to possess a standard local broadcast receiver which shall be always ready for use, simple enough to be operated by members of the family, and not in any way connected with one's experimental apparatus. Something in the nature of a "gramophone set" is needed, with a simple on and off switch, which can always stand ready to be switched on, and will never be interfered with in the course of experimental work.

The Need for a Special Local Set
Attempts to combine such a set with one of the various long-distance receivers which we most of us possess, or aim at possessing, are usually unsuccessful, chiefly because a certain amount of switching gear is necessary to cut out unnecessary valves, and otherwise to modify the set to make it suitable for purely local work. Moreover, one is constantly making alterations and improvements to experimental, long-distance sets, and such alterations are liable to interrupt the service of local broadcast, with consequent domestic friction.

Individual Requirements
The design and construction of a "gramophone set" is something of an individual problem, since local conditions, distance from the local station, the desirability or otherwise of making use of any form of external aerial, whether outdoor or indoor, or alternatively the use of a frame, will govern the circuit required to a large extent. I have recently built a receiver for my own use to conform to conditions which may apply to a considerable number of readers, and probably the instrument illustrated upon these pages will be found suitable by quite a number of constructors who have come to a similar conclusion with regard to the desirability of a separate set for the local station. At the same time, it is to be understood that since the design is intended for the advanced constructor, it will be quite permissible for him to modify it in certain ways, which will be discussed later, to suit himself.

High Frequency Amplification
My own requirements were that the set should be capable of giving loud-speaker results of a high degree of quality, without any external aerial or earth, an enclosed frame aerial being essential. Since this was to be done at a distance of approximately eight miles from a L.O., it was felt that a minimum of two high-frequency valves must be incorporated, and this number was finally chosen, with a crystal detector and two stages of low-frequency amplification.

The Circuit
The circuit finally chosen was one which can be depended upon to give adequate loud-speaking with the frame aerial which is built into the cabinet up to distances of approximately five miles from a main broadcasting station, this distance being chosen to represent the probable area within which the constructor of such a set would object to the provision of an outside aerial, or an indoor aerial, as an alternative. At greater distances from the broadcasting station,
Fig. 1.—The receiver employs two H.F. stages, crystal rectification and two choke-coupled L.F. stages.

it was felt that the provision of a small outdoor aerial or some sort of an indoor aerial would not be objected to, since one would then be in the suburban area, in which facilities for the erection of outside aerials are relatively good, and accordingly arrangements have been made for the use of an ordinary aerial and earth with this receiver, the frame aerial then being regarded merely as a tuning inductance.

As a matter of fact, at my own distance of eight miles, the set with its own frame aerial is capable of giving a satisfactory degree of loud-speaking, but this involves that the most suitable valves shall be used at each stage, a good setting obtained on the crystal, and a careful manipulation of the controls of the set itself, and I should not regard it as possessing an adequate factor of safety at this distance for general work. Accordingly, at this distance, I would advise that a small outdoor or indoor aerial be provided, independent of the frame aerial, only a few yards of wire being needed. As a rule, moreover, no earth connection would be needed at such a distance, although its use may be of some slight advantage. Since two high-frequency valves are incorporated, an efficient aerial is quite unnecessary, and it is possible to bring the lead-in to the set in a manner which would normally be regarded as very inefficient, but which is permissible in this case and enables one to use a suitably

Fig. 2.—The drilling of the panel can be obtained from this diagram or alternatively from Blue Print No. 144a, (price 1/6 post free).
The three chokes are mounted underneath the sub-base of the instrument.

concealed lead, thereby avoiding the usual unsightly arrangement.

Cabinet Requirements
Another obvious requirement of the type of set under consideration is that it shall be provided with an entirely independent set of batteries, and this being so they may as well be enclosed in the cabinet. Since the last valve in a set of this sort will commonly be a power valve drawing a considerable anode current, it will, in many cases, be desirable to use a high-tension accumulators for the anode supply, and accordingly ample room should be arranged in the battery compartment. The cabinet actually chosen for my own set is a standard line of one of the cabinet makers, some very slight modifications having been made, and it will be observed that there is quite a large cupboard below the set compartment which provides ample room for all types of batteries, especially if the user cares to insert a shelf about half-way up.

Valve Limitations
In deciding upon the circuit for a set of this sort, it was felt that most possible constructors of the instrument would regard the use of more than four valves for the local station as being excessive and therefore a crystal detector was incorporated, which, of course, has in itself a considerable attraction, in that it permits a high degree of purity to be obtained with considerable ease. It will be observed that the two high-frequency valves are coupled to each other and to the crystal detector by ordinary plug-in transformers, the first of these being tuned across its primary in the ordinary way, while the second one is tuned upon the secondary side, the necessary alteration being made to the wiring of its socket. (This point should be particularly noted by the constructor, who should follow the wiring arrangements shown on the wiring diagram in the case of the second transformer, rather than any diagram of connections which he may receive from the makers with his transformer.

The L.F. Amplifier
Following upon the crystal detector will be seen a low-frequency choke, whose lower end is connected back to the other end of the secondary winding of the H.F. transformer, this point being also indicated as one of the grid bias negative terminals. To the upper end of the choke is connected the grid of the first of the low-frequency amplifying valves, this arrangement being adopted in order that the steady current drawn by the crystal and passed through the choke might have the desired damping effect upon the circuit, as an aid to stability. Coupling the first to the second low-frequency valve is another iron-cored choke, with the usual grid con-
denser and leak; while an output filter is provided in the anode circuit of the last valve, consisting of a third low-frequency choke and a \( \mu \)F condenser. The loud-speaker is connected in circuit by the insertion of a telephone plug in the jack shown, this jack being of the filament control type, so that the act of inserting the loud-speaker plug switches on all the filaments. This is not shown in the circuit diagram, for the sake of simplicity, but the actual connections will be seen on the wiring diagram.

**Reaction Control**

A potentiometer control of the degree of natural reaction is provided, experiments with a neutrodyne method of control not having proved very successful, apparently on account of the erratic amount of damping introduced by the crystal circuit. Provided the low-capacity general purpose type valves are used in the first two sockets, this method has proved entirely satisfactory, and is to be recommended for a set which is intended for domestic use.

Those who desire to obtain a little greater efficiency, however, may care to incorporate a neutrodyne arrangement for the first valve, using one of the ordinary plug-in neutrodyne units and condenser, with potentiometer control for the second valve, since this arrangement overcomes the difficulty of the erratic crystal damping and proves quite effective in use. It was decided not to incorporate it in the general design, however, on account of the slight extra complication thereby produced.

**Constructional Details**

The actual construction of the set involves a good deal of work, but the arrangement of a sub-panel or shelf adopted will be found to render it into quite an easy matter. It will be observed that all the high-frequency circuits are wired up on the top of this shelf, all the valve sockets, etc., being placed upon it, while the three low-frequency chokes are placed underneath it, together with the stopping condenser of the output filter. In laying out the parts upon the shelf the constructor will be well advised to follow the arrangement illustrated with a reasonable degree of accuracy, since during the early experimental work with this receiver a certain amount of difficulty was experienced when the two H.F. transformers were differently...
The relative position of the sub-base can clearly be seen in this photograph.

A Wiring Point

The actual building of the set does not, I think, call for any explanation, as the various diagrams accompanying this article show clearly how it is put together. It should, perhaps, be mentioned, however, that certain parts of the wiring should be done before the baseboard is finally attached to the panel. These connections are those of the sockets for the second high-frequency transformer, and one of the connections to the permanent crystal detector. An examination of the photographs will show that the soldering of these wires would be distinctly awkward if it was attempted after the baseboard was fixed to the panel.

Components

In the construction of the original set the following components and materials were used:

- Special Grosvenor cabinet (Camco).
- One Radion panel, 22 ins. by 14 ins. by 7 ins.
- One wooden baseboard, 7 ins. by 20 ins., with brackets for fixing to panel.
- Two square law variable condensers of 0.003 µF (Peto-Scott, de luxe type).
- One ditto, of 0.005 µF.
- Four filament rheostats (C.A.V.).
- One potentiometer (McMichael, Ltd.).
- One "single filament" jack (Elwell).
- One permanent detector (Radio Instruments, Ltd.).
- Four board-mounting anti-capacity valve sockets (Peto-Scott, Ltd.).
- Two non-microphonic valve sockets (Benjamin Electric Co.).
- Three low-frequency chokes (Super Success, Beard & Fitch, Ltd.).
- One T.C.C. condenser of 0.125 µF.

Fig. 4—The wiring of the components on top of the sub-base can be seen from this diagram. Blue print No. 146b can be obtained on application (price 16 post free).

The relative position of the sub-base can clearly be seen in this photograph.
Fig. 5.—This view shows the wiring of the components below the sub-base.

One T.C.C. 1 µF condenser.
One fixed condenser of .0002 µF (Watmull).
Two terminal strips, one No. 1 panel and one No. 2 panel (Burne-Jones, Ltd.).
Radio Press Panel Transfers.
Two plug-in H.F. transformers. (Any standard make: McMichael, Bowyer-Lowe, Burne-Jones, Peto-Scott, etc.)

Terminals
The arrangement of terminals in the set perhaps calls for explanation, and it will be observed that two terminal panels have been attached to the rear edge of the baseboard, one of these being for connections to the frame and outside aerial, if used, the other being for the batteries. The frame aerial is wired to the terminal marked earth, and the aerial terminal nearest thereto. Inside the set, between the two aerial terminals, is connected the .0002 µF fixed condenser, which is intended to be brought into action when an external aerial of fair size is used. Under these circumstances, the frame aerial is left wired to its two terminals, an earth is connected to the appropriate terminal and the outside aerial is wired to the second aerial terminal. In this way the small fixed condenser is brought into use, in the same way as the constant aerial tuning condenser is employed in the well-known system. The actual capacity for this small fixed condenser should suit the aerial, and since as a rule only small aerials will be used, I have incorporated one of .0002 µF in the original set. When a full-sized outside aerial is to be used, however, the usual capacity of .0001 µF should be adopted.

The other terminal strip accommodates the battery terminals, and it will be seen that there are two high-tension positives, one of these being for the H.F. valves and the other, of course, for the L.F. The two terminals at the extreme end of the strip are for grid bias, and it will be observed that I have not used these as marked by the maker of the strip, for the reason that it simplified the wiring to reverse the positive and negative as shown. This, however, is a matter of taste and it involved re-marking the strip which was, of course, already engraved.

(continued on page 464.)
was hard at work the other afternoon in my laboratory. I hope that you have duly noted these words. In my early days as a wireless enthusiast I used to refer to the glory hole in which I did my old jobs as a workshop. But I never made that mistake now. All real wireless men refer to the place in which their constructional and experimental work is accomplished as the laboratory nowadays. A workshop is a crude amateurish kind of room containing a bench, an assortment of tools, and possibly a lathe. A laboratory is the same room with the same bench, the same tools and the same possible lathe, but with one important addition. This is the milliammeter. So long as you possess a milliammeter, which may or may not be in working condition, you are perfectly entitled to call your erstwhile workshop a laboratory, and to be thoroughly in the swim.

The Goop Elastic Aerial
I give this little explanation because many readers have been puzzled not a little over the topography of Mr. Hercy Parris’s abode. They observe that he now refers always to his laboratory. The explanation is perfectly simple. He has not added a room to his house; he has added a milliammeter to a room. Other readers have been seriously worried over the question of Mr. Parris’s aerial. In the last issue of the magazine, he told the world, on page 297, that his aerial was 45 ft. long and 35 ft. high, whilst on page 303 it had risen by 5 ft. and lost 5 ft. in length. The explanation is as simple as before. Mr. Parris has recently installed the Goop Elastic Aerial, whose height and length may be varied from day to day or even from hour to hour, or evener still from moment to moment. Full details of this wonderful aerial cannot yet be published, since it is the subject of some dozens of pending patents, provided that the Professor and I can raise the wind sufficiently to pay the required fees.

Back to Our Muttons
I fear that I have digressed a little, but you will agree that I had every reason for doing so. Even if you do not agree, the fact still remains, and no words or thoughts of yours will alter it. Let us return to our original theme. I was hard at work in my laboratory. It is not often, I must admit, that I am caught working hard, as I was in this case. Almost the last piece of really strenuous toil that I undertook was to paint, in beautiful Gothic characters upon one of the walls of my laboratory (I love that word so I cannot help repeating it) my family motto which was first borne upon the shield of Sir Perkyn Ye Lystener in the fourteenth century at the battle of Bofensham. This was a particularly good battle, for my distinguished ancestor having made the right call when the captain of the other side spun a coin and asked “Heddis or tayles?” put his opponents in to joust first on a wet wicket, and so carried off the honours of the day. The motto to which I refer is “Laborare est errare,” which I will not insult your intelligence by translating. Some of these old family mottoes take some living up to. I knew a man once whose motto was “Speak the truth,” and he died of the effort of living up to it. I may think, say that if Sir Perkyn Ye Lystener could drop into my laboratory unannounced he would in nine entrances out of ten find that I was living nobly up to the ancient motto of my race.

And Yet Again
It appears that I have digressed once more. You must forgive me, for we who are of the real blue blood cannot help being carried away occasionally by the very natural pride we take in our illustrious ancestry. You will see why at once if, as an example, I recount to you the story of another ancestor, Sir Velvytfoote Ye Lystener. (Certainly not. Return at once to your glory hole.—Ed.) My laboratory? Oh, very well. Just as you wish. All the same, it is a jolly interesting story. You see Sir Velvytfoote was . . . (We don’t see; we don’t want to see. Will you kindly get on with it?—Ed.) Owing to the editorial attitude I fear that I must switch off my story about Sir Velvytfoote, though it is highly probable that you will hear about him S.B. from all stations very shortly—“My Great-Great-Great Grand Step-Cousin’s Adventure on Wimbledon Heath,” or something of that kind.

Hard at Work
Let us, however, come with a bump to modern times, and return to my laboratory. I cannot, I think, do better than write once more the opening sentence of this veracious chronicle. I was hard at work in my laboratory. I imagine by now that you have got it firmly fixed in your mind, provided of course that you are equipped with anything of the kind, that I was toiling hard in the splendidly fitted room that is the scene of my wireless labours. Very well. I was just in the middle of an experiment on the effect of connecting the H.T. battery to the I.T. terminals of a receiving set, when there came a knock at the door.

“Come in!” I called. The door opened and there entered my friend Poddleby, who was quite...
obviously brimming over with enthusiasm.

Enter Poddleby

"Hallo!" I said. "Hallo, Hullo! What brings you round to see me?" I must apologise, said Poddleby, "for bursting like a fizzy into your workshop . . ." I pointed to the milliammeter, borrowed from Gubbsworthly, which occupied a place of honour upon the bench. "Workshop?" I said. "What is a workshop?" I seem to have heard the word sometime in the long-forgotten past, but for the moment I cannot recall its exact meaning. You are now, Poddleby, in my laboratory. The word is derived from the Latin labor, work, and avatori, specifying. It means taking a duty and attending to a lot about the work that you are going to do. As I am never going to do any work, I do not propose to make a speech, and I will therefore listen to what you have to say.

A Suggestion

"What you want," said Poddleby, is exercise. The life you lead is simply horrible. You get up in time for tea, you never take any exercise, except for a walk down the High Street, and the result is that your muscles, like your mind, are thoroughly flabby. That is the kind of insult that the blue blood which courses through my veins simply cannot endure. Picking up a spare high tension battery I hurled it at Poddleby, whom it caught squarely amidships. When he had recovered a little he admitted that flabby was not quite the right word. He said, though, that what I needed was fresh air and that if I would kindly refrain from throwing batteries about he would tell me why he had come. I found that his visit had nothing to do with wireless. He had come to suggest that I should join him and Professor Goop in an expedition to the flooded area in the neighbourhood of the Pud, where skating was in progress. Skating has always been a hobby of mine, and I readily assented to accompany him.

Passing down the High Street we picked up Professor Goop, who, when we found him, was engaged in explaining to a pillar box (which he had mistaken for a bun) his theory of the outside edge. When we had linked his arms in ours and borne him along with us the Professor continued to expatiate upon the mathematics of figure skating. I gained very little from him that the whole secret lay in keeping the centre of gravity of the body

B immediately over the centre of the blade of the skate. If this were done nothing could possibly go wrong. "Have you ever cut a three?" I asked. The Professor admitted that he had never previously worn a pair of skates, but he assured us that so long as

one adhered strictly to the formula which he had worked out, it was impossible either to make a mistake or to come into involuntary contact with the frozen surface of the flooded meadows.

Loose Ballast

Poddleby fought with me for the honour of putting on the Professor's skates. I said, "That's your job, you silly ass"; and he said, "No, I'm blows if it is." And then I pushed him over and slid out into the middle of the ice. I was engaged in cutting the diagram of a live valve, and was doing the most perfect circle to indicate V3, when the beauty of my work was spoilt by the arrival of the Professor and Poddleby. The former was advancing at a rapidity upon his back. When I picked up the Professor he explained that his theoretical centre of gravity had been slightly shifted by the presence in his pocket of some loose silver, whose weight he had failed to take into his calculations. I at once relieved him of the incumbrance, and as he then sat down with some violence, I told him that I suspected that other hidden forces might be at work. A careful search disclosed the presence in his waistcoat pocket of a well-filled note case. When I had disposed of this he fell sideways, and demanded the return of the silver to act as ballast. I refused very firmly to accede to this.

The arrival of the Professor and Poddleby.

I then skated towards the bank. When I arrived I found that the Professor had been thrown off balance, and I was asked to do it again. I immediately flew, but unfortunately landed upon my face, and was seized with the sudden desire to retire to the laboratory, and there propose a new formula. The Professor was so fatigued that he could only say, "No, I'm blows if it is." I immediately took him in hand, endeavoured to hold him up, and told him I was going forwards, VII. When I placed myself in front those tumbled backwards, dragging me with him. After some thought I induced him to lie flat upon his back, whilst I took his feet and skated towards the bank, towning him behind me.

The Expert

"Here is a case," said the Professor, "of a receiving set that is working far too near the point of oscillation. I will now show you how to correct the distortion that is manifesting itself."

He moved forward, and seizing a little knob gave it a tweak in an anti-clockwise direction. The music dropped down six octaves down the scale, whilst the time took on what I may describe as a rather fatigued tempo. "If'n," said the Professor, "the control appears to be very sensitive. It is quite obvious that there is insufficient high tension voltage, and I rather doubt whether the grid bias is as much negative as it ought to be." He seized another knob and tweaked that. The music ran up the scale, whilst the tempo became such that the various couples engaged in waltzing became mere blurs.

"Extraordinary!" said the Professor. "I have never before met with a receiving set in which adjustment of the tuning controls produced a speeding up or a speeding down of the received oscillations. This must be due to the fact that the temperature is several degrees below zero, and that the receiving set is situated close to a large expense of frozen water. Let me try once again. Now if . . . I . . . I . . . Ere!" said a voice.

"Ere! Kermorfit. Let my blinkin' gramophone alone can't yer?" Looking up, we saw a nasty looking individual clad in fearsome garments and a particularly unpleasant expression. On mature but rapid consideration, I hastily urged the very middle of the ice, leaving the Professor to expound his theory.

The Listener.
SEVERAL readers have written for more information concerning the value of the external impedance in the anode circuit in connection with the article in last month's MODERN WIRELESS by Mr. Reyner on L.F. Transformer Ratios.

In many cases the makers supply the actual inductance of the primary winding of their particular transformers, and in such a case the calculation is comparatively simple. Since the frequency, however, is varying in accordance with the speech or music being received, it is only possible to obtain an average value, and this is taken at a mean frequency, which is usually about 800 or 1,200 cycles per second. The reactance X is given by L w where L is the inductance in henries and w = 2π × frequency.

**Mean Frequency**

In practice the mean frequency is taken as 800 cycles per second for speech, and 1,000 or 1,200 cycles per second for music. The values of w at these frequencies are given approximately below, so that the calculation of the reactance can be made very simply, if the value of the inductance L is known.

<table>
<thead>
<tr>
<th>Frequency (cycles per second)</th>
<th>w</th>
</tr>
</thead>
<tbody>
<tr>
<td>800</td>
<td>5,030</td>
</tr>
<tr>
<td>1,000</td>
<td>6,285</td>
</tr>
<tr>
<td>1,200</td>
<td>7,540</td>
</tr>
</tbody>
</table>

The resistance of the average transformer is sufficiently low to be negligible in comparison with the reactance at this frequency so that this value of X may be substituted in the formula:

\[
\text{Overall amplification} = \sqrt{R^2 + X^2} \mu_0 n
\]

where \( \mu_0 \) = theoretical amplification factor of the valve.

\( n \) = transformation ratio of transformer.

In the last article the numerator of this expression was incorrectly quoted as \( X^2 \) instead of X.

The arbitrary values quoted for the external impedance in the article in question were obtained by taking the actual values of a representative transformer, but with the information given here it will now be possible for readers to make their own calculations. The second example of the three given contains a misprint: the value of the impedance should read 45,000, and not 15,000, as given.

For the benefit of readers we append a list of the average inductances of some of the principal transformers on the market. This list is not by any means complete, but in any particular case readers can obtain the inductance figures direct from the makers.

**Inductances of Commercial Transformers**

(These values are average figures only—where known the frequency at which they are taken is stated.)

<table>
<thead>
<tr>
<th>Transformer</th>
<th>Ratio</th>
<th>Inductance (henries)</th>
<th>Frequency (cycles per second)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marconiphone</td>
<td>2 7/8</td>
<td>51</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>4 : 1</td>
<td>28</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>6 : 1</td>
<td>12.5</td>
<td>1,000</td>
</tr>
<tr>
<td></td>
<td>1 : 8</td>
<td>7.2</td>
<td>1,000</td>
</tr>
<tr>
<td>Brandes</td>
<td>4 : 1</td>
<td>50</td>
<td>800</td>
</tr>
<tr>
<td>Gambrell</td>
<td>4 : 1</td>
<td>50</td>
<td>800</td>
</tr>
<tr>
<td>Lissen</td>
<td>2 1/2 : 1</td>
<td>20</td>
<td>1,200</td>
</tr>
<tr>
<td></td>
<td>4 1/2 : 1</td>
<td>17</td>
<td>1,200</td>
</tr>
<tr>
<td></td>
<td>4 : 1</td>
<td>9</td>
<td>1,200</td>
</tr>
<tr>
<td>R.I.</td>
<td>4 : 1</td>
<td>9</td>
<td>1,200</td>
</tr>
</tbody>
</table>

444
The circuit for this receiver is a loose-coupled filter arrangement suggested by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., and carried out, after due experiment, by the Elstree Laboratory Staff.

Since the commencement of broadcasting there has been a great deal of talk about selectivity and selective sets or circuits. The actual meaning of selectivity and its bearing on the problem of broadcasting is probably only thoroughly understood by comparatively few readers. A set which is very critical on adjustment is often spoken of as being a specially selective receiver, whereas it might be quite the reverse. Actually a receiver which is very sharp, on say, the condenser tuning, is not necessarily selective. For example, a station may be heard over a quarter of the scale of the condenser on one set and over only a very small fraction of the scale on another, and yet the set receiving the station over a quarter of the condenser scale might easily be more selective than the second set, owing to the condenser being of a much smaller value and covering a much smaller band of frequencies.

What is Meant by a Selective Circuit

From a broadcasting point of view a set would be considered selective if it could receive the weaker of two broadcasting stations which are separated by a frequency difference of 15 kilocycles, and whose signal strengths are in the ratio of 100 to 1. The selectivity of a circuit can actually be defined by the width of the resonance curve in kilocycles at a point such that the current is reduced to a small fraction of its maximum value. A typical resonance curve is shown in Fig. 2, and in this case the selectivity of the circuit might be defined as 50 kilocycles to a reduction of signal strength to one-tenth of its maximum value.

Can a Circuit be Too Selective?

It is well known that a broadcast station does not employ a single frequency, but covers a band of frequencies of more than 5 kilocycles on either side the carrier wave. In other words, a broadcast station covers a total band of frequencies of at least 10 kilocycles. The higher musical notes and their harmonics are produced by the outside frequencies of this band. It is thus obvious that in order to receive these high notes, and so to get good quality reproduction, it is necessary that a receiver should respond with reasonable efficiency over the whole of this band of frequencies.

Thus the resonance curve must be sufficiently wide so that signals which are 5,000 cycles out of tune on either side of the carrier wave can be received at an efficiency of not less than 50 per cent. This means that with ordinary circuits the width of the resonance band at a signal strength of the order of one-hundredth of its resonance value will be much more than is required for good selectivity.
The use of coupled circuits thus gives better quality for a given selectivity than is obtainable with a single circuit only, and the receiver described in this article employs two tuned filters.

The actual circuit is shown in Fig. 1.

The aerial is tapped at a point fairly low down the inductance L₁ and the first oscillatory circuit is formed by L₁, C₁ and a portion of L₂, the point of tapping to the coil L₂ being variable. The secondary circuit is tuned by the condenser C₂.

In the actual receiver plug-speak may be plugged in, when required, this operation automatically cutting the telephones out of circuit.

The components required are given in the list below, the actual making being also specified for convenience. Other reliable components may, of course, be substituted for those quoted.

One panel, 9 in. by 18 in. by ½ in. (Peto Scott Co., Ltd.).
One Panel, 10 in. by 14 in. by ½ in. (Peto Scott Co., Ltd.).
One coil holder, back of panel mounting (Woodhall Wireless, Ltd.).
Two 0.005 µF variable condensers, Vernier pattern (Service Radio).
Two filament resistances, suitable for valves in use (Service Radio).
Two vibratory valve holders (R. I., Ltd.).
Two 1 µF fixed condensers (Telephone Condenser Co.).
One 0.003 µF fixed condenser (Therla).
One 0.001 µF fixed condenser (Therla).
One baseboard mounting coil plug (Burne-Jones and Co., Ltd.).
One interstage transformer, 1st stage (C.A.V., Ltd.).
Eleven 4 B.A. W.O. type terminals.
One variable grid leak (Bretwood, Ltd.).
One switch plug and jack (General Radio Co., Ltd.).
Two brackets (Formo).
One key switch (Igranic).

The apparatus is well spaced out. Note the geared condensers employed.

The ideal resonance curve would have a flat top for about 10 kilocycles as shown above.

Effect on Quality

In actual practice, of course, circuits can be designed to give a selectivity much greater than this, but with such sets the high notes and their harmonics will be cut out, or very considerably reduced in strength, with the result that serious distortion will take place. The question of selectivity for broadcast receivers is therefore a difficult problem, as we have to design the set so that it will respond to the whole band of frequencies, say, the local broadcast transmission, and yet be sufficiently selective to receive a distant station the frequency of which is fairly close to that of the local station. In cases where extreme selectivity is essential it would be necessary to sacrifice to some extent the quality of reproduction.

The Ideal Case

The ideal resonance curve for a telephony receiver is one having a flat top so as to cover a band of frequencies of at least 10 kilocycles, and outside this band the signal strength should fall away very rapidly, as shown in Fig. 3.

It can be shown that this ideal type of resonance curve is obtained by using a chain of coupled circuits. The top of the resonance curve is then only slightly affected, but the sides become much steeper, so giving increased selectivity without the sacrifice of quality.
January, 1926

Ten 2 ft. lengths square tinned wire (Sparks Radio Supplies).

One suitable cabinet, 9 in. by 18 in., with room behind for baseboard of the size quoted below.

When this has been done the drilling may be commenced by running through all the holes with a small drill, say about \( \frac{1}{4} \) in. diameter, afterwards enlarging them to their required size. The holes in which the coil-holder, the two variable condensers, the filament resistances and the jack are mounted will need to be enlarged to \( \frac{3}{8} \) in. The grid leak will need a \( \frac{3}{8} \) in. hole and the terminals a 3-32 in., or a No. 26 Morris drill.

Mounting the Components
At this stage the panel transfers may be fixed, as it is much easier to do this now than when all the components are mounted.

Wiring up
The wiring of the receiver must now be started. The aerial terminal requires only a piece of flex connected to it about 10 in. in length, to reach the terminals of the tapped aerial coil. The same applies to the connection to the fixed vanes of the aerial tuning condenser, in this case the lead being taken to the tapped secondary coil.

The Reaction Coil
The grid circuits may be wired first, seeing that the wires are kept as far as possible from each other and any components. The two flexible leads to the reaction coil are soldered to the ends of the tuned wire leads, these being held in position by a small block of ebonite, the dimensions of which are given in Fig. 6.

The components and the metal brackets should afterwards be secured to the panel, and it is advisable to fix the large components last.

The baseboard can be attached to the brackets and the other components secured to this by either wood screws, or by bolts and nuts passed right through the board. The baseboard is further held in position by two screws passing through the panel into the wood.

The wiring is executed in stiff square wire, which presents a very neat appearance.
testing has been employed for the condenser shunted across the primary of the inter-valve transformer.

When the receiver has been wired it may be tested out.

Attach the appropriate leads to the aerial and earth terminals, insert the valves, and connect up the accumulator to L.T. + and L.T. -. Turn on the filament resistances and see if the valves are working. If they do, the H.T. and the grid bias may also be connected. Then attach the telephone tags to the telephone terminals, drawing the loud-speaker plug out of the jack.

Initially the flexible leads should be connected to the two largest tappings of their respective coils, as required until maximum signals are obtained. Slight readjustments of the filament resistances may be required, and also of the variable grid leak to give the best results. When the set has been handled a short while and its working understood, the tappings to the coils may be altered, maximum selectivity being obtained when the leads are on the smallest number of turns on both the coils.

Valves Employed

The receiver was tested at the Elstree Laboratories and various valves were tried out in both stages, resistance bobbins being employed to suit the different types of valves.

**Testing Out**

Keeping the reaction coil loosely coupled, slowly turn each of the condenser dials until signals are heard. Then leave the aerial condenser alone and tune the secondary condenser until maximum signal strength is observed, and finally tune the aerial condenser. The reaction may now be brought up, slowly retuning each condenser.

**Fig. 5.**—The wiring may readily be followed from this diagram. A Blue Print No. 142b may be obtained if desired. Price £1.6d., post free.

The receiver operates successfully with either bright or dull emitter valves, and for purposes of filament current economy a 3 volt .06 valve (B.T.H. B9) was used for the detector valve and a 3 volt .12 amp. (B.T.H. B6) in the amplifying stage.

For good reproduction a $4\frac{1}{2}$ volts
grid bias was used on this valve, but the actual valve employed depends on the high-tension voltage.

Test Report
With a small aerial good loud-speaker results were obtained from 2LO, while this station could be good strength and the tuning was found to be particularly sharp.
A definite log of the stations received has not been given, however, because the receiver is primarily intended for receiving the local station in areas where interference is experienced.
The receiver should be invaluable for those residing near the sea and who are troubled by interference from ship and shore stations.

Have you obtained your copy of
"The Wireless Constructor"
Special Christmas Number?
6d.—124 PAGES.—6d.

In addition to the usual practical constructional details, there are several articles of topical interest contributed by well-known authors.

HOW TO MAKE YOUR OWN CABINET!
How to Improve your Crystal Circuit.

By Major James Robinson
D.Sc., Ph.D., F.Inst.P.,
Director of Research.

Some interesting information on the relative merits of various types of coils in crystal circuits.

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In the following article it is proposed to give some interesting results of measurements on a number of simple crystal circuits. It is not claimed that these results are new, but often a few practical measurements will explain what is happening in a circuit in a more convincing manner than proof by theoretical considerations.

The Normal Crystal Circuit

Let us first of all consider a simple straightforward crystal circuit, as shown in Fig. 1. It is well known that the tuning of such a circuit is very flat, and that with such a circuit it would be impossible to separate two equally strong signals unless their frequencies were widely different. It might be said that the selectivity of a crystal circuit is of little importance as only the local station is usually received. Selectivity and strength of signals, however, are often bound up together, and by improving the selectivity of a circuit one can often get greatly improved signal strength. Also the results obtained with crystal rectification will often be found to apply to simple valve circuits using cumulative grid rectification.

Damping of the Circuit Caused by the Crystal

As the crystal naturally has to absorb energy from the high-frequency part of the circuit in order to give an audible response in the telephones, it is obviously impossible to eliminate entirely its effect on the damping of the circuit. If, however, the damping effect of the crystal can be made more or less equal to the damping caused by the other resistance in the circuit, then it can be shown that the maximum signals will be obtained. In order to obtain some measurements on signal strength and selectivity various types of crystal circuit were supplied with current from a local oscillator and the rectified current was measured with a sensitive microammeter.

Fig. 1 shows the resonance curve of a simple circuit when supplied with voltage at constant strength but varying frequency.

The Effect of Different Gauges of Wire

The former on which the inductances were wound for these experiments is shown in the heading. A spiral groove is cut on the former so that the same spacing of the wire could be easily obtained with wires of different thickness. A number of
inductances were wound up on this type of former, using copper wire varying from 18 S.W.G. to 36 S.W.G. The number of turns and the spacing of the wire were, of course, kept exactly the same in all cases. Fig. 2 shows the comparative resonance curves for inductances wound with copper wire of 18 S.W.G., 22 S.W.G. and 32 S.W.G., and when connected in the circuit of Fig. 1.

It will be seen from these curves that there is practically nothing to choose between any of the different wires used, either as regards selectivity or signal strength. The curves, of course, were taken with exactly the same coupling between the aerial and the oscillator, and also the same crystal setting. This means that there is practically no difference in the high-frequency resistance of either of the coils used, or else that the damping caused by the crystal is so large that any effect on the circuit due to the difference in the H.F. resistance of the coils would be negligible in comparison. The latter explanation is more likely to be correct, so that in a circuit in which a crystal is put across the whole of the coil, there is little advantage to be gained by using heavy gauges of wire.

**How the Effective Damping of the Crystal can be Reduced**

The effective damping in the circuit caused by the crystal can be reduced by tapping the crystal across part of the coil only. At the same time, however, use is made of only a fraction of the available H.F. voltage across the inductance. It is obvious that if the crystal were tapped at the bottom of the inductance, it would have no effect on the damping of the circuit, and there would be no high-frequency voltage across it, and consequently no signal would be received. By tapping...
the selectivity strength signal is signal falls strength this particular low loss of actual different lower rating current not enough the bad. If strength we tapped on Fig. 10 65
40
60
45
30
35
20
15
10
5
0
Fig. 5.—When the crystal tapping is varied, the size of wire may have considerable effect.

Effect on Crystal Tapping

Fig. 3 shows the relative signal strength for different tapping-points for the crystal. The actual coil used for these measurements consisted of 65 turns of 22 S.W.G. copper wire, wound on a low loss type of former. It will be seen that in this particular case the optimum point for signal strength is about 12 turns out of a total of 65 turns.

On either side of this point the strength of the signal falls away quite rapidly. When the crystal is tapped across the whole coil, the strength of the signal is only one-third that of its optimum value.

Effect on Selectivity

We have seen from the above that tapping the crystal across part of the inductance improves the strength of signals. In what way does it affect the selectivity? The curves A, B, C and D of Fig. 4 are resonance curves plotted for tapping-points at 5, 12, 30 and 65 turns (full inductance). It will be seen from these that the selectivity greatly improves as the number of turns across which the crystal is tapped is reduced. There is no optimum point for the selectivity, which is the greatest with the smallest tapping.

Effect of Gauge of Wire

As the optimum tapping-point for the crystal is dependent on the resistance of the high-frequency part of the circuit varying the gauge of wire alters the tapping at which best signals are received. The curves of Fig. 5 show the signal strength plotted against the number of turns across which the crystal was connected, for inductances wound with various gauges of wire from 18 S.W.G. to 40 S.W.G. It will be seen from these curves that the wire giving the best signal strength, No. 26 S.W.G., requires the least number of turns across the crystal, whilst that giving the poorest signal strength, No. 40 S.W.G., requires the most number of turns across the crystal. It will be noticed that the difference between the wires as judged by maximum signal strength is much greater in this case than in the case of Fig. 2.

It should be remembered that in all these coils the spacing was kept constant. With finer gauges of wire, however, the spacing may be reduced, which enables a shorter coil to be used, with consequent increase in efficiency. This factor tends to discount the apparent advantage obtained with thicker wire.

Fig. 6.—When the detector circuit was connected across the whole coil, the signal strength was continuously reduced as the aerial tap was reduced.
The Effect of Aerial Tapping

A circuit in which the aerial is connected to a tapping-point part way down the inductance is quite common practice (see Fig. 6). Measurements made on this type of circuit show that if the crystal is connected across the whole of the inductance, there is nothing to be gained by making an aerial tapping-point. In fact, as the number of turns in the aerial circuit is reduced, the signal strength becomes less and the resonance curve becomes flatter. Fig. 6 shows the relative strength for various aerial tapping-points, and Fig. 7 shows three resonance curves taken with 65, 50 and 30 turns in the aerial circuit respectively.

![Resonance Curves](image_url)

Fig. 7.—With the circuit shown the selectivity was made worse by tapping the aerial across part of the coil only.

Common Tapping-point for Aerial and Crystal

If, however, both aerial and crystal are tapped to the same point, an improvement immediately results.

The relationship between signal strength and tapping, as given by actual measurements, is shown in Fig. 8. It will be seen from this that the signal strength remains practically constant from the full 65 turns to about 25 or 30 turns. If the turns are reduced below the lower value, the signal strength falls away very rapidly. As regards selectivity, this improves as the turns are reduced. Thus with a tapping of about 50 turns the selectivity is good and there is little loss in signal strength. This would be the best point at which to work in practice. The relative shape of the resonance curves taken with tapping-points at 20, 30 and 40 turns is shown in Fig. 9.

![Resonance Curves with Tapping-Points](image_url)

Fig. 8.—If aerial and crystal were both tapped the signal strength remained nearly constant until quite small tappings are obtained.

Conclusions

These results, however, must be regarded with caution, in that they were taken on a particular aerial and cannot be considered of general application. The curves showing the variation of signal strength with aerial tappings, for example, would be of a different character for varying types of aerial. Moreover when an aerial tap is used in practice the size of the coil is correspondingly increased.

As far as the present experiments are concerned, however, the results may be summarised as follows:

1. With a plain untapped arrangement the resistance of the coil is swamped by the damping due to the crystal.

2. With a tapped arrangement a low loss coil is of advantage.

![Resonance Curves with Different Tapping-Points](image_url)

Fig. 9.—With a circuit such as that shown in Fig. 8 there is a definite advantage in using a tapped arrangement.
THE DUBLIN BROADCASTING STATION

Many readers will have heard 2RN, the Dublin Broadcasting Station, testing during the past few weeks. Here are some preliminary photographs.

The upper photograph shows the 6Kw. transmitter, while the view on the right gives some idea of the almost ideal site which has been chosen for the station.

This is a view of the motor alternators for supplying the high-tension voltage to the transmitting valves.
A THREE VALVE "PRINCE" RECEIVER

By A. S. CLARK

This receiver employs a form of trigger circuit due to C. E. Prince, and first described by G. A. Beddington. It is capable of giving signals of large volume with considerable purity of reproduction.

Although the "Prince" circuit, which is employed in this receiver is not entirely new, it has only appeared once before in a constructional article. A two-valve "Prince" receiver by D. J. S. Hartt, B.Sc., was described in Wireless, Vol. 1, No. 5, and not intended for distant reception, being designed to excel on the local station in purity and volume. It is ideal for the enthusiast who is anxious to obtain real loud-speaking with almost the purity of a crystal receiver.

Lust Valve Optional
Jacks are provided by means of which either two or three valves may be used. The two valves follow every word of the announcer at a considerable distance from the reproducer.

Circuit not Complicated
The circuit is not complicated, although it is unconventional; in fact it is perhaps more simple than a straight three-valve set. Only one fixed condenser is required, since this seems to be a component for which the set has no liking. No improvement is made by shunting one across various parts of the circuit such as the primary of the transformer or the loud-speaker. The extra expense of having two H.T. and two G.B. batteries is easily compensated for by the wonderful reproduction obtained, which must be heard to be fully appreciated.

The Tuning Arrangement
Referring to the theoretical circuit diagram, it will be seen that tuning is obtained by means of a variable condenser in parallel with an inductance coil which is of the standard plug-in type. This tuning circuit is shunted across the grid and filament of the first valve, the grid of which is given a negative potential by means of the grid bias battery. Fine adjustment of the potential of this grid is obtained with the potentiometer across the L.T. battery.

In the plate circuit of the first valve we have the H.T. battery, the negative side of which is connected directly to the grid of $V_1$. It is in this battery that the secret of the circuit lies. When the grid of $V_1$ is highly negative, this valve is non-conducting. The H.T. battery $A$ therefore cannot complete its circuit and the grid of $V_1$
behaves just as if it were disconnected. There will be a steady anode current flowing depending on the value of the grid leak R5. On the arrival of a signal, however, V1 becomes conducting and the battery A applies a large negative potential to the grid of V2, which reduces the anode current of this valve practically to zero. Thus a lead, whilst the third valve being a standard arrangement has its filament resistance in the negative lead. The resistance R1 is a fixed resistor which is placed in series with the filament rheostat of V1, because as a rule this valve has to be burnt at a less brilliance than usual. The set is of quite a moderate

trigger action is set up, this battery acting as the trigger, and due to this the circuit is sometimes called a "trigger circuit." The current flowing in the plate circuit of the valve V2 is fairly small, and this helps to compensate for the extra H.T. battery which has to be used. After the plate of the valve V2 the circuit is a conventional note-magnifier, except that no fixed condensers are incorporated. The jack connects the primary of the L.F. transformer in the plate circuit of V2 when no plug is inserted. When the plug is inserted with a loud-speaker attached, the primary is completely cut out of circuit and the loud-speaker inserted instead. The Jack is a single circuit jack and enables the loud-speaker to be put in the plate circuit of V2 when desired.

In accordance with the original circuit—the first two filament resistances are placed in the positive size and unobtrusive. All the components have been placed as close together consistent with good working as possible, thus making the receiver very compact. The set has a pleasing appearance, there is directly across the low-tension. The switch should therefore always be used for switching the set on, because if it is done with the resistances, a steady current will be passing through the potentiometer.

Components

The following list shows the complete set of components required to build the receiver, and in accordance with the usual practice we give the makers of the original parts used. It is not however strictly necessary to adhere to this list, as other suitable components of good make may be employed.

Black panel 14 in. by 7 in. by 3 1/2 in. (American Hard Rubber Co., Ltd.).

Cabinet to take same with 6 in. deep baseboard (Carrington Manufacturing Co., Ltd.)

Circuit board 6x4 in.

- H.T. condenser (Igravic Electric Co., Ltd.).

- Variable low-loss condenser (Falk. Stadelmann and Co.).

3 dual filament rheostats (Falk. Stadelmann and Co.).

Fig. 1.—The circuit employed makes use of a trigger action between the valves V1 and V2.
work may be commenced. The first thing to do is to make sure the panel will fit into the cabinet, if it is not supplied with it. If it will not, the edges should be scraped with a knife or filed until it will. Attention is now turned to drilling the panel.

Fig. 2 is a drilling diagram of the receiver, from which the panel may be commenced. The constructional panel are for screwing it to the baseboard. The small weight on the panel and its length in respect to its height, make the use of panel brackets unnecessary.

Mounting Components

When the panel is drilled, mount those components which go on the panel. The middle resistance is placed the opposite way round in relation to the others in order to allow more room for the potentiometer. Make sure that the contacts to the potentiometer are at the bottom, or the wires to this component will be unnecessarily long.

Having mounted those components which are fitted on the panel, attention may be turned to those for the baseboard. All these should be mounted except the transformer, for which the fixing hole should be drilled. Do not mount it because some of the wiring has to be done before this component is fixed into position.

The diagram of Fig. 4 shows details of the mount for the A.J.S. fixed resistor. These resistors are provided with two valve pins, and so two valve legs are fixed to a small piece of ebonite which is screwed to the baseboard. Two soldering lugs should be placed under the valve legs, and two terminal screw tops are used to lift.
The wiring of the receiver should be carried out in accordance with this diagram, a full-size blue print of which may be obtained for 1/6 post free. No. 141b.

The Terminal Strip

Having proceeded thus far, the switch may now be attached to the terminal strip. If a hole is not provided, one of the terminal holes can be enlarged to take it. The sixth hole from the left, looking at the front of the strip, is the correct one. Before screwing the terminal strip on it will greatly help in the soldering of the set if the ends of all the terminal shanks are filed bright and heavily tinned. After screwing on this terminal strip and screwing the panel to the baseboard, which should be done with both of these in the cabinet, the set may be wired.

Wiring

All points to be soldered should be tinned in the same way as the shanks of the terminals on the terminal strip before wiring is commenced. The filament circuits should receive attention first. The connections to the filament rheostats must be made before the transformer is mounted as already stated, the terminals on these resistances being tightened up with a pair of pliers. Apart from this point the wiring should present no difficulty.

Do not forget while wiring that certain amount of space must be left around the valve holders and coil socket. It is as well to keep a large valve handy while wiring, which may be inserted in the sockets occasionally to make sure that it
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Modern Wireless

does not foul any of the connections. Also make sure that the wires to the filament resistances allow room for the contact arms to be rotated.

The only constructional detail which remains after the wiring is to affix the panel transfers. This should be done in accordance with the lettering against the terminals in the wiring diagram.

Valves to Use

Before describing how to test and work the set, it will be as well to give a short description of the valves to use. At least one power valve will be required, and it is advisable to use two if possible owing to the large power to be handled.

The first valve should be a D.E. 3B or a D.E. 5B. The second is much more preferable, and goes very conveniently with D.E. 5's in the second and third valve holders.

Batteries

The first high tension battery should be a 36 volt one, about 18 or 20 volts usually being sufficient. Often best results are given with about 18 volts in this position. Both grid bias batteries should go up to 9 volts, in steps of 1½ volts. In the case of the first one as the H.T.A. volts are sometimes critical, but not to a very great extent.

Testing the Receiver

Connect the aerial and earth, and all the batteries to their correct terminals. Plug a suitable coil in the coil socket, say a No. 35 or No. 50, and if a D.E. 3B valve is used as the first, put the D.E. fixed resistor in, but if the D.E. 3B, put in a D. This resistor has almost a dead short between its pins.

Try at first with two valves by plugging the loud-speaker on to jack 1. With a given H.T.A. value, and the correct grid bias, it will be possible almost completely to lose the signals by turning the potentiometer either way. If this does not happen, different grid bias values should be tried until it does. Signals may be brought to their loudest by trying different combinations of H.T.A. and G.B. 1.

The tuning of the aerial is the same as usual, except that it will generally be found that distortion is introduced if the set is detuned in either direction.

When trying three valves, the loud-speaker plug is put in the second jack. The G.B. 2 should be adjusted until loudest and purest signals are obtained, and it should be kept as negative as possible, since this will help to keep the anode current down, which is inclined to become rather large.

Results

The best results were obtained by the author, when using a D.E. 3B and 2D.E.5 valves with 18 volts for H.T.A. and 4½ volts for G.B. 1. On the last two valves 120 volts were employed with 9 volts grid bias.

Those who have been looking for some advance in loud-speaker set design will find the receiver just what they require, and reports on results will be very welcome to the author.

All the terminals are at the back of the set, thus enabling all batteries to be kept out of sight.

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A number of inquiries have been received for further details of the high-frequency transformers used in the "Special Five" receiver by readers who desire to make their own, the following particulars may be of interest.

The Primary Winding

The primary consists of two coils of wire in series, wound side by side on an X former of ebonite in two separate slots. It has been found an advantage to separate these slots by a space of 1/2 in., although in the first transformers the two windings were closer together than this. There is room for a great deal of experiment with regard to these primary windings, and they may with advantage be of a gauge as small as 30 S.W.G. There are 20 turns on each X former.

The two coils are joined in series, one end of the pair of coils going to the anode, the middle point to the positive high-tension, and the other end to the neutralising condenser. The design of these transformers is such as to keep the capacity coupling between the primary and secondary as low as possible.

The Secondary Winding

The secondary of the transformer is a single layer winding of the outside of a 3 in. ebonite tube, at one end of which the X former carrying the primary and neutralising coil is placed. The wire used is No. 20 S.W.G, enamelled and spaced a distance equal to the thickness of the wire by being wound in a groove turned on the tube. As the turning of such a groove is beyond the ability of the average amateur who does not possess a lathe, a similar effect can be obtained by winding the enamelled wire and string of equal thickness simultaneously, the string thus serving as a separator for the adjacent turns.

An Improvement

The transformer thus comprises a solenoid secondary with a primary loosely coupled to it in such a fashion as to have very little capacity coupling. At my suggestion Messrs. Peto-Scott have now produced a modification of this transformer with more turns on the primary, but with the primary mounted in such a way as to allow it to rotate, thus varying the coupling between it and the secondary. I am now experimenting with this, and it is giving very interesting results.

Valves to Employ

The transformer as now made is particularly suited to the 1/4-amp. type of small-power valve, with which it oscillates readily. In using these transformers the feedback is sufficient to set up the required self-oscillation, which is checked by means of the neutralising winding and condenser. Some kinds of valve, particularly some bright emitters, do not oscillate so readily, and the feed-back is insufficient to produce oscillation, or even sufficient reaction effect to make the receiver really sensitive. For this reason I strongly recommend the use of 1/4-amp. small-power valves in this receiver.

Lower Frequencies

With regard to the reception of 5XX and Radio - Paris on this receiver, I have not arrived at a point when I can recommend suitable windings for this range, using both stages of high-frequency. Experiments are proceeding, and results will be published as soon as possible.

Winding Coils at Home

The beginner is apt to think that the winding of a tuning coil is an operation rather beyond his resources and capabilities, but as a matter of fact some of the most effective types can be made with the utmost ease, and without any elaborate appliances.

Home coil winding is a most fascinating branch of wireless, and the monetary saving effected by being able to wind a coil for, say, Daventry, at a cost of perhaps a shilling, with the aid of a round piece of wood and a few nails is obvious.

All that is required is a source of clear and dependable instructions for winding the various types of coil, indications of their suitability for various purposes, and so on, with definite information as to turn numbers; and all these points will be found to be fully covered in a book published by Radio Press, Ltd., entitled "Tuning Coils and How to Wind Them" (ts. 8d. post free), by G. P. Kendall, B.Sc.

One of the original experimental transformers employed by Mr. Harris.
Wave Traps and Their Uses.
By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

For those who already have sets, and who wish to try long-distance reception, the local station often proves a serious source of jamming. The use of one of the several types of wave trap described in this article will prove distinctly beneficial.

In the quest for selectivity any device which will reduce the effect of local jamming is eagerly welcomed by the great majority of listeners. In order to reduce such jamming there are two methods available. One of these is to increase the number of tuned circuits in the receiver, but this proceeding has the disadvantage that if more than two circuits are employed it is usually necessary to employ high-frequency amplification to make up for the signal strength which is lost in transferring the energy from one tuned circuit to the next.

On the other hand, there are many people who desire to improve their selectivity in so far as the elimination of jamming from the local station is concerned, without necessarily increasing the number of valves in their receiver or indeed without altering to any considerable extent the present arrangements.

What is a Wave Trap?

In such cases a suitable wave trap may be of considerable advantage. A wave trap is a device which is connected in a suitable portion of the circuit usually in such a manner as to act as a more or less complete barrier to currents of the frequency of the local station, which it is desired to eliminate, without affecting other frequencies to any appreciable extent. In certain cases circuits are employed for this purpose which achieve the desired result by increasing the elimination of any frequency other than that which is desired, but although these circuits will be discussed later, they are not, strictly speaking, wave traps.

Loose-Coupled Circuits

The question arises as to whether a wave trap is more effective than the addition of another tuned circuit. In any case, it is necessary to employ an extra time, and it might at first sight be thought that the same advantages could be gained by providing a loose-coupled tuned primary and inserting this in the front of the receiver. Such a circuit is shown in Fig. 1, and, suitably designed, there is no doubt that a material improvement in selectivity would result.

The disadvantage of this circuit, however, is that the signals from the wanted station will suffer slightly in strength due to the transfer of energy from the one circuit to the other. Although this may not be important on nearby stations, it may make all the difference between satisfactory reception or the reverse in the case of reception from distant stations. It is this disadvantage which has led to the use of extra high-frequency valves when using a chain of tuned circuits, the function of these high-frequency valves being more to make up the loss of energy at each stage, rather than to provide any very considerable overall amplification.

An additional disadvantage of this arrangement lies in the fact both circuits have to be adjusted for each station tuned in.

Advantages of Wave Traps

A wave trap, however, can be designed so that the signal strength of the wanted station is only affected...


to a very small extent. Moreover, with a suitably designed arrangement the setting of the wave trap only requires to be adjusted once and for all at the beginning of the operations, so that it can hardly be considered as an extra tune in the ordinary sense of the word.

**Operation of a Wave Trap**

The actual functioning of a wave trap is not quite as simple as it would appear at first sight. Fig. 2 is a simple diagram representing the condition of affairs in an aerial circuit provided with one of the simplest types of wave traps. The alternator is providing a small source of voltage which represents the incoming wireless signal. At first sight one would imagine that the wave trap inserted as shown could simply be tuned to reject or trap a certain frequency, and that all other frequencies would be passed without being appreciably affected.

---

**Fig. 4.**—In this circuit the trap is coupled to the coil $L_1$. $L_1C_2$ is tuned to the same station as $L_2C_3$.

---

**Fig. 5.**—A simple series rejector type of trap. $L_1C_2$ is tuned to the interfering signal.

**Fig. 6.**—A modification of Fig. 5. The trap circuit being coupled to the coil $L_3$ in the aerial circuit.

---

A little consideration, however, will show that the wave trap is really only one part of a somewhat complicated arrangement of tuned circuits, some in series and some in parallel. Because of this the wave trap produces an effect on the whole circuit, but by suitable design it can be arranged that the effect on the tuning of the receiver is comparatively small. The effect is then that the receiver tunes in the normal manner, but the whole circuit presents a very high impedance to one particular small band of frequencies only.

The actual consideration of the effects of a wave trap on the whole tuning circuit is by no means simple, and I do not propose to discuss this aspect of the subject here. With these few preliminary remarks therefore, we will pass on to the consideration of several types of trap in actual practice.

**Desirable Features**

First of all let us summarise the desirable properties of a wave trap. In the first place the tuning of the wave trap should affect the tuning of the set as little as possible. The ideal case is one in which the wave trap could definitely be adjusted to the unwanted station and left there, after which the set itself may be tuned in to any other station which may be required without affecting the setting of the wave trap in any way. This property is one which can easily be obtained with a suitable circuit. Another feature is that the effect of the insertion of the trap on the signal strength of any other station should be as small as possible. That is to say, in cutting down the unwanted station, the stations required should not be appreciably affected. These are the main points and we can now consider how they are carried out by the various types of circuits.

There are four principal types of wave trap. These are:

- **(a) The series rejector type.**—Here a rejector circuit is inserted in the aerial in series with the tuned circuit connected to the set.
- **(b) The parallel rejector type.**—In this case a tuned circuit is connected in parallel with the circuit of the receiver.
- **(c) The acceptor type.**—Here a series tuned circuit is connected in parallel across the tuned circuit of the set.
- **(d) The absorption type** in which a tuned circuit is loosely coupled to the tuned circuit of the receiver.

Of these, the first and last two are the most satisfactory types. These are all tuned to the interfering stations, whereas the parallel rejector type is tuned to the same frequency as the set itself, and therefore simply assists reception by increasing the selectivity of the receiver and requires readjustment for each alteration of the setting of the receiver itself.

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**Fig. 7.**—In this case the aerial is tapped across a small portion of the trap coil $L_1$.

**Fig. 8.**—An acceptor type of trap. $L_1C_2$ is tuned to the interfering signal and forms a by-pass.

**Rejector Circuits**

Fig. 3 shows this type of circuit, and it will be realised from what has been said that this circuit does not comply with either of the desirable...
features outlined above. The variation of the trap condenser \( C_1 \) will cause a variation of tune and the fact that it has to be adjusted afresh for each variation made to the set renders it somewhat less satisfactory than the other types. It does, however, produce a marked increase in the selectivity and has the advantage over the loose-coupled arrangement shown in Fig. 1 in that the rejector circuit \( L_1C_1 \) can be cut out while preliminary tuning is effected and subsequently cut in and tuned to the wanted station.

![Fig. 9.—The acceptor type of trap works better with a tight-coupled aerial.](image)

**Coupled Rejector Arrangement**

A modification of this circuit is shown in Fig. 4. Here the trap circuit instead of being connected across \( L_1C_1 \) is coupled to a coil \( L_4 \) shunted across \( L_1C_1 \). This circuit is rather more difficult to adjust than that of Fig. 3, because there is a tendency for the wanted signals to slip through \( L_4 \) as well as the unwanted signals. When suitably adjusted, however, this trap is capable of giving exceedingly good results. \( L_2C_2 \) and \( L_1C_1 \) are both tuned to the desired signal, \( L_1C_1 \) being tuned first without the coil \( L_4 \) connected.

**Series Rejector**

The circuit in Fig. 5 is a simple series rejector type of circuit. This circuit when suitably arranged has little effect on the wanted signals provided they are not too close to the frequency which is being eliminated. The tuning of this circuit of course depends on the coil employed. The lower the resistance the sharper will be the tuning, and stations quite close to the local station can be received satisfactorily.

The circuit behaves to a large extent as a series condenser in the aerial circuit, so when the trap is inserted \( L_4 \) has to be increased somewhat, a size larger being employed if plug-in coils are used. When this alteration has been effected, however, the interaction between the trap circuit and the receiver tune is quite small, and the tuning can be made very sharp.

**Practical Results**

This circuit is one of the several types which can be arranged with Mr. G. P. Kendall's 1BC Wave Trap, and using this type of trap, 2LO can be cut out and 2ZY received quite easily at 7 miles from 2LO with a receiver of average selectivity.

This circuit, however, is not the only one that can be obtained, utilising this parallel rejection principle. The circuit shown in Fig. 6 is electrically similar to that in Fig. 5. In this case, however, the trap circuit \( L_1C_2 \) instead of being connected direct to the aerial circuit, is coupled to a small coil \( L_4 \) in the aerial lead. The coupling between these two coils is kept comparatively weak, and with this arrangement the interaction between the circuits is somewhat reduced, although the effectiveness of the arrangement as a trap is somewhat impaired.

**Use of Aerial Tappings**

A modification of this circuit is shown in Fig. 7. Here instead of loosely coupling the trap circuit, the aerial circuit is tapped across a small portion of the coil \( L_4 \). This type of circuit is capable of giving exceedingly good results. The coil \( L_2 \) should be a size larger than \( L_1C_1 \) being a 0.005 \( \mu \)F condenser. For \( L_4 \), a 70-turn coil on a 3-in. former may be employed, or alternatively a Lissen 60 X coil, the tapping point on the X coil being used for connection to the aerial.

**The Acceptor Trap**

We now have to consider the next type of circuit, which is the acceptor circuit. An example of this circuit is shown in Fig. 8. Here it will be seen that a coil \( L_2 \) and Condenser \( C_2 \) are connected in series across the aerial and earth. If \( L_2C_2 \) is tuned to the frequency of the unwanted station, this arrangement will form a low-resistance path across the tuned circuit \( L_1C_1 \). The circuit \( L_2C_2 \) will have a comparatively high impedance to any other frequency so that the required signals will tend to go through \( L_1C_1 \) as required.

**Undesirable Effects**

This type of circuit, however, as shown, is not satisfactory. For one thing, the tuning of \( C_2 \) has considerable effect on the tuning of the set and vice versa. Secondly, the tuning is not very sharp, and the signal strength with the trap in place is not as good as without it. Moreover, it is usually found that subsidiary tuning points are obtained which may coincide with the very frequency which it is desired to receive. These effects are due to the fact previously mentioned that the trap...
MODERN WIRELESS

is really part of a complex system of inductances and capacities and the arrangement must be considered as a whole.

Tight-Coupled Aerials

Very much better results are obtained by using this trap when a tight-coupled aerial is employed, such as is shown in Fig. 9. Here owing to the removal of the tuned circuit L₁, C₁ from the aerial circuit, the energy simply being transferred via the small coupling coil L₄, it is found that the tuning of the acceptor trap is very much better and quite good results can be obtained. The tuning of C₂ and L₂ is largely independent.

Fig. 10 shows a circuit employing a series acceptor circuit with an auto-coupled aerial. This arrangement is satisfactory, but not so good as that shown in Fig. 9.

Rejector Circuits with Tight-coupled Aerials

The parallel rejector may be used very effectively in case of a tight-coupled aerial. Such a circuit is shown in Fig. 11. As previously stated the trap circuit L₂, C₂ requires to be tuned to the frequency of the wanted station and must be altered for any variation in the tune of the set, but in this circuit the sharpening of tune is particularly marked. C₂ should be at least 0.01 µF and L₂ proportionately smaller, depending upon the frequency being received.

The Absorption Trap

The last type of trap is the absorption type. This type is in many ways the most satisfactory, its primary advantage being that the effect upon the whole aerial circuit is less than with any other form of trap. The resonance curves of this type of circuit are almost perfectly regular and there are no subsidiary effects such as are obtained with almost every other kind of trap.

Damping Necessary

This type of trap, however, differs from the others considered in one rather important particular. The circuit L₃, C₃ is tuned to the interfering signal and is designed to absorb energy from the receiving circuit itself at the particular undesired frequency. Now in order to do this it must have a certain amount of damping. On the other hand, the less the damping the sharper the tune. Consequently a compromise must be adopted, a fairly sharp tune being employed with a fairly efficient absorption. The effect is that the actual tuning of the arrangement is not quite as sharp as can be obtained with some other arrangements, but this difficulty causes little trouble in practice.

For this type of circuit L₃ can conveniently be an ordinary 75 plug-in coil and C₃ a 0.003 µF condenser.

Weak Coupling

The coupling between the coils L₁ and L₄ should be kept exceedingly weak, as otherwise the trap circuit absorbs energy at frequencies other than that of the interfering station, i.e., the wanted signals are also reduced. The coupling should be made as weak as possible therefore, the best position being found by trial. It has sometimes been found that best results are obtained in positions where the coils do not appear to be coupled at all.

Recommended Types

These are a few of the various types of trap circuit which may be employed. The recommended ones are the types shown in Figs. 5 or 7 for tuned aerial working, while Fig. 12 is a good third. For tightly coupled aerial work the circuit shown in Fig. 9 is probably the most satisfactory. Various modifications will suggest themselves to readers, but the remarks which have been made at the beginning of this article indicate that the operation of a wave trap is not as simple as it would appear at first sight, and that the tuning of the whole of the aerial circuit must be taken into account.

A Frame Aerial Cabinet Set

(Concluded from page 141.)

The Frame Aerial

The frame aerial is wound upon the back of the cabinet, which is detachable for the purpose. Diagonals are drawn across the inside of this back, and small brass screws are driven in at suitable intervals, their heads being left projecting slightly. Under the heads the turns of the winding are held, the net result being seen in one of the photographs and Fig. 3.

The number of turns on the frame will depend upon the station which is to be received, and this is best ascertained by simple trial and error, aiming at such a number that the station is tuned in at only about 20 to 30 degrees of the frame condenser.

The interval between the screws should be half an inch, and fifteen turns should be adopted for the first trial for a station between 875 k.c. (350 metres) and 750 k.c. (400 metres), and twenty for one between 750 k.c. (400 metres) and 600 k.c. (300 metres), turns being added or subtracted as required until the desired condition is achieved. For a relay station, try twelve turns, and space the screws 3 of an inch. In each case make the outer turn as large as possible, and work inwards, securing the ends by gripping them under small blocks of wood or ebonite.

Daventry

No provision was made in the original set for receiving Daventry, but this station is easily obtained with the aid of an outside aerial of small size, or a good indoor aerial. Place a single coil socket inside the battery compartment, with a pair of flexible leads which can be brought up and connected to the terminals A and B instead of the leads from the frame. Insert a No. 150 coil, or its equivalent, in the socket, use suitable plug-in transformers, and attach aerial and earth to the pair of terminals mentioned above.

Valves

To obtain good results the two H.F. valves should not be of a type which oscillates extremely readily i.e., do not use one of the quarter-ampere power valves which are suitable for some types of H.F. amplifying circuits. Practically, any general purpose valve, bright or dull emitting, will work satisfactorily.

For the first L.F. valve a D.E.5B or D.E.3B type was found preferable, while the last valve should be of the small power type.
The extraordinary tuning facilities given by the GECoPHONE Low-Loss Slow-Motion Condenser are crystallised in the spontaneous statement of a user—"You cannot miss a station with it!"

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Simultaneous Reception of Two Stations

This receiver is designed to receive both the local and Daventry stations simultaneously. The circuit was originally suggested by Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., and has been developed at the Elstree Laboratories.

It often happens when a wireless set is in general use that one member of the family wishes to listen to the local station, while another would prefer to receive an alternative programme from 3XX. It is not very difficult to design either a crystal or valve circuit to receive both stations at the same time, and thus to satisfy both parties.

Various circuits may be employed, but the majority of these suffer from serious disadvantages. A really satisfactory circuit must enable both stations to be received without any trace of mutual interference, while the tuning of each must be entirely independent of that of the other.

A number of circuits were tried out at our Elstree Laboratories in an endeavour to find the most satisfactory.

The circuit shown in Fig. 1 was tried out first. Both stations could be received without mutual interference, although the tuning adjustments were not independent. The alteration of tuning of one circuit, as the condenser of the other was rotated, became less as the aerial coupling was loosened. It was, however, found impossible to make the tuning quite independent, and the use of reaction complicated matters considerably.

It was therefore decided to discontinue experiments on this circuit and to try a parallel tuned arrangement as in Fig. 1. It will be seen at once that this circuit has considerable theoretical advantages over the other two. Thus a choke is provided on the long wave side to prevent the short waves passing, while a small 0001 µF condenser on the short wave side provides a much higher impedance to the low frequency than to the high frequency which it is desired to pass.

Effect on Tuning

When first tried out, this circuit suffered from the serious drawback that if an adequate choke was employed on the long wave side, e.g., a No. 200, then it was only possible to tap the valve circuit across a No. 75. This was found to weaken signals very considerably, and slight interference took place between the two circuits. Both these faults were remedied by placing a 0001 µF condenser in series with the choke L4. It was then found that there was no interference between the two sides of the
Fig. 2.—The first circuit tried employed a series arrangement.

Fig. 3.—The panel layout may be obtained from this diagram. A blue print may be obtained on application, No. 143a, price 1s. 6d., post free.

Low Frequency Amplification

The two-valve set to be described is based on the circuit in Fig. 1, but has the additional advantage that when only one station is being received the other valve can be used as a low frequency amplifier to provide loud-speaker reception. An ingenious switching arrangement provides for using either valve as a detector alone, for using both valves for duplex reception on long and short waves respectively, and for receiving the local station or Daventry on a detector and note magnifier.

Although it might be imagined that a switching arrangement with these capabilities would be very complex, in practice it is quite simple. The terminals are at the back of the receiver, so that all unsightly connecting wires and batteries may be kept out of sight. The plugs employed are those in everyday use, the jacks being of the kind known as double-circuit telephone jacks.

Switching Arrangements

In the case of jacks A and D the inner strips are connected to the primary of the transformer while the outer ones go respectively to the reaction coil and to the H.T.
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Fig. 4.—The wiring can be seen from this figure, but wiring up will probably be facilitated by the use of blue print No. 143b. Price 1s. 6d., post free.

battery. When the plug is inserted the primary of the transformer is disconnected from the valve in the same circuit as the jack, and the telephones or loud-speaker take its place.

To receive the local station a telephone plug should be plugged into A, while for Daventry it should be plugged into D. By plugging into both at the same time both London and Daventry can be received. For loud-speaker reception on short waves the valve which previously functioned as a long wave detector is now employed as a note magnifier. For this purpose the telephone plug must be withdrawn from A, and the plug shown connected to the secondary of the transformer plugged in at C. A loud-speaker plug should of course be substituted for the telephone plug in D. Finally, Daventry can be obtained on the loud-speaker by putting the loud-speaker plug in the jack A and the transformer plug in B. In the actual receiver A and B are placed one side of the panel, while C and D are on the other. This makes it easier to memorise the various arrangements, since for loud-speaker work the plugs in use are always on the same side.

Components

The constructional work of this set is quite simple, and no difficulties should be encountered. It

This view shows the wiring very clearly.

471
Modern Wireless

is desirable, however, to mount and wire the panel components first. The components listed below were found to give good results, but other makes could probably be employed with equal satisfaction.

One ebonite panel, 18 in. by 9 in. by ½ in. (Peto Scott Co., Ltd.)
One ebonite panel, 1½ in. by 8 in. by ½ in. (Peto Scott Co., Ltd.)
Two 0.005 μF variable condensers (Victoria Electric Co.).
Two two-way coil holders (Goswell Eng. Co.).
Two 0.001 μF fixed condensers (Igranic Freshman).
Two 0.003 μF fixed condensers (Igranic Freshman).

Valves to Use

It is preferable to use two similar valves, which may be either general purpose valves or small power valves. If the latter are employed, then smaller reaction coils are desirable. The coils given are intended to be used in conjunction with general purpose valves. Owing to the presence of the 0.001 μF condensers which act as constant aerial tuning condensers, the size of coils to employ is practically independent of aerial characteristics, so that the coils mentioned below can be employed on any aerial.

On the short wave side No. 30 coils should be used for both tuning and reaction purposes, while Daventry may then be tuned in, and brought up to full strength by means of reaction as in the case of the local station. It will be found that this will have caused no difference whatever to the setting of the latter.

We are now in a position to obtain either station on the loud-speaker by employing either of the other two combinations. By inserting the transformer plug at C and a loud-speaker plug at D we can listen to the local station, while by employing the jacks B and A respectively Daventry can be obtained.

Test Report

The receiver was tested out on

This view of the back of panel arrangement shows how the long wave and short wave sides are kept separate.

Two 0.01 μF fixed condensers (Igranic Freshman).
Two two-megohm leaks (Mullard).
Two valve holders (Radio Instruments, non-microphonic).
Two filament resistances, dual type (Radio Instruments).
One first stage L.F. transformer (B.T.H.).
Four plugs and jacks (Ashley Radio).
Twelve terminals.
Four ebonite bushes.
Two pieces ebonite to mount grid leak.
Four grid leak clips.
One cabinet, 18 in. by 9 in.
One baseboard, 17 in. by 6 in.
Two panel brackets (Formo).

for long waves a No. 150 coil should be employed on the choke socket, a No. 230 for tuning, and a No. 200 for reaction.

Operation of Receiver

To operate the receiver, first tune in the short wave station. For this purpose plug a pair of telephones into the jack A, and turn on the rheostat on the left. Then rotate the left-hand condenser knob until the local station is heard. This may then be brought up to the desired strength by the use of reaction. It will be noticed that all the controls for the local station are on the left, while those for Daventry are placed on the right-hand side of the panel. Another telephone plug should now be inserted in D, an average aerial at our Elistree laboratories. Good telephone strength was obtained simultaneously from London and from Daventry. Altering the tuning or reaction on one station made no detectable difference to the other. Even when one side was made to oscillate the other side was not affected, except when a harmonic was heterodyned. When the detector and low frequency combinations were employed good loud-speaker strength was obtained from both London and Daventry. With small power valves (D.E.5's) moderate to weak loud-speaker strength was received simultaneously from London and Daventry.
Marconi Valves

A "Sound" product

Brief particulars of six popular types

<table>
<thead>
<tr>
<th>Type</th>
<th>Filament Volts</th>
<th>Filament Amps</th>
<th>Anode Volts</th>
<th>Anode Amps</th>
<th>Impedance (ohms)</th>
<th>Amplification Factor</th>
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<tr>
<td>TYPE R</td>
<td>6</td>
<td>0.7</td>
<td>30 - 100</td>
<td>0.3 - 0.35</td>
<td>50,000</td>
<td>9</td>
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January, 1926

MODERN WIRELESS

New facts about the
Aurora Borealis

by

Chester L. Davis, A.M.I.R.E.

How many people realise that the Northern Lights produce an alternating voltage in receiving aerials? This article, which describes some tests carried out in America, provides much food for thought.

Many people are familiar with the phenomena of the Northern Lights. Probably most people know less about the Aurora Borealis than they do about the sun, moon and stars. In fact, most people know nothing about it, other than the fact that they are aware of the sky's being of a peculiar hue. It is very much regretted that the Aurora Borealis is not present in this country for any great length of time.

The experiments herein described and observations given seem to prove that the Aurora Borealis produces an alternating voltage on receiving aerials. This alternating voltage is of a frequency lower than any that is used in the commercial world. It was found that it required 15 minutes for the voltage to travel from maximum reading on one-half of the cycle to maximum reading of opposite polarity. During the tests the maximum voltage observed with the apparatus employed was 28 volts. This value was not constant. The experiments as they were conducted will be described in the order that they were performed.

The sky was streaked with light. Sometimes the light would flash and often would change its position in the sky. Telegraphs, telephones and wireless stations were troubled with paralysis of their instruments. The first experiment was conducted on my radio receiver. A voltmeter was connected to the antenna and ground, but no reading was obtained. The antenna in use was 80 ft. in length. After this test, an ordinary 25-watt lamp bulb was connected to the antenna and ground connections. No effect was noticed. The third experiment was the same, excepting that a flashlight bulb replaced the larger one, but nothing happened. The next experiment was the one which disclosed some remarkable facts about the nature of the Aurora Borealis. A full description of all apparatus used in this experiment will first be given.

The Voltage Test

The apparatus used in this experiment was a telephone testing board and a cross-country telephone line. The testing board was one constructed of Western Electric apparatus of a standard pattern. The apparatus on this board were a Jewell D.C. voltmeter scale 0-30, polarity reversing switch and other switches necessary to obtain a reading of the voltmeter. The telephone line used was the one with which we obtained the highest voltage reading. This telephone circuit was of the ground return type. On it were 14 bridging telephones, each having a resistance of 1,600 ohms between the metallic and ground circuits.

The circuit used in making the test is shown in Fig. 1. The telephone testing switchboard was connected to one of the lines on which the interference was most noticeable and annunciator drops on the switchboard were failing, as though someone were ringing the operator. When the line was connected to the testing board and the voltmeter switch thrown, the voltmeter needle rose slowly. I continued to watch it rise until it had reached a reading of 28 volts. It remained at this value for no length of time, but began to slowly fall to zero. I waited patiently for a considerable time, all the while wishing that the voltage would return. After waiting for nearly 15 minutes the needle again began to rise. After the needle had returned to zero once more, and a period of 15 minutes had elapsed, the needle performed as before. It was the regular reading of the voltmeter and the regular occurrence of the waiting of 15 minutes that suggested to me the idea that probably the voltage was of an alternating polarity. Anyway, that would explain what was taking place during the 15 minutes of waiting. A polarity reversing switch was employed to reverse the polarity of the voltmeter and
the voltage was found to duplicate the performance. Whenever the voltmeter needle fell to zero the polarity on the voltmeter was reversed and reading on each half of the cycle was obtained in this manner. The experiment suggested to me the simplest apparatus to illustrate an alternating voltage.

Only one characteristic was obtained in regard to the amperage. A simple electric door-bell was connected, as was a small lamp bulb, to the circuit, but no indications of voltage were noted by the bell and lamp test. Other than the fact that there was sufficient amperage to cause the relays on the telephone switchboard to work, I discovered nothing about the amperage developed.

**An Explanation**

The theory I have advanced regarding the phenomenon is as follows:

Let us suppose the earth to be negatively charged. This is recognised by scientists, since the electrons are of negative polarity. Now suppose the atoms of the world are caused to throw off these electrons into the space in which the earth revolves. These free electrons will be attracted by the atmospheric layer where they are needed to complete the quota of electrons which are missing. This would give the earth a lower negative polarity and the negative polarity of the atmosphere would be increased. Since the atoms which lose their electrons are of positive polarity, because of their nuclei, there would be a potential difference. If we consider the earth to be one plate of a condenser and the atmospheric layer the other plate, we may say that the condenser is building up and discharging its voltage of one polarity and then charging and discharging the opposite polarity. This would be a simple oscillating circuit and the frequency was found to be very low.

Owing to the fact that in some parts of the country the Aurora Borealis is barely visible, uniform voltage would not be found. I noticed that when the sky began to darken again the voltage was not so great, and when the hue in the sky had vanished the voltage reading was zero. The change in the position of the streaks of light in the sky explains the various voltage readings I received. Even when the voltage was barely noticeable the frequency of oscillation was not varied in the least.

**An Oscillating System**

It is evident that when the Aurora Borealis is not present the earth and the atmospheric layer each have their proper number of electrons and there is no potential difference present. But when the earth is caused to throw off these electrons and is in a state of oscillation with some other body, a potential difference exists until the two bodies resume their proper charges and a state of rest occurs. These experiments were conducted during the last appearance of the Aurora Borealis in this vicinity, in the year 1919. There is, at present, much discussion on the utilisation of atomic energy. Recent developments have also shown that the Aurora may take some part in the electrification of the upper atmosphere which is responsible for so many of the curious phenomena obtained in wireless, and I hope that these experiments will add to the data already at hand in the development of this work.

---

*Interesting developments are anticipated from the experiments of Mr. W. W. Salisbury, who is perfecting a system of secret communication using very high frequencies. He hopes to be able to direct signals to a given spot within a few miles either way. This photograph shows Mr. Salisbury with his apparatus.*

---

[Image of a person with an apparatus]
January, 1926

**Warning.**

IN THE HIGH COURT OF JUSTICE, CHANCERY DIVISION.

BROWN BROTHERS, Ltd.

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AND

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and ALFRED PUGH

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On the 4th November, 1925, Mr. Justice Romer on the application of Brown Brothers, Limited, of Browns Buildings, Great Eastern Street, London, and elsewhere, Wholesale Motor Aircraft Cycle Tool and Radio Manufacturers and Merchants, granted an injunction against Thomas William Bell and Alfred Pugh, of 117, Adelaide Road and 19, Renshaw Street, Liverpool, restraining them from carrying on under the name of Brown Brothers or any similar name or any name of which such words form part any business of a similar nature to any business carried on by Brown Brothers, Limited, and from using the name of Brown Brothers or any similar name or any name of which such words form part calculated to lead to the erroneous belief that the business of the said Thomas William Bell and Alfred Pugh is or is in any way connected with the business of Brown Brothers, Limited.

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FERRANTI LIMITED,
HOLLINWOOD, LANCASHIRE
A Simple Unit for Obtaining H.T. from 220 volt D.C. Mains

Constructional details of the smoothing unit described in our last issue

The unit described below is capable of delivering 20 or 30 milliamps from 220 volt mains for indefinite periods, without any noise being experienced. A further advantage of this unit is the entire impossibility of fusing any valves in the receiving set, as the unit can pass no more current than is passed from filament to anode of the smoothing valve employed. The primary purpose of this valve is to smooth the ripple that is present in nearly all mains (caused by the generators employed at the power stations).

Valves to Use

The smoothing valve employed in this unit is of the .25 ampere small power valve type, such as the Marconi DE5, BTH R4, Mullard DFA1, or the Burndpept L525. On no account must a valve with a filament current of lower value be used, as there is a risk of fusing the filament. Again, valves which require larger filament current would probably not give sufficient emission under these conditions.

The Circuit

The circuit employed is shown in Fig. 1. From this it will be seen that the valve is used as a two-electrode valve by connecting the anode and the grid together, and in this way a larger current is passed. The filament of the smoothing valve is lighted from the mains by placing it in series with the lamps L1 and L2, and the resistance R. The lamps employed in this unit are two 220 volt 60 watt ordinary metal filament lamps in series, and the resistance R is tapped, the total resistance of R being 190 ohms. It is important that these lamps should be used, as otherwise the valve may be damaged.

Condenser in the Earth Lead

The condenser C1 consists of three Mansbridge type 2 µF condensers in parallel, and is employed as a reservoir condenser across the output of the unit. The rest of the circuit is quite clear from the accompanying diagrams. Care must be taken, however, to put a small condenser of about .0001 µF in series with the earth lead and the set as in Fig. 4, otherwise the mains will probably be fed direct to the set without passing through the smoothing valve, as usually one or other pole of the mains is earthed.

Components Required

The components required are stated below. The manufacturer's name is given in each case, but similar good quality components may be used if desired.

1. Valve holder, of anti-vibratory pattern (Radio Instruments, Ltd).
2. Valve port (Aeromic).

Fig. 1.—The circuit of the smoothing device.

Fig. 2.—The layout of the panel is simple and can readily be followed.
of the holes to be drilled can be seen from the accompanying diagrams. (Note that the resistance we have employed is mounted in position by tapping the panel and screwing the shanks of the terminals on the resistance in, but it is not essential that it should be secured in this way, as it can be fixed by ordinary bolts through the panel. The holes for the sockets should be countersunk from the front of the panel in order to take their heads.

The Resistance

The resistance should now be constructed. This is done by taking the strip of Poilite (or, other suitable material) and drilling a hole at each end for the terminals, which should be secured in position. Now wind the 36 gauge Eureka wire on tightly, leaving a small space between each turn, until 190 turns are wound on. Secure the ends of the wire to the terminals at each end.

Now mount this and the other components on the panel, and commence tapping the resistance, starting from the right, tap the first 40 turns at every ten turns and take them to the first five Clix sockets. The remainder of the resistance is tapped at every 30 turns, and taken to the remaining five sockets. Both ends of the resistance come to the end sockets, numbers 1 and 10 respectively. The remainder of the components should now be mounted on the baseboard, and the panel screwed in position.

The wiring can now be completed from the accompanying diagrams (Continued on page 326)

Fig. 3. — The wiring will readily be followed.

2 ordinary bayonet cap lamp holders (obtainable from any electrical stores).
11 Sockets (Clix).
1 Wander plug (Ever Ready).
1 ordinary type switch as employed in house lighting circuits. (This is also obtainable from any electrical stores.)
1 oz. 36 S.W.G. enamelled Eureka wire.
1 Strip 7 in. by 1 in. of slate, or an asbestos cement such as Poilite or Uralite. (Obtainable from any builders' merchant.)
2 Terminals.
1 Cabinet and baseboard, internal dimensions 9 in. by 7 in. by 8 in. (Carrington Manufacturing Co.)
1 Plug adapter (also obtainable from any electrical stores.)

Construction of the Unit

The first item to be attempted is the marking and drilling of the panel. The position

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Free, including coils (100 200 metres) ... £6 15 0

Or complete with D.C. Valves, Batteries and Loud-speaker £13 0 0

These two remarkable Receivers have the same circuit. NOTE the remarkable results which have been achieved by a purchase of a Baby-Two.

"With reference to the Baby-Two! Receiver which you recently supplied to me, you may be interested to hear that I obtained the following stations on the loud-speaker during tests on two consecutive evenings. All the French and German stations given were heard and could be easily distinguished outside the room in which the loud-speaker was placed. This was also the case with London, Bournemouth and Daventry, as well as the following stations:—


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B.T. TUNING CONTROL

For the D.X.5 Receiver described by D. J. S. Haswell, B.Sc., in the December issue of Modern Wireless.

The B.T. Tuning Control is simple to mount, gives hair-line control and ease action. There is no side strain or pull on shaft to wear out bearings or destroy alignment of condensers.

Readings are from 0 to 10. This centers the antenna as to electrical or anti-clockwise instruments. Registers dial numbers, wavelenghths or call letters. Adaptable for 1/4 and 3/16 inch shaft condensers.

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THE ROTHERMEL RADIO CORPORATION OF G.T. BRITAIN, LTD. 24-25, MADDOX STREET, REGENT STREET, LONDON, W.I.


THIS WANDER PLUG TESTS YOUR BATTERY AND SAVES VALVES!

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ORDER FIG. 828.

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From all Dealers, or direct.

Two shillings spent on this wander plug may save you several valves. If the high tension voltage is accidentally connected across the valve filaments, the fuse burns out and the valve or valves remain unbroken. The only cost then is a £1, replacement bulb instead of pounds for new valves. Is an efficient protection to bright or dull emitter type. Postage 2d. extra.

A. H. HUNT, H.A.H. Works, LTD., CROYDON, SURREY. (Dept. No. 5).
The Igranic Supersonic Heterodyne Receiver.


The Igranic Electric Co. have submitted a complete Superheterodyne Receiver for test at the Radio Press Laboratories. This particular instrument had been constructed by the firm from the complete outfit of components which they supply.

Makers' Claims

The special oscillator and intermediate frequency coupling units possess an inherent stability which ensures perfect clarity of reception. The outfit is extremely flexible in use, as by employing three separate oscillator units it is possible to cover a range of wavelengths up to above 4,000 metres. By using the Igranic frame aerial, interference from signals transmitted on wavelengths approximating to that of the intermediate frequency amplifier is eliminated.

The Set is of pleasing appearance. Note the two high-frequency tuning condensers.

Description of Complete Set

The external dimensions of the set are, height 8 in., length 28½ in., and depth 11 in., and the complete receiver is built up with units upon an earthed metal frame. The wiring is kept short and neat and should not be at all difficult for the constructor to carry out. There are two panels, the front one being spaced about 4½ in. from the rear one to allow the condensers to clear the other components, and also to give space for mounting the condensers at some distance away from the panel to avoid hand capacity. With this object in view there is a large earth shield between the oscillator condenser and the panel, and in addition the spindle of the condenser does not project through the panel, but the condenser dial is connected to the spindle by an ebonite sleeve. The combination of these precautions entirely eliminates hand capacity effects.

All the coils are made up in neat units which plug into sockets, while the oscillator unit contains a very small variable condenser operated by a wormscrew which projects from the casing. By means of this adjustment all radiation into the frame has been avoided.

The Frame Aerial

The Igranic frame aerial deserves special attention. Owing to the absence of short-wave high-frequency amplification, any long-wave signals picked up by the frame, especially those in tune with the intermediate frequency, would pass right through the receiver and interfere with the signal. To avoid this the frame is wound in two halves, one half being in opposition to the other.

One half only is tuned to the incoming signals, and since the second half is untuned it does not respond to the short waves, and is spaced sufficiently from the first half to avoid undesirable effects. Thus, owing to the fact that the intermediate frequency is widely different from that of the tuned half of the frame, the voltages produced by the long wave interfering signal across the two halves are equal and opposite. In this way no long-wave interference comes through to the set from the frame.

There is provision made for earth and aerial, which can either be used separately from the frame or in conjunction with it. The unidirectional effects of this combination are extremely useful for preventing interference.

Filter Units

The intermediate filter frequency is about 25 kilocycles (12,000 metres) enabling the set to function effectively as a superheterodyne up to a wavelength of 4,500 metres. There is a neutrodyning arrangement in each of these filter units which renders the intermediate frequency amplifi-
MODERN WIRELESS

for the last note frequency valve. A 2 \mu F condenser is connected across the 120 volt section, and the H.T. minus and the L.T. minus are common to earth. There is provision for two grid bias batteries, 1½ volts for the intermediate-frequency valves and about 18 volts or more for the low-frequency valves.

Laboratory Tests

The complete set was tested for general performance at the Radio Press Laboratories, 13 miles from 2LO, and also at a point in Earl’s Court, about 2½ miles from the same station. About thirty independent stations were logged in two hours, the only adjustments made during that time being the oscillator condenser and the frame condenser, together with the rotation of the frame. The long wave amplifier was not once made to oscillate, and the general stability was a very pleasing feature.

A good performance of the set was to receive Cardiff at very good loud speaker strength at Earl’s Court while the London station was transmitting, without a trace of the signals from the latter station.

The long-wave reaction control did not increase signal strength, any increase in reaction producing a weaker signal until finally a note howl was produced. However, as this control was not needed it did not affect the working of the set.

As can be judged from the photographs, the appearance of the finished set is particularly neat when the components are mounted according to instructions.

Catalogue Received.

We have received an interesting catalogue from Messrs. S.A. Cutters, Limited, of 18, Beresford St., entitled “Salient Features for the Wireless Enthusiast.” It contains useful hints and tips, information on valves, details of components and accessories for the principal Radio Press Sets. The price is 6d., which is refunded on the first purchase. It is proposed to issue the catalogue three times a year.
The most popular condenser

In the competition "Which is the most popular component?" held in connection with the Manchester Wireless Exhibition, popular vote of the radio public endorsed the opinion of constructional experts by "plumping" for the Igranic Low Loss Square Law Variable Condenser. The first choice went to a popular make of headphone, and second to the Igranic Low Loss Square Law Variable Condenser—so that of all components which go to build a receiver, the Igranic Variable Condenser was given pride of place. This is not surprising when one notes the receivers illustrated in this advertisement for which the authors have recommended the Igranic Variable Condenser. Volume, purity of tone, very sharp tuning, super-selectivity—these are the result of using this precision instrument. Build it and all IGRANIC RADIO DEVICES into your next circuit.

A point-to-point comparison proves the superiority of the Igranic Low Loss Square Law Variable Condenser.

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3. EARTHED ROTOR. Moving plates electrically connected to frame of condenser—provides adequate shield and eliminates stray capacity effects.

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9. EASY TO MOUNT AND CONNECT. Drilling templates provided with each condenser. Soldering tags to facilitate making connections.

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FOR THE FIRST TIME IN LOUD SPEAKER HISTORY, SCIENCE AND ART GO HAND IN HAND


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This article describes an ingenious arrangement whereby a two-circuit receiver may be tuned with only one condenser, thereby obtaining the increased selectivity of the two circuits without the additional complication.

It is now universally recognised that in order to obtain adequate selectivity with a single valve receiver it is essential to employ more than one tuned circuit.

Various ways of doing this have been devised from time to time with very good results. Unfortunately, however, the introduction of the additional tune necessitates an extra control, and although in many cases the operation of tuning is not unduly complicated, the simplification of the control of a wireless receiver is always a desirable feature.

Magnetic Coupling

In the receiver to be described, a novel principle has been adopted in which it is possible to employ two tuned circuits with only one tuning control. The ordinary coupled circuit is of the form shown in Figs. 1 and 2. Here we have a primary circuit which is either loosely coupled or auto-tapped to a secondary circuit. The energy is transferred from one circuit to the next through the magnetic or direct coupling, as the case may be. Both these circuits must, of course, be tuned in order to obtain the maximum result, and variable condensers are incorporated for this purpose.

Capacity Coupling

It is possible, however, to transfer the energy between two tuned circuits like this by replacing the magnetic coupling by an electro-static coupling. Fig. 3 shows an example of this type of coupling. Here we have the inductances and variable condensers as before, but in series with these is a fixed condenser which is common to both circuits. The current flowing in the first circuit produces a variation of voltage across this fixed condenser. Since this fixed condenser is also part of the secondary circuit the voltage variations produce currents in the secondary circuit also, and so transfer the energy from one circuit to the other.

It will be obvious that the extent of the coupling between the two circuits depends upon the value of the fixed coupling condenser. The voltage on a condenser is proportional to the current flowing through it. The larger the condenser, the smaller the voltage produced across it for a given current. Obviously, therefore, for a given current in the primary circuit, the larger the condenser the smaller will be the voltage introduced into the secondary, and so the weaker will be the coupling between the two circuits. In order to obtain good selectivity it is necessary for the coupling between two circuits such as this to be kept weak, and thus the coupling condenser must be fairly large in comparison with the other capacities in the circuit.

A Dual Purpose

This second type of circuit, as it stands, possesses no particular advantages over the ordinary electro-magnetic type of coupling. If we use a condenser, however, to couple the two circuits together, there is no reason why this condenser should not be made variable in order that it may serve a double purpose both of coupling the two circuits together and also of tuning.
them. This is the principle which has been adopted with the receiver to be described, the circuit of which is shown in Fig. 4. Here the primary circuit consists of the coil L1, the small fixed condenser C1, and the coupling condenser C2, which is made variable. The secondary circuit comprises the coupling condenser C2 again, the small condenser C3, and the inductance L2. The voltage developed across L2 is applied across the grid and filament of a valve in the usual manner, and the coil L4 in the anode circuit is coupled to L3 in order to produce the necessary reaction. The aerial circuit, as will be seen, is connected across a small portion of the coil L4.

Such a circuit would only work satisfactorily if C1 and C3 were equal, and also the effective inductances of L1 and L2. Such a condition of affairs is not feasible in practice, and consequently the condenser C1 has been made variable. This condenser requires adjustment when the set is first constructed, after which it will remain at the same adjustment, all tuning being carried out by means of the coupling condenser C2. Thus it need not be of an expensive construction, and I have used a Polar Junior for the purpose.

The Components

The components required are as shown in the following list. Provided reliable components are employed the actual make is immaterial, as the working of the set does not depend to any great extent on the components. The actual makes of apparatus employed, however, are shown with each item.

One Radion Panel, 12 in. by 7 in. by \( \frac{3}{4} \) in. (American Harl Rubber Co.).
One Cabinet to suit panel with base board 7 in. deep (Carrington Manufacturing Company, Ltd.).
One variable condenser (C3) .001 \( \mu F \) (Igranic Electric Co., Ltd.).
One variable condenser .0003 \( \mu F \). (Polar Junior).

One fixed condenser (C1) .0002 \( \mu F \). (Watmel).
One fixed condenser (C4) .0002 \( \mu F \), with two megohm grid leak (Watmel).
One two-coil holder with long handle (Lotus).

In the actual circuit adopted the coupling condenser C2 serves the double purpose of coupling and tuning the two circuits. C3 is adjusted once and for all when the set is first made.

One fixed coil holder (Burne-Jones and Co., Ltd.).
One valve holder, vibratory type (Burne-Jones and Co., Ltd.).
One filament rheostat (Polar).
Two terminal strips, each containing four terminals (Petos-Scott Co., Ltd.).
Two panel brackets (Carrington Manufacturing Co.).
Quantity of Glazite wire.

The tuning condenser and reaction control are the only adjustments required in practice.

One packet Radio Press panel transfers.

Operation of the Set

When the wiring of the set has been completed, it may be tested out in the usual manner by con-
Conscientious Constructors are Considering Chokes

Given a Choke and a Transformer costing the same, the Choke will be almost certain to give much more faithful reproduction. Like all A.J.S. Receivers, the one chosen by Sir Oliver Lodge was choke coupled.

Choke coupling on the L.F. side has not generally received the attention it deserves. Perhaps it is by reason of the fact that if a choke is used without due care in the choice of valves, necessary condensers and grid leaks, considerably less volume will result. If, however, valves of correct design are employed, there should be no falling off in signal strength.

Although this may not be obvious to all at first, it can easily be explained. Owing to the comparatively low impedance of the primary winding of the average transformer selling at a reasonable figure, low impedance valves must be used if good quality reproduction is desired.

Now low impedance valves generally have a low amplification factor. The average good choke, and the one illustrated in particular, has a high impedance at all audio frequencies, therefore high impedance valves, valves whose amplification factor is generally high, should be used on the L.F. side, so that any loss of volume due to absence of the step-up effect of a transformer is compensated for by the high amplification obtained from the valves. The only position in a choke coupled receiver in which a low impedance valve should be used is the last position.

There is another great advantage in the use of chokes for L.F. coupling, and that is, a considerable advantage in the use of these instructions are adhered to, it will be found that the amplification with choke coupling is normally quite equal to transformer amplification, with considerable increase in purity.

Three types of Chokes are supplied:

1. The Choke only.
2. A Choke Unit for the first stage of interstage coupling. This Unit comprises the Choke by-pass and coupling condensers, and grid leak.
3. A Choke Unit for the second and subsequent stages of interstage coupling, with coupling condenser and grid leak. These units only require the addition of a Valve holder Resistor, and the necessary connections to complete a low frequency amplifier.

Publication No. 115 tells you all about chokes and the valves to use.

A. J. STEVENS & CO. (1914), LTD.,
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The 'Silvervox' 4-rod Speaker will reproduce both speech and music without the loss of its original tone and quality. Coils wound to either 120 or 2000 ohms. The tone arm is a heavy aluminium casting. Total height 20 inches. Size of trumpet 124 inches diameter.
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On triangular ebonite former, complete with knob, pointer, black celluloid scale engraved in white, and two terminals for connections. The resistance wire is wound on an insulating rod, thereby giving a perfectly smooth adjustment.

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Liverpool: 31, Castle Street.
London: 100 and 102, Cannon Street.
January, 1926

Balancing the Circuits

The Polar Junior condenser should then be set at about the middle of the scale, and the aerial connected to one of the tapping points on the X coil. The valve is then turned on and the tuning condenser is adjusted to the local station, which should be heard without any difficulty. The tuning will be found reasonably sharp, but in the majority of cases not particularly so. Having tuned the local station approximately on the main condenser a fine tune should be made on the compensating condenser (Polar), and it will be found that there is a definite point on this condenser at which the signals are a maximum. This, of course, corresponds to the condition when the two circuits are in resonance. After the first principles have been grasped, in order to receive the higher frequency broadcasting a 75 X coil should be inserted in the fixed coil holder, a 75 in the fixed holder of the two-coil holder and a reaction coil of about 50 in the moving holder. It is advisable to use the coils specified because in order to obtain best results a tight-coupled aerial arrangement should be employed, an X coil being used here; and in order that the two tuned circuits may be as similar as possible a 75 coil of the same make should be inserted in the fixed holder of the two coil holders. The reaction coil, of course, is of less importance provided that it is sufficient in size to produce the necessary reaction.

The lay-out of the receiver is extremely compact, but adequate space is provided for satisfactory operation.

www.americanradiohistory.com
realignment of the compensating condenser.

Once set, therefore, the operation of the receiver is perfectly straightforward. In order to tune in to any other station the reaction coil should be brought up towards the oscillation point and the tuning condenser rotated until the required station is heard. At this point a final adjustment may be made on the compensating condenser, and it will be found that the strength will possibly be slightly improved by this adjustment. I do not wish to imply, however, that an alteration of the compensating condenser is essential. Once the correct position has been found no further adjustment is necessary, and all tuning can be done if desired on the main tuning condenser.

One Tune Sufficient

It will be seen, therefore, that the number of tuning controls has actually been reduced, and we are obtaining the benefit of 2 or possibly 2½ tuned circuits, allowing for the fact that the aerial is tightly coupled, with only one actual tuning control. The selectivity of the arrangement is good when the correct adjustment has been found.

Test Report

I have received the usual British and Foreign Continental Stations without any trouble, while 2LO, a distance of 11 miles was sufficient to operate a small loud speaker.

A general purpose valve or special rectifying valve is suitable. The DE5B gives very good results. The most interesting point, however, is that at the stated distance it was possible to receive the Bournemouth programme entirely free from interference from 2LO. This was not an isolated accomplishment, but could be repeated again and again when the correct adjustment had been found. As I stated earlier, until this correct adjustment is discovered the set may appear somewhat unselective. It is simply a matter of finding the correct value of the compensating condenser in order that the two circuits may actually be in tune. The variation of coupling condenser $C_9$, then, at the same time tunes both the circuits.

The setting of the compensating condenser will vary if the aerial tap is changed from one point to another. It is desirable to decide which tap is better, and then to adjust the compensating condenser once and for all.
January, 1926

MODERN WIRELESS

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BROWN and Headphones—the very names are almost synonymous. Ever since the day many years ago when the first BROWN A-type Headphone was demonstrated to a gathering of scientists, the name BROWN has been indelibly associated with the production of superfine telephones.

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For ordinary everyday use choose the Brown Featherweights. Weighing but 6 ounces including full length cords, they are the very embodiment of comfort. Indeed, the highest tribute that could be paid to them is to announce that Hospitals throughout the country are now adopting them as standard equipment. A finer acknowledgment of their superb dependability and absolute comfort could not be made.

For the Valve Set user keen to pick up long-distance Stations, and for the Crystal Set user, there is the new A-type BROWN Headphones. These remarkable ‘phones contain all the essential features of the original A-type. The tuned reed—the cone-shaped aluminium diaphragm—the external adjusting screw—all these exclusive features are now available for the first time at the remarkable price of 30/-. Only the tremendous manufacturing resources and skill acquired over a period of many years could produce such a wonderful Headphone at such a low cost.

For the man who is accustomed to stint himself of nothing—who can afford to satisfy his desires by choosing the finest that money can buy, there is still the original A-type. A positive masterpiece of fine workmanship and individuality. But whichever type of Headphone you choose be sure it is a BROWN—none other is backed by such experience and none other can give such lasting satisfaction.


Shops: 19 Mortimer Street, W.1, 55 Moorfields, Liverpool.
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Distributors (Wholesale only): 23 Wesley Park, Bristol.
Cross House, Westgate Road, Newcastle.

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You can reach out to far-distant stations, or isolate a near one from all others, by fitting the latest Ormond Square Law Low Loss Condenser with Vernier adjustment. It does not take long to tune in different stations, and you can soon settle down for a pleasant evening with the programme of your choice.

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Radio in Other Lands

The nearest Radio Station to the South Pole is one belonging to the Argentine Government, and is to be found in the South Orkney Islands. Any enthusiast, therefore, who picks up the call sign LRT will be in communication with the world's most Southern Radio Station. There is also a Meteorological Station attached to the Radio Station, and much valuable data is to be expected from this source.

Broadcasting was started a few months ago in Peru, the equipment of the station being very similar to that of 2LO. The apparatus, in fact, is more or less a duplicate of that installed at the London Station. The Peru station is situated at Lima, and operates on a transmitting wavelength of 360 metres. Look out for the call sign OAB!

In Syria the Government authorities will not yet allow the importation of transmitting apparatus of any description, although there is no ban on receiving gear. Listeners in this district therefore have to rely on foreign programmes for their entertainment, but with the increasing number of stations in Germany, Austria and Italy they will probably have a fair choice of programmes.

Radio apparatus in Holland is included amongst the list of luxury taxes, and it is now being considered by the Dutch Government in a new bill. It is proposed that it be collected in the form of a sales tax of five per cent.

A huge Radio Station is being constructed in the Philippines by the Radio Corporation of America, and when ready will be capable of communication with all parts of the globe. It appears that the use of high frequencies with small powers has not yet proved its commercial worth, and for solid 24-hour working the giant station is still to be employed.

Although it is illegal to import radio apparatus into China, a correspondent of the American Relay League states in a report that China has twenty privately owned broadcasting stations, and somewhere in the neighbourhood of 5,000 listeners. The public interest seems to be increasing and the majority of the sets are constructed by the dealers themselves. Presumably the parts are imported as electrical apparatus, then assembled, and sent to the customers. Magazines and newspapers print a large number of diagrams and instructions for building sets.

Static does not trouble listeners very much in California, states the San Francisco Daily News, and they do not experience the interference which is more prevalent in other countries. California is located on the western side of America, and has a clear, dry climate.

In Germany all transmitting stations are considered the property of the Imperial Post Office, but they are operated by private companies. This arrangement maintains the competitive spirit while retaining the advantages of Government control. The programmes from some of the German stations are admittedly of a very high standard.

At the Arlington Station, which is situated in the United States, two of the masts recently erected have a height of 450 ft., and a third has a height of 600 ft. This is one of the most up-to-date equipped stations in the United States, the power room being built underground so as to minimise any possible interference. The station will be used mainly for broadcasting weather and market reports.

Broadcasting is proving of great advantage to farmers in Canada, the market reports being of extreme importance. Previously farmers had to depend upon telegraphic market reports, and those who bought on the last quotation very often discovered a few hours later that the market was well below the price they originally bought at.

During the planting and growing season meteorological reports are of great value, and will very often enable a grower to take the necessary precautions against unseasonable frosts, and in harvest time against bad weather.
Some Further Notes on the DX FIVE
by D. J. S. HARTT, B.Sc.

A few further practical details on the DX Five, together with operating data. The Test Report by our Elstree Laboratories shows it to attain a high standard.

In last month's issue I gave some necessarily brief notes on the operation of the "DX Five," but there are perhaps a few points on which some further information is desirable.

Improved Coupling Units
It will be remembered that the coupling units shown in the photographs of the receiver were of an experimental type. These were subsequently replaced by others made to the same specification but incorporating minor refinements, a description of which will perhaps not be out of place. In each of the first two units the 40-turn secondary winding is placed in the centre of the 2 in. length of 3 in. diameter ebonite tube, and small soldering tags are provided for connection to the ends of this winding. In the third unit the 40-turn secondary winding is commenced at about 3 in. from one end of the 23 in. length of the same diameter ebonite tube, and the reaction winding of 30 turns, tapped at the fifth turn, is spaced 3 in. (that is, between the end of the 40-turn winding and the beginning of the reaction coil). Five small soldering tags are provided on the tube for connection purposes, two for the 40-turn winding, and three for the reaction winding, so that either 15 or 30 turns may be used, according to requirements.

Tapping Points
A refinement in the manner of making connection to the tappings on the primary coils, which are wound on the familiar X type of former introduced by Mr. Percy W. Harris, consists in soldering the bare and twisted loops and the bared wires from the beginning and ends of the coils to short lengths of B.A. screwed rod tapped into the arms of the former. For each of these primary coils there are six such pieces of screwed rod, suitably arranged in pairs on three of the arms of the X former. Connection to suitable tappings is then conveniently made by gripping the screwed rod between the jaws of the small spring clips.

Operating Conditions
Perhaps I can best give an idea as to the conditions for operating the set by indicating a few examples which have been found to give the best results in practice on my own aerial, which is of the single wire type, about 30 ft. in height with a horizontal span of about 60 ft.

One set of conditions is as follows: two ordinary bright emitter R type valves for V1 and V2, a C.T. 250 (resistance-capacity type) for V3, and a D.E.5 L.F. and D.E.5 for V4 and V5, respectively, with 90 volts on H.T. +1, 48 volts on H.T. +2, and 120 volts on H.T. +3, with the first primary (L1) at the grid end of the secondary winding (L2), the second and third primaries (L3 and L4, respectively) just inside the tubes of the coupling units, i.e., a short distance away from the grid ends of their respective secondaries, L1 and L4. Also using the full 35 turns for L2 and L5, and the 15-turn reaction coil; 15 volts negative bias on the grids of V1 and V5.

Excellent Results
Under these conditions, with 20 turns for L1, both Manchester and Cardiff can be received at full loudspeaker strength under favourable conditions, without any or at the most only an inappreciable background of 2L0's transmissions. On frequencies more remote from that of 2L0, up to about 700 kc. (about 425 m.) 35 turns for L1 may be used to advantage, while on frequencies corresponding to the upper part of the broadcast band the full 45 turns of L1 give the best strength. The circuit, under these conditions, is perfectly stable and reaction control on C1 is smooth and gradual.

Another Combination
Two D.E.5 type valves for V1 and V2, 60 volts on H.T. +1, 10 turns for L1 and L4, and the remainder of the conditions as above, also gave another very good combination. If the D.E.5 type valves were removed and the resistance capacity type substituted in the H.F. stages, a slight improvement in selectivity was noticeable.

Thus, having adjusted the primaries L1 and L4 to suit the conditions under which you are working, the main adjustment, apart from the actual tuning on the condensers and the reaction control, consists in varying the turn numbers of the first primary L1, to secure the best results on the particular station to which you are listening.

Oscillation Control
As far as the choice of these various arrangements is concerned, I personally prefer the first set of conditions with R valves for V1 and V2. When using the D.E.5 type of valve in the H.F. stages you may get a tendency to H.F. oscillation in certain cases but if this does occur the circuit can
Ribbons of steel
—the same century-old principles of construction are employed in every Cossor Grid.

From bank to bank across a girder bridge a train speeds on its way. A hundred tons or more of living freight suspended in mid-air on a few ribbons of steel. Such is the skill of man. Rigidity is the Alpha and Omega of bridge construction. Without rigidity no bridge can withstand the devastating forces of Nature.

Rigidity, too, is the very essence of successful Valve construction. Without rigidity there must be distortion and microphonic noises. Compare the Cossor Grid with the ordinary spiral Grid and you'll instantly appreciate why the Cossor Valve has won such a unique reputation for purity of tone.

The Cossor Grid is a wonderful piece of miniature engineering. It is built up on a stout metal Grid band, and each turn of the wire is secured in three positions—33 places in all. Was there ever such rigidity?

Combine that with the Cossor electron-retaining system of design and you'll readily recognise why the Cossor is by far the most popular British Valve.

Everywhere it is earning golden laurels for a mellowness of tone hitherto considered impossible.

Before choosing your next Valve ask your Dealer to show you the Wuncell—the Cossor Dull Emitter. Functioning at a dull red glow (almost invisible in daylight) it is, indeed, a supereconomy valve with an abnormally long life. For the first time it is possible to obtain a low temperature valve in every way as sensitive as the best bright emitter. The secret of Wuncell success is to be found in its wonderful filament. Instead of a wire, whittled down to the point of fragility, the filament used in the Wuncell is built up layer upon layer under the Cossor patent process. Instead of weakness there is strength.
Announcing Two New MH Products.

We describe below the latest additions to the famous range of MH Wireless Components. Consistent with the MH reputation for quality and efficiency, these new products represent a high standard of development, and are worthy of the attention of every keen enthusiast intent upon progressive results from his radio.

The MH RESISTANCE CAPACITY COUPLING.

The MH RESISTANCE CAPACITY UNIT is the result of extensive research work, resulting in a component which we can, with every confidence, recommend for application to the last stage or stages of L.F. amplification in any set. It provides an absolutely steady flow of current to the anode, and we guarantee it to be absolutely noiseless in operation.

The component consists of our well-known clip-in type mica Condenser, and our Grid Leak. The standard unit is fitted with a Leak of 0.5 meg., a transfer Condenser of 0.005 mfd., and an anode Resistance of 80,000 meg., these values in practice having been found to give the best result with the average valve designed for resistance capacity coupling.

PRICES:

- Complete with base (as illustrated) 12/6
- Anode Resistance only, with clips 4/6
- Leak only 2/6
- Condenser only 3/-
- Base only, with fittings 3/6

The MH SUPERSONIC OUTFIT.

British and Best.

SUPERSONIC reception, with its range and selectivity, is fully established in public favour.

MH Supersonic Components have shown marked superiority in these two qualities and have gained universal praise for their wonderful reproduction of music and speech when used in conjunction with other MH Components.

Guaranteed for 12 months. PRICE £5 5 0

The MH Supersonic Outfit Contains:

- 3 M.H. Tuned Transformers 21-
- 1 M.H. Tuned Filter 21-
- 1 M.H. Autodyne and Oscillator Unit 21-
- Full Size Blue Print—Layout Diagram and Booklet of Instructions.

In replying to advertisers, a 3c Order Form enclosed.
be made completely stable by reducing the number of turns in the primaries $L_1$ and $L_2$.

With valves of the resistance-capacity or special H.F. types as detectors, the 15-turn reaction coil should be adequate, but if this is found to be too small with a detector valve which oscillates less readily the whole of the reaction coil should be tried.

**H.T. Battery**

If a set of this type, where the total anode current may be about 15 milliamperes or more (a measurement when using four 25 ampere type and one R type valves gave 16 ma.) is worked consistently from H.T. dry batteries it is desirable to use those having the large size cells unless, say, the first three valves are supplied from one battery and the last two from separate batteries, so that the load on any particular battery is within safe limits.

**Stations heard**

It is of little use giving a long list of stations received, but some indication of the selectivity obtainable has already been given, and it will be sufficient to say that on my aerial many of the British main stations and the Continental stations between 250 and 350 metres are usually unpleasantly loud on the loud-speaker when using five valves; others come in at varying strengths, depending on conditions. Although I have not made a point of listening definitely for American stations, WGY was received on one occasion before 12.30 a.m. at moderate loud-speaker strength and, in spite of a bad background of "mush," speech and announcements were quite intelligible.

**Radio Press Laboratories' Test Report.**

The wiring and layout of this set is very good. On the front panel the only controls are four variable condensers and four variable rheostats.

**Performance**

The performance of this receiver was exceptionally good, Cardiff and Manchester both being obtained on a loud-speaker, whilst London was broadcasting, without a trace of London. Once the three tuning condensers are in adjustment the picking up of stations is quite an easy matter. The set was perfectly stable, the reaction control bringing signal strength up until finally there was a gentle oscillation.

**Preliminary Adjustment**

The adjustment of the various transformers and grid battery for any particular set of valves would no doubt take considerable time and careful work, but once adjusted they are absolutely constant, and the only variables that need be touched are the three tuning condensers on the outside of the panel, and also the reaction condenser.

There is little doubt that the special transformers in themselves do not entirely account for the extra selectivity obtained.

**Good Design**

The high tension is supplied to the high-frequency valves through chokes. The high-frequency circuit being led from the plate through a condenser, and then through the primary of the transformer and returned to earth, each valve has an entirely separate high-frequency path to the filament, thus avoiding a great deal of reaction which takes place through the high-frequency currents going through a common H.T. battery.

---

Messrs. Siemens Bros. have recently produced a new type of Direction Finder which contains several novel features. The operator is here seen handling the apparatus.
A simple arrangement employing two tuned circuits, one of which is semi-permanently tuned.

The enjoyment of the local station or of the Daventry transmission is frequently marred for many listeners who are unfortunate in living in coastal areas by the interference due to the morse transmission between ships and shore stations.

Because of its usually flat tuning and comparatively weak signal strength, the crystal receiver is more affected by such interference.

The problem is to increase selectivity without materially decreasing the signal strength.

Loose Coupling

One solution of this problem, and probably the most satisfactory, is to employ loose, or auto-coupling. This usually necessitates the multiplication of controls, but the receiver to be described has been so designed that once the correct tappings have been determined, there is only the one control.

Secondary Tuning

The circuit, which is illustrated in Fig. 1, consists of a tuned primary circuit, L₁C₁, auto-coupled to a low-loss secondary circuit, L₂C₂.

To increase still further the selectivity, the tuned primary circuit is tapped across a portion only of the secondary.

The secondary, of course, requires to be tuned to the frequency of the incoming signal. Instead of a variable condenser, however, a fixed condenser is employed, and the number of turns in the secondary circuit is made variable.

Straightforward Arrangement

Since a crystal receiver is essentially a one-station receiver, the only alteration of tuning required is to allow for small variations at the local station. Consequently, it is possible to find the optimum tapping on the secondary once and for all.

There is no serious disadvantage in employing a tapped secondary, for the number of tappings are sufficient to cover a fairly wide frequency range.

Should the selective arrangement only be required on occasion, it is quite possible by means of the clips to change over to the conventional each case for the convenience of those who wish to use the same components.

One chromium panel (9 in. by 6 in. by ½ in.) (Paragon).

One mahogany cabinet complete with baseboard to take this panel (Carrington Mfg. Co.).

One Lissen X coil, No. 50 or 60.

One Lissen X coil, No. 200 for Daventry.

Four terminals (Burne-Jones & Co., Ltd.).

One board-mounting coil socket (Burne-Jones & Co., Ltd.).

One 0.003 F variable square low condenser, low-loss type (Ormond).

One crystal detector, K type (Waters Bros.).

One low-loss coil former, 7 in. long (Collinson).

Three spring clips (Peto-Scott).

One 0.001 F fixed condenser (Watson).

Half-pound No. 22 enamelled or D.C.C. copper wire.

Flexible rubber covered wire.

Glazite for wiring.

Screws.

Radio Press panel transfers.

The Low-loss Coil

Our first step is the construction of the low-loss coil.

Secure the wire through the two holes provided at one end, leaving about six inches for connection later, and begin winding.

Wind on as many turns as can be accommodated, which will be found to be about 90 turns.

Taking Tappings

If cotton-covered wire is used, the covering may easily be removed for the purpose of taking tappings by running a hot soldering iron up and down between two of the rods of
Osram Valves
for Broadcasting

Type D.E.3
(Dull-Emitter)

Dry batteries will run the D.E.3—
a great consideration to those who
have not ready means available for
re-charging accumulators.

CRYSTAL USERS! Add a
stage of L.F.amplification fitted with
a D.E.3 Valve for more volume.

Characteristics:
Filament Volts 2.8
Filament Current 0.6 amps
Anode Volts 20-50
Impedance 22,000 ohms
Amplification Factor 7

Price 16/6 each

Sold by all leading
Wireless Dealers,
Electrical Contractors
and Stores.

Advt. of
The General Electric Co., Ltd.,
Magnet House, Kingsway,

In replying to advertisers, use Order Form enclosed.
FOR a considerable period we have carried out extensive research and experiment to produce a Dry battery with greater capacity than hitherto made. We have now much pleasure in announcing that we have produced a high grade battery, capable of withstanding really heavy continuous discharge and giving 3 to 4 times the life of the usual type now being sold. They are made with special large capacity cells, the construction of which is based on secret formulae, while minute care has been taken to ensure perfect insulation—a very important feature.

Supplies are actually available—and the prices are exceedingly reasonable. The following extract is from our List, which will be sent on application.

<table>
<thead>
<tr>
<th>Type</th>
<th>Voltage</th>
<th>No. of Cells</th>
<th>Without</th>
<th>With Tappings</th>
</tr>
</thead>
<tbody>
<tr>
<td>H. G. 2</td>
<td>30</td>
<td>20</td>
<td>9.9</td>
<td>10 -</td>
</tr>
<tr>
<td>H. G. 3</td>
<td>45</td>
<td>30</td>
<td>14.6</td>
<td>15 -</td>
</tr>
<tr>
<td>H. G. 4</td>
<td>60</td>
<td>40</td>
<td>19.6</td>
<td>19.6 -</td>
</tr>
<tr>
<td>H. G. 5</td>
<td>90</td>
<td>60</td>
<td>28.6</td>
<td>29.6 -</td>
</tr>
<tr>
<td>H. G. 6</td>
<td>105</td>
<td>70</td>
<td>33.6</td>
<td>34.5 -</td>
</tr>
<tr>
<td>G.B. 3</td>
<td>41</td>
<td>3</td>
<td>Price 1.6 each</td>
<td></td>
</tr>
</tbody>
</table>

**ROTAX HIGH GRADE LOW TENSION ACCUMULATORS**

PERFECT radio reception is more dependent upon the efficient performance of the low tension Accumulator than is fully realised. This is the outstanding feature of Rotax Accumulators. While our reputation as battery makers is your guarantee, in itself, for dependability, it is in actual use that their sterling qualities are fully appreciated.

A wide range of sizes and capacities is available. They are constructed in best quality ebonite cases, and marketed at reasonable prices. The sizes above are extracted from our list, which will be sent on application. Rotax Ebonite Accumulators eliminate the risk of FIRE associated with celluloid.

**THE ROTAX HIGH TENSION ACCUMULATORS**

In glass cases are offered for users of large sets to whom initial cost is not a material consideration. Prices and particulars on application.

ROTAX (MOTOR ACCESSORIES) LTD., WILLESDEN JUNCTION, LONDON, N.W.10.

Telephone: Willesden 2150 (Private Branch Exchange).
Telegram: Rotomatic, Plaut, London.

**BRANCH WORKS AND DEPOTS:**


*Cardiff:* 20, Queen Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Colchester:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Birmingham:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Gloucester:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Durham:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Newcastle:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Coventry:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

*Sheffield:* 1, 2, 3, High Street. Telephone: 24110. Telegrams: Rotasonic, Birminham.

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The low-loss secondary with the appropriate tapping arrangements can be seen in this figure.

The skeleton former. The same may be done with enamelled wire or such portions as are required to be bared may be scraped with a penknife.

The process of making the tapping points is greatly facilitated by taking with a match-stalk the bared portion of those turns to which the short tapping wires are to be attached. The match-stalk should then be laid under these turns, but over the adjacent turns, so raising the required turns clear.

Small pieces of square wire may then be soldered to the tapping points; as little solder as possible should be used because of the close spacing of the wire, or the adjacent turns may be shorted.

Primary Tappings
Tappings should be taken every two turns between 20 and 40 turns, counting from the end where the six-inch length was left for future use. Beginning now at the other end, tappings should be taken at 5, 10, 15, 20, 25 and 30 turns.

This completes the construction of the coil.

Drilling the Panel
Mark out the panel according to the drilling diagram shown in Fig. 2. Now take the panel and temporarily fix to the baseboard while in the cabinet. This ensures a good fit.

Laying out of Components
Withdraw the panel and baseboard and proceed to mark on the baseboard the position for the coil socket and low-loss former.

Insert a coil in the coil-holder to ensure adequate space being provided.

Mark the position for the fixing screws and affix the coil socket and former.

Remove panel from the baseboard and mount the condenser, terminals, and crystal detector sockets.

Wiring up
The wiring-up may readily be followed from the diagram given in Fig. 3, the only special point being that a piece of square wire of sufficient length to take two clips should be attached to the moving plates of the condenser. This is for the direct-coupled circuit to receive Daventry.

The components on the panel should be wired first, after which we may attach the panel to the base-board and complete the wiring.

By the aid of Fig. 3 the complete wiring may be accomplished, and should present no difficulties.

Testing the Set
Attach the aerial, earth and 'phones. The aerial clip should be attached to the strip of wire on the condenser, and also the crystal tapping taken to the same position. The clip from the condenser should be clipped on to the earth terminal.

This utilises the conventional straightforward circuit, and is the best means of testing for correct wiring and coil value. Owing to the selective nature of the set it is quite possible to miss the local
station at first, when using the loose-coupled arrangement. On rotating the condenser the local station should be heard. When the loudest signals possible have been obtained with this arrangement, the loose-coupling may be tried. If a Lissajou X coil is used, attach the aerial clip to one of the side terminals and retune by means of the condenser. Try which of the side tappings gives the loudest signals, retuning each time.

The flexible connection from the condenser should now be clipped on to a tapping (one of the close-spaced ones) and the crystal tapping taken to the top tapping of the low-loss coil. On retuning, the tuning will be found much sharper.

The effect of varying the condenser tappings should now be tried, taking care to retune each time. A position of greatest signal strength will be found.

When this has been done the variation of the position of the crystal tapping may be tried.

Test Report

The .0001 µF fixed condenser is suitable for the higher frequencies, but for the reception of the lower frequency stations such as Birmingham or Aberdeen a .0002 µF condenser should be used.

On test this receiver was found to function excellently with very marked sharpness of tuning.

When the correct tapping had been found for tapping F in Fig. 1, there was little decrease in signal strength as compared with a straightforward arrangement.

Daventry was also received at good strength, the straightforward circuit being adopted as previously stated.
The Best Value in Radio

The combination of the B.T.H. 2 Valve L.F. Receiver and B.T.H. Type C8 Loud Speaker undoubtedly represents the best value in radio. Good loud speaker results are given within 20-30 miles of a B.B.C. main station or 100 miles of Daventry.

<table>
<thead>
<tr>
<th>Description</th>
<th>Price</th>
</tr>
</thead>
<tbody>
<tr>
<td>B.T.H. 2 Valve L.F. Receiver</td>
<td>£6 0 0</td>
</tr>
<tr>
<td>Royalty</td>
<td>£1 5 0</td>
</tr>
<tr>
<td>B.T.H. Type C8 Loud Speaker</td>
<td>£1 15 0</td>
</tr>
<tr>
<td><strong>TOTAL (less valves and batteries)</strong></td>
<td><strong>£9 0 0</strong></td>
</tr>
</tbody>
</table>

The B.T.H. 2 Valve L.F. Receiver

The circuit employed is a detector valve with one stage of L.F. amplification. A neat plug-in aerial and reactance unit covering a range of 300 to 500 metres is provided. A similar unit is available for 1500 to 1800 metres at an extra price of 18/-.

The B.T.H. Type C8 Loud Speaker

This is an efficient but moderately priced instrument. Both body and horn are constructed of chocolate coloured non-resonant material which gives a beautifully mellow tone.

*Ask your dealer for a demonstration and for copies of leaflets R.7335 and R.7430*

**B.T.H. RADIO**

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King Components are carefully made

The success of Radio reception depends largely upon the quality of the components—if one is faulty, the whole receiver is at fault.

"King in Radio" components are made with the utmost care from the very best materials obtainable. The designs are the best—when the best is made by some other manufacturer, as in the case of Cardwell condensers, we manufacture it under license from the original manufacturer.

All the facilities of an eight-acre plant equipped with the most modern machines for the making of radio components helps to maintain the "King in Radio" high quality standards. Each component goes through a thorough system of inspection before it leaves the plant.

KING QUALITY PRODUCTS, INC.

European Branch:
27-28, ANNING STREET, LONDON, E.C.2, ENGLAND.
CASTON E. MARBAIX, Manager.
### WEEK DAYS.

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>G. M. T.</th>
<th>Name of Station</th>
<th>Call Sign and Wavelength</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>1</td>
<td>3:55</td>
<td>Hamburg</td>
<td>HA 305 m. and 400 m.</td>
<td>Germany</td>
<td>Time Signal, Weather Report</td>
<td>15 mins.</td>
<td>1.5 Kw. and 4 Kw.</td>
</tr>
<tr>
<td>2</td>
<td>6:40</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Weather Forecast</td>
<td>5 mins.</td>
<td>5 Kw.</td>
</tr>
<tr>
<td>3</td>
<td>7:55</td>
<td>Vax Daz</td>
<td>PCFF 1950 m.</td>
<td>Amsterdam</td>
<td>Stocks, Shares and News</td>
<td>10 mins.</td>
<td>1.4 Kw.</td>
</tr>
<tr>
<td>4</td>
<td>8:40</td>
<td>Radio-Wien</td>
<td>FL 2550 m.</td>
<td>Austria</td>
<td>Market Prices</td>
<td>10 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>5</td>
<td>9:23</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal</td>
<td>3 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>6</td>
<td>9:55</td>
<td>Vax Daz</td>
<td>PCFF 1950 m.</td>
<td>Amsterdam</td>
<td>Time Signal</td>
<td>3 mins.</td>
<td>1.4 Kw.</td>
</tr>
<tr>
<td>7</td>
<td>10:15</td>
<td>Radio-Wien</td>
<td>FL 2550 m.</td>
<td>Vienna</td>
<td>Morning Concert</td>
<td>14 hrs.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>10:00</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in Greenwich Sode real Time (Spark)</td>
<td>5 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>9</td>
<td>10:15</td>
<td>Breslau</td>
<td>FL 2650 m.</td>
<td>Silesia</td>
<td>Weather Report — Exchange</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>10</td>
<td>10:55</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Fish Market Quotations, Cotton Exchange (Monday excepted)</td>
<td>10 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>11</td>
<td>11:00</td>
<td>Frankfurt</td>
<td>FL 2650 m.</td>
<td>Germany</td>
<td>Concert</td>
<td>11.50 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>12</td>
<td>12:00</td>
<td>Leipzig</td>
<td>FL 2650 m.</td>
<td>Switzerland</td>
<td>Weather Report</td>
<td>5 mins.</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>12:20</td>
<td>Zurich</td>
<td>FL 2650 m.</td>
<td>Berlin</td>
<td>Exchange Opening Prices</td>
<td>5 mins.</td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>12:30</td>
<td>Voxhaus</td>
<td>FL 2650 m.</td>
<td>Sweden</td>
<td>Exchange Opening Prices</td>
<td>Noon</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>12:30</td>
<td>Stockholm</td>
<td>SAS 427 m.</td>
<td>Silesia</td>
<td>Morning Concert</td>
<td>12.25 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>16</td>
<td>12:50</td>
<td>Breslau</td>
<td>SAS 427 m.</td>
<td>Holland</td>
<td>Weather Forecast</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>17</td>
<td>13:20</td>
<td>Vax Daz</td>
<td>FL 2650 m.</td>
<td>Berlin</td>
<td>Midday Time Signal in G.M.T. (Spark) This Signal is relayed by Zurich and all German stations, except Munich and Stuttgart</td>
<td>8 mins.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>18</td>
<td>13:50</td>
<td>noen</td>
<td>FL 2650 m.</td>
<td>Switzerland</td>
<td>Weather Forecast, Shares &amp; News</td>
<td>5 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>19</td>
<td>14:00</td>
<td>Zurich</td>
<td>FL 2650 m.</td>
<td>Finland</td>
<td>Time Signal, Weather Report</td>
<td>5 mins.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>20</td>
<td>14:15</td>
<td>Munster</td>
<td>FL 2650 m.</td>
<td>Westphalia</td>
<td>Concert or Lecture</td>
<td>1:30 p.m.</td>
<td>3 Kw.</td>
</tr>
<tr>
<td>21</td>
<td>14:20</td>
<td>Radio-Paris</td>
<td>FL 2650 m.</td>
<td>Chichy</td>
<td>Concert, followed by News</td>
<td>2 p.m.</td>
<td>4 Kw.</td>
</tr>
<tr>
<td>22</td>
<td>14:30</td>
<td>Royal Dutch</td>
<td>FL 2650 m.</td>
<td>Utrecht (De Bilt)</td>
<td>Night Frost Reports</td>
<td>10 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>23</td>
<td>14:30</td>
<td>Meteorological Inst.</td>
<td>FL 2650 m.</td>
<td>France</td>
<td>Weather Report, Market Prices</td>
<td>10 mins.</td>
<td>250 Watts.</td>
</tr>
<tr>
<td>24</td>
<td>14:45</td>
<td>Vax Daz</td>
<td>FL 2650 m.</td>
<td>Amsterdam</td>
<td>Stocks and Shares</td>
<td>10 mins.</td>
<td>2 Kw.</td>
</tr>
<tr>
<td>25</td>
<td>15:00</td>
<td>Munich</td>
<td>FL 2650 m.</td>
<td>Bavaria</td>
<td>Price News, and Weather Report</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>26</td>
<td>15:15</td>
<td>Komarow</td>
<td>FL 2650 m.</td>
<td>Berlin</td>
<td>Stock Exchange News</td>
<td>5 mins.</td>
<td></td>
</tr>
<tr>
<td>27</td>
<td>15:30</td>
<td>Konigberg</td>
<td>FL 2650 m.</td>
<td>Czecho-Slovakia</td>
<td>Stock Exchange &amp; News and Exchange Quotations</td>
<td>10 mins.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>28</td>
<td>16:00</td>
<td>Breslau</td>
<td>FL 2650 m.</td>
<td>Silesia</td>
<td>Stocks, Shares and News</td>
<td>10 mins.</td>
<td></td>
</tr>
<tr>
<td>29</td>
<td>16:15</td>
<td>Vax Daz</td>
<td>FL 2650 m.</td>
<td>Westphalia</td>
<td>Exchange Opening Prices (Saturday excepted)</td>
<td>8 mins.</td>
<td>3 Kw.</td>
</tr>
<tr>
<td>30</td>
<td>16:30</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>News, followed by Concert</td>
<td>5 p.m.</td>
<td></td>
</tr>
<tr>
<td>31</td>
<td>16:45</td>
<td>Radio-Wien</td>
<td>FL 2650 m.</td>
<td>Vienna</td>
<td>Concert</td>
<td>5 p.m.</td>
<td></td>
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<tr>
<td>32</td>
<td>17:00</td>
<td>Stuttgart</td>
<td>FL 2650 m.</td>
<td>Wurttemberg</td>
<td>Music</td>
<td>4 p.m.</td>
<td></td>
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<tr>
<td>33</td>
<td>17:15</td>
<td>Hamburg</td>
<td>FL 2650 m.</td>
<td>Germany</td>
<td>Music</td>
<td>4 p.m.</td>
<td></td>
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<tr>
<td>34</td>
<td>17:30</td>
<td>Konigberg</td>
<td>FL 2650 m.</td>
<td>East Prussia</td>
<td>Light Orchestra (Wed. and Sat., Children's Hour)</td>
<td>5.30 p.m.</td>
<td>1 Kw.</td>
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<td>Ref. No.</td>
<td>G. M. T.</td>
<td>Name of Station</td>
<td>Call Sign and Wavelength</td>
<td>Situation</td>
<td>Nature of Transmission</td>
<td>Closing Time or Approx. Duration</td>
<td>Approx. Power used.</td>
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<td>Munich</td>
<td>FL 2650 m.</td>
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<td>5 p.m.</td>
<td>1.5 Kw.</td>
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<td></td>
<td></td>
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<td>500 Watts.</td>
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<tr>
<td>006</td>
<td>4.9</td>
<td>Poznan</td>
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<td>010</td>
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<td>036</td>
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<td>046</td>
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<td>Oslo</td>
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<td>022</td>
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<td>Konigsberg</td>
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<tr>
<td>020</td>
<td>7.00</td>
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<td></td>
<td></td>
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<td>073</td>
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<td></td>
<td></td>
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<tr>
<td>066</td>
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<td></td>
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<td>Konigswusterhausen</td>
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<td></td>
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<td>4.5 Kw.</td>
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<tr>
<td>026</td>
<td>7.50</td>
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<td></td>
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<tr>
<td>010</td>
<td>8.00</td>
<td>Agen</td>
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<td>024</td>
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<td>Lyon</td>
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<td></td>
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<td>Radio-Belge</td>
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<td>Geneva</td>
<td></td>
<td></td>
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<td>3 p.m.</td>
<td>4.5 Kw.</td>
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<tr>
<td>022</td>
<td>8.15</td>
<td>Radio-Paris</td>
<td></td>
<td></td>
<td></td>
<td>3 p.m.</td>
<td>4.5 Kw.</td>
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</table>
**Be Safe! Specify**

The quality of its component parts is the measure of the success of any radio receiver.

A set can be built for distance, volume or for clear tone, but for the best results from any circuit—build with MH Components—Quality Counts.

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### WEEK DAYS (Contd.)

<table>
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<tr>
<th>Ref. No.</th>
<th>G. M. T.</th>
<th>Name of Station.</th>
<th>Call Sign and Wavelength</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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<tr>
<td>212</td>
<td>8.25</td>
<td>Royal Dutch Meteorological Trst.</td>
<td>KNML Utrecht 1100 m.</td>
<td></td>
<td>Night Frost Report</td>
<td>5 mins.</td>
<td>2 Kw.</td>
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<td>164</td>
<td>8.30</td>
<td>Uniune Radiofonica Italiana</td>
<td>IRO 475 m. Rome</td>
<td></td>
<td>Concert, followed by News and Dance Music</td>
<td>11 p.m.</td>
<td>4 Kw.</td>
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<tr>
<td>254</td>
<td>8.30</td>
<td>Radio Toulouse</td>
<td>441 m. France Paris</td>
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<td>News, followed by Concert</td>
<td>10 p.m.</td>
<td>2 Kw.</td>
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<td>252</td>
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<td>Ecole Sup des Postes</td>
<td>FPTT 458 m. Clichy</td>
<td></td>
<td>Concert, sometimes preceded by Lecture</td>
<td>10 p.m.</td>
<td>500 Watts.</td>
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<tr>
<td>75</td>
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<td>Radio-Paris</td>
<td>SFR 1750 m. Barcelona</td>
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<td>177</td>
<td>9.0</td>
<td>Radio Club, Sevillano</td>
<td>EAJ 324 m. Germany</td>
<td></td>
<td>Concert, sometimes preceded by Lecture</td>
<td>9 p.m.</td>
<td>2 Kw.</td>
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<tr>
<td>312</td>
<td>9.0</td>
<td>Voxhaus</td>
<td>B 505 m. and 576 m. Berlin</td>
<td>Cabaret Dance Music Thurs. &amp; Sat.</td>
<td>11 p.m.</td>
<td>45 Kw.</td>
<td></td>
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<td>327</td>
<td>9.30</td>
<td>Bilbao</td>
<td>EAJ 1383 m. Spain</td>
<td></td>
<td>Concert, sometimes preceded by Lecture</td>
<td>12 midnight</td>
<td>1 Kw.</td>
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<td>78</td>
<td>10.0</td>
<td>Radio-Iberica</td>
<td>RI 392 m. Madrid</td>
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<td>Concert, sometimes preceded by Lecture</td>
<td>2 hrs.</td>
<td>3 Kw.</td>
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<tr>
<td>79</td>
<td>10.0</td>
<td>Eiffel Tower</td>
<td>FL 2650 m. Paris</td>
<td></td>
<td>Time Signal in Greenwich Side Real Time (Spark)</td>
<td>5 mins.</td>
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<td>80</td>
<td>10.10</td>
<td>Eiffel Tower</td>
<td>FL 2650 m. Paris</td>
<td></td>
<td>Weather Forecast</td>
<td>5 mins.</td>
<td>5 Kw.</td>
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<td>Radio-Catalana</td>
<td>EAJ 13460 m. Barcelona</td>
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<td>82</td>
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<td>Nauen</td>
<td>POZ 3000 m. Berlin</td>
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<td>Time Signal in G.M.T. (Spark)</td>
<td>12 midnight</td>
<td>1 Kw.</td>
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### SUNDAYS.

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<th>Closing Time or Approx. Duration</th>
<th>Approx. Power used.</th>
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<tr>
<td>64</td>
<td>Stuttgart</td>
<td>FL 2650 m. Wurtemberg</td>
<td></td>
<td>Wurttemberg</td>
<td>1 hour</td>
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<td>192</td>
<td>Munich</td>
<td>LP 1300 m. Bavaria</td>
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<td>Sacred Concert</td>
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<td>1.5 Kw.</td>
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<td>96</td>
<td>Königswusterhausen</td>
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<td>1 Kw.</td>
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<td>p.m.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>60 Kw.</td>
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<td>1.5 Kw.</td>
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<td>1.5 Kw.</td>
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<td>332</td>
<td>Radio Sala-manca</td>
<td>EAJ 22 290 m. Spain</td>
<td></td>
<td>Sacred Concert</td>
<td>10 mins.</td>
<td>4 p.m.</td>
</tr>
</tbody>
</table>

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### SUNDAYS (Contd.)

<table>
<thead>
<tr>
<th>Ref. No.</th>
<th>C. M. T.</th>
<th>Name of Station</th>
<th>Call Sign and Wavelength</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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<tr>
<td>168</td>
<td>3.0</td>
<td>Königsberg</td>
<td>--- 463 m.</td>
<td>East Prussia</td>
<td>Light Orchestra</td>
<td>5.0 p.m.</td>
<td>1 Kw.</td>
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<tr>
<td>107</td>
<td>3.0</td>
<td>Frankfurt</td>
<td>--- 470 m.</td>
<td>Germany</td>
<td>Children's Corner</td>
<td>4.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>106</td>
<td>3.0</td>
<td>Radio-Wien</td>
<td>--- 530 m.</td>
<td>Vienna</td>
<td>Afternoon Concert</td>
<td>5.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>105</td>
<td>3.0</td>
<td>Stuttgart</td>
<td>--- 446 m.</td>
<td>Württemberg</td>
<td>Light Orchestra</td>
<td>5.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>108</td>
<td>3.30</td>
<td>Mainach</td>
<td>--- 585 m.</td>
<td>Bavaria</td>
<td>Concert</td>
<td>5.0 p.m.</td>
<td>4.5 Kw.</td>
</tr>
<tr>
<td>109</td>
<td>3.30</td>
<td>Voskhod</td>
<td>B 305 m. and 576 m.</td>
<td>Berlin</td>
<td>Light Orchestra</td>
<td>5.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>170</td>
<td>3.30</td>
<td>Leipzig</td>
<td>--- 452 m.</td>
<td>Germany</td>
<td>Light Orchestra</td>
<td>5.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>167</td>
<td>4.0</td>
<td>Zurich</td>
<td>--- 515 m.</td>
<td>Switzerland</td>
<td>Hotel Brauer-lieb, Concert revealed</td>
<td>6.0 p.m.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>171</td>
<td>4.0</td>
<td>Frankfurt</td>
<td>--- 470 m.</td>
<td>Germany</td>
<td>Light Orchestra</td>
<td>5.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>217</td>
<td>4.40</td>
<td>Bloemendaal</td>
<td>--- 315 m.</td>
<td>Holland</td>
<td>Divine Service</td>
<td>6.30 p.m.</td>
<td>40 Watts.</td>
</tr>
<tr>
<td>111</td>
<td>5.0</td>
<td>Radio-Belge</td>
<td>--- 265 m.</td>
<td>Brussels</td>
<td>Concert</td>
<td>7.0 p.m.</td>
<td>1 Km.</td>
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<tr>
<td>219</td>
<td>5.0</td>
<td>Malmo</td>
<td>SASC 270 m.</td>
<td>Sweden</td>
<td>Concert</td>
<td>7.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>257</td>
<td>5.30</td>
<td>Hamburg</td>
<td>HA 395 m. and 420 m.</td>
<td>Germany</td>
<td>Concert</td>
<td>7.0 p.m.</td>
<td>4 Kw.</td>
</tr>
<tr>
<td>333</td>
<td>5.30</td>
<td>RadioBarcelona</td>
<td>EAJ7 375 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>9.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>310</td>
<td>6.0</td>
<td>Eiffel Tower</td>
<td>FL 2550 m.</td>
<td>Paris</td>
<td>Concert, followed by News</td>
<td>11.0 p.m.</td>
<td>750 Watts.</td>
</tr>
<tr>
<td>220</td>
<td>6.30</td>
<td>Voskhod</td>
<td>B 505 m. and 576 m.</td>
<td>Berlin</td>
<td>Evening Programme followed by Dance Music</td>
<td>11.0 p.m.</td>
<td>4.5 Kw.</td>
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<tr>
<td>335</td>
<td>6.30</td>
<td>Dortmund</td>
<td>--- 381 m.</td>
<td>Germany</td>
<td>Concert</td>
<td>8.30 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>174</td>
<td>6.30</td>
<td>Munich</td>
<td>--- 485 m.</td>
<td>Bavaria</td>
<td>Concert</td>
<td>9.30 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>269</td>
<td>7.0</td>
<td>Oslo</td>
<td>--- 382 m.</td>
<td>Norway</td>
<td>Concert, followed by Dance Music</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>336</td>
<td>7.0</td>
<td>Radio Cartagena</td>
<td>EAJ6 320 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>8.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>337</td>
<td>7.0</td>
<td>Radio-Cadiz</td>
<td>EAJ3 330 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>9.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>338</td>
<td>7.0</td>
<td>Berne</td>
<td>--- 302 m.</td>
<td>Switzerland</td>
<td>Concert</td>
<td>9.30 p.m.</td>
<td>1 Km.</td>
</tr>
<tr>
<td>337</td>
<td>7.0</td>
<td>Strassenfield</td>
<td>--- 516 m.</td>
<td>Switzerland</td>
<td>Concert</td>
<td>8.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>176</td>
<td>7.0</td>
<td>Copenhagen</td>
<td>--- 475 m.</td>
<td>Denmark</td>
<td>Concert, followed by News</td>
<td>8.30 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>173</td>
<td>7.0</td>
<td>Frankfurt</td>
<td>--- 470 m.</td>
<td>Germany</td>
<td>Concert, followed by Dance Music</td>
<td>9.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>119</td>
<td>7.0</td>
<td>Hamburg</td>
<td>HA 325 m. and 420 m.</td>
<td>Germany</td>
<td>Concert, followed by News</td>
<td>9.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>129</td>
<td>7.0</td>
<td>Eiffel Tower</td>
<td>FL 2550 m.</td>
<td>Paris</td>
<td>General Weather Forecast</td>
<td>8 mins.</td>
<td>3 Kw.</td>
</tr>
<tr>
<td>125</td>
<td>7.0</td>
<td>Stuttgart</td>
<td>--- 446 m.</td>
<td>Württemberg</td>
<td>Concert</td>
<td>10.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>124</td>
<td>7.0</td>
<td>Basel</td>
<td>--- 418 m.</td>
<td>Switzerland</td>
<td>Light Orchestra, Dance Music from 9.00</td>
<td>10.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>116</td>
<td>7.0</td>
<td>Munster</td>
<td>--- 410 m.</td>
<td>Westphalia</td>
<td>Classical Concert</td>
<td>9.0 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>122</td>
<td>7.15</td>
<td>Zurich</td>
<td>--- 513 m.</td>
<td>Switzerland</td>
<td>Concert, followed by News</td>
<td>10.0 p.m.</td>
<td>300 Watts.</td>
</tr>
<tr>
<td>123</td>
<td>7.15</td>
<td>Leipzig</td>
<td>--- 425 m.</td>
<td>Germany</td>
<td>Symphony Concert</td>
<td>10.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>118</td>
<td>7.20</td>
<td>Königsberg</td>
<td>--- 493 m.</td>
<td>E. Prussia</td>
<td>Concert</td>
<td>9.0 p.m.</td>
<td>1 Kw.</td>
</tr>
<tr>
<td>270</td>
<td>7.40</td>
<td>Hilsenska</td>
<td>NSP 1020 m.</td>
<td>Holland</td>
<td>Concert</td>
<td>9.10 p.m.</td>
<td>30 Watts.</td>
</tr>
<tr>
<td>175</td>
<td>7.40</td>
<td>Radiofonica-Italia</td>
<td>TRD 425 m.</td>
<td>Rome</td>
<td>Concert, followed by late News</td>
<td>10.0 p.m.</td>
<td>3 Kw.</td>
</tr>
<tr>
<td>121</td>
<td>8.0</td>
<td>Lausanne</td>
<td>HS 580 m.</td>
<td>Switzerland</td>
<td>Concert or Talk</td>
<td>9.30 p.m.</td>
<td>300 Watts.</td>
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<tr>
<td>339</td>
<td>8.0</td>
<td>Radio Alger</td>
<td>--- 318 m.</td>
<td>France</td>
<td>Weather Forecast</td>
<td>10 mins.</td>
<td>3 Kw.</td>
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<tr>
<td>340</td>
<td>8.0</td>
<td>Radio-Catalana</td>
<td>EAJ7 340 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>128</td>
<td>8.15</td>
<td>Radio-Paris</td>
<td>EFR 2750 m.</td>
<td>Clichy</td>
<td>Detail News Bulletin</td>
<td>9.0 p.m.</td>
<td>4 Kw.</td>
</tr>
<tr>
<td>127</td>
<td>8.30</td>
<td>Radio-Beige</td>
<td>SDR 265 m.</td>
<td>Clichy</td>
<td>Concert, followed by News</td>
<td>10.10 p.m.</td>
<td>2.5 Kw.</td>
</tr>
<tr>
<td>341</td>
<td>8.30</td>
<td>Radio-Toulouse</td>
<td>--- 147 m.</td>
<td>France</td>
<td>Concert</td>
<td>10.30 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>129</td>
<td>8.30</td>
<td>Ecole Superieure</td>
<td>FPRT 425 m.</td>
<td>Paris</td>
<td>Concert or Lecture (May begin 15 mins earlier or later)</td>
<td>10.30 p.m.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>139</td>
<td>8.45</td>
<td>Radio Paris</td>
<td>EFR 1750 m.</td>
<td>Clichy</td>
<td>&quot;Radio Ball&quot; Programme of Dance Music</td>
<td>10.30 p.m.</td>
<td>4 Kw.</td>
</tr>
<tr>
<td>342</td>
<td>9.0</td>
<td>Radio Saldanha</td>
<td>EAJ2 290 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>343</td>
<td>9.0</td>
<td>Radio-Sevillano</td>
<td>EAJ5 330 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>10.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>344</td>
<td>9.30</td>
<td>Petit-Parisien</td>
<td>--- 315 m.</td>
<td>Paris</td>
<td>Concert (items announced in English as well as French)</td>
<td>11.0 p.m.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>133</td>
<td>10.0</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in Greenwich Sidereal Time (Spark)</td>
<td>3 mins.</td>
<td>60 Kw.</td>
</tr>
<tr>
<td>344</td>
<td>10.0</td>
<td>Radio-Vizaia-Dubao</td>
<td>EAJ1 383 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>12 midnight</td>
<td>1.5 Kw.</td>
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<tr>
<td>134</td>
<td>10.41</td>
<td>Eiffel Tower</td>
<td>FL 2650 m.</td>
<td>Paris</td>
<td>Time Signal in Greenwich Mean Time (Spark)</td>
<td>3 mins.</td>
<td>60 Kw.</td>
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<tr>
<td>315</td>
<td>11.0</td>
<td>Radio-Sevilla</td>
<td>EAJ7 300 m.</td>
<td>Spain</td>
<td>Concert</td>
<td>1.0 a.m.</td>
<td>1.5 Kw.</td>
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<tr>
<td>335</td>
<td>11.57</td>
<td>Naunen</td>
<td>POZ 300 m.</td>
<td>Berlin</td>
<td>Time Signal in G.M.T. (Spark)</td>
<td>8 mins.</td>
<td>50 Kw.</td>
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<td>Call Sign and Wavelength</td>
<td>Situation</td>
<td>Nature of Transmission</td>
<td>Closing Time or Approx. Duration</td>
<td>Approx. Power used</td>
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<tr>
<td>156</td>
<td>11.0 a.m.</td>
<td>Radio-Wien</td>
<td>-- 530 m.</td>
<td>Austria</td>
<td>Tues., Thurs., Sat. Concert</td>
<td>12.50 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>224</td>
<td>3.20 a.m.</td>
<td>Munich</td>
<td>-- 485 m.</td>
<td>Bavaria</td>
<td>Wed., Children's Corner</td>
<td>3 hour</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>203</td>
<td>4.0 a.m.</td>
<td>Gothenburg</td>
<td>-- 460 m.</td>
<td>Sweden</td>
<td>Tues., Concert</td>
<td>8.0 p.m.</td>
<td>200 Watts.</td>
</tr>
<tr>
<td>180</td>
<td>5.30 a.m.</td>
<td>Belgrade</td>
<td>-- 1650 m.</td>
<td>Serbia</td>
<td>Tues., Thurs. and Sat. Concert</td>
<td>1 hour</td>
<td>750 Watts.</td>
</tr>
<tr>
<td>142</td>
<td>7.40 a.m.</td>
<td>Hilversum</td>
<td>-- 360 m.</td>
<td>Holland</td>
<td>Mon., Children's Hour</td>
<td>6.46 p.m.</td>
<td>2 K.</td>
</tr>
<tr>
<td>271</td>
<td>9.0 a.m.</td>
<td>Helsingfors</td>
<td>-- 440 m.</td>
<td>Finland</td>
<td>Tues., Thurs., and Sat. Concert</td>
<td>8.0 p.m.</td>
<td>2 K.</td>
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<tr>
<td>217</td>
<td>2.30 a.m.</td>
<td>Stockholm-137</td>
<td>-- 405 m.</td>
<td>Sweden</td>
<td>Wed., Thurs., Fri., Sat., Concert</td>
<td>7.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>137</td>
<td>6.15 a.m.</td>
<td>方式进行</td>
<td>-- 850 m.</td>
<td>Switzerland</td>
<td>Wed., Children's Corner</td>
<td>1 hour</td>
<td>300 Watts.</td>
</tr>
<tr>
<td>221</td>
<td>7.0 a.m.</td>
<td>Copenhagen</td>
<td>-- 775 m.</td>
<td>Denmark</td>
<td>Thurs. and Sat. Concert</td>
<td>8.30 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>258</td>
<td>7.30 a.m.</td>
<td>Ryvang</td>
<td>-- 1150 m.</td>
<td>Denmark</td>
<td>Thurs. and Sat., Dance Music.</td>
<td>8.30 p.m.</td>
<td>500 Watts.</td>
</tr>
<tr>
<td>223</td>
<td>8.0 a.m.</td>
<td>Malmo</td>
<td>-- 370 m.</td>
<td>Sweden</td>
<td>Thurs. and Sat., Dance Music</td>
<td>10.0 p.m.</td>
<td>2 K.</td>
</tr>
<tr>
<td>225</td>
<td>8.30 a.m.</td>
<td>Le Matin</td>
<td>-- 270 m.</td>
<td>Paris</td>
<td>Sat., Special Gala Concert</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>252</td>
<td>9.0 a.m.</td>
<td>Voxhaus</td>
<td>-- 530 m. and 576 m.</td>
<td>Berlin</td>
<td>Thurs. and Sat., Dance Music</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>210</td>
<td>9.0 a.m.</td>
<td>Radio-Wien</td>
<td>-- 530 m.</td>
<td>Vienna</td>
<td>Wed. and Sat., Dance Music</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>154</td>
<td>9.15 a.m.</td>
<td>Petit-Parisien</td>
<td>-- 345 m.</td>
<td>Paris</td>
<td>Tues., Thurs. and Sat. Concert</td>
<td>11.00 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>155</td>
<td>10.0 a.m.</td>
<td>Radio-Paris</td>
<td>SFR 1750 m.</td>
<td>Clichy</td>
<td>Two evenings per week, Dance Music</td>
<td>10.45 p.m.</td>
<td>1.5 Kw.</td>
</tr>
<tr>
<td>272</td>
<td>10.0 a.m.</td>
<td>Munich</td>
<td>-- 485 m.</td>
<td>Bavaria</td>
<td>Wed. and Sat., Dance Music</td>
<td>11.0 p.m.</td>
<td>1.5 Kw.</td>
</tr>
</tbody>
</table>

Special Days:

*The following are Relay Stations:*
- Kassel, 288 m. (1 kW); relays Frankfurt.
- Dresden, 392 m.; mostly relays Leipzig.
- Hjorring, 1520 m.; relays Copenhagen.
- Odense, 950 m.; relays Ryvang.
- Lyons, 450 m.; relays Marseille, 350 m., and Toulouse, 310 m.; relays École Superieure, Paris.
- Bremen, 279 m., 1 kW.; and Hanover, 296 m., 1 kW.; relay Hamburg.

As most readers know, the licence of the British Broadcasting Company terminates at the end of this year, and a committee is now sitting to decide what shall be the future of broadcasting in this country.

Preliminary meetings of the committee were held at the House of Lords on December 3rd and 4th, 1925, at which evidence was taken from the three principal parties.

The evidence of the Post Office was first heard, but this hearing was in camera, so that no details are available.

The B.B.C., in outlining their position and plans for the future, had a very able exponent in Mr. J. C. W. Keith, the Managing Director.

He stated that, whatever the future of broadcasting might be, it would be necessary to have unified control. They (the B.B.C.) had been criticised, of course, as a private concern enjoying the privileges of a monopoly, but they had always tried to do their duty to the public.

Future schemes proposed included the reduction of the number of stations from twenty-two to fifteen, the smaller number being compensated for by larger powers. The problem of providing alternative high- and low-brow programmes was receiving their consideration at the present time, and it was hoped that a solution of the difficulty would be found by providing two transmissions on different frequencies, from the same station.

The evidence of the third party—the Wireless League—was intended to represent the point of view of the listeners. The chairman, Sir A. Stanley, proposed a British Broadcasting Commission on the lines of the National Gallery Trustees. The suggested constitution, however, approximates very closely to the existing board, so that the necessity for change was not apparent.

A complete report of the proceedings appeared in *Wireless Weekly* for December 16, and also *Wireless* for December 19. Full reports of the further meetings on the subject now being held will also appear in these journals.
THE WORLD'S MOST POWERFUL LONG DISTANCE RECEIVER

For RANGE
Wonderful results are still being received at my "Duodyne V" Loud Speaker reception of KLA and XIF, Radio Central (L.L) and KLA, The Times, Parkland Building, Los Angeles, California. Other stations heard were STW, WFC, several East and Western stations unknown, possibly in South America.

January, 1926

For POWER
On a house constructed net, two wires, can be tuned and one by means of the "Duodyne" in the same manner as the set. I have received KFLA, WFC and several other American stations.

As a Wireless Engineer, I should like to distinctly state that the results with the "Duodyne" are indescribable compared to those with any other set I have heard.

As an additional remark, I should like to state that the valves in the "Duodyne" are almost inaudible compared to those with any other set I have heard.

Aerial and detector are the Duodyne "Superhet" type. The valves are the Duodyne "Superhet" type. The aerial and detector are the Duodyne "Superhet" type.

The Duodyne, manufactured by the Curtis Double Circuit Super-Het. 8, is the ideal receiver for those living in close proximity to a broadcasting station.

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The Curtis Double Circuit Super-Het. 8 operates on a frame aerial and either circuit is brought automatically into operation by the means of a switch.

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January, 1926

Send Coupon For Free 70-Page Book "How to Build a 5-Valve Neutrodyne."
It is well known that improved results are obtainable on a crystal set by tapping the detector circuit across part of the coil only. This article explains why and where to tap for the best signals.

One of the most desirable tendencies in present day wireless is the introduction of exact measurements of high-frequency losses in wireless circuits.

In this article an attempt has been made to elucidate a very general principle involving damping in wireless circuits, and to indicate the best sizes for coils in crystal sets.

Fig. 1.—For best results the crystal is only tapped across part of the coil L.

Fig. 2.—This circuit is equivalent to that of Fig. 1.

Consider this as being made up of the product of two other ratios, 
\[
\frac{E_1}{E} \quad \text{and} \quad \frac{E_2}{E_1}
\]

Now \( \frac{E_1}{E} \) is equal to the ratio of the impedance of the coil to that of the whole circuit, i.e.,
\[
\frac{\omega(L_1 + L_2)}{R + \omega L_1}
\]

since the impedance of the latter when it is tuned is purely resistive, and equal to \( R + \omega^2 L_2 \). This ratio is thus greatest when \( L_2 \) is least, which means that to make the P.D. across the whole coil a maximum, the crystal should be tapped across as few turns as possible.

On the other hand, in order to make \( e \) as large as possible we should tap across all the turns in circuit. In this case \( e = E_1 \) and the ratio has its maximum value of unity.

We have thus to effect a compromise between two contradictory conditions. If we start by tapping
across zero turns, and gradually increase the inductance $L_1$ across which we tap the crystal, we shall gradually increase the ratio — and

$$E_1$$
decrease. At a certain point $E$ which is known as the optimum tapping the product attains its maximum value. Thereafter it decreases owing to the decrease in $E_1/E$ outweighing the increase in $e/E$.

It can be shown mathematically that this occurs when $R = \frac{a^2 L_1}{2}$ or in other words, when the damping due to the series resistance $R$ is equal to that due to the parallel load $r$. The above formula can also be expressed in the form

$$L_2 = \frac{\sqrt{Rr}}{a}$$

Practical Deductions

Several deductions can be drawn from this expression which are of general interest to designers of crystal sets. Thus in a low-loss aerial and earth system, used in conjunction with a well-designed coil, we should expect $R$ to be small; and, therefore, to get the best results the crystal should be tapped across only a few turns, in other words, $L_1$ should be small. With a poor aerial, i.e., one with a large high-frequency resistance, we

should find on the other hand that the crystal must be tapped across almost the whole of the inductance. This is the reason why a tapped coil is of little advantage on a poor aerial system.

We may now consider the effect of $L_1$, i.e., that portion of the inductance across which the crystal is not tapped. This portion of the inductance has quite an appreciable resistance of its own, and it is therefore desirable to cut it down as much as possible. In other words, our coil should be as small as is consistent with there being sufficient inductance on which to obtain an optimum tapping-point and to tune the circuit.

It is well known to those who use tapped coils that the best tapping-point varies to some extent according to the crystal contact. This is owing to the differences in the resistances of the contact, and is to be expected theoretically. If a perikon combination is used instead of the more usual galena, a considerably larger inductance will be required. This is due to the larger resistance and therefore smaller damping of the perikon.

**Selectivity**

Before concluding we may draw attention to one other question which is of importance in connection with tapping, and that is selectivity. This is discussed elsewhere in this issue by Dr. Robinson.

If a condenser in parallel with the coil is used for tuning, the theory must be somewhat modified, but the general conclusions are not greatly affected.

---

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For the past two years International Broadcast tests have been arranged in the middle of the winter, when the conditions are the most favourable, in order to try and establish records of long-distance reception. To facilitate such reception arrangements are made on both sides of the Atlantic for broadcasting stations to transmit definite and suitable programmes at certain stated times only, after which all transmission ceases as far as possible. Thus at the time when the American stations are transmitting every endeavour will be made to restrict transmission on this side of the Atlantic so that the listeners may have the greatest possible opportunity for receiving the American programme.

Careful Organisation

The arrangements naturally require considerable preparation beforehand, and the organisation for this third International test is now well advanced. In America our contemporary, Radio Broadcast, is making the necessary arrangements, the organisation on this side being carried out by Radio Press, Ltd. Detailed information will be given immediately prior to the event in our weekly publications, Wireless Weekly and Wireless. We are able to give preliminary information, however, as follows:

The last week in January has been fixed for the test. Experience indicates that it is the most satisfactory time from all points of view. The American, Canadian, Mexican and Cuban Broadcasting Stations will transmit from 10 to 11 p.m., Eastern standard time, beginning on the evening of Sunday, January 24th, and continuing throughout the week. Owing to the difference in time between America and Europe, these times will be 3 a.m. to 4 a.m., G.M.T. The English and Continental stations will then take the air from 4 a.m. to 5 a.m. G.M.T.

Progressive Transmissions

Some interesting arrangements are being made in America to group the stations in one or more of the nights, e.g., during the first 15 minutes of the hour the Eastern Group will transmit, the second period being given to Central zone, the third to the Western Mountain Group and the last 15 minute period to the stations in the Pacific zone.

It is possible that similar arrangements will be made among the

CALIBRATE YOUR OWN RECEIVER.

On Wednesday, January 13th, the BBC stations will be accurately measured by the Radio Press Laboratories at the following times:

<table>
<thead>
<tr>
<th>Station</th>
<th>Time (p.m.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aberdeen</td>
<td>7:45</td>
</tr>
<tr>
<td>Birmingham</td>
<td>7:55</td>
</tr>
<tr>
<td>Belfast</td>
<td>8:5</td>
</tr>
<tr>
<td>Glasgow</td>
<td>8:15</td>
</tr>
<tr>
<td>Newcastle</td>
<td>8:25</td>
</tr>
<tr>
<td>Bournemouth</td>
<td>8:35</td>
</tr>
<tr>
<td>Manchester</td>
<td>8:45</td>
</tr>
<tr>
<td>London</td>
<td>8:55</td>
</tr>
<tr>
<td>Cardiff</td>
<td>9:5</td>
</tr>
</tbody>
</table>

The results will be published in "Wireless Weekly" the following Wednesday, so enabling readers to calibrate their own receivers.

European stations on the last night of the test, Saturday, January 29th, will present arranged, transmission of programmes will take place from several British stations including 5XX, and from leading stations on the Continent.

Arrangements are also in hand for a test of the effect of latitude on the reception. Thus for one quarter of an hour, say, the Canadian stations would transmit, followed in quarter of an hour periods by the Northern and the Southern United States stations, and finally the stations south of the United States. Similar arrangements may be made on this side of the Atlantic.

Good Conditions

The times, of course, are somewhat awkward. They have to be chosen because it is only during this period that complete darkness stretches over the Atlantic and reception is satisfactory. We trust that all who can will participate in this test, which should be particularly interesting in view of the almost complete absence of interference which is expected owing to the fact that all the regular broadcasting stations on this side will have closed down.

Readers who are interested should make a particular point of following our weekly publications during the next few weeks in order that they may keep informed of the arrangements which are being made. In America the actual programme transmitted any one night is being published the next morning in the daily press.

Calibration of Receivers

In order to take fullest advantage of this test it is necessary for the receiver to be accurately calibrated. We would particularly refer our readers, therefore, to the calibration scheme organised by our Eeltree Laboratories, which is now in full swing.

On certain evenings the frequencies of the main stations of the B.B.C. are accurately measured at stated times. These results are published in the following issue of Wireless Weekly.

The amateur, therefore, simply tunes into as carefully as possible to each broadcasting station at the appropriate time and notes the dial reading. Reference to the published figures the following week will give the exact frequencies (or wavelengths) at these points, so that a calibration curve may be drawn from the receiver.
FOLLOWING a series of resolutions adopted at the meeting of the International Time Commission at Cambridge in July last, certain changes will be made in the issue of Time Signals from radio stations in France, commencing on January 1st, 1926.

The present series of signals from the Eiffel Tower (FL), Lyons (Doux, YN) and Bordeaux (Lafayette, LY) will be withdrawn and will be replaced by the series shown in table at foot of page.

This series will be put into operation in the first instance for a period of four months, after which it is contemplated that No. 3 may be withdrawn and No. 5 replaced by an issue of the International and Rhythmic Signal from FL, simultaneously with that from LY at 20h. By that time it is expected that the issue on spark from FL will be replaced by an issue on modulated CW.

In the meantime the issues Nos. 3 and 5 will take the same form as hitherto, and for ordinary users the only service which is withdrawn is the issue of the Old Semi-automatic Series from FL at 20h. 45m.

The form taken by the issue No. 1 is the following:

(a) Preliminary signal.
(b) Times of issue of rhythmic signal of the previous day as determined by the Bureau International de l'Heure, Paris.
(c) Commencing at 7h. 57m. 55s., the International Signal, as hitherto, except that the three dashes which have constituted the Time Signal are to be replaced by dots, commencing at the seconds 55.6, 55.6, 57.0, 58.0, 59.0, 00.0 and lasting each about 0.2 sec.
(d) Commencing at 8h. 1m. 0s., a new rhythmic issue of 306 signals, falling as follows:

<table>
<thead>
<tr>
<th>No.</th>
<th>G.M.T.</th>
<th>Signal</th>
<th>Station</th>
<th>Wavelength</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8.0</td>
<td>International and Rhythmic Signals</td>
<td>FL</td>
<td>2,600</td>
</tr>
<tr>
<td>2</td>
<td>8.0</td>
<td>Do</td>
<td>Do</td>
<td>CW</td>
</tr>
<tr>
<td>3</td>
<td>9.30</td>
<td>International</td>
<td>LY</td>
<td>23,400</td>
</tr>
<tr>
<td>4</td>
<td>20.0</td>
<td>International and Rhythmic Signals</td>
<td>FL</td>
<td>2,600</td>
</tr>
<tr>
<td>5</td>
<td>22.45</td>
<td>Old Semi-automatic Signal</td>
<td>FL</td>
<td>2,600</td>
</tr>
<tr>
<td>6, 7</td>
<td></td>
<td>Short Wave Emissions—see text.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The commencements of all these signals are to be evenly spaced; the commencements of the dashes are intended to fall precisely at the commencements of the seconds of mean time and they will be each about one-half second in duration; the dots will be about one-fifth of a second in duration.

Besides these issues upon the wavelengths hitherto employed by FL and LY respectively, issues Nos. 6 and 7 will be made at 8h. and at 20h., simultaneously by both stations on short wave-lengths—namely, 32 metres and 75 metres, on the same pattern as the issues Nos. 1, 2 and 4 below, during the probationary period of four months. After that, it is contemplated that one or other of these wavelengths may be suppressed and the other retained permanently in addition to the series (1)–(5) below.

A period of probation of four months has been adopted in order to ascertain how far the new issues meet both general and scientific requirements.

Any comments which are the result of experience on the working of the new issues, or upon the abolition of the old issues, should be addressed either to M. le Directeur, Bureau International de l'Heure, Observatoire National, Paris, XIVe, or to the undersigned. They should arrive not later than the beginning of March.

R. A. Sampson,
President, International Time Commission.
Royal Observatory, Edinburgh
9th December, 1925.
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<th></th>
<th>Ohms</th>
<th>Model</th>
<th>Price</th>
</tr>
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<tbody>
<tr>
<td>SENIOR</td>
<td>2,000</td>
<td>W290</td>
<td>£5 0 0</td>
</tr>
<tr>
<td>MODEL</td>
<td>120</td>
<td>W291</td>
<td></td>
</tr>
<tr>
<td>JUNIOR</td>
<td>2,000</td>
<td>W295</td>
<td>£2 15 0</td>
</tr>
<tr>
<td>MODEL</td>
<td>120</td>
<td>W296</td>
<td></td>
</tr>
<tr>
<td>CLARITONE HEADPHONES</td>
<td></td>
<td>W216</td>
<td>20/-</td>
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</tbody>
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50 ... ... 5/6
75 ... ... 5/6
Daventry ... ... 7/6

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A Simply Constructed Frame Aerial for the Broadcast Frequencies

by JOHN UNDERDOWN

Constructional Work
Since a "diamond" type frame is easier to make than a "box" type and is also somewhat more suitable, this method of construction was chosen. The two pieces of 1 in. by ½ in. cross-section oak, which should be of well-seasoned material, are used for the diagonals, and after the surfaces have been planed (if necessary) the shorter piece is half-notched in the centre and the latter at 2½ in. from one end. This operation should be carried out with some care to obtain a good fit. (Fig. 1.)

 Provision for Orientation
In order that the frame may be easily rotated the end of the longer cross-piece opposite to that from which the previous 2½ in. measurement was made should be reduced to ½ in. circular section to fit into the base on which the frame will eventually stand, and square shoulders should be left (Fig. 2). The circular section may conveniently be made ½ in. in length.

Simplified Winding
Having previously measured, by means of a megger, the insulation resistance between two tacks driven into well-seasoned oak at a distance of ½ in. apart and obtained readings of infinity, it was considered unnecessary to insulate the frame. The turns are made on notched ebonite strips, and the simple method of winding seen in the photograph was adopted. At 4½ in. from the centres of the notches on the diagonals, rows of tacks, separated by ½ in. spacing, are driven in. Over these tacks the final winding is placed. To prevent splitting the wood it is best to drill small holes for the tacks with a suitably small drill. Thirteen tacks are required on the three upper ends of the cross-pieces and 14 for the lower end where the winding starts and finishes.

Tuning Range
By far the greater number of broadcasting stations work on frequencies between 500 and 1,500 kilocycles, and the frame about to be described is designed to tune over this range with a 0.0005 µF variable air condenser in parallel. On actual measurement, with a J.B. low-loss condenser of the above capacity this range was more than covered, the combination tuning to 1,500 kc. with the condenser all out, so that the minimum capacity is taken into account.

Material Required
In constructing the frame the following material will be necessary:

One piece of thoroughly well-seasoned oak 4 ft. by 1 in. by ½ in. and one piece 3 ft. 6 in. long of same cross-section.

One heavy wooden block of suitable dimensions to act as a base.

One square piece of oak or any hard wood of 4½ in. side and ½ in. thick.

Four ¾ in. No. 4 wood-screws.

Fifty-three tacks (½ in. or 2½ in. long).

Half pound 20 or 18 gauge enamelled copper wire.

illegible
The Base

A fairly heavy wooden base is desirable for the frame, and a 6 in. square block, 3/4 in. thick, serves admirably. This should be drilled in the centre to take the 1/2 in. diameter circular end of the longer cross-piece. The latter should be made to rotate easily before the two cross-pieces are finally joined together.

Before the winding is commenced the 1/2 in. square piece of oak should be screwed into position as seen in the photographs to give added rigidity to the framework, and is best affixed on the opposite side of the latter to that on which the turns will be wound later.

The Winding

Winding the frame is not a single-handed job unless the framework is clamped to the top of a table, and it is best to obtain assistance if possible. Bare one end of the 20 or 18 gauge enamelled copper wire specified and twist several times round one of the rubber covered wire to go to the frame terminal of the set. Finally the wood of the frame should receive a coating of varnish or shellac, when a useful and efficient frame results.

Fig. 2.—The end of the longer cross-pieces should be rounded as shown.

inside tacks. The winding is thus commenced with the inner turns and wound outwards. Keep an even tension on the wire and little difficulty should be experienced in obtaining a neat appearance. I actually used 20 gauge wire and employed about six ounces thereof.

The thirteenth turn should be finished off in a similar manner to that employed at commencing. To the beginning and end of the winding solder suitable lengths of rubber covered wire to go to the frame terminal of the set. Finally the wood of the frame should receive a coating of varnish or shellac, when a useful and efficient frame results.

SIR,—I am sure you will be interested to hear what good results I get from the Crystal Set by D. J. S. Hartt, in MODERN WIRELESS, September, 1924. My house is in Dorchester, on the south-west coast, and lays in a valley. Bournemouth we get very well with a No. 25 coil, and by using a No. 150 coil Daventry comes through much louder than Bournemouth. All who have listened to it say it is the best crystal set they have heard and I think so too. I have made several sets with the same circuit for friends.—Yours truly, H. A. TOWNSEND.


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The All-Concert Receiver in New Zealand.

Sir,—I was recently fortunate enough to pick up an old copy of MODERN WIRELESS, dated September, 1923, and a perusal of its pages led to my being interested in the "All-Concert Receiver," described by Mr. Percy W. Harris. I had previously been using a simple 3-coil single valve regeneration set (home-made) and was getting excellent results from all New Zealand stations on phones up to 680 miles. The reading of the above-mentioned article fired me with ambition to get further afield, which to us in these islands is a very far cry, the nearest foreign station being approximately 1,260 miles. I decided to adapt my old receiver, and although I could not follow Mr. Harris's instructions as to lay-out rigidly, I must say that the ultimate results exceeded all expectations. The only variation I used in the general idea was to use separate H.T. for each valve and potentiometer control on the H.F. valve. With this set I now get all New Zealand stations on the loudspeaker with sufficient strength to fill the house. The distances of our New Zealand stations from here are Auckland, IYA and 1YB, 300 miles; Wellington, 2YK and 2YB, 310 miles; Christchurch, 3AC, about 500 miles; Dunedin, 4YA, 700 miles; I have to detune slightly. These are our main stations, but there are numerous small stations of very low power which I hear on phones. Outside our own land I regularly each night, between 9.30 p.m. and 11.30 p.m., hear Australian stations, and I have no difficulty in receiving at comfortable loudspeaker strength either 2BI, Sydney, or 2FC, Sydney, a distance of 1,260 miles from here. I have at various times when conditions were very favourable picked up KGO, California, and KHJ, in the same American State, these stations being approximately 6,800 miles, and on one occasion, only for a brief period of about 35 minutes, I heard KDKA experimenting, reception being faint but clear. These latter stations received on phones of course, needless to state. The possibilities of this type of receiver are indeed great, and I have no hesitation in recommending it to those in need of a simply operated yet effective means of hearing broadcast music. I forgot to mention that, except for loudspeaker work, I use a 2-ft. frame aerial, made up with 72 ft. of No. 18 s.w.g. copper, for New Zealand stations. My outside aerial is stranded copper, 35 ft. high and 95 ft. long, earth and lead-in included, the earth being 3 ft. of heavy copper strip about 1 in. by 1 in., soldered to a water pipe. With reference to the coil I use in my All-Concert Receiver, the following may be of use to other wireless enthusiasts. For broadcasting wavelengths I use cardboard cylinders 4 in. in diameter, 1 in. in width. The primary or aerial coil has a winding of 18 turns 20-gauge copper d.c.c., the anode 25 turns of 28 gauge d.c.c. copper, and the reaction 23 turns 28 gauge d.c.c., and I find them very effective, using series or parallel condenser as needed.—Yours truly,

SAM. J. PEARSON,
Gisborne, New Zealand.

A Single-Valve Receiver for KDKA.

Sir,—May I add my congratulations to those of the many readers of MODERN WIRELESS who have built the "Single-Valve Receiver for KDKA" described by Mr. Stanley G. Rattee in the March, 1925, issue of MODERN WIRELESS.

This circuit really has solved the problem of long-distance reception on short waves. The dream of the wireless enthusiast has come true at last, namely, to be able to invite friends in any evening and get KDKA as easily as one would tune in any other station. Using a note magnifier, music can be heard comfortably loud on the loudspeaker, with remarkable purity of sound, while the absence of self-oscillation is a delight.

The fact that I followed Mr. Rattee's lay-out to the letter no doubt accounts for the pleasing results obtained.—Yours faithfully,

ROBERT J. NICHOLS.
Eltham, S.E.9.
(Continued from page 380)

in the usual manner. If with the type of lamp-holders used the connections have to be taken through the baseboard, and brought through outside the holder, care should be taken to make grooves in the underside of the baseboard for the wires to run in. When the wires are in position these should be filled with paraffin wax or some similar material.

**Testing out the Unit**

When the construction is completed the unit can be completed up and tested, not forgetting to include the condenser in the earth lead of the set, as mentioned above and shown in Fig. 4.

The flex connected to the input of unit is joined to any convenient form of main plug, which should be plugged into the house mains, and the terminals marked output + and - are connected respectively to the H.T. + and - of the set. After ascertaining that the valve and hands are alright the switch should he switched on and tuned as usual. If no signals are heard, the main plug should be reversed in its socket.

The unit was tested at our Elstree laboratories on a three-valve set of the detector and 2 L.F. type, and also a Harmony Four Receiver, which embodies two H.F. valves. It was found to give extremely satisfactory results, no difference, indeed, being noticed to the performance with large H.T. accumulators which are normally employed.

**Super-Heterodyne Reception in South Africa**

Sir,—Please find enclosed two photos of a Supersonic Heterodyne Wireless Set.

This was taken from the article by Mr. John Scott-Taggart in *Modern Wireless* for May, 1924, only I have designed an oscillator of my own. The set is capable of receiving any wave-length by means of plug-in coils.

**American Reception**

This set can be used with outside or frame aerials, and switches are provided for cutting out any high or low-frequency valves, which may be necessary. For instance, Johannesburg, 600 miles, Durban 300 miles, and Cape Town 500 miles, can be heard at loud-speak strength on outside aerial with detector, oscillator, one intermediate stage, second detector, and one stage of power amplification, which is equivalent to any good five-valve neotreodyne set made, and is free from distortion. On short wave work this set is wonderful. KDKA up to a week or two ago could be received at loud-speak strength any morning I wished to get up, and was free from distortion, and as clear as if it were only a few miles away. There is no doubt the supersonic is the set for short waves.

The wire wound frame aerial in the lid of the cabinet works very well, or alternatively we use an external frame of our own design. It is equivalent to an excellent outside aerial, with the addition of one or more valve, which shows that the design of our aerial is right. On the base of the frame will be seen two copper rails insulated on ebonite rods 1½ in. apart, on which two wires of brass spring are attached to two terminals which lead to the set. This can be rotated in any direction and any number of complete turns can be made without interference to the leads to the set.

This frame was picked out after making about six different patterns; the wire spacing was also got at by first starting at 1 in apart and going up to 1 in. apart, but we found that 1½ in. was the right thing. The wire used is Danish, 14 strands 40 S.W.G. enamelled and double silk covered, making it look like a single wire 14 DSC.

A comprehensive switching system has been adopted. Three switches are employed by means of which the number of valves in circuit is varied. One switch controls the power valves, and either a 120 or 2,000 ohm loud-speaker is used.—Yours truly, WALTER WILSON.

Port Elizabeth.

**YOUR EARTH LEAD MAY BE INEFFICIENT**

Read the interesting articles in the current issue of *Wireless*.

2d. Now on Sale 2d.
January, 1926

U.S. Transformers give Unequalled Service

SUPER TRANSFORMER
"Modern Wireless" says of the U.S. Super Transformer:
"The present instrument, if the high quality of the specimen submitted is an indication, can be heartily recommended, and indicates the vast strides that have been made recently in the design of really effective transformers for L.F. amplification."

Fidelity

JUST as the master musician interprets with absolute fidelity the creation of a composer, so does the U.S. Super Transformer interpret radio transmissions. Every shade of musical tone colour, stirring overtures, whispering lullabies, is reproduced faithfully and without distortion. U.S. Super reproduction is, in fact, a revelation of what a good transformer is really capable of. It gives unusually high amplification over the whole band of audio frequencies which is consistently maintained throughout the entire range. Know the joy of perfect audio amplification and faultless radio reproduction—Incorporate the U.S. Transformer in your set.

The U.S. Transformer's success lies in the excellence of its design. The core, with no bolts through it, is packed with finest steelloy iron, allowing fullest amplification without hint of distortion; winding is done by experts; terminals are large and comfortable, with ebonite strips at top and soldering tags. Ratios guaranteed 5:2 and 3:1. British Made.

TWO VALVE CABINET SET
Complete Outfit including—
Set (Two Valve, cabinet as below), High Tension Battery box, Low Tension Battery, Coils (for 300-500 metres), Valves (two Dull Emitter), Standard Loud-speaker, Aerial Equipment. Flex for connecting up.

PRICE
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Absolutely Complete.

We are offering a complete Western Electric 5-valve Receiving Set complete with Loud Speaker for £27-17-0. This set will meet the most critical demands and gives excellent loud-speaker results from both home and foreign stations. Units may be purchased separately if desired.

Write for our booklet No. W546 for details of Western Electric Valves, Receiving Sets, Amplifiers, Loud Speakers, and Igranic accessories.

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And now the IGRANIC for all British Wireless

Thus another step in the elimination of guesswork is taken. Wireless Constructors seeking highest attainable efficiency in their sets may select from the Igranic-Pacent range of components secure in the knowledge that all of these represent the most recent developments of radio engineering research.

By the addition of the Pacent Radio Essentials Igranic have welded the experience of two great radio engineering organisations.

This is good news for those constructors and experimenters who have learned by experience that the brand Igranic signifies the super-component—for now new components augment the already comprehensive Igranic range.

The Pacent Radio Essentials have won such renown in America as to be made standard equipment in forty nationally-distributed radio receiving sets.

Write to-day for our new Igranic-Pacent booklet P8, which gives full details regarding these new devices.

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Branches: BIRMINGHAM, BRISTOL, CARDIFF, GLASGOW, LEEDS, MANCHESTER, NEWCASTLE.

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Constructors era dawns

THE IGRANIC-PACENT MICROVERN.
A combined operating knob and vernier control, which can be fitted to any variable condenser, variometer, variocoupler or other tuning device. Fitted with a slow motion mechanism, with a reduction ratio of 5 to 1, possessing unique features. No gears are used and there is no backlash or alteration to tuning when the hand is removed from the knob.

The outside diameter is 1 in., and the dial sets effectively as an electrostatic shield, preventing hand capacity effects. Stations can be recorded with pencil by name, wavelength or frequencies and the records easily and cleanly erased with a damp cloth.

THE IGRANIC-PACENT PORCELAIN JACKS AND PLUGS.
These jack plugs provide a simple, efficient and very convenient means of carrying out many operations which are difficult with switches. In America, practically all phone and loud-speaker jacks are fitted on the panel so that the main fact of slipping the plug in the appropriate jack determines the number of valves used. The springs are of German Silver with silver contacts riveted in. Nickel-plated brass is used for the frames so as to render them non-magnetic, and the special insulating material used is far superior to the fibre insulations in so many jacks.

THE IGRANIC-PACENT BATTERY SWITCH.
A neat and well finished "On and Off" Switch generally used for battery switching. Substitution and reliable contact is assured, and there is nothing to get out of order. Special terminal points are fitted to facilitate connecting up.

THE IGRANIC-PACENT TRUE STRAIGHT LINE FREQUENCY VARIABLE CONDENSER.
A high grade variable condenser with low-loss characteristics, a true straight line frequency curve and negligible minimum capacity. Fixed and moving plates are of brass, riveted together and soldered, ensuring permanent alignment and sound electrical connection.

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Radio Press News

The preliminary announcements which appeared in the last issue of Modern Wireless concerning the Radio Press Year Book for 1926, have aroused so much interest that some further details will no doubt be appreciated.

A special feature which was not disclosed in the previous announcement will be found in an exceedingly complete and accurate list of call signs of experimental transmitting stations.

A special effort has been made to bring this list up to date and to make it thoroughly dependable, and it will prove invaluable to everyone who listens on other wavelengths than the broadcast band.

The valve data section will make a strong appeal to the serious experimenter, providing as it does an almost unrivalled collection of easily accessible information. Just the things the practical man wants to know about a valve are presented in handy tabulated forms for scores of different types.

For the more advanced worker, again, actual characteristic curves of a very large number are also given.

For the non-technical reader the general section will be found to provide a fund of interesting and helpful matter by well-known authorities, which covers a remarkably wide field.


The articles and condensed information in the workshop section include such items as instructions on marking out and drilling panels, mating bionite, general hints on wiring and soldering, tables of sizes of drills and taps, tables of weights per pound of bionite, and so on. This part of the book has received special attention, and the home constructor will find that the expectations aroused by these hints will be fully borne out by the book itself when he receives his copy.

The majority of home constructors do not as a rule feel that wireless calculations come within their field, but this is partly due in large part to a feeling that the formula involved in such operations as the calculation of the number and size of plates required in making a fixed condenser of a certain capacity are difficult to use. The section of the Year Book which deals with simplified calculations will be found to remove such ideas with singular completeness, and to prove that everyone may carry out such elementary design work for himself with the aid of the simplest arithmetic.

This section has been prepared by an author well known for his capacity to present mathematics in simple form, and covers all the important calculations met with in every-day wireless work.

"TANGENT" The Better Coil!

Backed by the personal guarantee of Faraday House

That's the reason why Therla Fixed Condensers and Grid Leaks should have a place in your receiver. They are guaranteed to give you good service. Every Therla product is individually tested by the famous electrical laboratory of Faraday House, and carries the hall mark of an industry founded by this institution—a personally signed blue label signifying that the product is correct to within a narrow commercial limit of the stated capacity.

This guarantee means that you get what you paid for. Yet Therla Condensers and Grid Leaks cost less than many other instruments of similar type. Get them from your drake.

Therla Grid Leaks

Size:
250,000 clamp.
500,000 clamp.
1,000,000 clamp.
3 megohms

Price: 1/3

Therla Fixed Condensers

Price:
- .0001 mfd. 1/4 each.
- .005 mfd. 2 each.
- .006 mfd. 2 each.

Grid Condenser with Clips 1/3

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6 Creeks Liverpool, England

BUY GUARANTEED PRODUCTS & BUY SATISFACTION

January, 1926

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SELECTIVITY is one of the essentials nowadays for efficient long distance reception, and in this connection might be mentioned a small and compact two-valve receiver which is described in the current issue of The Wireless Constructor by A. V. D. Hort, B.A. The set is specially designed for sensitivity combined with selectivity.

Selectivity

Whilst speaking of selectivity, an article by which every experimenter can benefit is that which G. F. Kendall, B.Sc., contributed to the December 26 issue of Wireless, entitled "What is Flat Tuning?"

The issue of Wireless Weekly dated December 9 also contained an interesting article on the subject by J. H. Reyner, B.Sc. (Hons.), A.M.I.E.E., which gave some material information regarding the design of tuning circuits, showing just how much resistance was necessary in a circuit in order to obtain satisfactory reproduction.

Economy of Construction

The two-valve receiver, using variometer reaction control, which was described in Wireless dated December 26, by C. P. Allinson, makes use of a somewhat neglected method of oscillation control, and here all the necessary tuning coils are incorporated in the receiver.

Similarly, no external coils are necessary in the "Single Coil Two-Valve Receiver," described by E. J. Marriott in the current issue of The Wireless Constructor.

Every enthusiast will find some very material information in the article by P. W. Harris, M.I.R.E., which appeared in Wireless dated December 20. This was entitled "False Economy in Set Construction," and should be read by all constructors of wireless sets.

Neutrolyzing Methods

In the construction of sensitive receiving equipment the neutrolyzing of the H.F. valves employed is a practice which has been proved extremely efficient, and it is now extensively used. Mr. P. W. Harris, M.I.R.E., has had a wide experience in this field, so that his discussion in Wireless Weekly, dated December 23, of the various neutrolyzing methods possible, will be found of considerable practical help to experimenters.

The possibility of distortion developing in the L.F. stages of a wireless receiver, apart from the grid bias question, is one against which adequate precaution must be taken if pure reproduction is to be obtained. Mr. J. H. Reyner has written an article dealing with this subject in a most interesting manner, and those who desire faithful reproduction of broadcasts would do well to read it.

Super-Sets

Multi-valve receivers are very popular in certain circles, but it should be borne in mind that when purchasing a receiver which comes under this category, that several points must be reckoned with.

Advice to the prospective purchaser of a super-set was given in Wireless dated December 10 by Capt. H. J. Round, M.C., M.I.E.E., and some useful hints are given therein.
### Regular Programmes from American Broadcasting Stations

*Hours of transmission given in Greenwich mean time and in local time prevailing.*

*Telephony only. Corrected up to December 19th, 1925.*

*Edited by Captain L. F. Plugge, B.Sc., F.R.Ae.S., F.R.Met.S.*

<table>
<thead>
<tr>
<th>No.</th>
<th>G.M.T.</th>
<th>Local Time prevailing</th>
<th>Station, Call Sign and Wave-length</th>
<th>Town. Nature of Transmission</th>
<th>Approx. Duration</th>
</tr>
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<tbody>
<tr>
<td>A. 97</td>
<td>10.30 p.m.</td>
<td>7.30 a.m.</td>
<td>Fort Worth Star Telegram, WRAP</td>
<td>Fort Worth, Texas</td>
<td>Police News</td>
</tr>
<tr>
<td>A. 1</td>
<td>11.0 p.m.</td>
<td>8.00 p.m.</td>
<td>Willard Storage Battery, WTAM</td>
<td>Cleveland, Ohio</td>
<td>Dinner Concert</td>
</tr>
<tr>
<td>A. 65</td>
<td>11.0 p.m.</td>
<td>9.00 p.m.</td>
<td>American Tel. &amp; Tel. Co. “The Detroit News”</td>
<td>New York</td>
<td>Musical Programme</td>
</tr>
<tr>
<td>A. 61</td>
<td>11.15 p.m.</td>
<td>9.15 p.m.</td>
<td>Westinghouse Elec. &amp; Mfg. Co.</td>
<td>Detroit, Mich.</td>
<td>Dinner Concert except Sat.</td>
</tr>
<tr>
<td>A. 4</td>
<td>12.00 p.m.</td>
<td>11.00 a.m.</td>
<td>Westinghouse Elec. &amp; Mfg. Co.</td>
<td>Pittsburg, Pa.</td>
<td>Dinner Concert</td>
</tr>
<tr>
<td>A. 68</td>
<td>12.15 p.m.</td>
<td>11.15 a.m.</td>
<td>L. Bamberger &amp; Co.</td>
<td>Newark, N. J.</td>
<td>Talk, Sports, News</td>
</tr>
<tr>
<td>A. 99</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Westinghouse Elec. &amp; Mfg. Co.</td>
<td>Newark, N. J.</td>
<td>Dinner Music (except Sat.)</td>
</tr>
<tr>
<td>A. 2</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>General Electric Co.</td>
<td>Springfield, Mass. &amp; Talk</td>
<td>Dinner Concert except Sat.</td>
</tr>
<tr>
<td>A. 15</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>General Electric Co.</td>
<td>Schenectady, N.Y. &amp; Music and/or Talks</td>
<td>Dinner Concert except Fri. and Sat.</td>
</tr>
<tr>
<td>A. 100</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Pittsburgh Press, Kaufmann &amp; Bauer Co. “Kansas City Star”</td>
<td>Pittsburg, Pa.</td>
<td>Dinner Concert</td>
</tr>
<tr>
<td>A. 5</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>WDAF</td>
<td>Kansas City, Mo.</td>
<td>Market, Weather, Time and Road Report</td>
</tr>
<tr>
<td>A. 80</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Gamble Bros.</td>
<td>Philadelphia, Pa.</td>
<td>Children's Corner</td>
</tr>
<tr>
<td>A. 6</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>“Kansas City Star”</td>
<td>Kansas City, Mo.</td>
<td>Talks, Stories, Music</td>
</tr>
<tr>
<td>A. 66</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Chicago Tribune Broadcasting Co.</td>
<td>Chicago, Ill.</td>
<td>Dinner Concert</td>
</tr>
<tr>
<td>A. 9</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Goodyear Tyre &amp; Rubber Co.</td>
<td>Cleveland, Ohio</td>
<td>Orchestra (except Saturday)</td>
</tr>
<tr>
<td>A. 12</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Woodmen of the World</td>
<td>Omaha, Nebraska</td>
<td>Talk or Concert</td>
</tr>
<tr>
<td>A. 89</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Henry Field Seed Co.</td>
<td>Shenandoah, Iowa</td>
<td>Concert (except Sat.)</td>
</tr>
<tr>
<td>A. 101</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Fort Worth Star Telegram</td>
<td>Forth Worth, Texas</td>
<td>Dinner Music</td>
</tr>
<tr>
<td>A. 102</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Jetnet Radio &amp; Phonograph Co.</td>
<td>Detroit, Mich.</td>
<td>Orchestra</td>
</tr>
<tr>
<td>A. 103</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Chesapeake Tel. Co.</td>
<td>Washington.</td>
<td>Market News followed by Concert (Mon. Wed. and Fri.)</td>
</tr>
<tr>
<td>A. 17</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Sears-Roebuck &amp; Co.</td>
<td>Chicago, Ill.</td>
<td>Music and Concert</td>
</tr>
<tr>
<td>A. 10</td>
<td>12.30 p.m.</td>
<td>11.30 a.m.</td>
<td>Westinghouse Elec. &amp; Mfg. Co.</td>
<td>Pittsburgh, Pa.</td>
<td>Children's Hour</td>
</tr>
<tr>
<td>A. 104</td>
<td>12.30 a.m.</td>
<td>11.30 a.m.</td>
<td>John Wanamaker</td>
<td>Philadelphia, Pa.</td>
<td>Dinner Concert</td>
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Magnadyne Super-Het arranged convenient to purchase outright.

For SHAW'S 3 4 7 terminals used on several Radio Press Sets.

In Wireless, together, with a skilled panel, is purchased.

None terminals -STEP CAT.

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Extra.

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D.E., 66.

G. R. C. Push-Pull System.

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As described in this issue by Mr. A. S. Clark.

1 Potentiometer, M.H

2 G.R.C. Single Circuit Telephone Jack

9 Delco Dual Indicators

6 Leaks, 5, on Base

2 A.T.S. Fixed Resistance, D.

6 A.T.S. Fixed Resistance, D.E.

2 C.C. Condensers, 0.0005

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MODERN WIRELESS

"But I can't afford to scrap my 2-valve Set," said Dick Rogers.

Leslie Hillman was building the latest "Modern Wireless" Harmony Four and his friend Dick Rogers had just dropped in to see what progress he had made.

Y.ES," said Dick, "I should certainly like to build up this Set. A fellow at the office has been telling me of the wonderful results he has had from it. But I can't afford to scrap my 2-valve Reflex." "No need to," answered Leslie, "why not use the parts as far as they go and buy the remainder? Just a minute while I get my Pilot Manual..." Here you are! Page 33 gives the full list of parts you need for a Harmony Four. Now let's make a list of all the parts you already have. So they wrote down the list and Dick found to his satisfaction that he already had a great number of the components. "According to this Pilot Manual," he said, "I don't think I shall need to spend more than about £4 or so on new parts." "Don't forget the cabinet," put in Leslie. "Oh! I shan't trouble about that at first," replied Dick. "I see that it is a baseboard type of Set. If I keep the dust from it I can manage without a cabinet for a few weeks." "But... what about Peto-Scott's? Will they supply me with a wiring diagram and instructions if I don't buy all my parts from them?" You needn't worry about that," said Leslie, with a smile, "the Set I'm building now was originally a 3-valve 'All Concert de Luxe' which I built up under the Pilot System. That shows the wisdom of buying good components in the beginning," he added. "Well, I think I'll send for the parts tomorrow, and perhaps you'll come along next Saturday and give me a hand." "To be sure I will," answered Leslie.

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77 CITY ROAD, E.C.1
BRANCHES: 62 High Holborn, London, w.c.1
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January, 1926

FILAMENT RESISTANCES ON BAKELITE MOULDINGS

7 ohms - 2/6
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NEW WESTERN ELECTRIC LOUD SPEAKERS. Complete with Cord in Makers' Sealed Carton, 4,000 ohms ... 20s.; 2,000 ohms ... 20s.; 70 ohms ... 17s. 6d.

"THE CATALOGUE THAT SAVES YOU MONEY," to be seen in the Department of British Headphones, shows for 4d. 1,000,000 to a 30,000,000 volt controller, and covers all requirements. If you cannot call and inspect goods in our showrooms, between 2 a.m. and 6 p.m. it will be your to send 4d. for our Catalogue at once. Goods promptly despatched all over the world.

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Remused to any Resistance and made equal to none. Price quoted on receipt of instruments. Prompt Delivery.

THE VARLEY MAGNET CO.
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Established 25 years.
Phone: Woolwich 888.
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<tr>
<td>A. 16</td>
<td>12:35 a.m.</td>
<td>1:35 p.m.</td>
<td>Chicago, Ill.</td>
<td>KYW</td>
<td>Children's Hour (Tues., 7:15 E.S.T.)</td>
<td>15 min.</td>
<td></td>
</tr>
<tr>
<td>A. 106</td>
<td>12:30 a.m.</td>
<td>1:30 p.m.</td>
<td>Pittsburgh, Pa.</td>
<td>KDKA</td>
<td>Address from University (except Sat.)</td>
<td>2 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 70</td>
<td>1:00 a.m.</td>
<td>2:00 a.m.</td>
<td>St. Louis, Mo.</td>
<td>WJNO</td>
<td>Concert (Thurs., Silent)</td>
<td>2 hrs.</td>
<td></td>
</tr>
<tr>
<td>A. 64</td>
<td>1:00 a.m.</td>
<td>2:00 a.m.</td>
<td>Boston, Mass.</td>
<td>WJTM</td>
<td>Dinner Concert</td>
<td>4 hrs.</td>
<td></td>
</tr>
<tr>
<td>A. 105</td>
<td>1:00 a.m.</td>
<td>2:00 a.m.</td>
<td>Chicago, Ill.</td>
<td>WGN</td>
<td>Concert and News (Mon., Thur, and Sat.)</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 85</td>
<td>1:00 a.m.</td>
<td>2:00 a.m.</td>
<td>Springfield, Mass.</td>
<td>WSPR</td>
<td>News and Music (Mon., Wed., Fri.)</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 11</td>
<td>1:00 a.m.</td>
<td>2:00 a.m.</td>
<td>Kansas City, Mo.</td>
<td>WDAF</td>
<td>Concert or Musical Programme (except Sat.)</td>
<td>30 min.</td>
<td></td>
</tr>
<tr>
<td>A. 109</td>
<td>2:00 a.m.</td>
<td>3:00 a.m.</td>
<td>Chicago, Ill.</td>
<td>KDKA</td>
<td>Musical Programme (except Sat.)</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 110</td>
<td>2:00 a.m.</td>
<td>3:00 a.m.</td>
<td>Troy, N.Y.</td>
<td>WFCN</td>
<td>Musical Entertainment (except Mon.)</td>
<td>1-2 hrs.</td>
<td></td>
</tr>
<tr>
<td>A. 111</td>
<td>2:00 a.m.</td>
<td>3:00 a.m.</td>
<td>Portland, Oregon</td>
<td>KGW</td>
<td>Concert (Thurs., Silent)</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>A. 86</td>
<td>2:00 a.m.</td>
<td>3:00 a.m.</td>
<td>Detroit, Mich.</td>
<td>WJR</td>
<td>Musical Programme</td>
<td>2 hrs.</td>
<td></td>
</tr>
<tr>
<td>A. 87</td>
<td>2:00 a.m.</td>
<td>3:00 a.m.</td>
<td>Pittsburgh, Pa.</td>
<td>WABC</td>
<td>Vocal and Instrumental Music (except Mon.)</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 21</td>
<td>2:55 a.m.</td>
<td>4:55 a.m.</td>
<td>Philadelphia, Pa.</td>
<td>WOIO</td>
<td>Concert or Variety Programme (except Sat.)</td>
<td>50 min.</td>
<td></td>
</tr>
<tr>
<td>A. 22</td>
<td>2:55 a.m.</td>
<td>4:55 a.m.</td>
<td>Pittsburgh, Pa.</td>
<td>WOIO</td>
<td>Concert, Address, Dance Music (Mon. only)</td>
<td>2 hrs.</td>
<td></td>
</tr>
<tr>
<td>A. 24</td>
<td>3:00 a.m.</td>
<td>5:00 a.m.</td>
<td>Omaha, Nebraska</td>
<td>KDKA</td>
<td>Dinner Concert</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 88</td>
<td>3:00 a.m.</td>
<td>5:00 a.m.</td>
<td>Oakland, California</td>
<td>KDKA</td>
<td>Variety, &quot;Jewett, Jesters, and Paige Six&quot;</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 73</td>
<td>3:00 a.m.</td>
<td>5:00 a.m.</td>
<td>Los Angeles, Cal.</td>
<td>WABC</td>
<td>Concert (Mon., Tues., and Wed.)</td>
<td>1 hr.</td>
<td></td>
</tr>
<tr>
<td>A. 77</td>
<td>3:30 a.m.</td>
<td>5:30 a.m.</td>
<td>Fort Worth, Texas</td>
<td>KFI</td>
<td>U.S. Naval Observatory Time Signal, followed by U.S. weather forecast</td>
<td>Don. do.</td>
<td></td>
</tr>
</tbody>
</table>

**WEEK DAYS (Contd.).**
<table>
<thead>
<tr>
<th>No.</th>
<th>G.M.T.</th>
<th>Local Time prevailing</th>
<th>Station</th>
<th>Call Sign and Wavelength</th>
<th>Town.</th>
<th>Nature of Transmission</th>
<th>Approx. duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 26</td>
<td>3:30 a.m.</td>
<td>7:30 p.m. PST.</td>
<td>&quot;Morning Oregon&quot;</td>
<td>KGW 491.5 m.</td>
<td>Portland, Oregon</td>
<td>Market, Weather, News, Police Reports</td>
<td>15 min.</td>
</tr>
<tr>
<td>A. 62</td>
<td>3:30 a.m.</td>
<td>7:30 p.m. PST.</td>
<td>State College of Washington</td>
<td>KEAE 526 m.</td>
<td>Pullman's Washington, Los Angeles</td>
<td>Concert (Mon., Wed. and Fri.)</td>
<td>1½ hr.</td>
</tr>
<tr>
<td>A. 82</td>
<td>4:00 a.m.</td>
<td>8:00 p.m. PST.</td>
<td>&quot;The Times&quot;</td>
<td>KHJ 393 m.</td>
<td>Chicago, Ill.</td>
<td>Dance Orchestra and Popular Songs (except Mon.)</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 68</td>
<td>4:00 a.m.</td>
<td>10:00 p.m. CST.</td>
<td>Chicago Tribune Broadcasting Co.</td>
<td>WGN 370 m.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. 29</td>
<td>5:45 a.m.</td>
<td>11:45 p.m. CST.</td>
<td>&quot;Kansas City Star&quot;</td>
<td>WDAF 365.6 m.</td>
<td>Kansas City, Mo.</td>
<td>Musical Entertainment</td>
<td>1½ hr.</td>
</tr>
</tbody>
</table>

**SUNDAY**

<table>
<thead>
<tr>
<th>No.</th>
<th>G.M.T.</th>
<th>Local Time prevailing</th>
<th>Station</th>
<th>Call Sign and Wavelength</th>
<th>Town.</th>
<th>Nature of Transmission</th>
<th>Approx. duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. 113</td>
<td>9:45 p.m.</td>
<td>1:45 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 309 and 64 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Vesper Service</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 91</td>
<td>10:00 p.m.</td>
<td>4:00 p.m.</td>
<td>John Wanamaker</td>
<td>WOO 508.2 m.</td>
<td>Philadelphia, Pa.</td>
<td>Organ Recital</td>
<td>—</td>
</tr>
<tr>
<td>A. 114</td>
<td>11:15 p.m.</td>
<td>5:15 p.m.</td>
<td>Shepherd Stores</td>
<td>WNAC 280.3 m.</td>
<td>Boston, Mass.</td>
<td>Church Service</td>
<td>—</td>
</tr>
<tr>
<td>A. 91</td>
<td>11:30 p.m.</td>
<td>5:30 p.m.</td>
<td>Henry Field Seed Co.</td>
<td>KFV 286 m.</td>
<td>Shenandoah, Iowa</td>
<td>Divine Service</td>
<td>—</td>
</tr>
<tr>
<td>A. 115</td>
<td>11:30 p.m.</td>
<td>5:30 p.m.</td>
<td>Pittsburg Press</td>
<td>WCAE 461.5 m.</td>
<td>Pittsburgh, Pa.</td>
<td>Dinner Concert, Will Peni. Hotel Dinner Concert</td>
<td>—</td>
</tr>
<tr>
<td>A. 116</td>
<td>11:30 p.m.</td>
<td>5:30 p.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 309 and 64 m.</td>
<td>Pittsburgh, Pa.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. 59</td>
<td>Midnight</td>
<td>7:20 p.m.</td>
<td>Chesapeake Tel. Co.</td>
<td>WCAP 496 m.</td>
<td>Washington, D.C.</td>
<td>Musical Programmes and Organ Recitals</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 31</td>
<td>Midnight</td>
<td>6:00 p.m.</td>
<td>Woodmen of the World</td>
<td>WOOAW 526 m.</td>
<td>Omaha, Nebraska</td>
<td>—</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 117</td>
<td>Midnight</td>
<td>7:00 p.m.</td>
<td>General Elec. Co.</td>
<td>KFMY 337 m.</td>
<td>Schenectady, N.Y.</td>
<td>—</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 118</td>
<td>Midnight</td>
<td>7:00 p.m.</td>
<td>Carleton College</td>
<td>WGY 379.5 m.</td>
<td>Worthfield, Minnesota</td>
<td>—</td>
<td>2 hrs.</td>
</tr>
<tr>
<td>A. 66</td>
<td>12:00 a.m. (Monday)</td>
<td>5:00 a.m.</td>
<td>American Tel. &amp; Tel. Co.</td>
<td>KFI 182 m.</td>
<td>New York</td>
<td>—</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 33</td>
<td>12:30 a.m. (Monday)</td>
<td>5:30 a.m.</td>
<td>General Elec. Co.</td>
<td>WGY 379.5 m.</td>
<td>Schenectady, N.Y.</td>
<td>—</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 32</td>
<td>12:30 a.m. (Monday)</td>
<td>5:30 a.m.</td>
<td>Strawbridge &amp; Clothier</td>
<td>WFT 365 m.</td>
<td>Philadelphia, Pa.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. 92</td>
<td>12:30 a.m. (Monday)</td>
<td>5:30 a.m.</td>
<td>Henry Field Seed Co.</td>
<td>KFNF 260 m.</td>
<td>Shenandoah, Iowa</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. 30</td>
<td>12:45 a.m. (Monday)</td>
<td>5:45 a.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KDKA 309 and 64 m.</td>
<td>Pittsburgh, Pa.</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>A. 36</td>
<td>1:00 a.m. (Monday)</td>
<td>6:00 a.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>KIY 539 m.</td>
<td>Chicago, Ill.</td>
<td>Service and Musical Programme</td>
<td>—</td>
</tr>
<tr>
<td>A. 40</td>
<td>1:00 a.m. (Monday)</td>
<td>6:00 a.m.</td>
<td>Westinghouse Electric &amp; Mfg. Co.</td>
<td>WBZ 333.1 m.</td>
<td>Springfield, Mass.</td>
<td>Concert or Music, etc.</td>
<td>—</td>
</tr>
<tr>
<td>A. 77</td>
<td>1:00 a.m. (Monday)</td>
<td>6:00 a.m.</td>
<td>Sears Roebuck &amp; Co.</td>
<td>WLS 395 m.</td>
<td>Chicago, Ill.</td>
<td>Church Service</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 116</td>
<td>2:00 a.m. (Monday)</td>
<td>7:00 a.m.</td>
<td>Watch Tower</td>
<td>WJBH 271.6 m.</td>
<td>Staten I., N.Y.</td>
<td>Bible Lecture and Sacred Music</td>
<td>1½ hrs.</td>
</tr>
<tr>
<td>A. 93</td>
<td>2:00 a.m. (Monday)</td>
<td>7:00 a.m.</td>
<td>Wilbur Glenn Volta</td>
<td>WOBD 341.6 m.</td>
<td>Zion, Ill.</td>
<td>Concert</td>
<td>—</td>
</tr>
<tr>
<td>A. 120</td>
<td>3:15 a.m. (Monday)</td>
<td>8:15 a.m.</td>
<td>Woodmen of the World</td>
<td>WOA 526 m.</td>
<td>Omaha, Nebraska</td>
<td>Chapel Service</td>
<td>1 hr.</td>
</tr>
<tr>
<td>A. 38</td>
<td>3:30 a.m. (Monday)</td>
<td>9:30 a.m.</td>
<td>&quot;Morning Oregonian&quot;</td>
<td>KGW 491.5 m.</td>
<td>Portland, Oregon</td>
<td>Church Service</td>
<td>1½ hrs.</td>
</tr>
<tr>
<td>A. 94</td>
<td>4:00 a.m. (Monday)</td>
<td>10:00 a.m.</td>
<td>General Electric Co.</td>
<td>KG 361 m.</td>
<td>Oakland, California</td>
<td>Divine Service</td>
<td>—</td>
</tr>
<tr>
<td>A. 43</td>
<td>5:00 a.m. (Monday)</td>
<td>11:00 a.m.</td>
<td>Pacific Coast Broadcasting Station</td>
<td>WRAP 475.9 m.</td>
<td>Fort Worth, Texas</td>
<td>Dance Orchestra</td>
<td>1 hr.</td>
</tr>
</tbody>
</table>
This day twelvemonth will tell you

It is not what you pay to-day in first cost but what you'll have paid in charging fees during the next twelve months that will prove the wisdom of your accumulator choice.

Perhaps you selected hap-hazardly and chose the first offered to you. Maybe already you have noticed that it needs to be recharged rather more often than when it was new. That's the worst of accumulators built to a price.

We could make an accumulator at half the price but it would not be an Oldham and it would certainly not be made under the Special Activation Process. And after quite a short while you'd be complaining of its lost power.

So we make the Oldham Accumulator to a definite standard of performance. We make it to hold up under all circumstances. Even if left idle for several weeks on end it must not sublimate.

And above all it must deliver up the whole of the electrical energy stored within its four walls.

Ask your Dealer to let you examine one. Note its robust case, its specially constructed plates—its generous moulded coloured terminals—its screw-in vent plug.

Compare it with any other Accumulator and you'll inevitably choose the Oldham—none other can compare with it for honest value.

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Glasgow: 273 Wellington Street

Special Activation Process

Oldham Standard Accumulator
Supplied in 2-volt Units as follows:

| No. | Capacity | Price
<table>
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<tr>
<td>10amp</td>
<td>0.9 amp</td>
<td>8/6</td>
</tr>
<tr>
<td>20amp</td>
<td>1.1 amp</td>
<td>11/1</td>
</tr>
<tr>
<td>30amp</td>
<td>1.3 amp</td>
<td>16/1</td>
</tr>
<tr>
<td>40amp</td>
<td>1.6 amp</td>
<td>18/9</td>
</tr>
<tr>
<td>50amp</td>
<td>2.0 amp</td>
<td>21/4</td>
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</tbody>
</table>

4-volt and 6-volt at proportionate prices.

Oldham N.T. Accumulator
An entirely new high-grade Accumulator, with cells constructed of stout glass boxes instead of flimsy test tubes. Each cell can be tapped by a wrapper plug. Assembled in 20-volt Units. Price 20s. per 20-volt Unit and two such. Particulars post free.
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BOWYER-LOWE CTD. LETCHWORTH

January, 1926

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Tested Super-Heterodyne Transformers

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Neutrodyne Condensers

Designed for use in Neutrodyne circuits, this instrument has also proved excellent sensitive as a Vernier when used in parallel with an ordinary condenser. It is invaluable in Super-Het. circuits. Fitted in panel with single screw and 1/4 inch hole for speaker. PRICE 5s.

The FOUR-SQUARE Ball Bearing Condenser

This precision instrument meets the highest demands of the most critical experiments. Its brass frame, soldered in position, and mounted on ball bearings, are balanced to give tuning of the most accurate order. The instrument has the lowest losses of any condenser yet devised, and yields signals of remarkable strength and purity. Oscillation on wavelengths below 29 metres is a simple matter with this instrument. Each condenser has a four alternative capacities, three single and one double. The two models cover most amateur needs. Model I. Nominally .0003 Mfd., (converts to .00015 and .000075 single; and .00015 dou- bles). PRICE 28s. Model II. Nominally .0005 Mfd., (converts to .00035 and .00025 single; and .00035 doubles). PRICE 30s. These are available in ratios of 1 to 1, 2 to 1, 3 to 1, 4 to 1, 5 to 1, 6 to 1, 7 to 1, 8 to 1, 9 to 1, 10 to 1, 11 to 1, 12 to 1, 13 to 1, 14 to 1, 15 to 1, 16 to 1, 17 to 1, 18 to 1, 19 to 1, 20 to 1, 21 to 1, 22 to 1, 23 to 1, 24 to 1, 25 to 1, 26 to 1, 27 to 1, 28 to 1, 29 to 1, 30 to 1, 31 to 1, 32 to 1, 33 to 1, 34 to 1, 35 to 1, 36 to 1, 37 to 1, 38 to 1, 39 to 1, 40 to 1, 41 to 1, 42 to 1, 43 to 1, 44 to 1, 45 to 1, 46 to 1, 47 to 1, 48 to 1, 49 to 1, 50 to 1, 51 to 1, 52 to 1, 53 to 1, 54 to 1, 55 to 1, 56 to 1, 57 to 1, 58 to 1, 59 to 1, 60 to 1, 61 to 1, 62 to 1, 63 to 1, 64 to 1, 65 to 1, 66 to 1, 67 to 1, 68 to 1, 69 to 1, 70 to 1, 71 to 1, 72 to 1, 73 to 1, 74 to 1, 75 to 1, 76 to 1, 77 to 1, 78 to 1, 79 to 1, 80 to 1, 81 to 1, 82 to 1, 83 to 1, 84 to 1, 85 to 1, 86 to 1, 87 to 1, 88 to 1, 89 to 1, 90 to 1, 91 to 1, 92 to 1, 93 to 1, 94 to 1, 95 to 1, 96 to 1, 97 to 1, 98 to 1, 99 to 1, 100 to 1.

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BOWYER-LOWE CT. LETCHWORTH

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January, 1926

MODERN WIRELESS

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<tbody>
<tr>
<td>A. 41</td>
<td>11.30 p.m.</td>
<td>6.30 p.m. E.S.T.</td>
<td>General Electric Co.</td>
<td>WGY 370.5 and 1630 m.</td>
<td>Schenectady, N.Y.</td>
<td>Mon., Tues., Wed., and Thurs.— Hotel Music relaxed Friday—Children's story</td>
<td></td>
</tr>
<tr>
<td>A. 45</td>
<td>12.30 a.m.</td>
<td>7.30 p.m. E.S.T.</td>
<td>John Wanamaker</td>
<td>WOO 508.2 m.</td>
<td>Philadelphia, Pa.</td>
<td>\—</td>
<td></td>
</tr>
<tr>
<td>A. 46</td>
<td>7.0 p.m. C.S.T.</td>
<td>6.0 p.m. E.S.T.</td>
<td>Woodmen of the World</td>
<td>WOAW 526 m.</td>
<td>Omaha, Nebraska</td>
<td>Thurs. and Fri.—Instrumental Music Thurs. and Sat.—Concert Mon., Wed., Sat.—Musical Programme, Talks</td>
<td></td>
</tr>
<tr>
<td>A. 47</td>
<td>8.0 a.m. E.S.T.</td>
<td>Strawbridge &amp; Clothier</td>
<td>WGT 395 m.</td>
<td>Philadelphia, Pa.</td>
<td>\—</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. 48</td>
<td>6.0 a.m. E.S.T.</td>
<td>L. Bamberger &amp; Co.</td>
<td>WOR 495 m.</td>
<td>Newark, N.J.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A. 49</td>
<td>8.0 a.m. E.S.T.</td>
<td>Willard Storage Battery Co.</td>
<td>WTAM 389 m.</td>
<td>Cleveland, Ohio</td>
<td></td>
<td>Mon. and Wed.— Concert Saturday—Dance Programme</td>
<td></td>
</tr>
<tr>
<td>A. 50</td>
<td>8.0 a.m. E.S.T.</td>
<td>Willard Storage Battery Co.</td>
<td>WTAM 389.4</td>
<td>Cleveland, Ohio</td>
<td></td>
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<tr>
<td>A. 51</td>
<td>9.0 a.m. E.S.T.</td>
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SPECIAL DAYS. (Days refer to local time)

Letters From Our Readers

Sir,—I made the set in the enclosed photograph from various designs in your Radio Press series, and am really delighted with same. I might add that I have also built and used your "Family Four" described by Mr. Harris in Envelope No. 2, and some of the crystal circuits described in the Constructor.

The main set is the "Transatlantic Four," described by Mr. Harris in Modern Wireless for November, 1924, which you will see at the bottom of the cabinet. Above, on the left-hand side, is the "Fool-Proof Crystal Set," from the Wireless Constructor, January, 1925, and designed by Mr. Harris also, but instead of the "Eureka" detector I have substituted a "Burnsdep." This is connected by a D.P.D.T. switch to a "Two-Valve Power Amplifier," as described by John Underdown in Modern Wireless, December, 1924, and this is also connected by the other throw of the switch to the "Transatlantic," so that by cutting out with the switch provided I am able to use as a five-valve with two L.F. stages.

In the small cupboard let in the top of the supporting cabinet is an "A.B.C. Wave Trap," which may be used if desired. This panel also contains the plugs for connecting to the accumulator at the base, on the right-hand side is the H.T. battery.

"A B.C. Wave Trap," which may be used if desired. This panel also contains the plugs for connecting to the accumulator at the base, on the right-hand side is the H.T. battery.

An Improved Two-valve Receiver

Sir,—I wish to thank you very much for the "Improved Two-valve Receiver" described in the January, 1925, issue of Modern Wireless, by Stanley G. Rattes, M.I.E. I had a 2-valve H.F. and detector tuned anode set and converted it to the above-named set, and the results are more than 100 per cent. improved. I get all B.B.C. main stations excepting Cardiff at very good phone strength. Chelmsford, 2LO and 6BM I have to tone down for comfortale strength. On the loud-speaker I get Chelmsford, 2LO, 6BM and 3NO. The first two are good for an ordinary-sized room, the two latter are heard comfortably. Several Continental stations come in very loud on phones. Am using Marconi Osram D.E.3 valves, and get these results both with a 4-volt accumulator and with two dry cells in series. I have now put in a separate lead to the amplifier so that I can put up to 10 v. on the detector and up to 80 v. on the L.F. valve. Again thanking you,—Yours truly.

Horace R. Ward,

Woking.

E. M. Hains
Some Common Faults
By JOHN UNDERDOWN

Last month I dealt with the subject of certain faults peculiar to Supersonic-heterodyne receivers, and in this article it is proposed to consider briefly a number of more common difficulties chiefly experienced with straight sets.

Induction Effects from Alternating Current Mains

A very interesting case of induction from alternating current wiring has recently come to my notice, and probably the remedies which proved efficacious will be of interest to a large number of readers who are similarly troubled.

A straight, general-purpose type 3-valve receiver employing the circuit shown in Fig. 1, was installed for convenience in a wooden shed close to the house for which the set was to be used. The disposition of the garden and the receiving shed was such that long leads had to be taken through several rooms in the house in order to reach that in which it was desirous to have the loud-speaker. A preliminary test in the shed gave good loud-speaker results from the local station, ZLO, fifteen miles away. When, however, the loud-speaker was taken by means of twin flex leads to the room previously mentioned, the signals were almost completely drowned by a coarse, grating continuous howl which sounded like the well-known tuning note with a loud buzz superimposed upon it.

Since the house lighting supply was

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Made in six sizes, viz., 0·5, 1·0, 2·0, 3·0, 4·0 and 5·0 megohms.
2/6 each.

THE EDISON SWAN ELECTRIC CO., LTD., 123/5, Queen Victoria Street, E.C.4.
Faults in Two H.F. Transformer Coupled Receivers

For listening to American broadcasting stations, receivers employing circuits on the lines of that shown in Fig. 3 proved both effective and simple to handle, more especially if the two H.F. transformers are tuned by a dual condenser.

For efficient working it is essential, in this case, that the two H.F. transformers, L₁, L₂ and L₃, should be perfectly matched, as also should the two halves of the dual condenser, shown as Cₕ and Cₗ, respectively. Where good components are employed and the wiring is carried out in a suitable manner, little trouble is experienced, but small departures from these conditions often give rise to very puzzling faults.

Unsuitable Dual Condensers

An unsuitable type dual condenser, although perfectly matched as far as capacity is concerned, generally results, in operation, in the set becoming absolutely unmanageable through uncontrollable oscillation. Where this component is responsible for trouble, it will generally be found possible to stabilise the set and obtain some results by dimming either of the H.F. valves on their respective filament resistances, and by no other means can oscillation be brought under control. The only remedy here is that of replacing the dual condenser by one of the well-known types proved to give satisfactory working.

Bad Matching

Where difficulty is experienced in obtaining oscillation with a set of the type shown in Fig. 3, employing a dual condenser for Cₕ and Cₗ, bad matching of either the H.F. transformers or of the two halves of the dual condenser should be suspected. A test which throws useful light on the degree of matching of the H.F. transformers is to remove the first valve V₁ and its associated

---

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It gives distortionless amplification on a sensitive background, and its immunity from breakdown is remarkable.

Made in ratios of 1 to 1, 1 to 2, 1 to 3, 1 to 4, and 1 to 5, there is a model to suit all purposes.

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MODERN WIRELESS

H.F. transformer and plug from the grid of $V_1$, to the socket of the secondary winding of the first H.F. transformer which is connected to the grid of $V_2$.

Testing the Matching

If now a weak transmission is tuned in and the first transformer is inserted in place of the second, it will readily be seen, according to whether alteration of the setting of the dual condenser is required (all other controls remaining untouched), whether the two transformers are properly matched. If by carrying out this test on several sharply tuned weak transmissions on different wavelength covered by the transformers, it appears that the latter are correctly matched is probable that the two halves of the dual condenser are not matched or that the particular wiring adopted is responsible for the curious degree of weakness.

By temporarily connecting a small vernier condenser in parallel with each half of the dual condenser in turn, when a weaker transmission is tuned in, it should be possible to adjust the tuning and determine where the fault lies.

A Potentiometer Fault

Should the potentiometer break down at its positive end, the set will behave in an extremely stable manner, and only an alteration to permit the application of direct magnetic reaction will give oscillation. With batteries and valves removed, the “click” telephone test should be carried out across the potentiometer winding to locate a fault of this type. If one side of the low-tension battery is connected to one end of the potentiometer winding and one tag of a pair of telephones to its other terminal, tapping along the bare portion of the wire will give loud “plonks” in the telephones until the point is passed where the break has occurred.

From the break to the other end of the winding no clicks or only very feeble ones should be heard. With certain potentiometers it may be possible to repair the break, but in most cases it is best to purchase a new component.

Fig. 3. If $C_1$ and $C_2$ are the two halves of a dual condenser, the transformers $L_1$, $L_2$, and $L_3$ should be matched to obtain best results.

- Some Neutrodyne Faults

Neutrodyne receivers are becoming increasingly popular for long-distance reception, and some of the faults experienced in this type of set, and their remedies, will prove of interest.

With the receiver employing the simple 2-valve circuit of Fig. 4, the tuning of the condenser $C_1$ was found to vary from night to night, and sometimes during a

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A complete and compact Moving Coil Testing Set. Beautifully balanced and perfectly accurate. In every high resistance of 333.3 ohms per volt makes the Voltmeter almost electrostatic, which is essential for measurement of H.T. Battery Voltage. It measures every circuit in your Valve Set, and the resistance of all your accessories. It enables you to obtain perfect reception and to know exactly what methods you have attained it. Will last a lifetime with ordinary care.

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January, 1925

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The Bowyer-Lowe POPULAR Low Loss Condenser

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transmission itself. Previous to any alteration being required on the setting of the aerial condenser C, a plop was always heard in the telephones.

**A Short Circuit**

This at once gave a clue to the trouble, which was due to the Neutrodyne condenser, shown as N.C., shorting through the plates touching, these remaining together after the set had been jarred. This placed the neutralising coil $L_3$ in parallel with the aerial coil $L_1$, which connection, of course, resulted in the inductance of the two coils being less than that of either employed separately, thus necessitating an increase of capacity with C.

Another trouble often experienced is that one setting of the neutrodyne condenser N.C. does not hold for the whole frequency-band covered by the neutrodyne unit $L_3, L_1$. In certain cases two settings are required, one holding, for example, roughly from 300 to 400 metres ($10,000$ to $7,500$ Kc) and the other from 300 to 400 metres, ($1000$ Kc to $600$ Kc). Investigation has sometimes shown that this is due to the necessity of changing the size of the aerial coil to cover the whole of the broadcast frequency band. This difficulty can usually be overcome by employing either constant aerial tuning or the so-called auto-coupled arrangement shown in Fig. 4. By either means a suitable coil can be made to cover practically the whole of the $500$ to $1000$ Kc range, thus obviating any necessity for re-neutrodyning.

**Fig. 4.-A short circuit on the condenser N.C. caused a puzzling fault**

**CAN YOU TRACE FAULTS?**

Obtain a copy of the standard book on fault finding and get rid of the feeling of helplessness which is apt to assail one when a set breaks down. "Wireless Faults and How to Find Them," by R. W. Hallows, M.A. (Radio Press Ltd., post free, 1s. 8d.), is the standard book on the subject, and makes the tracing of even obscure faults a simple matter of working almost mechanically through a table of tests.

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FROM the earliest stages in the manufacture of Bretwood Wireless Components, exactitude is the dominating factor. The material with which each is made, the detailed construction and final tests are all guided by the utmost precision. Such painstaking exactitude ensures the quality and efficiency of every Bretwood Component reaching a very high standard, which is guaranteed to be maintained for a period of three years.

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The Vernistat absolutely safeguards valves from accidental burn-outs, as three complete turns of the knob are required to bring in or take out the whole resistance.

For Bright Emitter Valves, Resistance 5 ohms, 6/-
For Dull Emitter Valves, Resistance 30 ohms, 6/-

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Write for Catalogue No. 559/3 describing all Efesca Components

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Combined Filament Resistance and Valve Holder

A GARNETT’S combined filament resistance and valve holder has been submitted to us for test.

Description of Component

This component is designed for back-of-panel mounting, and incorporates the filament resistance and valve holder in one unit. One-hole fixing is employed, and the rheostat knob is the only portion visible above the panel surface. This knob is of fluted black moulded material, a curved white arrow on the top of the knob indicating the direction of rotation for increasing the filament current. A brass nut is embedded in the knob, and enables it to be screwed on to the spindle. A circular locknut of almost the same diameter as the knob is provided, while one-hole fixing is secured through the agency of a screwed sleeve concentric with the spindle. Two nuts screw on to this, one to fix the sleeve to the panel, and the other to secure a metal plate to the sleeve. This metal plate serves to support the rheostat.

The resistance element of this rheostat consists of resistance wire wound tightly on a cylinder of insulating material. The rheostat arm is of curved section, so that as it sweeps over the resistance it makes smooth contact and does not scrape. It is fixed to the spindle by two nuts, and a spring washer causes it to be pressed firmly against the resistance winding. A stop is provided at the “On” position, and at the other end the contact arm is free to move clear of the resistance winding, so that the valve can be switched off by means of the rheostat knob.

The resistance element and rheostat arm are supported by the metal plate beneath the spindle.

That part of the metal plate above the spindle carries a small right-angled insulating panel, which is fixed to it by two screws. This panel is about 2¾ in. long, and at its distant end four brass valve sockets are inserted. These are tapped at their lower ends and screws are inserted, and when screwed up these hold soldering tags in place against the base of the sockets. These tags are of sufficient length, but there is no adequate provision for fixing connections without the aid of soldering. Sufficiently large terminals are, however, provided for the rheostat.

Laboratory Tests

The resistance of this rheostat was found to be 28 ohms, which is sufficient for controlling valves of the 1100 amperes class with a 4-volt battery. On test the rheostat was found to work smoothly and to be practically silent in operation. Rotation through 90 degrees was sufficient to turn the rheostat arm from the “On” to the “Off” position. The insulation resistance of the valve sockets was found to be infinite, and it was impossible to insert a valve in the wrong position so as to damage the filament by contact with the anode socket. The fit for several types of valves was found to be satisfactory.

Elwell Receiving Set

M. ESHER, C. F. ELWELL, LTD., have submitted one of their Statophone receivers for test at our Elstree laboratories.

Description of Set

The complete receiver, which is self-contained except for the aerial system and low-tension battery, is enclosed in a mahogany cabinet. Two small doors at the base of the cabinet permit access to the tuning controls for tuning and reaction, and also a filament switch for three valves and an additional switch for a fourth valve when working distant stations. This last valve does not in any way affect the position of the other controls. Two large doors at the rear of the cabinet allow the components to be examined, while the loudspeaker opening at the front of the cabinet is protected by a fine-mesh net. Two neat slabs are supplied containing the tuning coils, one to cover the British broadcasting band and the other for the Daventry and high wavelength stations. These are inserted into position in a slot on the front control panel.

Laboratory Tests

The set was subjected to an aerial test, using the Mullard valves supplied—viz., 2 H.F. red ring, one D.F.A.4, and one D.F.A.1. The results of these tests can be summarised in the following manner:

(1) Various stations are quite easily obtained, most of the B.B.C. stations being heard on the loudspeaker.

(2) Operating the tuning condenser produced very sharp resonance effects, and on slightly detuning from London the signals are cut down rapidly to a definite value. On further detuning, London’s signal strength only decreases.
slightly from this definite value, and consequently Bournemouth is received with 2LO as a background. This effect was still obtained when receiving Birmingham, but in this case the reduced background was not strong enough to unduly interfere with good reception.

(3) There are only two tuning controls to manipulate, and the whole set is easy to operate.

(4) With the loud-speaker supplied, clear reception was possible provided the signals were not too loud, but with loud signals a pronounced rattle in the loud-speaker was an unpleasant feature.

The Mullard P.M.4 Valve

Our readers will probably have noticed the appearance of the new Mullard Power Valve.

Three Valves of the P.M.4 type have been sent to us for test, a practice which has previously been recommended as it enables us to test their uniformity. These valves are of the 100 milliamperes class, and the rated filament voltage is 3-8 volts. The anode voltage necessary is 30 to 100 volts, which is rather lower than for most other power valves. Using these values, the makers state that the approximate impedance is 9,000 ohms, while the amplification ratio is 6, and the total emission 20 milliamperes.

Laboratory Tests

The valves submitted have been tested by us on our valve test bench, and the general results are shown in the accompanying table. It will be seen that both the impedances and amplification ratios are somewhat higher than the manufacturers state, but in no case is the discrepancy large enough to affect seriously the operation of the valve. The flash emission is also high, but this is an error on the right side. In one case the flash emission was exceptionally high, but the other constants of this valve were not very different from those of the other two. Moreover, on testing it in a receiving set, its performance was not appreciably different from the others.

The general performance of these valves was found to be quite good, and to compare favourably with that of other valves of the same type. A special feature was the entire absence of microphonie noises, which is in accordance with the maker's claim. The valves were found to handle quite a large amount of power without distortion, and can be recommended for general loud-speaker work.

Amateurs should, however, confine themselves to as low a filament voltage as will give the necessary results. On test it was found that 3.0 to 3.2 volts gave quite an adequate anode current. Increasing the voltage above the latter value resulted in no appreciable increase in anode current, while the filament current rose above the rated value of 100 milliamperes.

The valves are pipless, while the black cap is of a hard insulating material.

(Continued on page 551).
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**No. 1 W.**

*Standard Pocket Lamp Size—* 4½ volt with patent spiral wire terminals and plug sockets to take Wander Plugs.*

*Note:* 100. = 34 volts.

*Used units replaced easily.*

Connect as illustrated

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- Rs. 2. = 6½ volts, 3 volt tapping. *Price 3/-
- Rs. 4. = 6½, 4½ volt tapping. *Price 5/-
- Rs. 5. = 6½, 4½, 3½ volt tapping. *Price 7/-
- Rs. 6. = 6½, 4½, 3½, 2¾ volt tapping. *Price 10/-

To connect in Series insert straight Terminal in Spiral of next battery, Bend spiral and thus ensure permanent electrical connection without soldering.

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Is Short-Wave Reception Worth While?

By L. H. THOMAS (6QB)

MOST of the radio enthusiasts who have been keen enough to acquire a working knowledge of the Morse Code need, by now, no proof of the extraordinary interest attaching to short-wave reception. The less fortunate listeners, however, who are only interested in the reception of telephony, must often be worried by the question, "Is Short-Wave Reception Worth While?"

The average broadcast listener's impression of long-distance reception on short-waves is intimately connected with cold, the early hours of the morning, and the unpleasant sensation of getting out of bed in obedience to the call of an alarm clock.

No Early Rising

The object of this short article is to show him that this need not necessarily be the case, and to give an idea of what may be heard with a short-wave receiver of quite average efficiency.

In the first place, it is possible to receive American short-wave broadcasting as early as 10 p.m. on a night when the mysterious "conditions" that govern short-wave reception are fairly favourable.

KDKA, the Westinghouse Company's station at Pittsburgh, is working on 61 metres (4920 Kc.), commencing at about 5 p.m. American time, and therefore may be heard here at about 10.30 p.m. WGY, however, the station of the American G.E.C. at Schenectady, is carrying out experimental transmissions on 40.8 metres (7350 Kc.) and has been heard by the writer as early as 9 p.m. corresponding to 4.15 p.m. by their time. His telephony is often strong enough to be heard three or four feet from the "phones with an ordinary receiver of the "Detector and Note-Mag." type.

These two stations should be received without the least difficulty on any Broadcast receiver which has been slightly redesigned, the chief objects in view being the shortening and spacing of all leads, and the use, whenever possible, of "low-loss" components, especially where coils and condensers are concerned.

The Antipodes

For the more ambitious listener who has hopes of receiving Australia or New Zealand without the trouble of learning Morse Code, it will be a consolation to learn that several New Zealand "amateur" stations are audible in this country when using telephony, sometimes at quite good strength. The reception of these stations does not necessitate a nightly vigil, as the best time to listen for them is between 7.30 and 8.30 p.m. On the morning of December 12 the writer received intelligible telephony from New Zealand and Australia at 6.10 a.m., using the two-valve receiver illustrated on this page.

Broadcasting

The Australian broadcasting station 2FZ has also been heard in this country on 45 metres (6607 Kc.). The best time to listen for Australia is not the same as for New Zealand, but is between 6.30 and 7.30 p.m.

Learn Morse

The would-be short-wave enthusiast will, however, find it very well worth his while to persevere at the Morse Code. The best way of learning it is, after memorising the letters, simply to keep listening to Morse stations that are sending faster than he can read, and not to be discouraged even if he only succeeds in identifying one letter in each word.

He will find himself almost unconsciously receiving more and more of every transmission to which he listens, and, when he is "Morse perfect," he may look forward to receiving almost every active country in the world without much difficulty. Short-wave reception is, therefore, well worth any trouble that may be spent in preparation.

The writer does not, however, recommend the use of one receiver for both the ordinary broadcast wavelengths and the short waves. It will certainly be preferable to keep a separate receiver for the latter purpose, particularly if the reader's broadcast receiver employs radio-frequency amplification, which is of little or no use at the higher frequencies.

One stage of audio amplification will be all that is needed for the reception of KDKA and WGY; in fact, the writer employs a stage of resistance coupled amplification for his own receiver.

A CORRECTION.

The "Liberty" detector employed in the crystal set in our last issue is made by the Radi-Aire Electrical Co., Ltd., and not by Mors Radios, Ltd., as was stated.
Here are two more of the Utility range. Like all other Utility Components these are unconditionally guaranteed to give you complete satisfaction. If they do not, return them direct to us, and we will at once replace them. That is a plain guarantee and it will be plainly carried out.

"UTILITY" LOW LOSS CONDENSERS.

End-plate losses halved as only one end-plate is used. All solid dielectric external to electrostatic field. Exceptionally long spindle bearing automatically taking up wear and eliminating end-play and end-thrust. So to a Reduction Vernier Condenser available at slight extra cost. Utility one hole fixing.

"UTILITY" VALVE SWITCH UNIT.

Combines switch valve holder and rheostat all in one unit, enabling the listener to control a valve and switch it in and out whilst still preserving the continuity of the circuit. Lower self-capacity, less wiring and lower cost than separate components. One hole fixing. Supplied complete with wiring diagram and with 6 or 30 ohms Resistances as desired.

For 1-3 valves. Types HA or HB. £4 15s.
For 3-5 valves. Type HB. £4 15s.
For 5 valves or more. Types A or B. £5 15s.

Every component used in the "Sparta" is the outcome of equally careful thought—it is, in fact, the co-ordination into one instrument of all the worthwhile features in Loud Speaker construction.

"SPARTA"
The Speaker for 1926

New resolutions, new endeavours—progression in the world of wireless. And yet our energies are not fully productive unless the loud speaker—the voice of the receiver—performs its duty supremely well. Lucky the man who owns a "Sparta"! This speaker, designed by master craftsmen, will awaken your receiver to vigorous tuneful life. Down in the base lies the secret of its extraordinarily good reproduction—the tone modulator. Provided with six stops it allows perfect tone control throughout the complete range of vocal and instrumental reproduction.

Ask your Dealer for a demonstration, and let your own ears prove that the "Sparta" is different.

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Fuller's United Electric Works, Ltd., Woodland Works, Chadwell Heath, Essex.

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Every one of these highest
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FULLY GUARANTEED.

Save Money on Valves!

RADI#N DE '26 3-valv. (H.F. or L.F.) 10/6.
RADI#N 2 v. DE '26 (H.F. or L.F.) 10/6.
RADI#N PYRAMID Power Valves 3-v., 4-v.
& 5-v. types. Guaranteed Filaments 22s. 6d.
(The first power valves on the market).
RADI#N G.F. 2 4-v. Bright valve only 7/6
NEW TYPES JUST OUT !
New 2-volt Power Valve 12/6
New special detector valve 7/6
Radion iron Ring Antiphon Dall
Emitter 06 Valve 12/6
From selected dealers at direct cost price.
RADI#N LTD., Bulbring, Nr. Macclesfield, Cheshire.

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Marconi Valves for High and Low Frequency Working

(Condensed from page 346.)

Readers who have used Marconi valves of the DE5, DER, and other types will be pleased to learn that there are now available some Marconi dual-emitter valves of the 120 milliampere class.

Description of Valves

In all, four valves have been submitted to us for test, i.e., one each of the four types—DE8LF, DESHF, DE2LF and DE2HF. The former two of these require a 6-volt battery, while the latter two can be worked with 2 volts. The DE8 valves are large and have pippless bulbs. The plate and grid are of a flat rectangular shape, while the filament is in the form of an inverted V, the two ends being secured at the base, while the centre of the filament is hung over a support at the top of the valve. The DE8 valves are smaller in size than the DE8 valves, and have pipples, while the getter renders them almost opaque. This type of valve employs the usual cylindrical anode.

In all four valves the pins have spring sides, and are not split. The caps are of hard black insulating material, and are provided with a ridge to indicate the position of the anode pin. A letter A renders identification still easier. A particularly desirable feature is that the caps are hollow inside, and as thin as is consistent with mechanical strength. This is useful in reducing the self-capacity of the high-frequency valves.

Laboratory Tests

In the case of the DE2HF the amplification ratio varies with the high-tension used, this quantity being greatest with a high anode potential. In the case of the DE8LF there is a smaller relative variation of impedance with anode voltage. For the other two valves both the amplification ratio and

<table>
<thead>
<tr>
<th>SIX-SIXTY VALVES</th>
<th>Fl. volts</th>
<th>Fl. amps</th>
<th>Impedances</th>
<th>Amplification factor</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>15-2</td>
<td></td>
<td>270-00</td>
<td>70-75</td>
</tr>
</tbody>
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January, 1926
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42 | 1/6 | 1/8 | J. | E. | Harris | M.I.R.E. | How to Erect Your Wireless Aerial.
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45 | 1/6 | 1/8 | J. | E. | Harris | M.I.R.E. | How to Erect Your Wireless Aerial.
46 | 1/6 | 1/8 | J. | E. | Harris | M.I.R.E. | How to Erect Your Wireless Aerial.
47 | 1/6 | 1/8 | J. | E. | Harris | M.I.R.E. | How to Erect Your Wireless Aerial.
48 | 1/6 | 1/8 | J. | E. | Harris | M.I.R.E. | How to Erect Your Wireless Aerial.
49 | 1/6 | 1/8 | J. | E. | Harris | M.I.R.E. | How to Erect Your Wireless Aerial.
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<tr>
<td>00075</td>
<td>25/-</td>
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<tr>
<td>0005</td>
<td>28/-</td>
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<tr>
<td>0003</td>
<td>30/-</td>
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<td>Also two other models.</td>
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<th>Capacity</th>
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<tr>
<td>0007</td>
<td>9/-</td>
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<td>0003</td>
<td>10/-</td>
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<tr>
<td>0001</td>
<td>11/-</td>
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<tr>
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