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MODERN WIRELESS

1/- MONTHLY

Edited by
J. H. REYNER
B.Sc. (Hons). A.M.I.E.E.

Vol. VI. No. 5. OCTOBER, 1926.

How to make A SCREENED-COIL SUPERHETERODYNE

By G.P. KENDALL, B.Sc.

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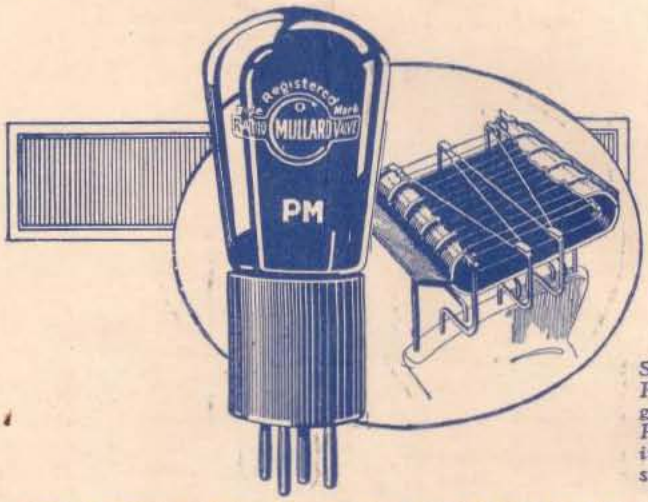

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Edited by J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E.

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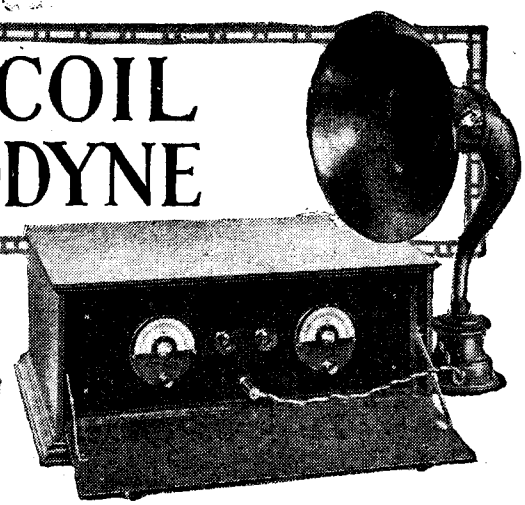
A SCREENED-COIL SUPERHETERODYNE



By G. P. Kendall, B. Sc.

This eight-valve superheterodyne illustrates an interesting application of the newly introduced screening boxes. Each of the principal units of the circuit is separately screened and the intermediate frequency transformers are mounted on the standard six-pin bases so that different makes can be tried.

AFAIRLY long and at times rather bitter experience of super-heterodynes and their ways has convinced me that one of the most important problems in their construction is to arrange that each individual section of the receiver does its own job, does not interfere with the functioning of some other part of the circuit, and does not take on some job which should be done by another part of the set. As a matter of fact, this sort of thing is quite common in the average super-heterodyne, and really satisfactory working is impossible so long as it goes on.

An Example

As an example of the kind of trouble to which I am referring, I will quote the case of a certain super-heterodyne made by a constructor who has had a long experience of straight receivers, but has not done very much with supers. When I was invited to hear his new instrument it was grunting and squawking in a most objectionable manner when any attempt was made to bring the potentiometer controlling the long-wave side round towards the most sensitive position (with the long wave amplifiers somewhere near the verge of oscillation). Furthermore, the adjustment of the long-wave potentiometer did not hold good for the different wavelengths being received, and altogether it was behaving in a way which convinced me that the trouble was that high-frequency currents were getting through into the low-frequency amplifying circuits.

The Solution

I suggested that the constructor should take the appropriate steps, and he proceeded to try shunting condensers acting as by-passes in various parts of the circuit, chiefly across the low frequency inter-valve coupling units and across the loud-speaker terminals, and he very soon got rid of the trouble in this way.

This is but one example of misbehaviour upon the part of one section of a super-heterodyne receiver, and there are various other ways in which trouble may occur. The long-wave transformers, for example, may start picking up signals on their own, instead of leaving that duty to the frame aerial, and such signals will not as a rule be the ones it is desired to hear again; the oscillator valve, instead of sticking to its job of generating oscillations and feeding

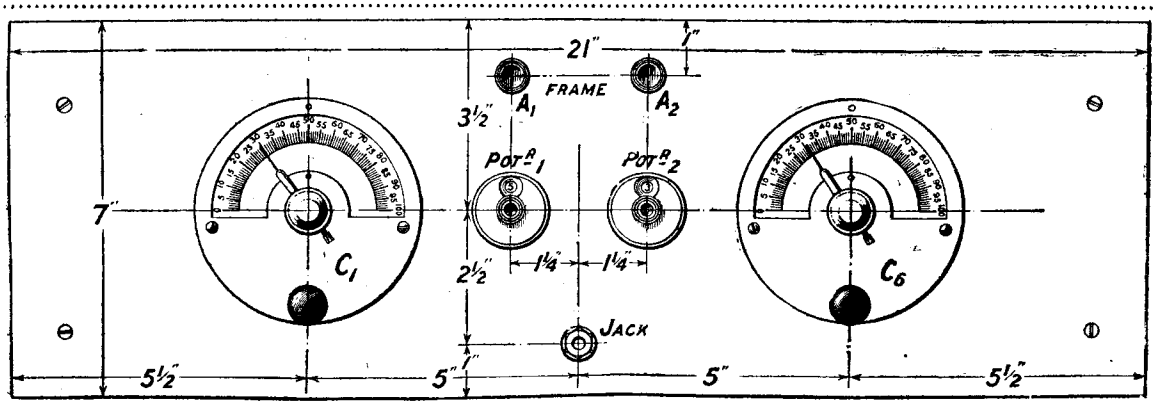


Fig. 1.—The panel drilling is quite simple, the condensers and potentiometers being on the same centre line. Blueprint No. 182a (free).

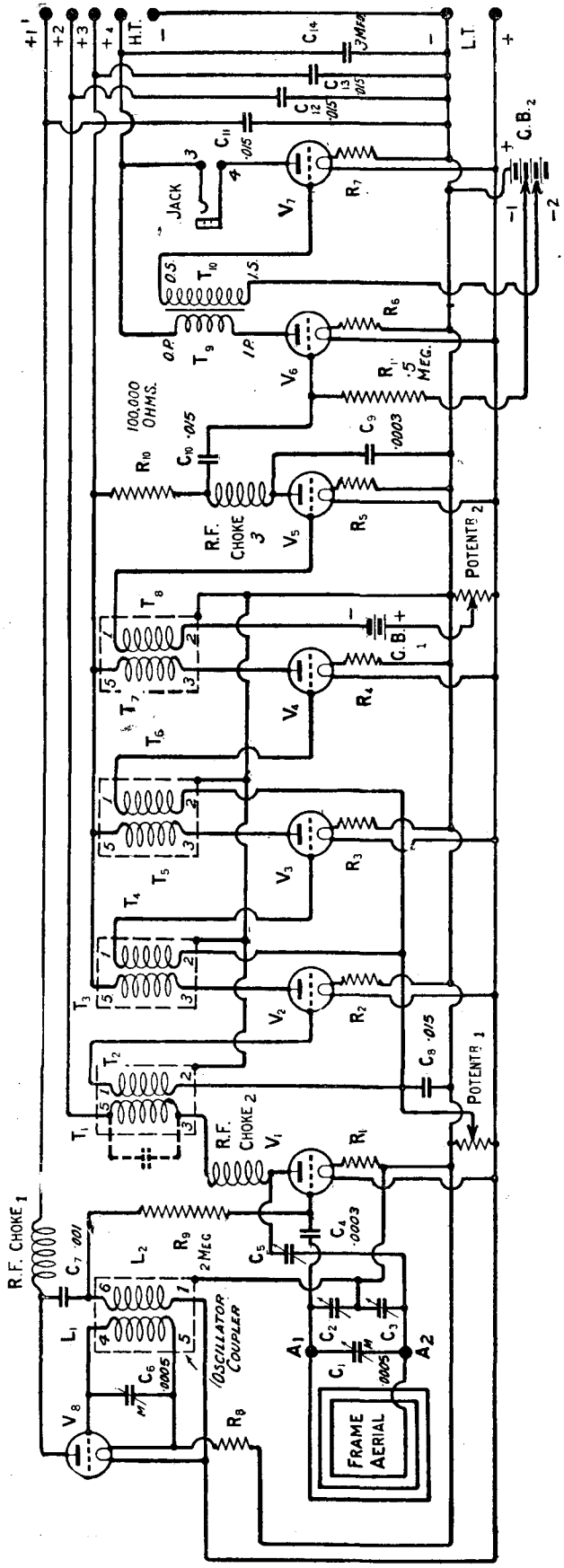


Fig. 2.—The simplified circuit diagram. The filament connections to the jack are omitted in order to retain simplicity. Note that H.T. — is joined to L.T. —

A Screened-Coil Superheterodyne

(Continued)

them to the grid of the first detector valve, may start inducing high-frequency currents into places where they may do more harm than good; and it will be understood that these high-frequency currents may be not merely of the fundamental frequency which is being generated but of all sorts of harmonic and overtone frequencies which may cause much annoyance.

The Circuit

Before proceeding to describe the various measures which have been taken to make all the different sections of the circuit behave themselves in a proper manner, let us take a look at the circuit adopted. This is illustrated in one of the diagrams accompanying this article, and it will be seen that a separate oscillator valve is provided, instead of the combined oscillator-detector which is something of a weakness of mine. The reason why a separate oscillator was adopted in this case was to enable reaction upon the frame circuit to be used from the first detector, which is not readily achieved if that valve is also the oscillator.

The Oscillator

The oscillator employs a parallel feed circuit, with a high-frequency choke in the anode circuit of the valve, a by-pass condenser conducting the high-frequency impulses through a shunting coil to the filament circuit. The grid circuit of this valve is tuned in the ordinary way, and it is found to be a very stable and convenient oscillator, with certain advantages upon short waves which will be found beneficial when the receiver comes to be used for such stations as KDKA, in a manner which I hope to describe at a later date.

In order to avoid the difficulties arising from the use of magnetic coupling between the oscillator circuit and the frame aerial circuit, a special method of feeding the local oscillations on to the grid of the detector valve has been adopted. This is quite simple, and consists merely in taking the bottom end of the grid leak of the detector valve, instead of directly to filament positive, to that point by way of the anode

AN EFFICIENT EIGHT-VALVE RECEIVER

circuit coupling coil of the oscillator valve. In other words, the lower end of the grid leak is connected to the upper end of the oscillator coupling coil, whose lower end is wired to filament positive.

Oscillator Coils

There are thus no special couplings to arrange, which makes it easier to prevent the straying of the local oscillations about in different parts of the set, and is also convenient when working on short waves. There being no variable couplings or other difficulties of this sort to arrange. All the local oscillator coils are wound upon a single former, and the whole is placed inside a standard screening box, so that one can be fairly sure that the local oscillations are fed only to the one place they are required—namely, the grid of the first detector valve.

The Centre Point

The first detector rectifies by means of the leaky grid condenser method, and reaction is taken from this valve by the scheme usually known as the Hartley arrangement, with a slight modification. This scheme, it may be remembered, usually requires the use of a centre-tapped frame aerial, which is not always available. To remove this necessity, I have incorporated the split-condenser method of obtaining a centre point, so that the ordinary frame aerial without a centre tap may be employed. The split condenser is simply a small balancing condenser made by Messrs. Peto-Scott, connected directly across the ends of the frame aerial, the centre point being connected to filament negative in the ordinary manner. This condenser may be set to its intermediate value at the outset and tuning is done by a separate .0005 condenser connected across the ends of the frame.

Reaction Control

The reaction effect itself is obtained by means of a small variable condenser, this being of the baseboard mounting neutrodyne type, but of special capacity, connected between the end of the frame aerial, remote from the grid of the valve, to the anode of the valve itself, a high-frequency choke being connected in the anode circuit to ensure the best results.

Intermediate Amplifier

Following the first detector valve we have the intermediate-frequency amplifier, which consists of three valves, arranged in a perfectly normal fashion. Each of the intermediate transformers, and, of course, the input filter, is contained in one of the standard screening boxes introduced for the shielding of coils by the Elstree laboratories. The idea is to mount each of these units

STATIONS RECEIVED

Pending the publication of a fully detailed test report next month, the following list of stations heard during a short test will give an idea of the capabilities of the receiver. All these stations were heard on the loud-speaker, and only those which could be identified definitely by the announcer's words are included in the list. Numerous other transmissions were heard, but were either not identified or were not capable of being received clearly because they were being heterodyned or otherwise interfered with :—

Aberdeen.	Glasgow.	Newcastle.
Belfast.	Dublin.	Manchester.
Birmingham.	Stoke-on-Trent.	Bournemouth.
Brussels.	Munster.	Berne.
Rome.	San Sebastian	Toulouse.
Frankfurt.	Hamburg.	

COMPONENTS REQUIRED

Cabinet, baseboard and brackets (Camco).
Panel, $21 \times 7 \times \frac{3}{16}$ (Camco).
Two S.L.F. variable condensers, capacity .0005 (Portable Utilities, Ltd.).
Two slow motion dials (Cleartron Radio, Ltd.).
Two high resistance potentiometers (Igranic Electric Ltd.).
One single filament control jack (Igranic Electric Ltd.)
One low-frequency transformer, 5 : 1 ratio. (Igranic Electric, Ltd.).
One balancing condenser, base-board mounting (Peto-Scott Co., Ltd.).
One neutrodyne-type condenser of special capacity, base-board mounting (Peto-Scott Co., Ltd.).
Three H.F. chokes (Varley Magnet Co., Ltd.).
Five fixed condensers, type 610, capacity ·015 (Dubilier Condenser Co., Ltd.).
Two fixed condensers, type 610, capacity ·0003 (Dubilier Condenser Co., Ltd.).
One fixed condenser, type 610, capacity ·001 (Dubilier Condenser Co., Ltd.).
One grid-leak, 2 meg. (Dubilier Condenser Co., Ltd.).
One grid-leak, $\frac{1}{2}$ meg. (Dubilier Condenser Co., Ltd.).
Two grid-leak holders (Dubilier Condenser Co., Ltd.).
One wire-wound anode resistance 100,000 ohms (Varley Magnet Co., Ltd.).
Eight spring valve sockets (Garnett, Whiteley & Co., Ltd.).
One Mansbridge-type condenser, capacity 1 microfarad (Telegraph Condenser Co., Ltd.).
One Mansbridge-type condenser, capacity 2 microfarads (Telegraph Condenser Co., Ltd.).
Two ebonite-topped terminals (Belling-Lee & Co., Ltd.).
Five H.T. battery plugs, 2 red, 3 black, for grid-bias connections.
Eight fixed resistors and sockets (Burne-Jones & Co., Ltd.).
Five "screened-coil" boxes and bases (Burne-Jones & Co., Ltd.).
One special oscillator-coupler (Burne-Jones & Co. Ltd.).
One input filter unit, mounted on standard "screened coil" base (Burne-Jones & Co., Ltd.).
Three intermediate frequency transformers, mounted on standard "screened-coil" bases (Burne-Jones & Co., Ltd.).
Glazite wire.

A SCREENED-COIL SUPERHETERODYNE—*(Cont.)*

upon a standard base of the type normally used for the coils which are used inside these screening boxes, and to plug it into position inside the box.

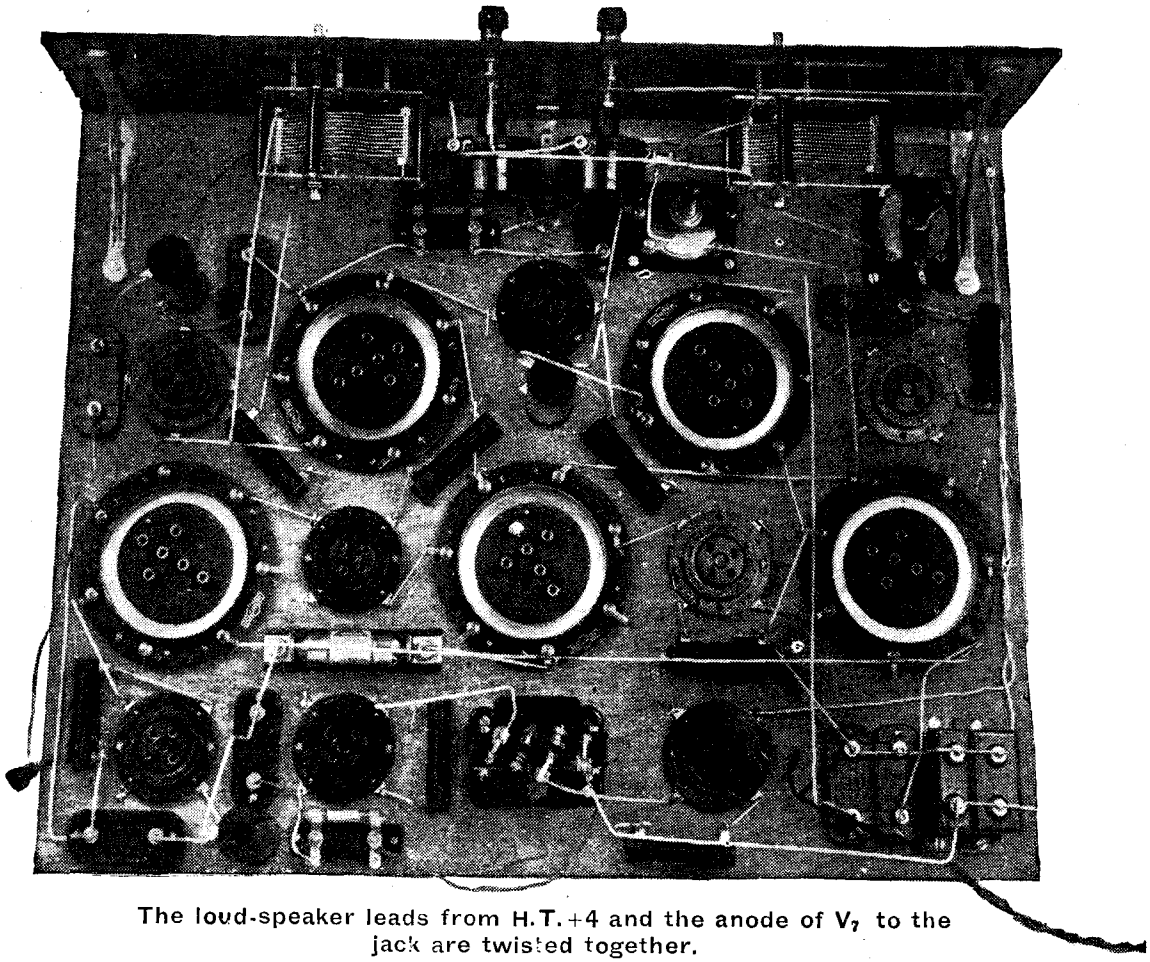
A very useful measure of screening of the intermediate frequency amplifying circuit is obtained in that way, and a notable freedom from direct pick-up of long-wave interference, mush, and so on is achieved.

L.F. Couplings

Following the second detector there are two stages of low-frequency amplification, the first being resistance-coupled and the second transformer-coupled, an arrangement which is found particularly suitable in view of the fact that the second detector operates on the anode bend principle, which means that this valve has a very high impedance under normal conditions.

A Safety Device

The expedient adopted in this set is to connect also a high-frequency choke in the anode circuit of the detector, and to place a by-pass condenser directly between the anode of the valve and the filament circuit to exclude these high-frequency currents as far as possible from the low-frequency coupling unit. The value of the by-pass condenser will, in some cases, require a little experimenting, although a value of ·0003 is found suitable in my set. This may be increased to ·0005 if troubles are experienced from high-frequency currents getting through to the low-frequency circuits.



The loud-speaker leads from H.T.+4 and the anode of V_7 to the jack are twisted together.

Second Detector

The second detector operates on the anode bend principle, a special small grid-bias battery being fitted to provide the desired negative bias upon its grid. The exact adjustment of the negative potential of the grid of this valve is done by means of a second potentiometer, the connections of this potentiometer and grid-bias battery being shown in the circuit diagram.

This arrangement is particularly suitable when the detector valve is worked in such a way as to have a very high impedance, but it must be remembered that a resistance in the anode circuit of the detector valve will also act as a high-frequency coupling unit, and therefore some steps should be taken to prevent the high-frequency currents being passed on into the low-frequency circuits where they may cause trouble.

Practical Details

Turning to the actual lay-out and arrangement of the practical details of the receiver, it will be seen that a very simple panel

A SCREENED-COIL SUPERHETERODYNE—(*Cont.*)

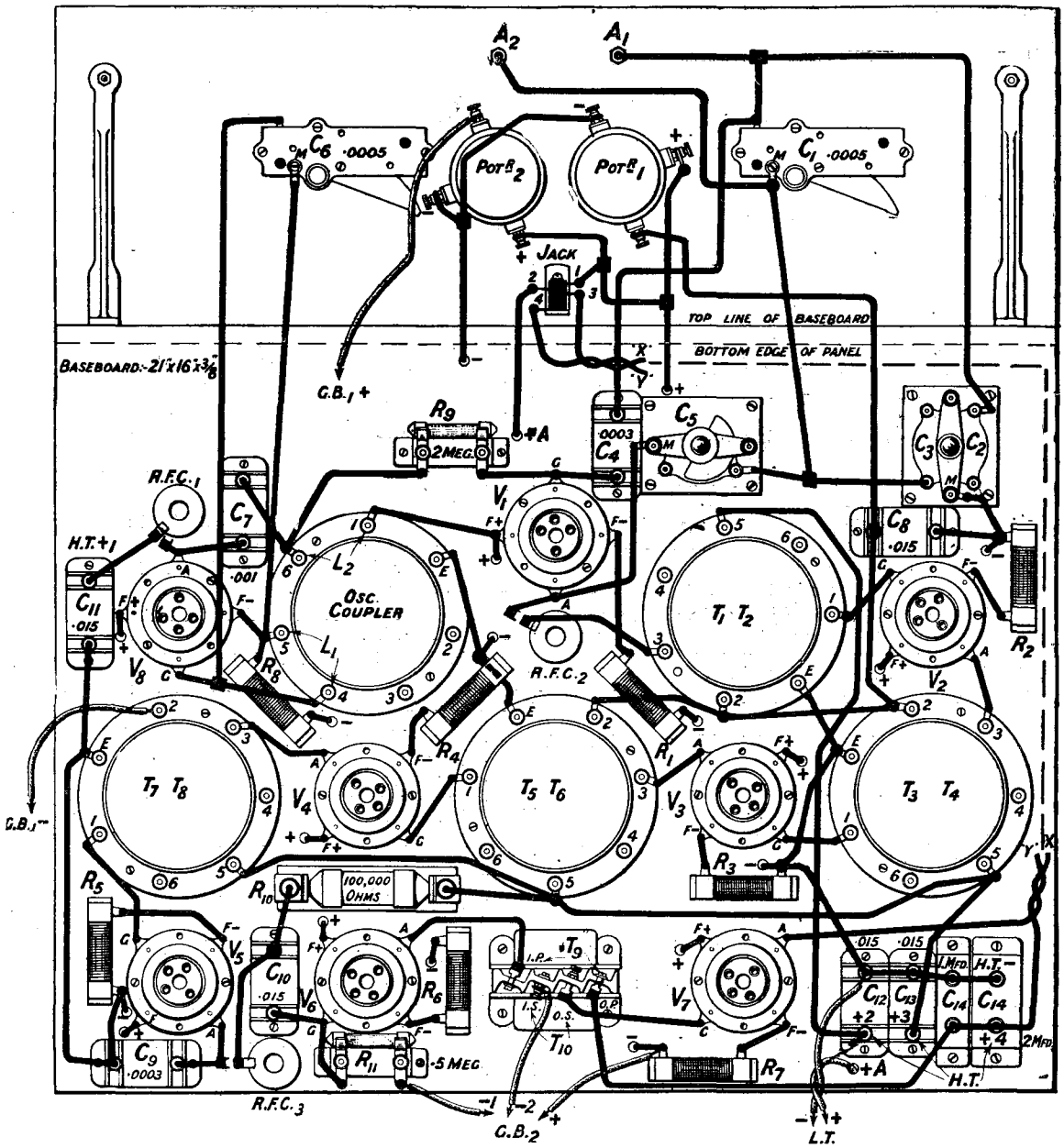


Fig. 3.—The connections to the filament tags of the valve holders are carried beneath the baseboard. Blueprint No. 182b (free).

lay-out has been used. Looking at the panel from the front, the two variable condensers will be seen, each with its slow-motion dial, the left-hand one controlling the tuning of the frame circuit, and that on the right the frequency of the local oscillations. Between them are the two potentiometers, one of these controlling the intermediate-frequency amplifier, and he other the exact amount of bias upon the grid of the second detector. Above the two potentiometers are the frame aerial terminals, and below them is the loud-speaker jack, which, it should be explained, is also the on and off switch for the filaments of the valves.

All the other components are mounted upon the baseboard of the receiver, and a careful examination of the wiring diagram will provide all the necessary information. One or two points here, however, call for a word of explanation, as to the uses of the various devices.

Battery Leads

Take first the question of the battery connections. It will be seen that no terminal strip is used, connection for the battery leads being made direct to various components which bear terminals. All the H.T. leads are connected to terminals upon the various shunting

AN EFFICIENT EIGHT-VALVE RECEIVER

WIRING INSTRUCTIONS

Join long lengths of wire to contact 3 and contact 4 of Jack, twist these together and join wire from contact 4 of Jack to A of V7, and wire from contact 3 of Jack to one side of both parts of C14; same side of C14 to OP of T9T10.

Join contact 1 of Jack to + of Potentiometer 1 : + of Potentiometer 1 to + of Potentiometer 2 : continue wire from + of Potentiometer 2 through baseboard.

Join wire to contact 2 of Jack and take end through baseboard.

Join − of Potentiometer 1 to − of Potentiometer 2 : continue wire from − of Potentiometer 2 through baseboard.

Join flex lead to remaining terminal of Potentiometer 2 for + of G.B.1.

Join A1 to fixed plates of C2, and fixed plates of C1 : fixed plates of C1 to one side of C4.

Join A2 to moving plates of C1 : moving plates of C1 to fixed plates of C5 : fixed plates of C5 to fixed plates of C3.

Join remaining terminal of Potentiometer 1 to one side of C8 : same side of C8 to terminal 2 of T3 T4 : terminal 2 of T3 T4 to terminal 2 of T1 T2 : terminal 2 of T1 T2 to terminal 2 of T5 T6.

Join F − of V1 to one side of R1.

Join wire to other side of R1 and take end through baseboard.

Join F+ of V1 to terminal 1 of L2 : continue wire from terminal 1 of L2 through baseboard.

Join F− of V2 to one side of R2.

Join other side of R2 to moving plates of C2 and C3 : moving plates of C2 and C3 to remaining side of C8 : continue wire from same side of C8 through baseboard.

Join wire to F + of V2 and take end through baseboard.

Join F − of V3 to one side of R3.

Join other side of R3 to E of T3 T4 : E of T3 T4 to E of T1 T2. Also join same side of R3 to one side of C12 : same side of C12 to one side of C13 : same side of C13 to remaining terminals of both parts of C14.

Join flex lead to terminal of C12 which is connected to E of T3 T4.

Join wire to side of R3 which is connected to E of T3 T4 and take end through baseboard.

Join wire to F + of V3 and take end through baseboard.

Join F − of V4 to one side of R4.

Join other side of R4 to E of Oscillator Coupler and to E of T5 T6, also join wire to same side of R4 and take end through baseboard.

Join wire to F + of V4 and take end through baseboard.

Join F− of V5 to one side of R5.

Join other side of R5 one side of C9 : join same side of C9 to E of T7 T8 : join E of T7 T8 to one side of C11.

Join wire to side of R5 which goes to C9 and take end through baseboard.

Join wire to F + of V5 and take end through baseboard.

Join F − of V6 to one side of R6.

Join wire to other side of R6 and take end through baseboard.

Join line to F + of V6 and take end through baseboard.

Join F − of V7 to one side of R7.

Join wire to other side of R7 and take end through baseboard, also join flex lead for GB2 + to this side of R7.

Join wire to F + of V7 and take end through baseboard.

Join F − of V8 one side of R8 : same side of R8 to terminal 5 of Oscillator Coupler : terminal 5 of Oscillator Coupler to moving plates of C6.

Join wire to other side of R8 and take end through baseboard.

Join wire to F + of V8 and take end through baseboard.

Join remaining side of C4 to G of V1 : G of V1 to one side of R9.

Join other side of R9 to terminal 6 of L2 : terminal 6 of L2 to one side of C7.

Join other side of C7 to A of V8 : A of V8 to one side of R.F.C.1.

Join other side of R.F.C.1 to remaining side of C11.

Join moving plates of C5 to A of V1 ; A of V1 to one side of R.F.C.2.

Join other side of R.F.C.2 to terminal 3 of T1T2.
Join G of V2 to terminal 1 of T1T2.
Join A of V2 to terminal 3 of T3T4.
Join G of V3 to terminal 1 of T3T4.

Join A of V3 to terminal 3 of T5T6.

Join G of V4 to terminal 1 of T5T6.

Join A of V4 to terminal 3 of T7T8.

Join G of V5 to terminal 1 of T7T8.

Join A of V5 to one side of R.F.C.3 : same side of R.F.C.3 to remaining side of C9.

Join other side of R.F.C.3 to one side of C10 : same side of C10 to one side of R10.

Join other side of C10 to G of V6 : G of V6 to one side of R11.

Join flex lead for G.B.2.− 1 to other side of R11.

Join A of V6 to 1P of T9T10.

Join G of V7 to OS of T9T10.

Join flex lead for GB2 − 2 to 1S of T9T10.

Join G of V8 to terminal 4 of L1, and to fixed plates of C6.

Join terminal 5 of T1T2 to remaining side of C12.

Join terminal 5 of T7T8 to remaining side of R10 : same side of R10 to terminal 5 of T5T6 : terminal 5 of T5T6 to terminal 5 of T3T4 : terminal 5 of T3T4 to remaining side of C13.

Join flex wire to terminal 2 of T7 T8 for GB1 −.

Connections under baseboard.

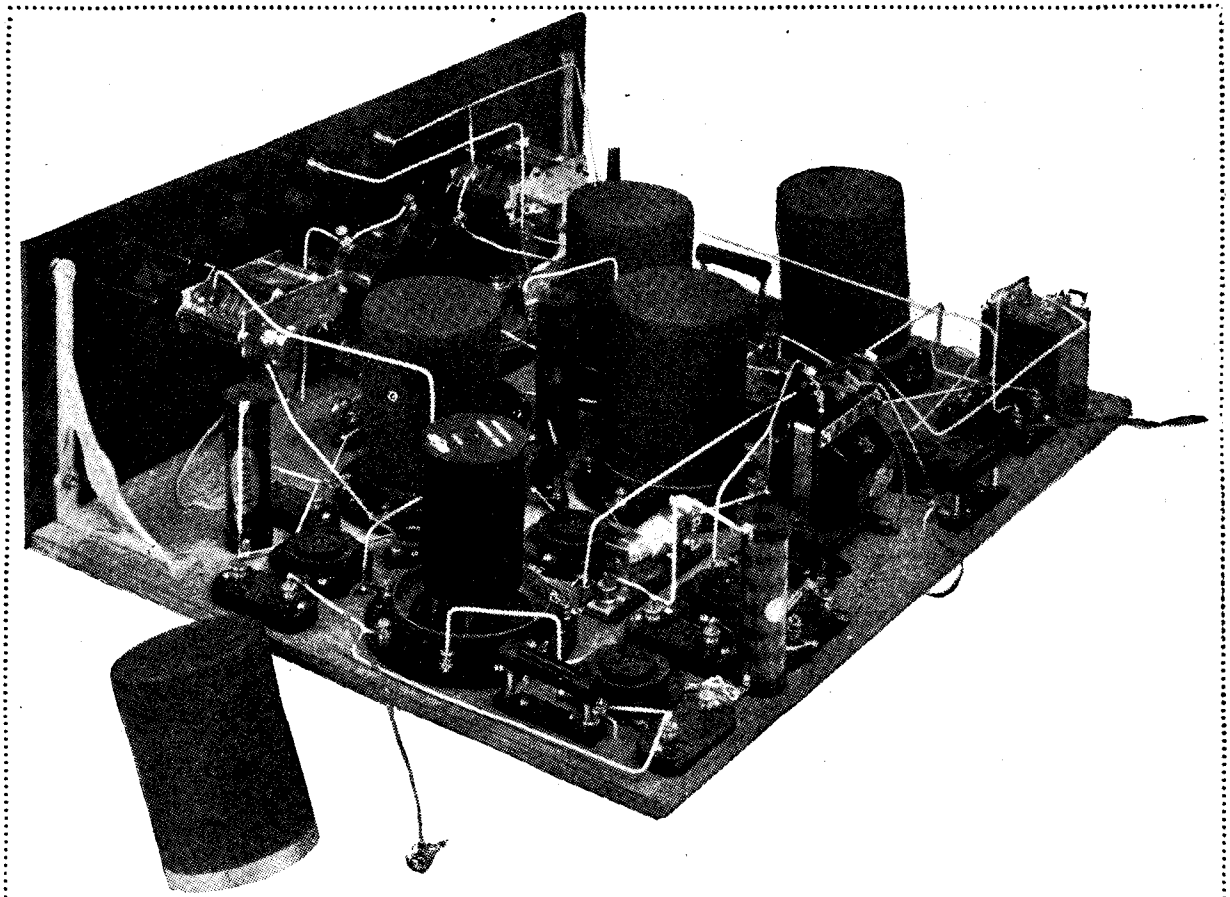
Join + A to flex lead for LT+.

Join all wires going through baseboard with — against them in wiring diagram together.

Join all wires going through baseboard with + against them in wiring diagram together.

A SCREENED-COIL SUPERHETERODYNE—(*Cont.*)

condensers, one of these condensers being provided across each H.T. tapping. It will be seen that there are five of these condensers, three of them being Dubilier condensers of the Type 610 variety, of ·015 capacity, these being for the tappings for the oscillator, the first detector, and the intermediate frequency amplifiers and second detector. Two T.C.C. Mansbridge-type condensers are provided to form the shunt for the low-frequency tapping. One of these is of two microfarads and the other of one microfarad, the two being connected in parallel to give a total capacity of three microfarads, which can of course be provided by means of a single condenser if such is available.



A view of the receiver showing the coil screens.

Terminals

These condensers are all fitted with terminals, and under the appropriate one can be connected the flexible lead which goes off to the H.T. battery tapping point. H.T. negative is connected to one of the terminals upon the opposite side of the bank of condensers, which of course, are all connected together on this side. This point is also L.T. negative, a pair of flexible leads being provided for connection to the accumulator. L.T. positive is soldered directly on to the wiring under the baseboard so that this pair of leads is more or less permanently connected to the set. All the leads, it will be understood, are taken out through holes in the back of the cabinet.

Oscillator Tapping

It will be noted that the high tension connection point for the oscillator valve is at the opposite side of the receiver from the group of shunting condensers for the other tappings, and it should be explained that the shunting condenser for this particular tapping should only be fastened in position after the various connections have been made to the oscillator valve.

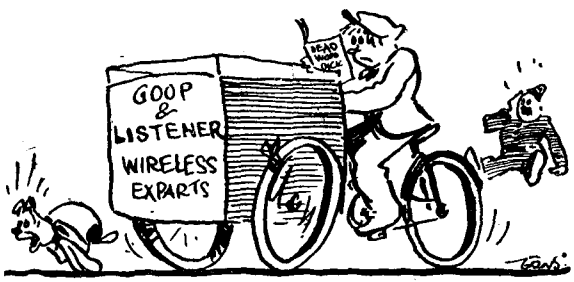
The only other point in the construction or wiring of the receiver which seems to call for comment concerns the connection between two of the high frequency chokes and the anode points upon the appropriate valve sockets. The chokes are fastened in position quite close to the sockets, and unless you possess a fairly small soldering iron you may find it difficult to operate in the limited space available.

A Warning

Due care should be taken here, because the chokes are covered with what appears to be celluloid, so that if they are touched with the soldering iron fireworks may result. If any difficulty is experienced,

(*Continued on page* 523.)

I WAS a little shy at first about Professor Goop's suggestion that he and I should start a wireless service station together. Somehow the word "service" has a nasty suggestion of work about it, and even on the hottest day the very thought of work gives me cold shivers right down the spine. It is not, mark you, that I am a slacker; few people, in fact, have put in more accumulator-ton-miles than I have, whilst an eminent mathematician has calculated that the energy expended by me during the last five years in twiddling condenser knobs would be sufficient to drive all London's 'buses at sixty miles an hour for a week—in which case it is highly improbable that there would be many Londoners left.



. . . Edward Bugsnip to provide the motive power.

Organisation

It is rather that, having been provided by nature with an outsize in brains, which becomes most active when the rest of me is quiescent, I find that my strong suit lies in organisation rather than in mere manual labour. Give me a comfortable chair, beneath the shade in summer or before a cosy fire in winter, and I have few rivals as an organiser. Such, in fact, is my concentration when I am organising that people who do not understand the process that is going on frequently prod me in the ribs and ask me to stop snoring. Poddleby, who is a rude fellow, has been known to refer to my periods of absorption as nasal-organising. This just shows how easy it is for brilliant people like myself to be misunderstood by their so-called friends.

The Scheme

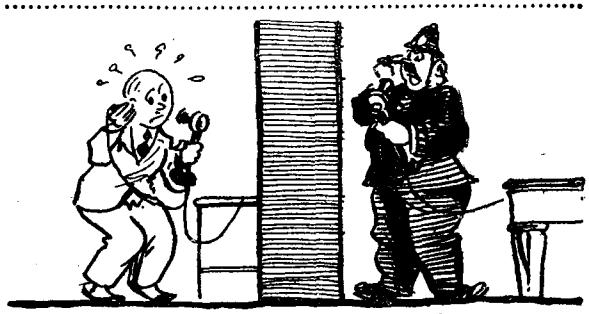
Professor Goop's idea was that a service station run by him and me would be a positive godsend to the inhabitants of Little Puddleton. "You know what it is," he said; "all wireless men are the same. When a high-tension lead comes adrift from its moorings they say 'Oh, I'll re-solder that to-morrow.' Then they twist it up somehow and every day they keep on reminding themselves that they really must get out the soldering iron. One evening it comes adrift again and clings like the tendril of a vine to a low-tension wire. Up goes anything from one to nine valves and then the job really does get done. If my idea materialises those who have small defects of this kind in their sets will merely ring up on the telephone or send us a post-card. We will then collect the set and deliver it in a few hours in perfect condition." "I suppose," I said, "that you are not suggesting that I should spend all my time running round Little Puddleton and bringing dud sets for you to tinker with?" "Far from it," cried Professor Goop. "What really gave me the idea was that at a jumble sale last week I picked up for a mere song a tradesman's delivery tricycle."

The Mechanic

I was preparing to walk out of the room, for I have never really enjoyed tricycling as a pastime, when the Professor hastened to add that he had already engaged young Edward Bugsnip to provide the motive power. "Anyhow," I said, "I refuse to spend my whole time soldering. I *hate* soldering; it makes one's waistcoat so greasy and the frizzling noise always makes me think of sausages." The Professor calmed my fears by saying that besides propelling his quaint vehicle young Bugsnip would also act as mechanic; all that he and I would have to do would be to direct operations and to divide the cash.

We Decide

That sounded better; in fact, for many years I have been looking for a job demanding exertions of this kind. In a moment my mind was made up. "Professor . . . ," I cried, striding across the room with outstretched hand, tripping over little Bingo and landing face downwards on the hearth-rug. Really I think those woolly sheep-skin hearth-rugs ought to be forbidden by law. For some little time my speech, like that of some loud-speakers, was distinctly woolly, but eventually I managed to make



"I 'ave just fished young Bugsnip out of the 'orsepond."

IN PASSING — (*Continued*)

the Professor understand that I was enthusiastically accepting his offer and not hurling reproaches at him, as he had at first supposed. We resolved to start business upon the very next day. We therefore sped to the *Gazette* office bidding them put through a rush order for business cards. They undertook delivery at breakfast time the next morning, provided that we would leave the proof reading to them. This we naturally agreed to, for the *Gazette*, like everything else in Little Puddleton, is nothing if not efficient. You will, I think, agree with me that the business card reproduced herewith is almost beyond criticism.

MEssrs.
GOoP aND LeSsenEr,
Wireless exparts.
Repairs executed at
SHortest NOTicE

We Start

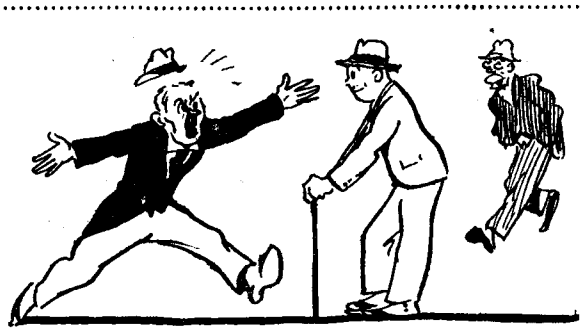
We agreed that the Professor should be on duty in the morning, for that is the time I usually devote to the beauty sleep which prepares me for the real labours of the day. Professor Goop is generally up and about quite early, because he so frequently forgets to go to bed. When I called round at "The Microfarads" shortly after mid-day I found the Professor in a great state of excitement. "I have launched our dove from the ark," he said, "and now we must wait to see what he brings back." Though no one in the ordinary way would refer to Edward Bugsnip as a dove, I saw at once what he meant. We had not long to wait, for almost instantly the telephone bell rang clamorously. I leaped to the instrument. Professor Goop leaped at the same time, but I got there first. "P.C. Bottlesworth speaking," said the well-known voice of our local guardian of law and order. "I 'ave just fished young Bugsnip out of the 'orspond with an 'ay rake, and if you want that there three-wheeled bicycle 'e was ridin' you 'ad better put on a bathin' suit and come and get it."

Slightly Annoyed

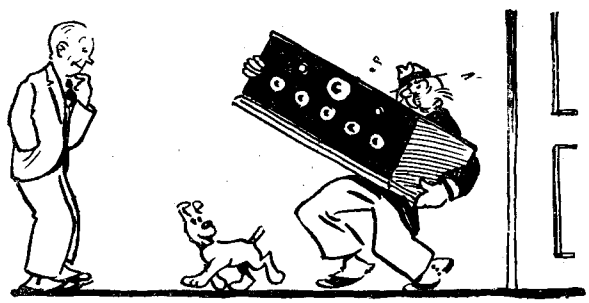
The lad Bugsnip, I elicited by inquiry, had spent half the morning in giving his little friends rides down the steep hill at the far end of the Goop Boulevard. Eventually, whilst conveying a round half-dozen of them he had attained such a velocity that he had been unable to round the bend at the bottom and had gone, like a Brooklands racer, over the banking and into the pond. When the Professor and I reached the scene of the catastrophe we found that quite a crowd had collected, amongst them Admiral Whiskerton Cuttle and Snaggsby, both of whom seemed to be slightly annoyed about something. The Admiral was simply keeping his mouth open and letting words pour forth in a torrent. Snaggsby was holding young Bugsnip by the scruff of the neck and shaking him violently.

A Catastrophe

Directly he saw me Snaggsby let the lad drop into the pond and came striding up. "Do you know," he roared, "that my new superheterodyne receiver is in that Noah's Ark of yours at the bottom of the water? What on earth do you mean by it?" "That," I said sweetly, "is *quite* in order; we make a point of washing sets that come from certain houses before we handle them. Meantime, had you not better go to the rescue of our van driver and head mechanic who seems to be in difficulties?" Snaggsby turned round to look in the direction in which I was pointing, but it was the push administered by me and not his own nobler feelings that prompted him to make his first attempt at life-saving. As he struggled towards the bank with young Bugsnip clinging to his coat-tails the Admiral, true to the fine traditions of the Senior Service, leaned down and stretched out a helping hand. At that moment Snaggsby fell over something and the Admiral joined them with a graceful if unpremeditated dive. "Since you are all on the spot," I shouted, "you might as well fish out our delivery van." It took quite a little persuasion to make them do it.



The General arrived.

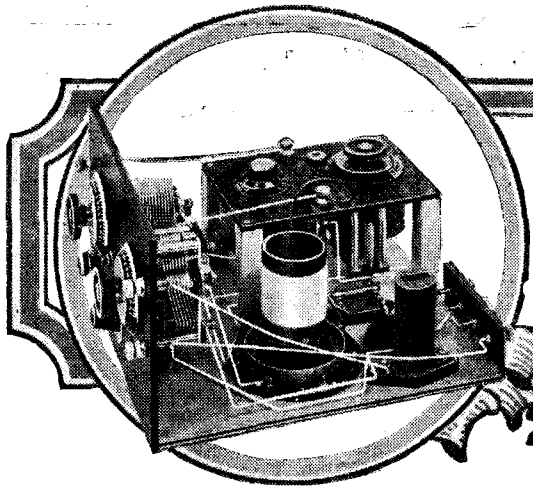


Snaggsby came striding up.

Progress

We had quite an unpleasant time with Snaggsby and the Admiral over their sets, for neither of them would be convinced that such an immersion was an essential part of the process of bringing them to a state of perfect efficiency. The Admiral actually brought round in a bottle a tadpole which he had found in one of his H.F. transformers and threatened to make Professor Goop eat it. So many

(*Concluded on page* 507.)



MODERN DESIGN in SIMPLE SETS

by J. H. REYNER, B.Sc. (HONS.), A.M.I.E.E.

The recent great improvements that have taken place in the design of multi-valve sets apply equally to small simple receivers. A modern small set must be selective and the reaction effect must be easily controllable, as Mr. Reyner shows in this interesting article.

WE have recently made some very rapid strides in the science of radio. We have had, for example, such receivers as the "Elstree Six," which succeeded in receiving in daylight a considerable number of stations at loud-speaker strength. In fact, the daylight performance of this receiver would have constituted a good test report during the hours of darkness for the type of set which used to be produced only a few years ago.

Daylight Range

This daylight range is only made possible by the fact that we have definitely obtained methods of high-frequency amplification which are thoroughly efficient. During the daytime the wireless waves travel over the surface of the ground. Owing to the ionisation of the atmosphere these waves are more or less rapidly absorbed, with the result that after a comparatively short distance the waves practically cease to exist. At certain times of the day, for example, it is impossible, even on the "Elstree Six," to hear the carrier waves of certain distant stations only 300 or 400 miles away, let alone any satisfactory telephony.

Night Effects

At night time, on the other hand, we have this direct wave which, incidentally, is not absorbed to the same extent, and we also have an indirect or reflected wave which travels to the higher regions of the atmosphere and is reflected down to earth again by a layer of electrified particles which acts as a mirror. This will result in stations being received at ranges which are absolutely impossible during the daytime, and such short distances as 300 or 400 miles become, comparatively speaking, child's play.

Defeating America

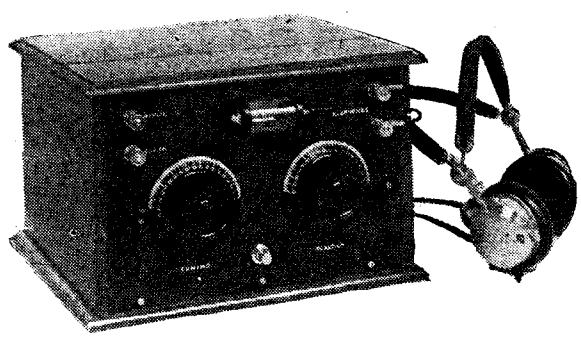
In another direction I set myself the problem of defeating one of the best American designs, and moreover achieving this result before the original American design could be considered obsolete. This I ultimately succeeded in doing in the "Magic Five," and, following it one stage further, came the "Solodyne," which was described in last month's issue.

All these achievements have been rendered possible by the fact that we have tackled the problem of radio reception, and particularly high-frequency amplification, in a scientific manner, and we have obtained definite data concerning the laws which govern the various actions.

Smaller Sets

The receivers which I have just mentioned are large and comparatively expensive. Have we, then, neglected the smaller types of sets employing two or three valves only? I think not, and a glance through the pages of MODERN WIRELESS for the past few months will show a tendency to change the design of these simple sets and to bring them into line with the latest practice. Let us consider some of the ways in which these recent developments have affected the design of small and simple receivers.

Considering the case of a single-valve receiver, this is becoming of use principally for local station work. The man who wants distant reception, as we shall see shortly, will add one or more stages of high-frequency amplification.

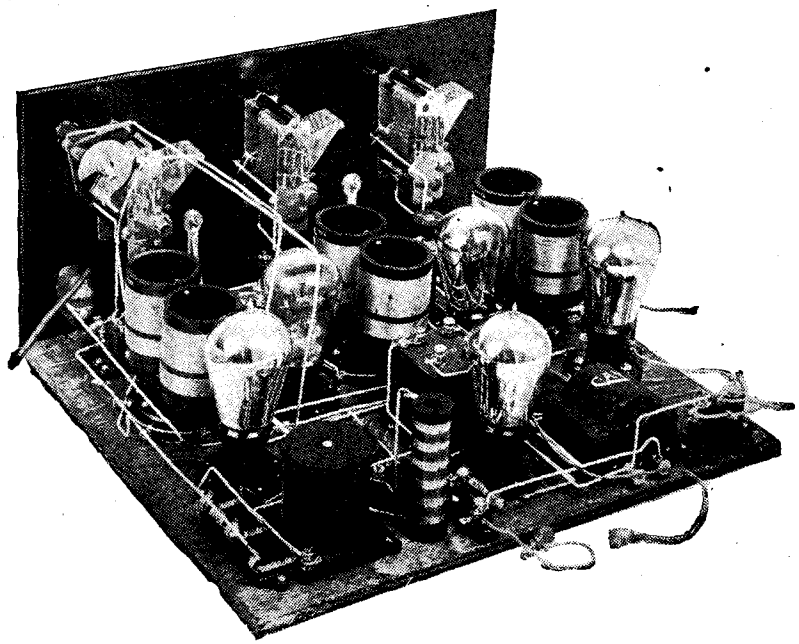


A compact small set embodying modern practice—the "Midget Reflex Receiver" described in the free gift envelope included with every copy of the November "Wireless Constructor."

MODERN DESIGN IN SIMPLE SETS—*(Continued)*

Single-Valve Range

"Local-station reception" is a phrase which is often used without due thought. One naturally thinks of the man situated 10 or 20 miles away from the local station when the term "local station" is used. What of the man, however, whose nearest station is 50 or 60 miles away? For him a single valve receiver is quite satisfactory provided it is efficient, and it is in rendering the single-valve receiver capable of receiving signals 50 to 100 miles away with ease, and without danger of inadvertent oscillation, that modern design is different from older types of construction.

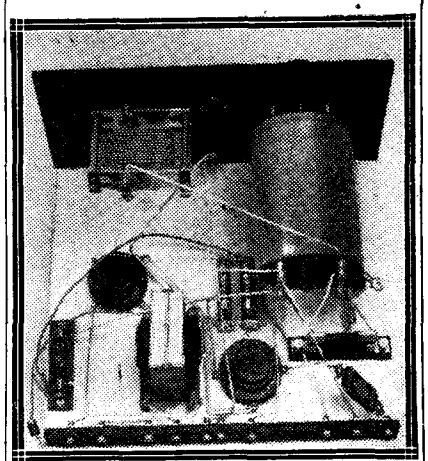


Binocular coils are eminently suited to small or large sets. The photograph shows these coils in the "Night Hawk," a Radio Press Star design.

Reaction

The principal development, therefore, in single-valve reception has been in the direction of improving reaction control. The modern tendency is to use some variation of the Reinartz principle. The older system in which a fairly large coil is connected in the anode circuit of the detector valve and is variably coupled to the grid circuit is considered to be obsolescent.

It may be that a series condenser is inserted in the reaction circuit, the value being varied in order to control the amount of current which is permitted to flow through the circuit. Alternatively, we may arrange a circuit providing two paths for the reaction currents, one of which shall definitely produce reaction, and the other serve merely as a by-pass. As we increase the by-pass effect so we starve the reaction coil proper and the reaction effect is reduced.



Fixed resistors for filament control are tending to replace rheostats, thereby simplifying the panel layout.

Distant Reception

With the increased number of stations operating on the Continent, many of them working with considerable power, it is quite possible to receive several of these stations also on a suitably designed single-valve receiver. There are, however, two objections to this process, as a result of which there is an increasing tendency to the use of one or more high-frequency stages.

Selectivity

In the first place, if any satisfactory distant reception is to be achieved a certain measure of selectivity is necessary. It is by now common knowledge that adequate selectivity consistent with good quality cannot be obtained with only one tuned circuit. If the experimenter is situated close to a local station (by close I mean anything from 10 to 15 miles), then the reception of stations operating quite near in wavelength to the local station is completely out of the question with only one circuit. Granted that it can be done, but the quality is poor, and even with two circuits quality suffers on some stations.

For the man who lives in the country the problem is not so acute, but, even so, in order to separate some of the distant stations and still retain satisfactory quality more than one tuned circuit is desirable.

There are now so many stations working simultaneously that unless a reasonably selective circuit is available they interfere with each other, and for this reason more than one tuned circuit is desirable.

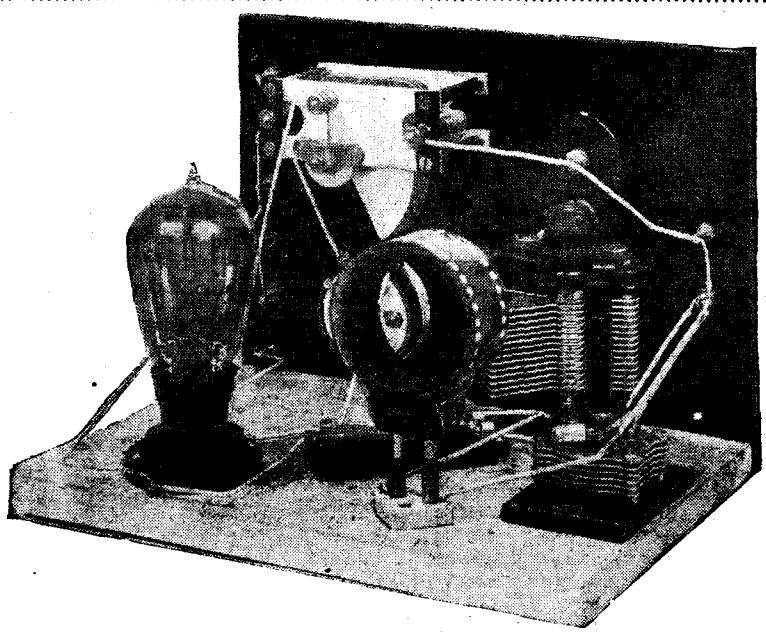
H.F. Amplification

The second reason for the use of the high-frequency valve lies in the fact that the selection of these stations is made many times easier by the use of such an accessory. The present high-frequency valve really does amplify.

The amplification obtainable from an H.F. valve is nearly as good as that from a low-frequency valve in a correctly designed receiver. The modern detector does not obey a linear law, so that if we double the voltage applied to the detector valve we obtain distinctly more than twice

MODERN DESIGN IN SIMPLE SETS—*(Continued)*

the output. This being so, it pays very definitely to use a high-frequency valve in front of the detector valve. Moreover, with a high-frequency valve the reaction control is not so critical, and also can be placed on the second tuned circuit. Such an arrangement minimises considerably the risk of interference with one's neighbours. Everyone knows that he ought not to howl, yet, for a real treat, one has only to listen-in after the B.B.C. stations have closed down! The frenzied whistling and howling that takes places in the frantic search for distant stations is pitiful. All this trouble would be obviated by the use of a correctly operated high-frequency valve. Even one valve would bring in the distant stations, and at any rate would render possible the use of non-radiating circuits.



The modern tendency is towards the use of capacity controlled reaction of the Reinartz type. This permits a very accurate adjustment to be made.

Neutralising Receivers

From the point of view of non-radiating, a neutralised receiver is unquestionably the best. With the modern bridge methods of neutralising, it is possible to obtain a definite balance between the capacity feed-back of the valve and the capacity feed-back through the neutralising condenser. In fact, one of the most common methods of neutralising a circuit, and one which I always use myself whenever practicable, is to turn out the valve to be neutralised, tune the receiver to the local station, and then adjust the neutralising condenser until no signals are heard. In this position the energy which is passed through the valve capacity is cancelled out by the energy passing through the neutralising condenser, and the result is that no signals are heard.

Conversely, if the second circuit (that associated with the detector valve) is allowed to oscillate, then, obviously, any energy from these oscillations which feeds back through the valve will immediately be cancelled out by an equal and opposite amount of energy fed through the neutralising condenser. The receiver is therefore definitely non-radiating, and tests have shown conclusively that this is no mere theory but an actual established fact.

In the case of an H.F. amplifier the question of selectivity is of considerable importance. The object of adding high-frequency valves is to enable distant stations to be received, so that some measure of selectivity is essential.

Aerial Damping

The aerial damping is one of the most fruitful sources of loss, and this is minimised by the use of a tapped aerial coil or a tight-coupled aerial circuit. There are one or two disadvantages to this arrangement, the most serious being that there is a possibility of dead spots occurring at some point, or points, in the tuning range, and to avoid these it is necessary to make provision for changing the tapping point on the coil or the number of turns in the aerial coil. Possibly other methods will be devised in time which do not suffer from this disadvantage, but for the present this method of so-called "aperiodic" aerial coupling is very convenient.

Valve Damping

A question on which considerable light has been thrown during the past year is the effect of the valve on the tuned circuit. The purpose of a valve is to amplify, and if it were a perfect amplifier it would not have any deleterious effect upon the circuits associated with it. Careful application of theory to the actual results obtained in practice, however, showed that the selectivity obtainable with various types of circuits was very definitely below what would theoretically be expected.

Further investigations showed that this was due to damping arising from the presence of the valve. In a tuned-anode circuit, for example, the valve is virtually across the tuned circuit, so acting as a leak shunted across the whole. Obviously, this will result in an

MODERN DESIGN IN SIMPLE SETS—*(Concluded)*

increase in the effective resistance of the circuit itself, and consequently it will give poor selectivity.

Centre-Tapped Circuits

These difficulties are overcome in two ways. First of all we can arrange to tap the anode of the valve across a part of the tuned circuit only. If the valve is only tapped across half of the coil, then the extra damping introduced into the circuit is reduced to one quarter of what it would be if the valve were connected across the whole of the coil.

This has given rise to a series of centre-tapped circuits. By connecting the high-tension battery to the middle of the coil instead of the end we obtain a zero-potential point in the middle of the coil, so that the remote end of the coil is at the opposite potential to the anode, and can therefore be used as a source of neutralising voltage.

Using such a circuit therefore we have at once reduced the effect of the valve to one-quarter, and provided ourselves with a ready method of neutralising the circuit. This method is both convenient and easy to put into operation, yet there are many people who are still using the straight-forward tuned-anode, and who cannot be bothered with neutralising! If they would only try it, they would be astounded at the increase in efficiency.

Transformer Coupling

The other method of achieving similar results is by the use of transformer coupling. If instead of tapping the anode of the valve across a portion of the coil we connect the anode circuit through a small primary and couple it to the secondary we obtain an effect which is electrically very similar. In order that the effect shall be practically identical it is necessary to have a tight coupling between the primary and the secondary. The actual number of turns on the primary may be only quite small, but the two windings must be close together in order to obtain a tight coupling.

Wireless in the Army. A portable field set in use during the recent manœuvres.

Binocular Coils

Now these various methods have been developed for the larger sets, and definite and standard types of coil have been designed. We have the screened coils, which are made in a variety of different patterns. We have the binocular coils, which have been developed and used by Mr. Allinson for some time past, and which were used by Mr. Harris in the "Night Hawk."

These types of coils are excellently suited for use in simple circuits. Although in some cases slightly better results could be obtained by designing a special transformer to suit the individual case, yet these standard transformers which are produced comparatively cheaply enable satisfactory results to be obtained from the general class of valve, and the results obtained will be markedly superior to those obtainable with the older types of non-scientific circuit.

Screening

The question of screening is interesting if we consider these simple circuits. Screening is principally useful in reducing interaction between the various stages of a multi-valve receiver. On the other hand it also has very considerable effect in reducing the direct pick-up on the local station. I was experimenting the other day with a "Magic Five" receiver on which I had made slight modifications. I had the receiver tuned to Cardiff while London was operating, but there was still a faint background of London.

An Interesting Example

Now the presence of the screens increases the resistance of the coils very slightly, the theory upon which I have based my design being that this increase in resistance is more than compensated for by savings in other directions. I thought that it would be interesting to observe whether the removal of the last screen would reduce the resistance sufficiently to enable Cardiff to be received quite clear of London.

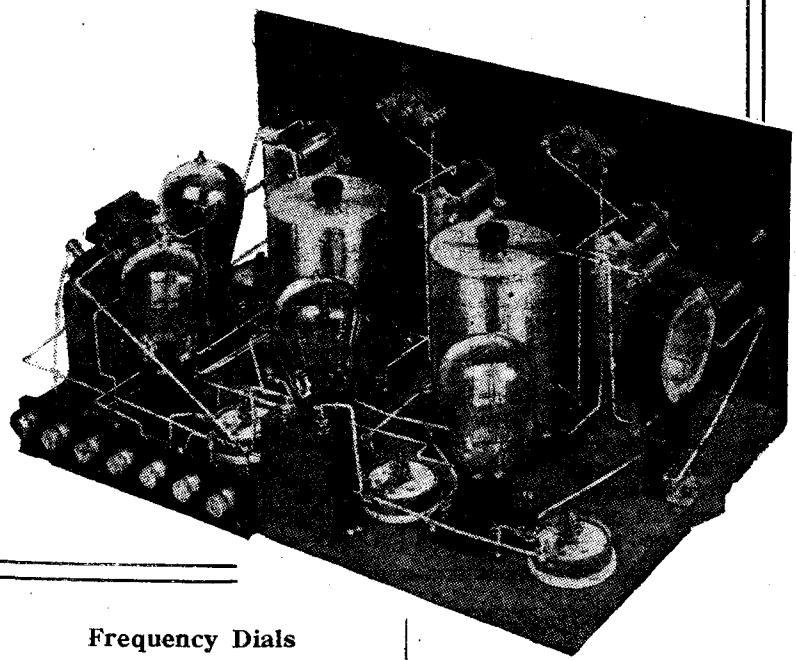
I removed the screen, therefore, form the last tuned circuit, *i.e.*, the one connected to the detector valve. On re-tuning the circuit to allow for the change in inductance caused by the removal of the screen I could only hear London! Cardiff was faintly audible in the distance when London stopped working. No amount of re-tuning or re-adjustment made any difference, and this afforded a striking proof of the correctness of my theories. The combined effects of direct pick-up and stray energy losses were sufficient to destroy the fine selectivity previously possible.

For simple circuits, however, there is no reason why these transformers should not be used without their screens.

A "FOUR" FOR RANGE AND SELECTIVITY

By W. Q. KAY

This useful four-valve receiver is capable of receiving many British and Continental broadcasting stations on the loud-speaker. At a distance of twelve miles from 2LO it will eliminate this station and bring in Manchester.



AS all the European stations are being allocated on a fresh basis, amateurs are attacking the problem of distant reception with renewed zest owing to the greater freedom from interference which is expected to result when the system has got into proper working order. The present receiver is one which was constructed recently with the object of providing ready reception of the various distant stations while giving comfortable loud-speaker reception on the local station when desired.

Frequency Dials

Since the new scheme makes use of the 10 kilocycle method of separation, straight-line frequency condensers have been employed in this receiver. As the capacity is reduced so the frequency is increased in proportion, and with the plates all out the dial reading is 180. Thus the dial readings are the reverse of what is usually found to be the case, but any difficulty which may be experienced in this direction will soon be overcome after a little practice.

The Circuit

For the receiver a straightforward H.F. circuit has been employed, utilising one of the standard patterns of screened transformer now on the market. The actual circuit is shown in Fig. 1, and will be seen to include two high-frequency stages, a detector, and a low-frequency amplifier. The aerial circuit is a simple tapped coil, which has not been enclosed in a screening case, being one of the various makes of tapped coils on the market. The high-frequency transformers are of the split-primary type, one half of the primary being in the anode circuit of the preceding valve, the other portion being utilised as a neutralising winding.

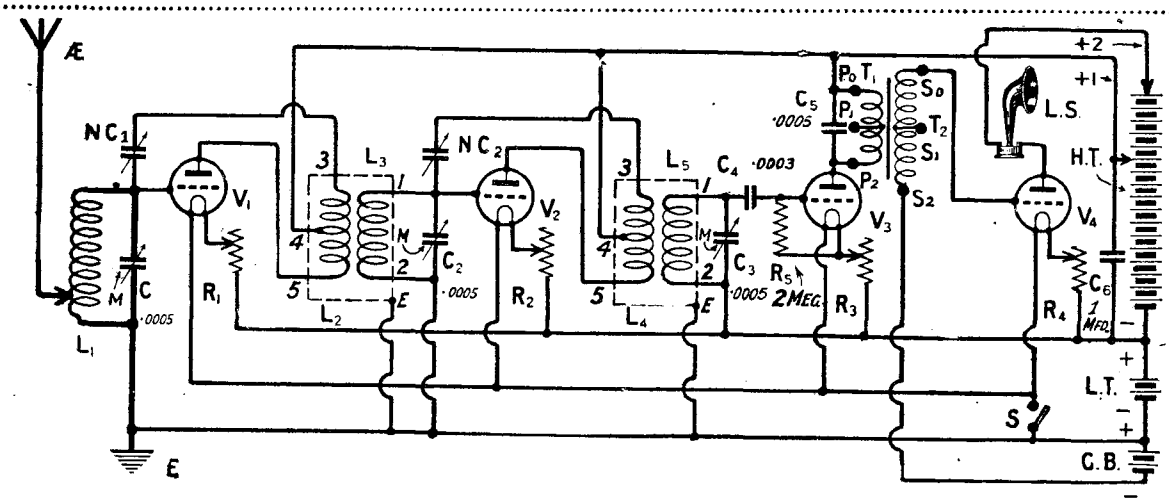


Fig. 1.—The theoretical circuit. The coil L_1 is an ordinary X coil.

A "FOUR" FOR RANGE AND SELECTIVITY—*(Continued)*

Panel Layout

The grid circuits of the various valves are tuned by the three condensers, which are placed symmetrically upon the panel, and in this case the two neutralising condensers have been mounted on the panel as well. The first of these needs adjusting to the correct neutralising point and is left in position. The second condenser is made rather larger and is utilised to provide a reaction effect by increasing its capacity beyond the neutralising point.

Reaction Control

This method of producing reaction is a reasonably satisfactory one, and has the merit of cheapness. Moreover, it enables the receiver to be maintained in a sensitive condition without much variation with a "flat-spot" on the aerial in use.

Filament Resistances

"Variable" fixed-resistors are incorporated in the set, these being a baseboard mounting model of the ordinary type of filament rheostat. In this case they have been made of 30 ohms resistance, so enabling practically any type of valve to be used in the circuit. They are adjusted to the correct point when the set is first tested out, and are afterwards left fixed. By this means we obtain all the advantages of fixed resistors without the lack of flexibility which is their principal disadvantage.

A Novel Device

Grid rectification has been employed for the sake of simplicity, and in this case only a grid condenser is required external to the valve holder, the grid leak being incorporated as part of the valve holder. The unit, which is similar in appearance to the ordinary type of valve holder, provides a neat method of supplying the necessary leak from grid to filament.

Compact Layout

Space has been economised in this receiver to a large extent, and in fact the receiver has been designed to fit inside a fairly small cabinet. The actual size of the panel is 16 in. by 8 in., and there are many people who already possess cabinets of this size. In this set the baseboard is required to be 10 in. deep, which is a little

STATIONS RECEIVED on the LOUD-SPEAKER

Dial Reading.	Station.	Dial Reading.	Station.
25	Birmingham.	62	London.
28	Frankfurt.	72	San Sebastian
37	Berne.	82	Hull.
41	Rome.	86	Nottingham.
42	Glasgow.	88	Barcelona.
45	Münster.	94	Stoke.
48	Newcastle.	100	Hanover.
50	Dublin.	105	Dortmund.
52	Hamburg.	124	Elberfeld.
55	Bournemouth	145	Kiel.

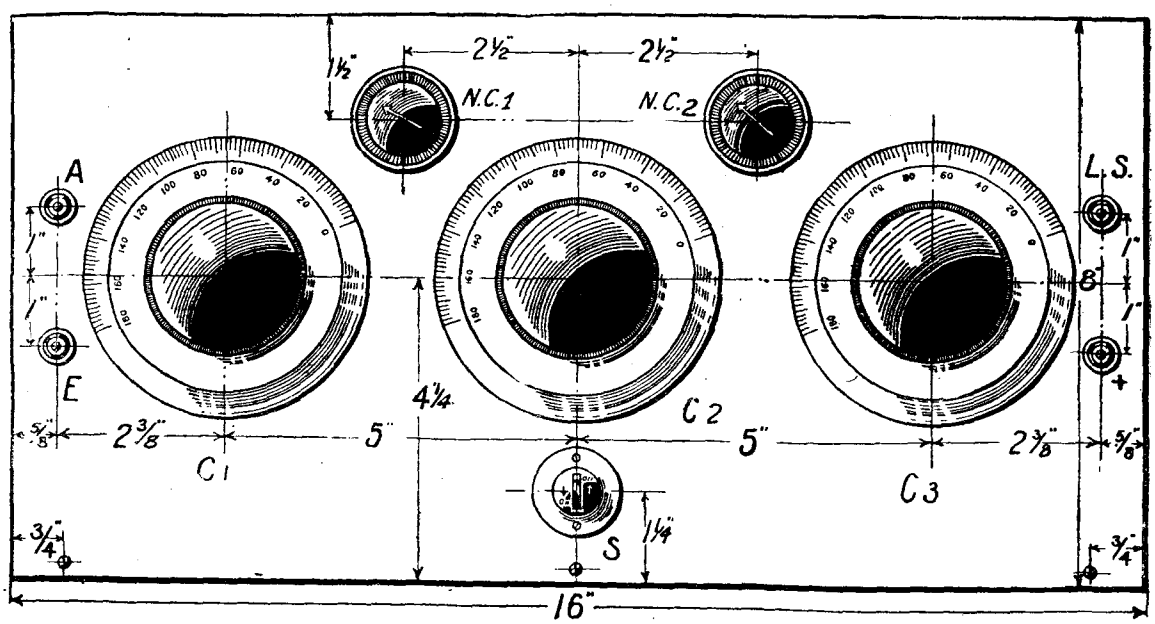


Fig. 2.—This drilling diagram may be obtained free. Ask for Blueprint 181a, free.

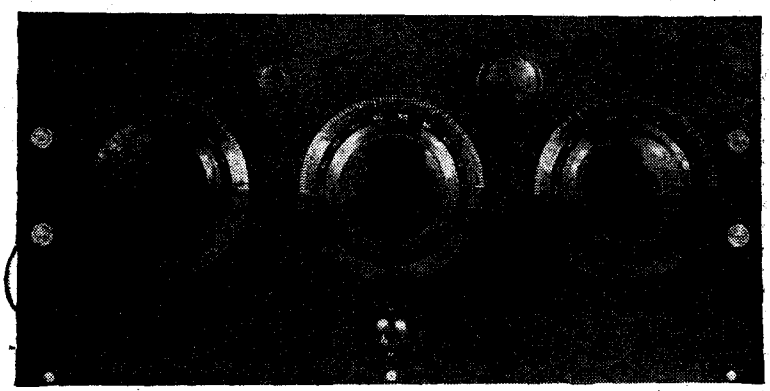
A "FOUR" FOR RANGE AND SELECTIVITY—*(Continued)*

deeper than the normal, but it does not require a special double-depth cabinet.

If necessary the baseboard could be made 9 in. deep by placing the components carefully.

Constructional Details

The first operation is the marking out and drilling of the panel. The panel should be marked out in accordance with the front-of-panel diagram supplied with this article, after which the condensers may be mounted in the positions shown. Details of the actual position of the holes can easily be obtained from the templates supplied with the condensers.



The layout of the panel is neat and symmetrical.

The mounting of the two neutralising condensers requires no comment save a note that the larger condenser is that marked N.C.2 on the drilling diagram. The four terminals and the on-off switch may then be mounted, and this completes the layout.

temporarily in position in order to make sure that ample space is left round all the components, and that none of the condensers or other components on the panel foul any of the baseboard components. When the various parts have been correctly spaced they may be screwed down and the wiring up commenced in accordance with the blueprint and wiring instructions.

Testing Out

The receiver is then ready for testing out. Carefully check over the connections and ensure that they are in accordance with the diagram given. Then tune in to the local station, the approximate setting being obtained from the test report given with this article.

Place the first neutralising condenser about half-way round, and the second all out. With average valves this will be found satisfactory, and no further adjustment is required.

If desired, of course, the first valve may definitely be neutralised by the usual methods, but the circuit is stable over a wide band of the neutralising condenser setting, and is thus not critical of adjustment. The second valve, of course, is deliberately over-neutralised to provide reaction.

Dial Settings

Other stations may readily be tuned in by setting the three dials approximately to the positions given in the test report. Tuning is somewhat sharp, so that difficulty may be experienced at first until the actual dial settings for the various stations have been logged.

The reaction condenser does not produce any increase in strength until the last two circuits are in tune. It is advisable, therefore, to move the condenser a little at a time and to re-tune on each occasion, as otherwise the set may burst into oscillation unexpectedly.

Valves

The first three valves should be of the high-impedance type usually employed for high-frequency work.

COMPONENTS REQUIRED

One panel, 16 in. by 8 in. by ¼ in. (Ebonart.)
One cabinet to suit, with baseboard, 16 in. by 10 in. by ⅝ in. (W. H. Agar.)
Three .0005 straight-line frequency condensers. (Eureka, Ormond or other suitable S.L.F. condensers.)
Two coil screens. (Bowyer-Lowe, Efesca, Lewcos, Magnum or Peto-Scott.)
Two split-primary transformers. (Ditto.)
One tapped coil. (I have used here a Lissen 60X, which approximately matches the screened coils in inductance, and so gives similar dial readings.)
One L.F. transformer. (R.I. multi-ratio.)
Three vibratory valve holders. (Lotus.)
One vibratory valve holder with 2 megohm grid leak incorporated. (Lotus.)
Four baseboard mounting filament resistances, 30 ohms. (A. F. Bulgin.)
One .0003 fixed condenser. (Finston.)
One .0005 fixed condenser. (Finston.)
One 1 mfd. fixed condenser. (T.C.C.)
One Marco three-plate neutralising condenser. (R. A. Rothermel.)
One Marco seven-plate neutralising condenser. (R. A. Rothermel.)
One coil mount. (Burne-Jones and Co., Ltd.)
One terminal strip, carrying seven terminals, 7 in. by 1¼ in. by ¼ in.
Four 4 B.A. terminals.
One Frost toggle on-off switch. (R. A. Rothermel.)
Glazite wire.
Radio Press panel transfers.

Baseboard Components

The remainder of the components may then be placed on the baseboard, and in view of the remarks which have already been made little comment is necessary at this stage. It is advisable to place the panel

A "FOUR" FOR RANGE AND SELECTIVITY—*(Continued)*

WIRING INSTRUCTIONS

Join one side of R1 to one side of R2 and thence to one side of C6, one side of R3, H.T.—, L.T.+, one side of R4, moving plates of C3 and terminal 2 of L5.

Join remaining sides of R1, R2, R3 and R4 to F+ contacts of V1, V2, V3 and V4 respectively.

Join L.T.— to G.B.+ and thence to one side of S, the two E terminals of screened coil bases, terminal 2 of L3, moving plates of C2, moving plates of C1, earth terminal, and pin connection of L1.

Join remaining side of S to F—contacts of V4, V3, V2 and V1.

Join other side of L1 to G of V1 and to remaining side of C1, and thence to moving plates of N.C.1.

Join A of V1 to terminal 5 of L2.

Join terminal 3 of L2 to remaining side of N.C.1.

Join terminal 1 of L3 to G of V2 and to remaining side of C2 and thence to moving plates of N.C.2.

Join A of V2 to terminal 5 of L4.

Join terminal 3 of L4 to remaining side of N.C.2.

Join terminal 1 of L5 to one side of C4 and to remaining side of C3.

Join other side of C4 to G of V3 (The gridleak R5 is already incorporated and connected in the valve-holder, V3.)

Join A of V3 to terminal P2 of transformer primary T1, and thence to one side of C5.

Join terminal Po of T1 to other side of C5 and to H.T.+1, and thence to remaining side of C6 and the No. 4 terminals of L2 and L4 respectively.

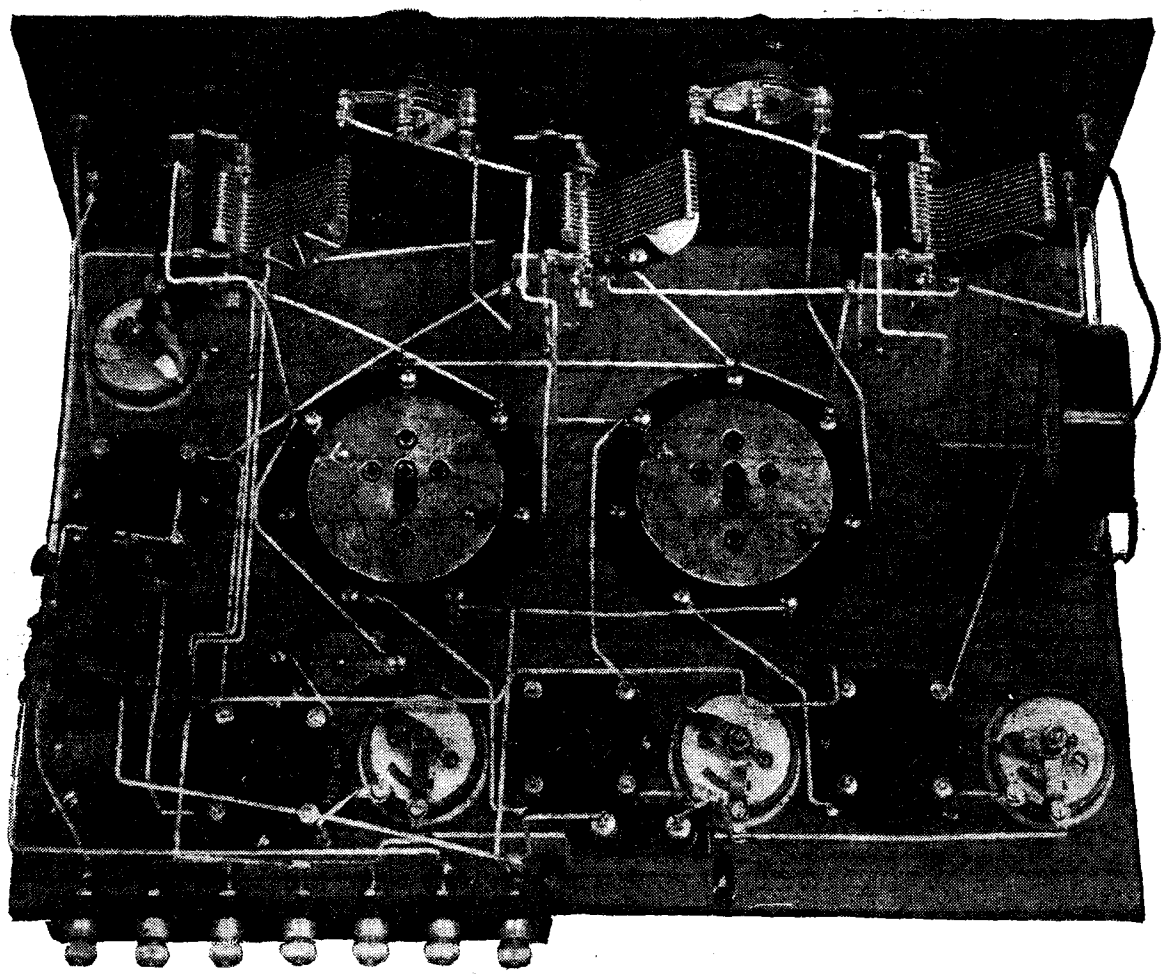
Join terminal S0 of transformer secondary T2 to G of V4.

Join S2 of T2 to G.B.—

Join A of V4 to top L.S. terminal.

Join L.S.+ to H.T.+2.

Join L1 tap lead to aerial terminal with flexible wire.



The H.F. stages incorporate screened coils, but the first grid circuit employs a tapped plug-in coil.

A "FOUR" FOR RANGE AND SELECTIVITY—*(Concluded)*

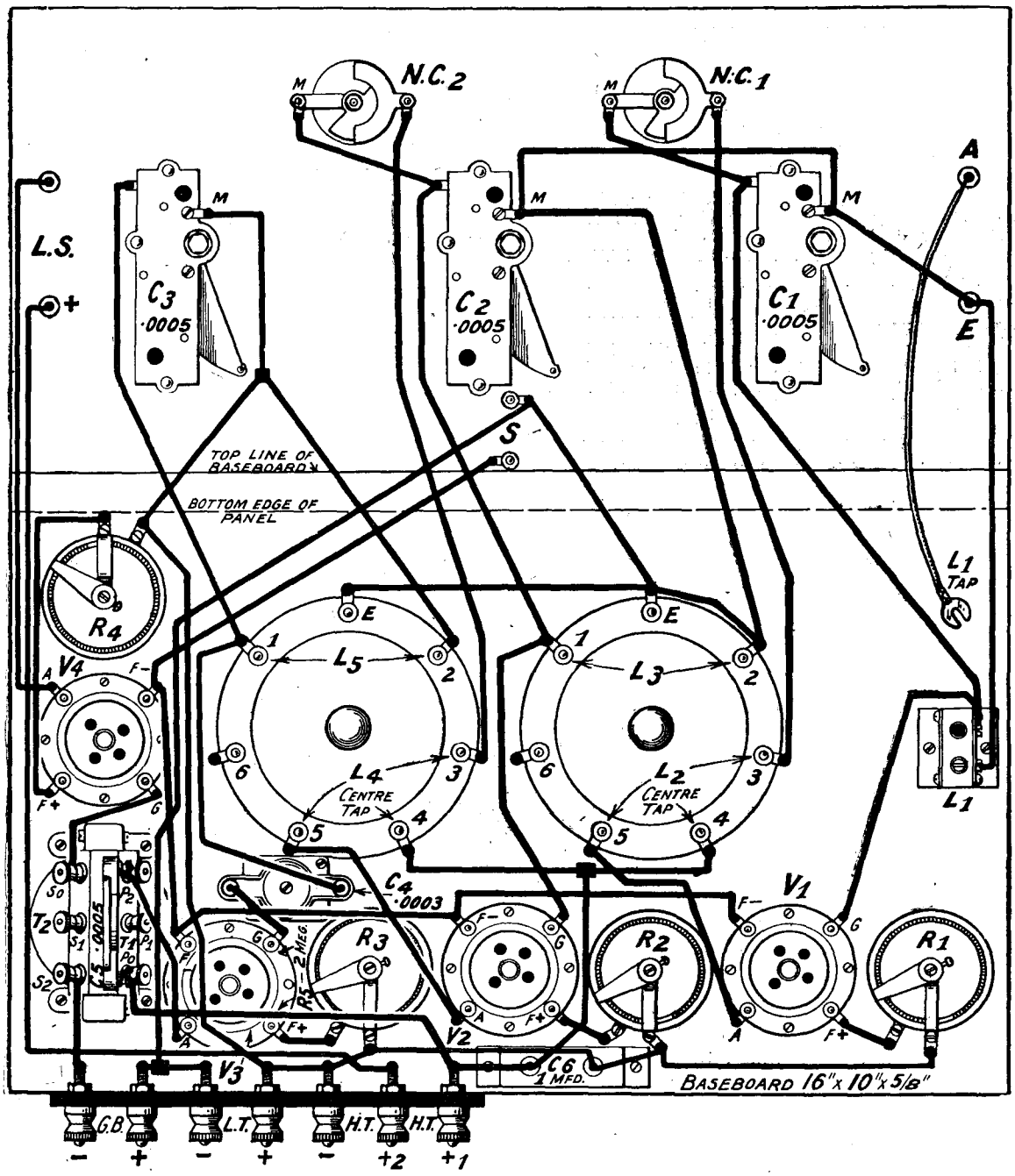


Fig. 3.—The condenser N.C.2 enables a reaction effect to be obtained. Blueprint 181b may be obtained free.

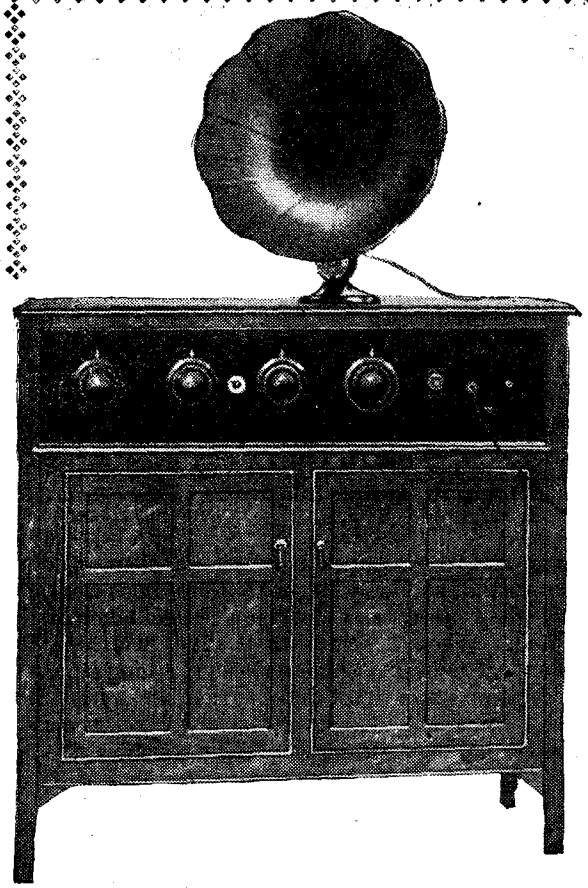
The last valve may be a low-impedance power-valve.

The H.T. voltages may be for H.T.+1 about 60-80 volts, and for H.T.+2 about 120 volts.

The set generally is not critical as regards valves, provided that the types specified are employed. With regard to the grid bias, this, of course, will depend upon the L.F. valve and the H.T. voltage. With the ordinary small power-valve working on an H.T. voltage of 120, the grid-bias may be from 6-7½ volts.

It will be noticed that the L.F. transformer used in the set is one with tapped windings. With the aid of these tappings various ratios can be tried and the best arrangement found by experiment to suit the particular detector valve used.

MORE "ELSTREE SIX" SUCCESSES



The "Elstree Six" built by Mr. Stafford.

"No Trouble"

SIR,—I have very great pleasure indeed in telling you that I completed the "Elstree Six," early last month. I had no trouble of any kind, and really cannot say how grateful and pleased I was. For the past three years I have tried various hook ups, spending much time and money, but I never even approached the results that the "Elstree Six" gave so easily; indeed, the results seemed too good to be true. I have sent the set to my brother at Travancore, South India, and hope in due course to receive a delighted report from him,—Yours truly,

C. W. STANDEN.

S.W. 11.

"A Lovely Set"

SIR,—Since the advent of wireless I have constructed innumerable sets of all descriptions, and have also heard the majority of the best proprietary brand sets that have been placed on the market.

I can conscientiously say that there is nothing to compare with the "Elstree Six." I enclose you a photograph of the set. The selectivity, volume and quality of this receiver is perfect. I have no difficulty in separating Cardiff, London and Manchester.

I receive all B.B.C stations at comfortable loud-speaker strength and the Continental stations are quite easy to tune in.

This is certainly the set for the wireless enthusiast who requires to receive all stations within a radius of 500 miles at full loud-speaker strength.

I shall be only too pleased to demonstrate it to anyone living within the neighbourhood of Wendover.

Thanking you for placing such a lovely set before the public.—Yours truly, H. STAFFORD.

"Huntly," Victory Road, Wendover.

"Super-sensitive"

SIR,—I have much pleasure in informing you that I have completed the "Elstree Six" with entirely satisfactory results. Using the coils for range 2 I have tuned in most of the B.B.C. stations and a fair number of the Continentals for which readings were given in the June issue of MODERN WIRELESS. These stations were received at good strength and without the least interference from the local station, which is about one mile distant.

The set is super-sensitive and yet ridiculously easy to control. I have tuned in three stations within the limits of one degree of the dial without the slightest overlapping or interference. In conclusion, may I thank you and your staff for such a design "par excellence" as the "Elstree Six."—Yours truly,

S. H. F. WILLIAMS.

Devonport.

Immediate Results

SIR,—Our Bristol office has asked the writer to report on the result of the "Elstree Six," which he has made up to test. He must congratulate your Elstree staff on their success. After completing and placing the dials in position for Cardiff, as given in the MODERN WIRELESS that station came in at loud-speaker strength immediately, and since then the set has been successful in bringing in all the B.B.C. stations on the loud-speaker, and the writer can well recommend this receiver to any keen listener who delights in getting all stations on the loud-speaker.—Yours truly, Pp. Automobile Accessories (Bristol), Ltd.,

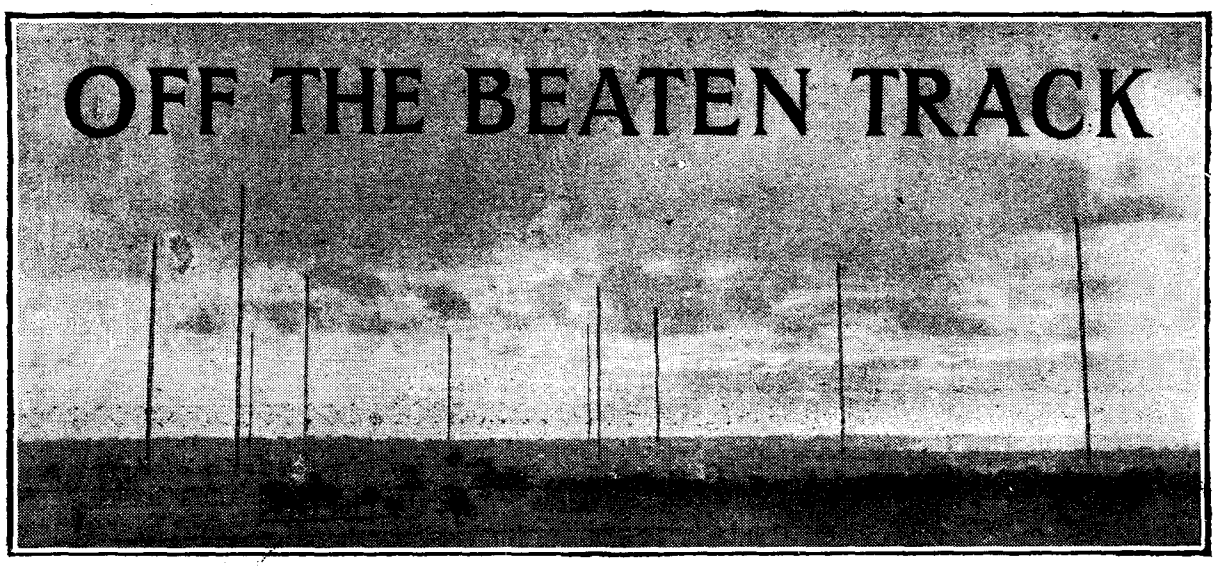
F. NEWCOMBE, Director.

Exeter.

Valves for the "Elstree Six."

As many readers are anxious to know whether 2-volt valves work satisfactorily in the "Elstree Six," a number of tests of these valves have been made at our Elstree Laboratories. Although our tests are not yet completed with all makes, we are in the position to say that Cossor Point One H.F. in the first three sockets, and Cossor Stentor Two in the last three are quite satisfactory.

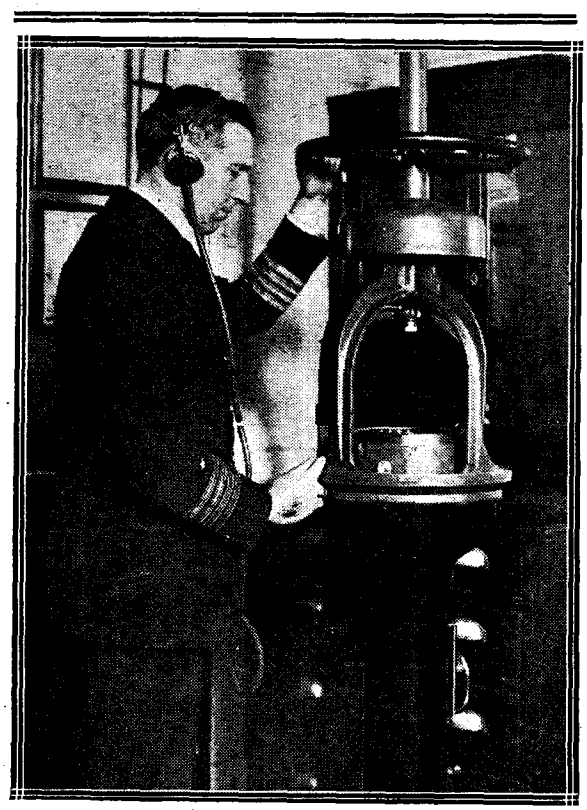
OFF THE BEATEN TRACK



TELEPHONY is apparently destined to "rule the waves" as far as wireless is concerned. One can no longer escape from it by ascending into the heights or descending to the depths! Rugby has been rampant on several different wavelengths between 4,000 and 8,000 metres, especially on Saturdays and Sundays, during the last month, and Nauen has started telephony transmissions on about 39 metres. The latter station has been received in London with a detector and one stage of L.F. at the same strength as 2LO, and with a superheterodyne adapted for working on wavelengths down to 20 metres he seemed as if he would burn out the loud-speaker. The station is also very sharply tuned, and really causes remarkably little interference.

Higher Up

NOTHING startling has been heard on the longer waves for some time now. From 600 metres up one seems to know just about what may be expected to happen, which certainly cannot be said about the shorter waves, extremely erratic in their performance as a rule. Probably the fact of the matter is that I have become "hardened" to the short waves, and the manner in which stations 5,000 miles distant suddenly begin to come in as clearly as if they were next door has been taken for granted. When I return to the longer waves, I half expect to hear a Chinese station lurking among the ships on 600 metres, and begin to feel hurt if it doesn't come off! However, the longer waves may certainly lay claim to much greater constancy.



The dangers of fog at sea have been greatly reduced by the use of direction-finding apparatus. Here we see a bearing being taken on board the s.s. "Leviathan."

Short or Long

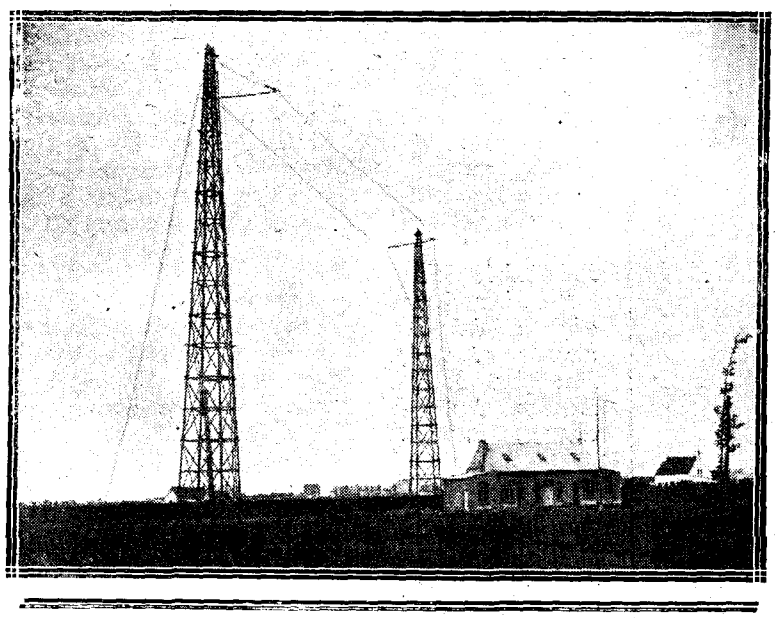
I VERY much doubt whether the long-wave C.W. stations will ever be superseded by short-wave stations working on lower power. To start with, "local" conditions have a much greater effect "down below," and fading and atmospherics also take their toll. Then there is the difficulty that crops up when high power is used on waves round about 40 metres. The range of the station is so tremendous that, according to reports of tests carried out by the American Government stations, the waves continue to chase one another round the earth, not being content to travel to their intended destination and stop there. The result is that when the transmitting station sends one dot, a station at the Antipodes would receive this, followed very closely by a weaker one, and possibly a few more!

OFF THE BEATEN TRACK—*(Concluded)*

This would, of course, make high-speed transmission very difficult, and unless wireless traffic can be handled just as fast on the short as on the long waves, the powers that be would doubtless prefer to stay where they are!

Some Unofficial Research

SEVERAL ships are working unofficially on the shorter wavelengths at the present time. These are chiefly of Swedish origin, since nearly all the motor-liners that ply between Gothenburg and Rio de Janeiro are equipped with 40-metre I.C.W. sets as well as the normal 600 metre spark (or 2,100 metre C.W.). The *San Francisco* (SGC) may often be heard working with amateur stations, as also can the *Suecia* (SGT) and the *Kiruna* (SDK). Others heard are SKA and SAD.



An important link in the Continental air traffic system — the wireless station at the Ostend aerodrome.

Two or three British boats are similarly equipped, the largest being the Cunarder *Carinthia* (GLKY), although its equipment has probably been rigged up chiefly by the operator.

An Interesting Test

MR. ERIC MEGAW (GI—6MU), of Belfast, recently travelled to Canada and back from Dublin, and obtained permission to take his transmitting and receiving gear with him on the ship. He has been working amateurs on both sides of the Atlantic with the call sign GX—6MU, and has gathered many useful particulars of the behaviour of short waves. It is rather remarkable that, some time after 5XX had become too weak to be enjoyable, amateur telephony on 45 metres, with powers of about 10 watts, was quite strongly received.

Short-wave Aerials

AERIALS for short-wave reception are apt to present a bit of a problem, but I have come to the conclusion that a fairly long aerial very loosely coupled to the set is difficult to improve upon. This also carries with it the great advantage that it is considerably more efficient on the broadcast band than a very short, low aerial, erected specially for short-wave work, would be. It is true that the use of a short aerial cuts down the strength of atmospherics very considerably, but if the longer aerial is sufficiently loosely coupled these will not be found too troublesome.

Low-Power Tests

I am glad to see that the R.S.G.B. (T. & R. Section) is arranging a series of low-power tests to be held during the week November 1 to 8. The maximum input power that will be allowed will be 10 watts, and the tests will take place between 11 p.m. and 8 a.m.

Such tests as these provide a real opportunity for the dry-battery specialists to show what they can do, particularly as the higher-powered stations will be closing down during the periods over which the tests are held.

Doubtless reports on reception of the competitors will be welcomed, especially if they come from fair distances.

OPERATING THE ELSTREE "SOLODYNE."

See page 471.

PRESS-MEN TEST THE "SOLODYNE"

An Interesting Demonstration at Elstree

IN accordance with the declared policy of Radio Press, Limited, of giving regular demonstrations of its new Star receivers, the remarkable Elstree "Solodyne" was demonstrated to a gathering of Press representatives at the Elstree Laboratories on Tuesday, August 31, last. Among those present were representatives of the following newspapers: *Morning Post, Daily Express, Daily Telegraph,* the *Scotsman and Dispatch, Daily News,* the Press Association and the Exchange Telegraph Co.

One Dial Control

Mr. J. H. Reyner, in charge of the demonstration, began by explaining to the visitors the difficulties that had to be overcome in designing a set in which one dial control was to be obtained without sacrificing efficiency. The set was thereupon connected to a small aerial—not a large and highly efficient aerial which might give misleading results, but a small affair comparable with that used by the average listener. One after another British and Continental stations were tuned in on the loud-speaker, the stations being so numerous that in many cases two or three stations were found within a couple of degrees on the dial.

Trying It Themselves

To prove that there was "no deception," as the conjurors will have it, each Press representative was invited to take charge of the instrument and turn the dial backwards and forwards to see how simple it was to pick up the stations. Although no member of the audience had previously handled a set, everyone agreed it was exceedingly simple to work.

Opinions

Among the numerous complimentary expressions of opinion published subsequently in the journals, we may give the following:—

MORNING POST

"A set that in actual test has received 50 Continental stations by merely turning one knob instead of endless fiddling with two or more controls, usual with such selective reception, was demonstrated to the Press last night. The set, which is called the 'Solodyne,' has been designed by the technical staff of Radio Press, Ltd., and the tests were held at the firm's laboratories at Elstree. By slowly rotating a large knob in the centre of the set, the loud-speaker responded to one station after another with a clarity and precision that was almost uncanny."

DAILY NEWS

"Universal reception made easy. . . . Last night I picked up a dozen stations in as many seconds by turning the dial a few fractions of an inch. Frankfurt, Munster, Bournemouth, San Sebastian, London, Cassel and Dresden tumbled over each other as I turned the dial slowly round."

DAILY EXPRESS

"A wireless receiver which is the last word in simplicity, and on which all Europe can be heard by rotating a single dial, was demonstrated to a 'Daily Express' representative last night. The set has five valves, and as the single dial was rotated,

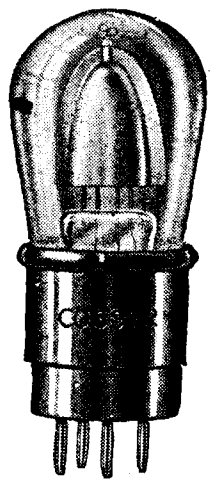
(*Concluded on page* 486.)

COMPONENTS FOR THE ELSTREE "SOLODYNE"

The Elstree "Solodyne" has achieved a popularity only equalled by the well-known "Elstree Six." Within a fortnight of the first details being published in the September issue of MODERN WIRELESS, applications were received for over two thousand wiring blueprints. At the National Radio Exhibition at Olympia the Solodyne was the centre of attraction. In view of this widespread interest, will readers please note that in addition to the Lewcos screened coils mentioned in the list of components, the following alternative makes will give satisfactory results: Bowyer-Lowe, Burhe-Jones, Efesca and Peto-Scott.

While approved components can be substituted for many others named in the original article, a mere claim that such-and-such a component is recommended by its maker as suitable for the "Elstree Solodyne" is no indication that it has been approved by the Elstree laboratories for the purpose. It is necessary to emphasise this point as several triple condensers in which the spindle is common to all three condensers are being erroneously recommended for this receiver. It should be noted that the three spindles must all be insulated from one another, and independent adjustment provided for each.

Here is absolute uniformity—longer life—increased sensitivity—incredible economy of operation—a shockproof filament—Co-axial mounting system—the same Cossor unblemished standard of excellence.



COSSOR POINT ONE
[Red Top]
For H.F Amplification and Resistance Capacity Coupling

Normal filament voltage 1·8
Filament current ·1 amp.
Maximum anode voltage 120 volts.
Impedance 42,000 ohms.
Amplification factor 13.

14/-

[Plain Top]
For Detector and L.F. use.

Normal filament voltage 1·8
Filament current ·1 amp.
Maximum anode voltage 120 volts.
Impedance 22,000 ohms.
Amplification factor 9.

14/-

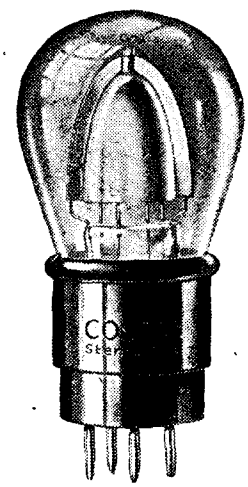
PERIODICALLY Cossor has inaugurated improvements in valve design so far reaching in effect as to be hailed as milestones in the progress of the industry. The first self-supporting unsprung filament was in the Cossor P1—still regarded as the standard British bright emitter. The first triple-coated filament to work at a really low temperature was to be found in the Wuncell Dull Emitter.

And now Cossor has aroused universal interest among all radio enthusiasts with the wonderful new Cossor Point One—the first Valve ever to utilise successfully Co-axial Mounting.

Already eager thousands have discovered in this new Dull Emitter a standard of performance which has never before been available in any valve. They have revelled in a super sensitivity which has enabled them to smash with ease their own records for long distance reception, and with the Stentor Two in the power stage they have been dumbfounded at the superb fulness of tone from the Loud Speaker.

Yet sensitivity and tonal purity are but two of the outstanding features of this new valve. Co-axial mounting permits the use of a shockproof filament suspension system which assures an abnormally long life. A new method of filament manufacture cuts current consumption to one tenth of an ampere. A new grid of exceptional rigidity banished for ever the bugbear of microphonic noises.

Obtain some of these wonderful new Cossor Valves without delay—they will set you a-tingling with enthusiasm and awake your admiration for the British research workers who have made such remarkable results possible.



STENTOR TWO
POWER VALVE.

Normal filament voltage 1·8.
Filament current ·15 amp.
Maximum anode voltage 150 volts.
Impedance 8,000 ohms.
Amplification factor 8.

18/6

Ask your Dealer for the new Cossor Folder which fully explains the new system of Co-axial mounting.

The new and amazing

Cossor Point One

Advertisement issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5.

A THREE-VALVE TRAP RECEIVER

By C. P. Allinson, A.M.I.R.E.

This selective receiver is of particular interest to the listener residing within the shadow of the local station, since at a distance of 1½ miles from 2LO it has been found possible to cut out this station and to receive Manchester free from interference.

I WAS chatting to a friend of mine the other day who lives within two miles of 2LO. "I'm very keen to search round and listen to other stations," he said, "only I find it practically impossible to cut London out. I can't afford to make a big multi-valve set (I haven't got room for it if I could) with numerous H.F. stages, special coils, extra valves, etc. Isn't there a set reasonably easy to control and not using more than three valves which will cut out 2LO and let me get something else?"

Living as I do about a mile and a half from 2LO the question of selectivity has always been one of special interest to me, and the set to be described in the following article is the outcome of much work done in this connection. I have endeavoured to make the control and handling of the set as simple as possible, while at the same time no special coils need to be made up. All the components used are standard parts and easily procurable.

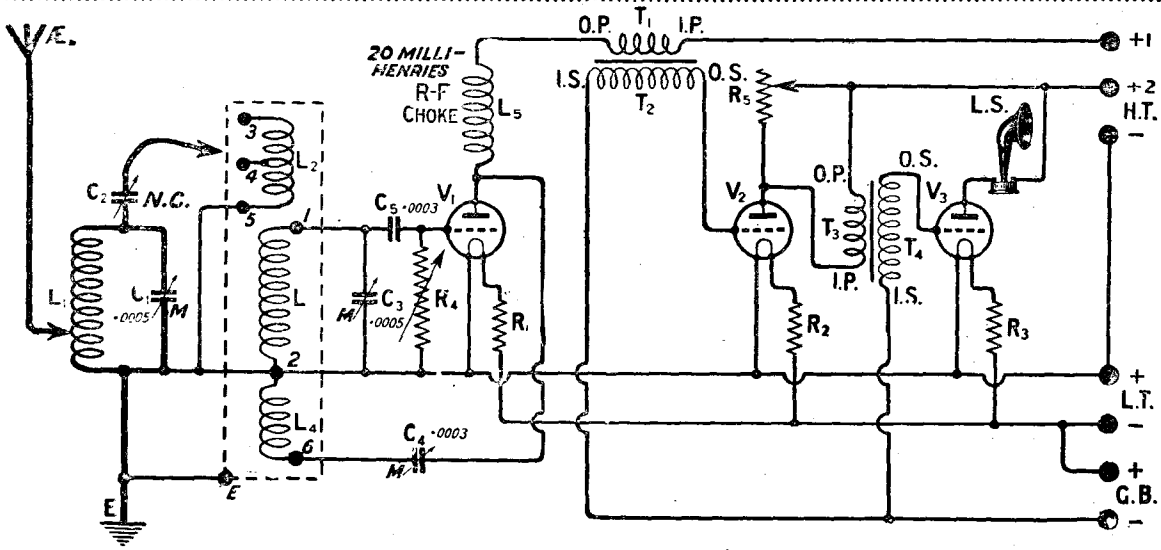


Fig. 1.—The simplified theoretical circuit. The jack connections are shown separately in Fig. 2.

Selectivity

With this set in use at about a mile and a half from 2LO the difference in selectivity is little short of astounding. With the aerial connected direct to terminal 3 of the screened coil Birmingham cannot be received owing to swamping from 2LO. With the second circuit in use however and the neutralising condenser about half way in, Bournemouth can be received without interference from the local station, while with a slight reduction in the coupling capacity and care in tuning it has been found possible to eliminate the local transmission on Manchester and receive this station quite clear though somewhat reduced in strength.

On the higher wavelengths it will be found an advantage to increase the value of the coupling con-

A THREE-VALVE TRAP RECEIVER—(Continued)

denser to obtain the best signal strength, while for the shorter wavelengths the reverse will generally be found the case.

Results

When tested out on a short aerial at a mile and a half from 2LO it was found possible to receive one or two stations beside the local one on the loud-speaker in daylight, the two best being Bournemouth and Birmingham. Manchester was extremely weak but could be tuned in nearly free of 2LO. At night this station could be received quite clear of interference and a number of British and Continental stations were received. Among these were Elberfeld, San Sebastian, a couple of relays, Union Radio Madrid, Manchester, Oslo, Bournemouth, Radio Toulouse, Hamburg, Dublin, Newcastle, Münster, Rome, Frankfurt, Birmingham, and others not identified. Some of these were received on the loud-speaker with three valves, others were received on the phones with only two of the valves in use.

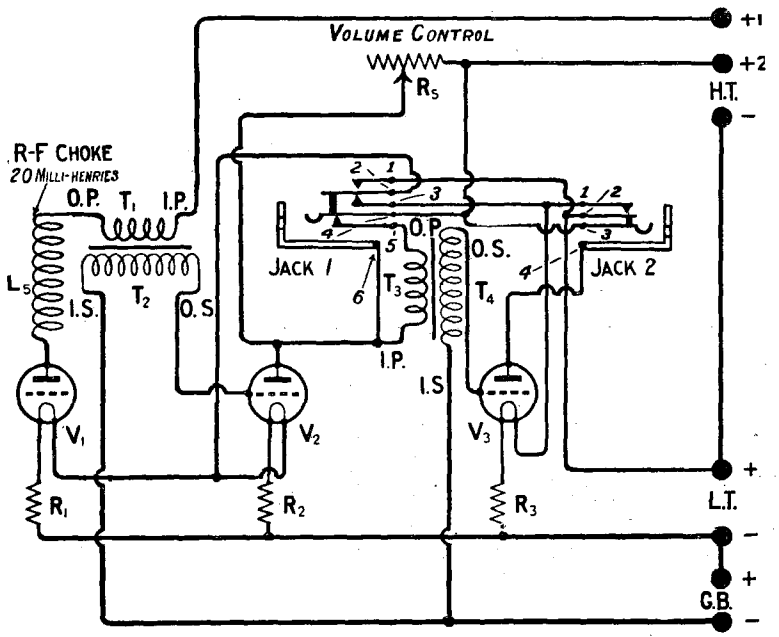


Fig. 2.—The jack switching permits two or three valves to be used as desired.

The Circuit

The theoretical circuit diagram is shown in simplified form in Fig. 1, and a brief consideration of the principles involved may be of interest.

The aerial is auto-coupled to a tuned circuit L_1 C_1; this circuit comprises the right-hand tuning condenser (as seen from the back of the panel) and the tapped plug-in coil seen in the single holder on the right-hand edge of the baseboard. This circuit is coupled to the detector grid circuit, and since it is not only important to have this coupling absolutely under control but also to eliminate direct pick-up in the grid circuit, this has been done by using a screened coil as shown in the views of the interior of the set.

The arrangement actually employed gives a very flexible scheme by means of which various degrees of coupling can be obtained. The screened coil used is the tapped primary H.F. transformer, which is provided with a reaction winding.

Coupling

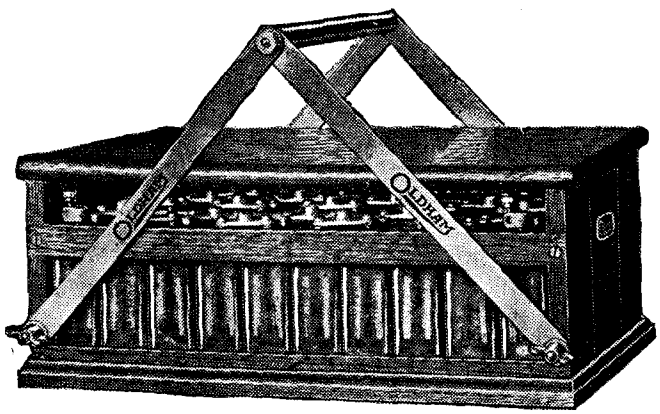
The coupling between the two circuits L_1 C_1 and L_3 C_3 is obtained by means of a small variable condenser C_2. This is actually a neutralising condenser. One side is connected to the top of the circuit L_1 C_1 while a flexible lead on the other side enables it to be con-

COMPONENTS REQUIRED

One ebonite panel, matt finish, 20 by 8 by ¼ in. (Paragon.)
One cabinet for same with loose baseboard 8½ in. deep. (Peto-Scott Co., Ltd.)
One screened coil with screen and base. Type tapped primary H.F. transformer with reaction winding. (Bowyer-Lowe, Efesca, Lewcos, Magnum, or Peto-Scott.)
Two ·0005 variable S.L.F. condensers and
One ·0003 variable S.L.F. condenser. (The Formo Co., Ltd.)
Two L.F. transformers, first and second stages. (Gambrell Bros.)
One 20 millihenry H.F. choke. (Bowyer-Lowe Co.)
Three fixed filament resistances. (Bowyer, Lowe Co.)
One double circuit double filament control jack. (Bowyer-Lowe Co.)
One single circuit single filament control jack. (Bowyer-Lowe Co.)
One plug. (Bowyer-Lowe Co.)
One baseboard mounting neutralising condenser. (Peto Scott Co., Ltd.)
One baseboard mounting single coil socket and
One variable grid leak. (Beard and Fitch, Ltd.)
3 anti-microphonic valve holders. (Etherplus.)
Two National Velvet Vernier dials. (Rothermel Radio Corporation of Great Britain, Ltd.)
One volume control. (Burne Jones, Ltd.)
One ·0003 fixed grid condenser type 600A. (Dubilier Condenser Co., Ltd.)
Nine terminals.
Three or four packets of Glazite. (London Electric Wire Co., Ltd.)
Strip of ebonite 7 by 2 by ¼ for terminal panel.
One dial and knob for reaction condenser. The ones used were obtained from Messrs. Burne Jones, Ltd., but an ordinary dial may be used here if desired.
Two spring clips.

Don't throw your Fountain Pen away every time it runs dry!

NO fountain pen user would think of throwing his pen away whenever it ran dry. Yet that is exactly what thousands of wireless users are continually doing — whenever their H.T. Dry Battery "runs out" they are obliged to scrap it and buy a new one. But those who have discovered Oldham are more fortunate; they just charge their H.T. Accumulators whenever they run down (four times a year) and forget them! Thus has the Oldham High Tension Accumulator solved the vexed question of H.T. Supply. There are so many improvements embodied in this latest Oldham triumph that it is difficult to imagine anyone ignoring it for one of different make. The refinements which the Oldham includes have long been eagerly looked for by all who deplored the inefficiency of the old dry battery. Think what it means to have an Accumulator which gives the many following advantages:



10d. per volt

60 volts £2 10 0, 100 volts £4 3 4
80 volts £3 6 8, 120 volts £5 0 0

Complete with lid and handles
Solid Oak Base, 3/6 extra.

A glance at the illustration will show it is built on the unit system—like an expanding bookcase. You can start with, say, 60 volts, and then add to it in 20 volt units as the need arises; 80, 100, 120 volts—just as you will.

The Accumulator is always neat and tidy—fit to take its place in any room. Acid can't be spilt, and when it needs recharging a convenient carrying handle is available. Each of its big capacity cells is a miniature Oldham accumulator capable of holding its charge for months on end. Each plate is made under the same Special Activation Process which has made the name Oldham famous throughout the world.

Which do you prefer—the ordinary dry H.T. Battery with its conseqeunt noises and cracklings—after some of the cells have become weak—its distortion, lack of volume and constant expense for renewals; or the Oldham H.T. Accumulator which will give a new lease of life to your set, more volume, greater sensitivity, and the utmost economy in operation? Once a man chooses this Oldham he never goes back to expensive dry batteries.

Ask your dealer to show you one of these handsome H.T. Accumulators — don't be put off with a substitute. Nothing can take its place for none other can give you the same steady flow of power—the same freedom from sulphation and the same generous length of service.

OLDHAM & SON, Ltd., Head Office & Works: Denton, MANCHESTER.

London Office and Service Depot: 6, Eccleston Place, S.W.1. (Phone: Vict. 0286).

Special Activation Process

OLDHAM

Gilbert A.I. 5816

Here are the N.P.L. figures

—now you can judge for yourself!

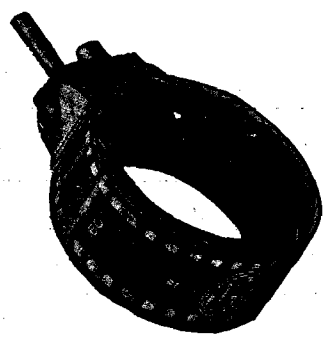
TABLE 1			TABLE 2			
Coil	Inductance in microhenries	Self-capacity in micro-microfarads	Coil	Parallel capacity in micro-microfarads	Wave-lengths in metres	Effective resistance in ohms
35	61	15	35	300	264	2.8
40	90	15	40	,,	318	2.9
50	150	9	50	,,	406	3.3
60	200	13	60	,,	472	4.4
75	295	12	75	,,	573	5.3
100	540	11	100	,,	774	6.6
150	1,410	12	150	,,	1,250	15.8
200	2,220	17	200	,,	1,580	19.7
250	3,070	17	250	,,	1,860	24.9
300	4,800	14	300	,,	2,320	28.2

IN the design of radio inductances it is a well-established fact that the smaller the R/L value for any circuit the greater is the selectivity and signal strength.

Because this fact predominated in the design of the LEWCOS Coil we can publish without fear the R/L values obtained in independent tests by the National Physical Laboratory.

Why the wave-length is given.

We would draw the attention of readers to the wave-length at which the measurements were made. This is a most important point which is often overlooked by amateurs and sometimes even by manufacturers when quoting the H.F. resistance figures for their coils. Resistance in high frequency varies with the frequency and to give a figure for H.F. resistance without the wave-length at which that resistance was measured is valueless.



Try this better coil yourself!

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Price .	4/6	4/6	4/6	5/-	5/6	5/6	6/9	7/6	8/6	9/-	10/-

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CUTS OUT 2LO AT 1½ MILES

nected to various points. By connecting it to terminals 3 and 4 a combination of capacity and magnetic coupling is obtained. By connecting it direct to the grid of the detector valve (terminal 1 on the screened coil) capacity coupling only is employed.

The last method appears to give somewhat tighter coupling, in fact under some circumstances it may be too tight, and the first method is frequently to be preferred. It will be seen then how important it is that no stray coupling be present between the two circuits, and the use of the screened coil enables this to be accomplished.

A note of warning may be sounded here. The coupling between the two circuits must be loose if satisfactory results are to be obtained. If it is too tight the two tuning controls will not be independent, but the interaction between them will make it practically impossible to handle the set, while the effect on reaction, too, is disastrous. In order to facilitate the tuning of this receiver the use of some form of vernier control is most certainly desirable and geared dials have been fitted to the tuning condensers for this purpose.

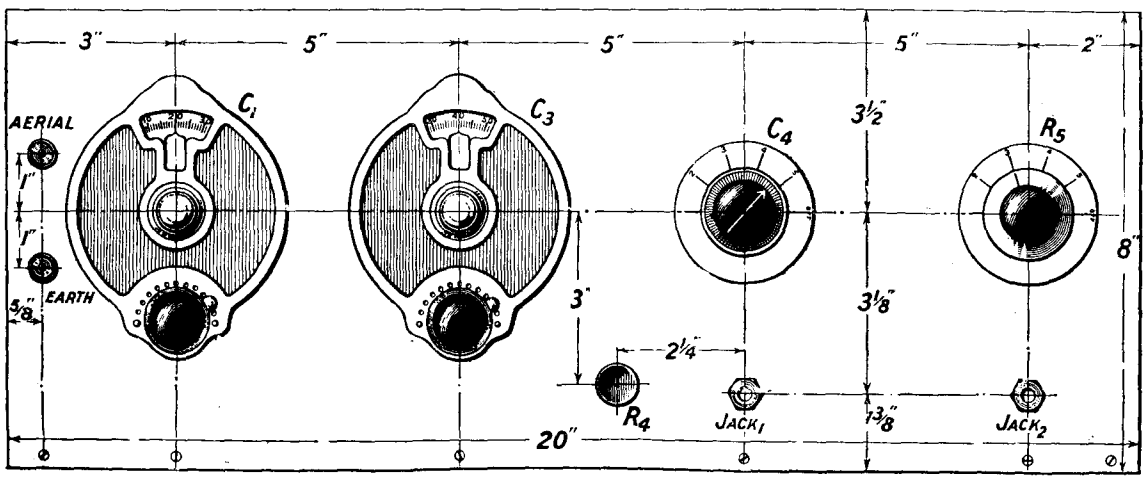
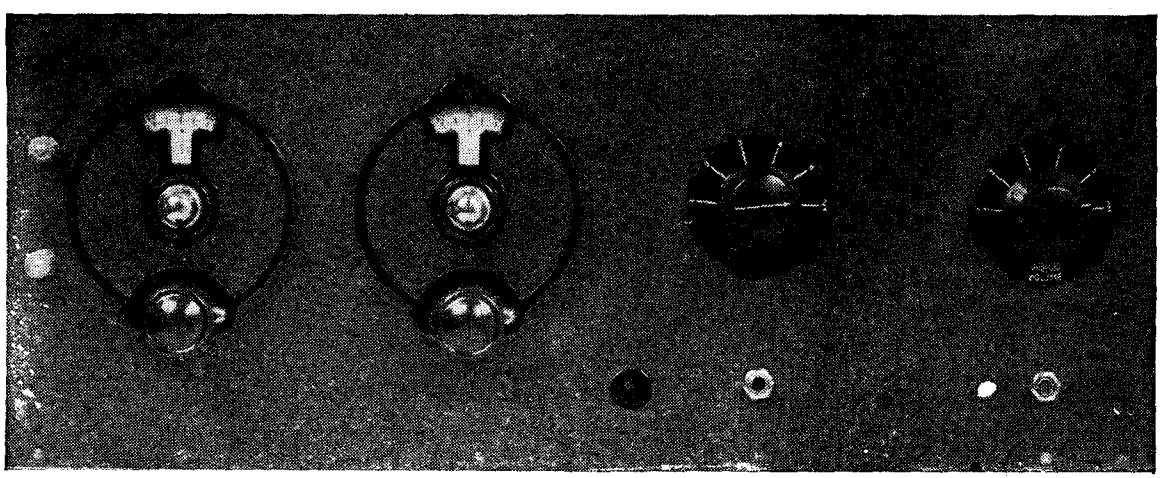


Fig. 3.—The slow motion dials have a fine and coarse adjustment incorporated. Blueprint No. 180a may be obtained free of charge.

The L.F. Stages

The two stages of low-frequency amplification are quite straight forward and jack switching is employed to enable either two or three valves to be used at will. Filament control jacks have been used so that inserting the phone or loud-speaker plug in either jack lights up the correct number of valves. The connections for this are shown in a separate diagram in Fig. 2 for the sake of clearness, and



The knob on the extreme right is a volume control which enables very strong signals to be adjusted to a pleasant strength.

A THREE-VALVE TRAP RECEIVER—*(Continued)*

the contacts have been numbered so as to simplify reference to it in conjunction with the wiring diagram for making the connections in the set itself.

It should be noted that the primary connections of the second L.F. transformer are reversed to those of the first one, and this must be followed if the same transformers are used as are in the set.

Resistances

Before going on to the constructional work we have yet to decide what value filament resistances to use. If 5 volt valves of the ¼ ampere type are to be employed then the correct values for these resistances when a 6 volt battery is used will be 4 ohms. Of course where 2 or 4 volt valves are used throughout with 2 or 4 volt batteries respectively no resistances need be used at all. If it is intended to use two ·06 valves for the detector and first L.F. followed by a five volt power valve, then the first two resistances will need to be 50 ohms each and the last one 4 ohms as before. If the last valve is to be a 4 volt valve with the ·06 valves for the first two and a four volt accumulator is employed then the first two resistances will be 17 ohms and no resistance is needed for the last valve.

These figures are merely to serve as a general indication of some of the more usual values—it is obviously impossible to give a full list of the various types of valves and the values of the resistances that would be required since the large varieties of types of valves with different voltages and ratings would require a few pages being devoted to this alone.

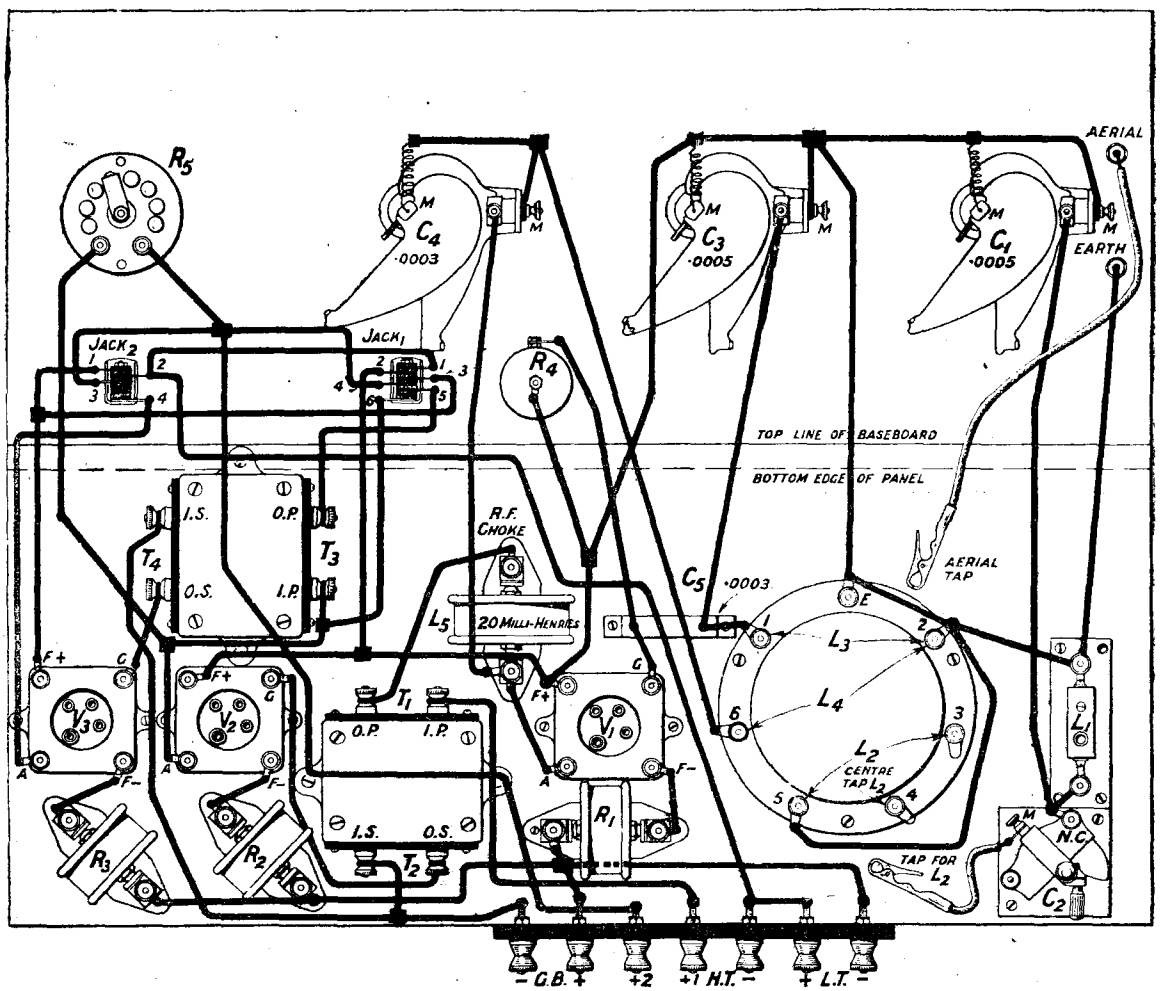


Fig. 4.—The connections to the L.F. transformer primary windings should be followed with care. Blueprint No. 180b is available free.

Components

A complete list of the components required to construct this receiver is given herewith, but it should be borne in mind that the particular makes mentioned are not indispensable to the working of the receiver provided that any parts substituted are of reliable make.

Construction

The first stage of the constructional work is to prepare the panel

Clothed in Metal

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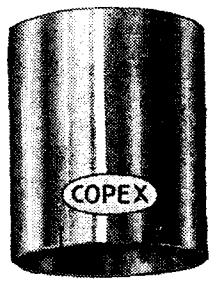

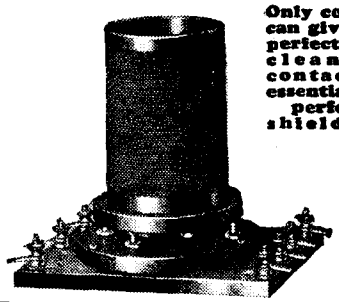

Note:
Only copper can give the perfect self-cleaning contact so essential for perfect shielding.

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Send a postcard for a free copy of the "Pilot Manual" giving comp'ete specifications and details of many of the new Radio Press Receivers. Several pages are devoted to useful constructional hints. Fully illustrated.

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Such selectivity has at last been rendered possible by the development of shielded coils. In the new Radio Press Sets, shielded coils are used to eliminate "direct pick up" and to ensure absolute stability by abolishing interaction.

One of the first shielded coils — if not the first—to be developed in conjunction with the Radio Press Laboratories at Elstree was the Copex. This highly efficient Coil and Shield has been approved by Radio Press and since used by them in a number of their most recent Receivers.

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The Copex Shielded Coil possesses valuable exclusive features. Its shield is made of copper — thus ensuring perfect electrical contact between the detachable top and its base. Aluminium tends to oxydise and particles flake off—this prevents a really good contact being maintained and negatives much of the advantage of shielding. Within the shield is the standard six-pin base which permits the use of interchangeable coils and H.F. transformers. All Copex coils are accurately wound on genuine ebonite tube. Only silk covered copper wire of the highest conductivity is used and all H.F. Transformers are accurately matched to ensure the highest degree of selectivity being obtained.

For the Elstree SOLODYNE

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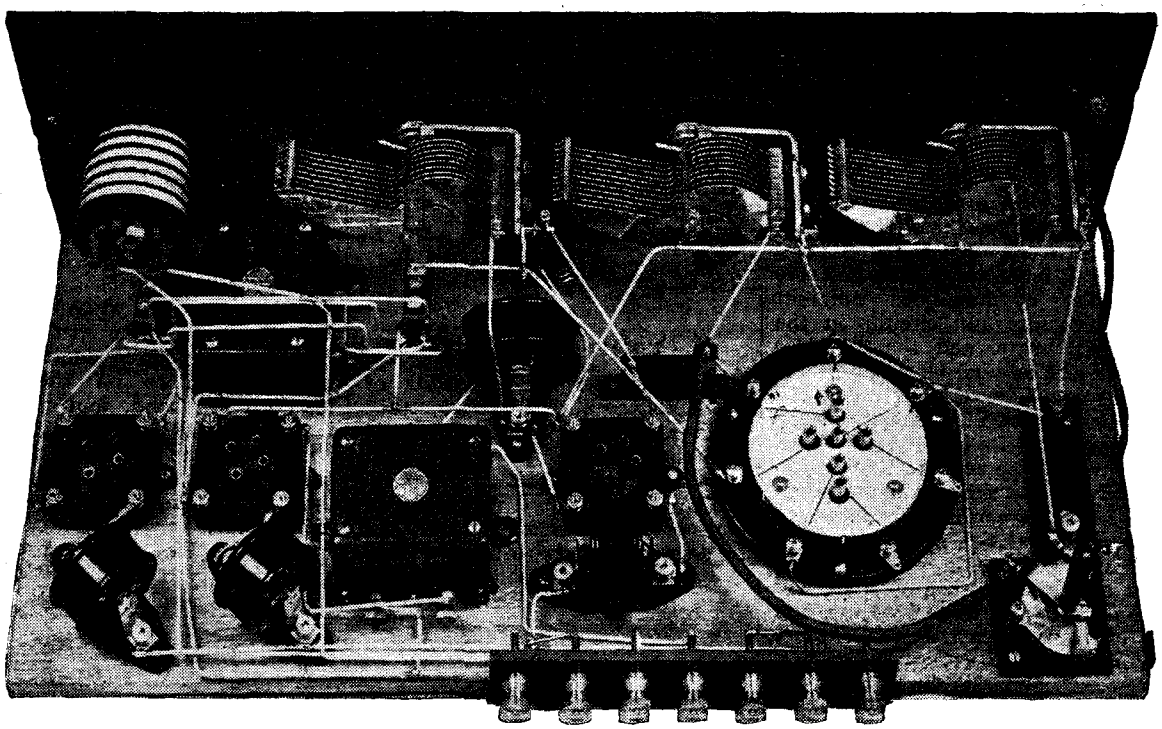
COPEX COPPER SHIELDED COILS

Gilbert Ad. 5821

A THREE-VALVE TRAP RECEIVER—*(Continued)*



The small neutralising condenser on the right-hand edge of the baseboard is the coupling condenser C2.

for mounting the components on it. For this purpose the panel lay-out shown in Fig. 3 should be consulted. Not only does this give the various dimensions, but it is drawn to scale. It will be found of great help in marking out the panel. The holes for the variable condensers, volume control and jacks may all be $\frac{3}{8}$ in., while 5-16 in. will serve for the variable grid leak. The holes for the two terminals and the fixing screws by means of which the panel is fixed to the baseboard will depend on the terminals and screws actually used.

The components are now mounted on the panel and this is fixed to the baseboard, and the components which go thereon may be placed in position. The wiring may then be carried out in accordance with the instructions and blueprint.

(Concluded on page 492.)

WIRING INSTRUCTIONS

Join IS of T4 to IS of T2: IS of T2 to GB—.
Join OS of T4 to G of V3.
Join OP of T3 to Contact 5 of Jack 1.
Join Contact 6 of Jack 1 to IP of T3: IP of T3 to A of V2: A of V2 to one side of R5.
Join A of V3 to Contact 4 of Jack 2.
Join Contact 4 of Jack 1 to remaining side of R5, Contact 3 of Jack 2, and H.T.+2.
Join Contact 3 of Jack 1 to Contact 1 of Jack 2: Contact 1 of Jack 2 to F + of V3.
Join Contact 1 of Jack 1 to Contact 2 of Jack 2: Contact 2 of Jack 2 to H.T. —: H.T. — to L.T.+.
Join Contact 2 of Jack 1 to F+ of V2 and F+ of V1: F+ of V1 to one side of R4 and to moving plate contacts of C3: moving plate contacts of C3 to moving plate contacts of C1 and E of coil screen base: E of coil screen base to terminal 2 of L3: terminal 2 of L3 to terminal 5 of L2 and pin of holder for L1: pin of holder for L1 to earth.
Join L.T. — to GB +: GB + to one side of R1: same side of R1 to one side of R2: same side of R2 to one side of R3.
Join remaining side of R1 to F — of V1.
Join remaining side of R2 to F — of V2.
Join remaining side of R3 to F — of V3.
Join OP of T1 to one side of L5.
Join IP of T1 to H.T. + 1.
Join OS of T2 to G of V2.
Join flex lead with spring clip on end to aerial terminal.
Join fixed plates of C1 to socket of holder for L1: socket of holder for L1 to fixed plates of C2.
Join flex lead with spring clip on end to moving plates of C2.
Join fixed plates of C3 to one side of C5: same side of C5 to terminal 1 of L3.
Join remaining side of R4 to remaining side of C5: same side of C5 to G of V1.
Join A of V1 to remaining side of L5: same side of L5 to fixed plates of C4.
Join terminal 6 of L4 to moving contacts of C4.

THE "ELSTREE SIX"

Further Letters from Readers who have tried this remarkable Receiver for themselves.

"Surpasses all Others"

SIR,—I was agreeably surprised with the results I heard during the demonstration of the "Elstree Six." I have tried and had the handling of numerous different types of sets and circuits in the last six years, and the "Elstree Six" certainly surpasses all others with regard to selectivity and the elimination of interference, in my estimation.

I would like to take this opportunity of thanking you and your staff for the cordial way in which we were received at your laboratories; everything possible being done to make us comfortable, and no pains spared to demonstrate and explain any query that was asked.—Yours truly,

L. A. GREENWOOD.

N.4.

"Truly Wonderful"

SIR,—*Re* the demonstration of the "Elstree Six," I consider that it is a truly wonderful receiver. The stability and selectivity are all that could be desired.

The way one can go from one station to another, only one degree or so apart on the dials, without a sign of self-oscillation or interference from other stations is wonderful.

Wishing you every success with all your publications.—Yours, etc.,

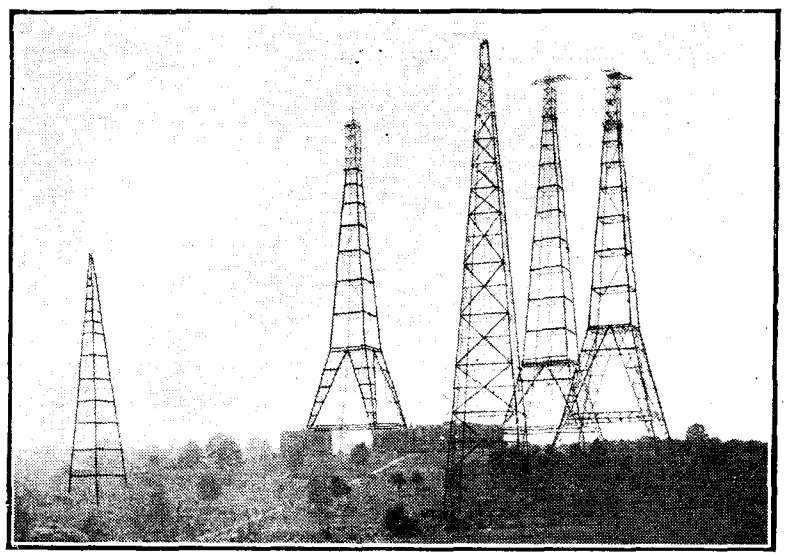
G. SMITH.

Reading.

Before I close I take this opportunity of congratulating you on the production of this remarkable set.—Yours truly,

W. BARROW.

S.W.11.



Some of the giant masts which support the aerials of NAA, the United States Navy Department Station, situated at Arlington, U.S.A.

"Selectivity Remarkable"

SIR,—It is with much pleasure that I give you my opinion of the "Elstree Six." The evening that I heard this set I think atmospheric conditions were very bad. This speaks all the more for the set, as at that time I could hardly get any distance on my own set. Nevertheless, that evening I heard every B.B.C. station, including relays, using the "Elstree Six." The selectivity of the set was remarkable; but more surprising still was the simplicity of tuning, although four tuning dials were used. Later on in the evening, about 10 o'clock, the different stations came in at tremendous strength.

"Easy to Handle"

SIR,—I was very much impressed, during my visit to your laboratories, by the efficiency of the "Elstree Six," and in the three hours or so I spent at Elstree was given a demonstration such as I had not had the good fortune to witness before. There is no doubt that the "Elstree Six" marks a big step forward in radio science. On working the set myself, I found it as easy to handle as a one-valve reaction receiver, while its selectivity and range were all that could be desired. It was demonstrated in my presence on the whole broadcasting band, and reception in all cases was pure and distortionless, while the neutralisation was complete over the entire range, thus making the receiver quite stable.—Yours truly,

S. KINGHAM HERBERT.

London.

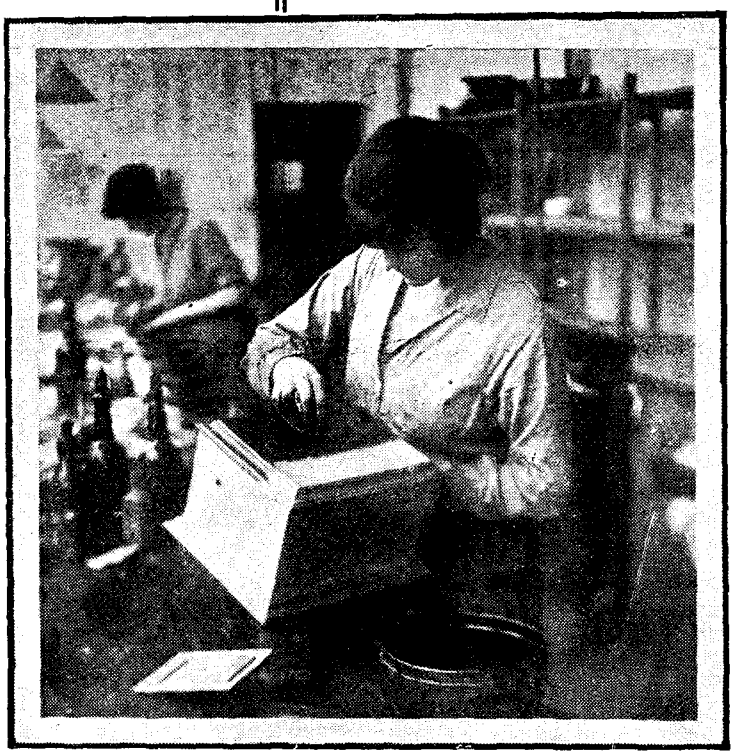
"Wonderful Achievement"

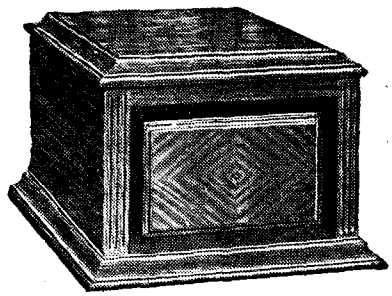
SIR,—I am writing to thank you for the privilege of seeing and trying for myself the "Elstree Six." I think it a most wonderful receiving set, and I was amazed at the selectivity and ease with which one could tune in station after station.

I should like to compliment your engineers on their wonderful achievement.—Yours truly,

A. WATERS.

Surbiton.





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Gilbert Ad. 5804.

MORE FACTS ABOUT AUDIO FREQUENCY TRANSFORMERS

The simplified expression giving the amplification ratio of valve and L.F. transformer is—

$$\mu \times \sqrt{\frac{Z^2}{R^2 + Z^2}}$$

where μ is the amplification factor of the valve.

"Z" is the impedance of the transformer.

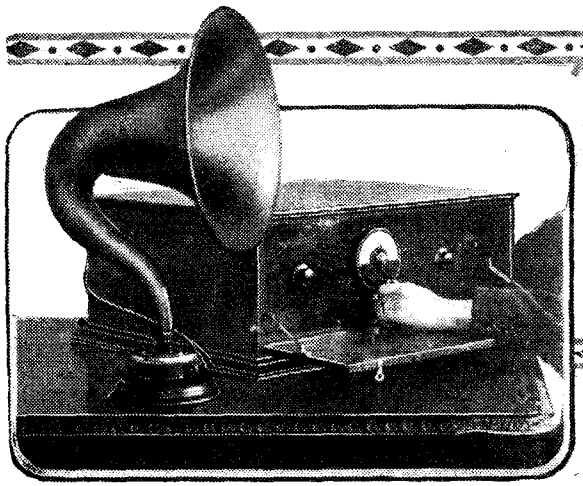
"R" is the impedance of the valve.

If, at a given frequency, the valve impedance "R" equals the transformer impedance "Z," the expression becomes $\mu \times \sqrt{\frac{1}{2}}$ or $\mu \times 0.7$.

On the other hand, the greater the transformer impedance "Z" the more nearly does the expression become equal to $\mu \times \sqrt{1}$ or $\mu \times 1$.

Thus, the greater the transformer impedance the greater the amplification ratio, and to choose a transformer of lower impedance to match the impedance of the valve merely results in impairing the amplification.

Therefore, to obtain the best results choose a transformer of very high impedance, and, seeing that transformer impedance varies with frequency whilst valve impedance is practically unaffected by frequency, choose a transformer which has high impedance at low frequency, say 100 : otherwise, low notes will not be reproduced satisfactorily.



OPERATING THE ELSTREE "SOLODYNE"

By J.H. REYNER B.Sc.(Hons.)A.M.I.E.E.

THE SENSATION OF THE SHOW

Single-Dial-Operated Long Distance Set makes History at the Radio Exhibition

"The very set I have been waiting for!" Thus exclaimed almost every member of the large crowd who jostled one another to inspect the "Solodyne" at the Olympia Wireless Exhibition. This article tells you how to make those essential adjustments which, once performed, enable you to equal the wonderful results already publicly demonstrated at Elstree. Thousands of readers are already building the set from the constructional details given last month.

THE instructions for making and wiring up this receiver were given last month, and the receiver is so simple in operation that I have no doubt that many constructors have already obtained good results on their own receivers. There are however, one or two points upon which the actual methods adopted at Elstree will be of interest.

Before passing on to these, however, reference should be made to the fact that the slow-motion dial employed on this receiver was inadvertently omitted from the list of components. As the photographs and diagrams, however, indicated fairly clearly this was one of Messrs. Cleartron's Micro-Selector dials. Those readers who prefer to use the dial supplied with the condenser can of course do so, but I have found that a slow motion dial is of distinct advantage.

We will assume that the receiver has been satisfactorily made up in accordance with the instructions given last month, and that the usual preliminary tests have indicated that the wiring is correct.

Balancing

The first step is now the balancing of the triple condenser. First roughly neutralise the receiver by placing the neutralising condensers about one quarter of the way round, that is to say very nearly at the minimum capacity. Now tune in to the local station, the approximate position of which may be obtained from the test report given last month. The aerial should be connected either to A_1 or A_2 according to the actual size of the aerial. If a large aerial is being employed then the smaller tapping, *i.e.*, A_2 should be employed. If a small aerial is used, then the larger tapping A_1 should be chosen.

The Aerial Condenser

Having chosen the aerial tapping required, the set is then tuned in to the local station as just mentioned. Now unscrew the small locking screw in the universal joint between the aerial condenser (the condenser farthest away from the panel) and the remainder of the triple condenser. When this screw is loosened it will be found possible to rotate the aerial condenser independently of the other two. By this means the aerial circuit may be brought approximately into tune. An accurate balance cannot quite be obtained by this method because tuning on the local station at first will be found a little bit broad. This serves, however, for a preliminary balance, and the screw may then be tightened up again.

Neutralising

The receiver should now be neutralised correctly. Leave the receiver tuned to the local station, and remove the fixed resistor for the first high-frequency valve. This is the one on the right hand side of the set at the rear of the baseboard. Signals will still be heard in all probability, and the neutralising condenser should be adjusted until a silent point is obtained. The neutralising condenser may then be locked in position.

OPERATING THE ELSTREE "SOLODYNE"—(Contd.)

The fixed resistor is now re-inserted, and the resistor for the second valve is removed. The process of neutralising is then repeated for this valve, the neutralising condenser being fixed once again in the position of zero signal strength.

It is important to remember that the reaction condenser should be set at zero during the neutralising operations.

Final Adjustments

After the receiver has been neutralised in this manner the final balance-up on the triple condenser may be carried out. This should be done on a distant station, and it will be found that even with the crude adjustment already obtained, several distant stations can quite easily be received. Tune in to some distant station approximately in the middle of the dial. For example at Elstree the final balancing up is usually carried out on Bournemouth, a distant station which comes in at or around 46 degrees.

Tune in therefore to a suitable distant station, and if necessary increase the strength a little by means of the reaction adjustment on the right hand side of the panel. Now undo the locking screw on the coupling between the second and third condensers, that is to say the middle condenser, and the condenser nearest the panel. These condensers control the second and third high-frequency circuits respectively.

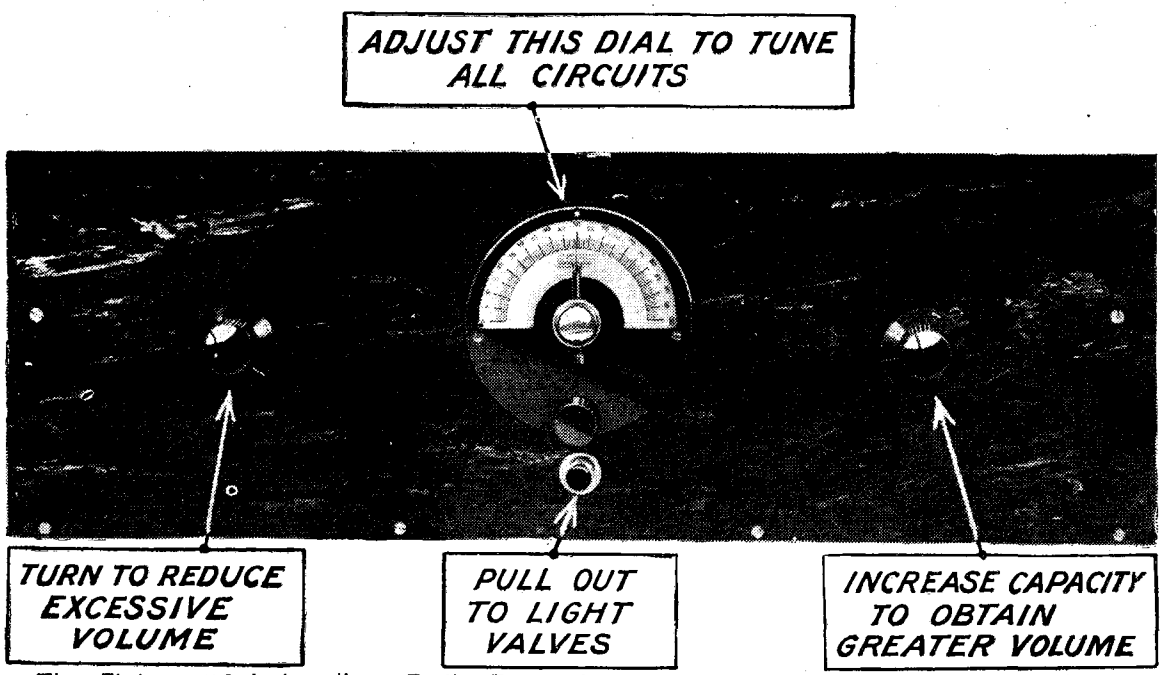
Now rotate the last two condensers (that is to say the aerial and the middle condenser) together until the distant station is at its loudest. Having tuned on these two condensers you should then tune-in on the third condenser (nearest the panel), by utilising the dial on the front of the receiver. When this has been completed the second and third circuits will have been adjusted to tune together. It now remains to make a final adjustment of the aerial condenser, which should be done while the set is still tuned to the particular station chosen.

Reaction

The method of adjusting the aerial condenser is exactly the same as that previously described, except that the tuning will now be found to be sharper than it was in the first rough adjustment. When the three circuits are all correctly balanced up, it will be found that the increase of the reaction condenser causes a progressive increase in strength up to the oscillation point. If the receiver does oscillate, no radiation will be caused, but of course the quality of reproduction will suffer if the reaction is pushed too far towards the oscillation point.

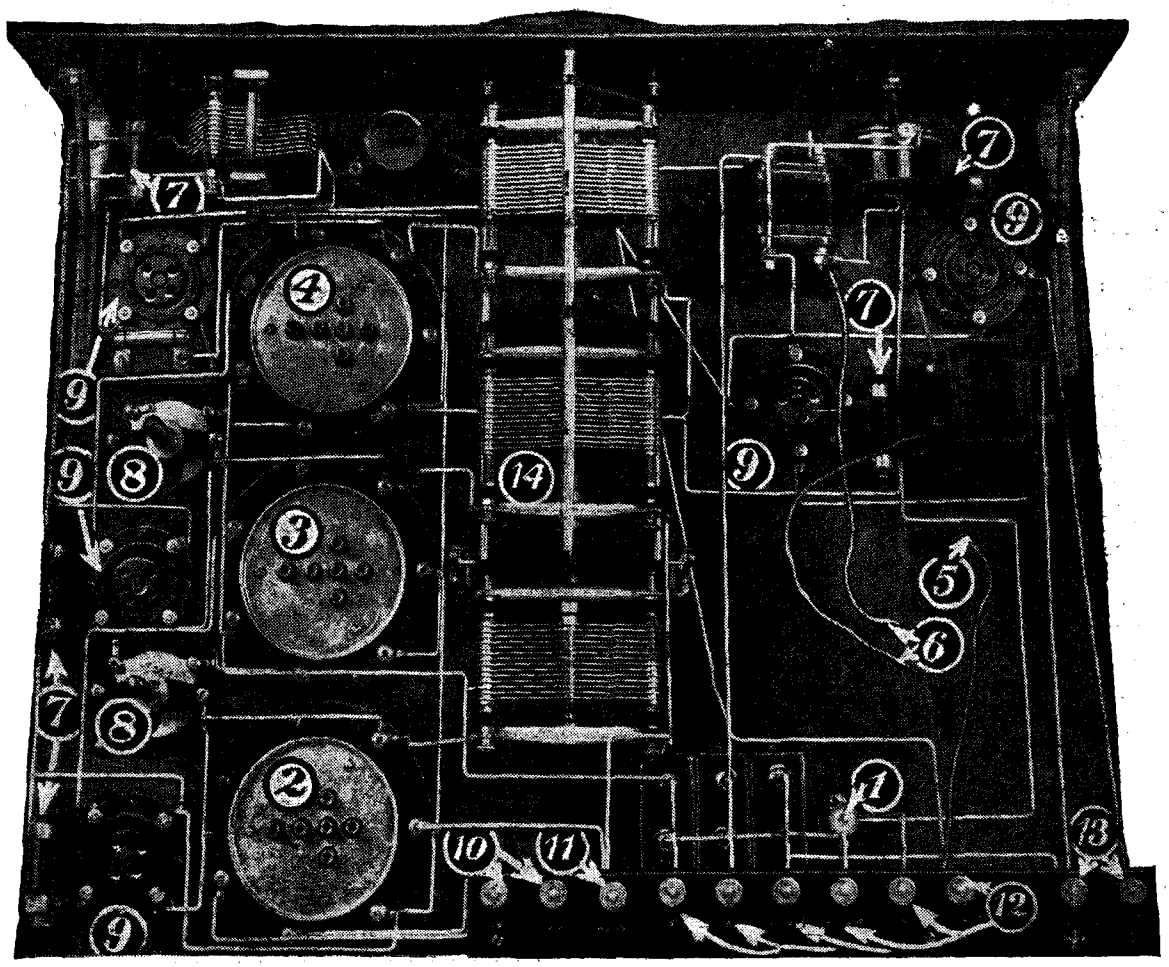
It is as well to summarise the several points in their correct sequence as shown in the table.

It will now be found that it is possible to run from bottom to top of the scale, and the stations will come in one after the other in a most surprising manner. The reaction condenser should be practically all out at the bottom of the scale and be found to require a slight increase as the dial reading increases. Thus very little reaction would be required on Cassel or Hanover while on Birmingham or Zurich an appreciable amount of reaction is desirable. Apart from this, however, no other adjust-



The Elstree "Solodyne"—a Radio Press Star set—has received over fifty stations on the loud-speaker. There is only one dial to adjust.

OPERATING THE ELSTREE "SOLODYNE"—*(Contd.)*



NOTE THESE POINTS

1.—Flash lamp bulb will burn out if H.T. "shorts" across L.T. battery.

2.—Insert aerial coil here.

3.—Insert standard split-primary coil here.

4.—Insert standard split-primary coil with Reinartz winding here.

5.—Plug-in to + socket of grid bias battery.

6.—Plug-in to grid-battery at voltages to suit valves used. Maker's pamphlet will give suitable values to be employed.

7.—The values for the fixed resistors will depend upon the types of valves used and upon the voltage of the L.T. battery. These resistors can be changed in a moment, and are made to suit all valves.

8.—Adjust neutralising condensers as instructed in this article.

9.—Insert valves of types suggested.

10.—Try both aerial taps (A_1 and A_2) in order to find out which suits your aerial best.

11.—Attach earth lead to this terminal.

12.—Take particular care in connecting up the high-tension and low-tension batteries. H.T.+1 requires the highest voltage, generally about 120 volts. H.T. + 2 goes to the detector, and a value of 30–40 volts is required. H.T. + 3 feeds the two high-frequency valves, and a value of between 60 and 90 volts is suitable.

13.—Join the two ends of the loudspeaker flexible lead to these terminals, connecting the positive tag (usually marked red) to the L.S. + terminal shown in the wiring blue print.

14.—Follow out the instructions given on page 471 regarding the adjustment of the triple condenser.

OPERATING THE "SOLODYNE"—(Concluded)

ment is required except the simple rotation of the main dial.

Volume Control

Should any station be over loud, it is quite easy to cut down the strength by use of the volume control on the left hand side of the front panel.

Valves

A most important point is that of the valves and voltages to employ. A fairly wide choice is available in this connection. For the high-frequency valves and the detector valve we require a type having a fairly high impedance. I say fairly high deliberately, because there are several types of valve having impedances of the order of 60,000 ohms or more, and this value is too high. A valve having an impedance of the order of 25,000 to 30,000 ohms with an amplification ratio of the order of 15 to 20 is what is required. If lower impedance valves than this are used the selectivity will be impaired, while if higher values are used, the signal strength will fall off. The circuit, in fact, has been designed to suit the particular types of valve specified because extended research has indicated that this is the best characteristic for modern types of high-frequency circuit.

L.F. Valves

The first low-frequency valve should be of medium to low impedance, anything from 7,000 to 15,000 ohms, while the last valve should be of very low impedance in order to handle large volume, something of the order of 4,000 ohms. If desired an ordinary low-impedance power valve may be employed in the last stage, but the quality will be found not to be quite as good.

Voltages

These few remarks will serve to give some indication to intending constructors as to the type of valves which may be employed in the various stages. The best results both as regards signal strength and quality of reproduction cannot be expected unless these remarks as to choice of valves are borne in mind when selecting. Any makes, however, may be employed, provided they have impedances of the order specified. **It should be noted that the fixed resistors used depend on the valves employed and it is absolutely essential in ordering these components to state the valves with which they are to be used.**

As far as high-tension voltages are concerned from 60 to 90 volts should be used on the H.F. valves, about 40 volts on the detector valve, and the maximum permissible on the two L.F. valves. Something of the order of 120 volts is satisfactory in this last case.

H.T. Current

The question of high-tension battery consumption is of considerable importance, and the choice of voltages is to some extent connected with this problem. By using high impedance valves in the high-frequency stages, apart from the other desirable features which accrue from this proceeding, we obtain a distinctly minimised high-tension consumption. At the same time the voltage applied to the high-frequency valves should be as low as possible consistent with good signal strength. It will be found that up to a point the voltage may be reduced without any considerable loss of signal strength, and the more this can be done the less will be the consumption of the two valves in question.

Long Wave Reception

One of the most interesting features about the receiver is the considerable efficiency on the higher ranges. If it is desired to receive Daventry, Radio-Paris, Konigswusterhausen, etc., it is only necessary to obtain the equivalent aerial coil and split primary H.F. transformers for the Daventry range, and to replace the existing coils with the longer range pattern. No alteration of the neutralising setting is required, and it will be found in the majority of cases that the balancing of the condensers also remains unaffected on these longer waves.

LONG WAVE STATIONS RECEIVED ON THE LOUD-SPEAKER

Dial Setting.	Station.	Wavelength.
11.5	Croydon and French Aircraft	900
14	Dutch Aircraft Stations	950
22.5	Hilversum	1,050
37	Hjörring	1,250
40	Königswusterhausen	1,300
44	Karlsborg	1,350
63	Daventry	1,600
77	Radio-Paris	1,750
97	Amsterdam	2,150

ADJUST YOUR "SOLODYNE" AS FOLLOWS:

1.—Choose aerial tap according to size of aerial.
2.—Set neutralising condensers about one quarter of the way round.
3.—Tune the receiver to the local station.
4.—Adjust aerial condenser (that farthest away from panel) until the aerial circuit is approximately in tune.
5.—Neutralise first valve.
6.—Neutralise second valve.
7.—Tune in to a distant station.
8.—Balance up second and third circuits by uncoupling connections between the respective condensers. This involves altering the aerial condenser and the second condenser together so that it is finally necessary to
9.—Balance the aerial condenser on the distant station.

A Notable & Popular Broadcaster's opinion of

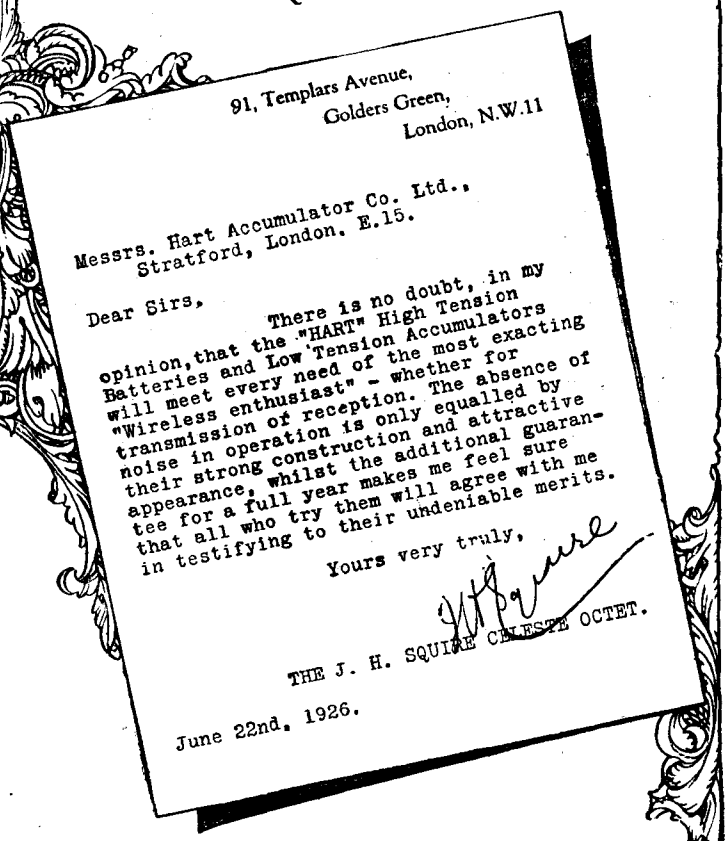
'HART' BATTERIES

'MEET EVERY NEED OF EXACTING WIRELESS USERS'

says

J·H·Squire

OF THE CELEBRATED
J·H·SQUIRE CELESTE OCTET



91, Templars Avenue,
Golders Green,
London, N.W.11

Messrs. Hart Accumulator Co. Ltd.,
Stratford, London. E.15.

Dear Sirs,

There is no doubt, in my opinion, that the "HART" High Tension Batteries and Low Tension Accumulators will meet every need of the most exacting "Wireless enthusiast" - whether for transmission of reception. The absence of noise in operation is only equalled by their strong construction and attractive appearance, whilst the additional guarantee for a full year makes me feel sure that all who try them will agree with me in testifying to their undeniable merits.

Yours very truly,

J H Squire

THE J. H. SQUIRE CELESTE OCTET.

June 22nd. 1926.

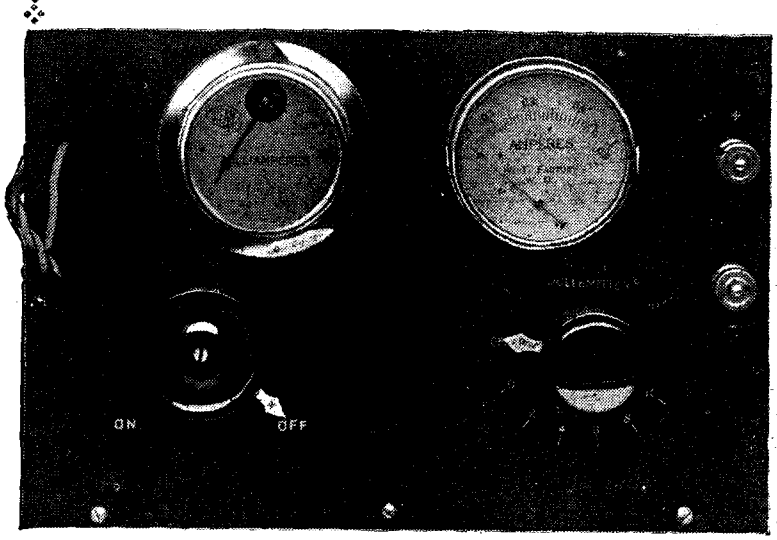
HART

THE BATTERY OF QUALITY

There are models of "HART" BATTERIES for all wireless circuits. Write to-day to Department M.W.2 for illustrated leaflets and full particulars.

HART ACCUMULATOR CO. LTD. STRATFORD LONDON E.15

AN H.T. CHARGING UNIT FOR HOME USE



By the Staff of the Elstree Laboratories

With the increasing popularity of multi-valve receivers, H.T. accumulators are rapidly finding favour. Many readers have asked us how they may charge batteries of this type from the A.C. mains, and it is to fulfil the needs of such that this neat and efficient little unit has been designed.

THE high-tension accumulator is rapidly coming into favour owing to the increasing demand for high-tension supply of 20 milliamps or more, which is beyond the capacity of the average dry battery.

The principal difficulty about high-tension accumulators lies in the charging. Where a source of D.C. is available, the problem is comparatively simple, and has already been discussed on various occasions. The problem of A.C. supply is rather more difficult because it is necessary to rectify the current before it can be utilised to charge the accumulators.

Charging from A.C. Mains

The unit to be described herewith has been designed to enable charging to be carried out with a minimum of trouble from the ordinary A.C. mains. For this purpose special rectifying valves are employed, made up by the Osram Lamp Works.

These valves, which are known as the U.4 type, are similar in general construction to the D.E.5 type of valve, with the exception that the grid is omitted altogether, and one pin on the base is therefore cut off. The filament is of the usual 5 volt ¼ ampère dull emitter type, and the total emission when the filament is being run at its correct current is of the order of 15 to 20 milliamps.

Saturation

This, of course, is the saturation value, and is obtained when the anode voltage is of the order of 60 to 80 volts or more.

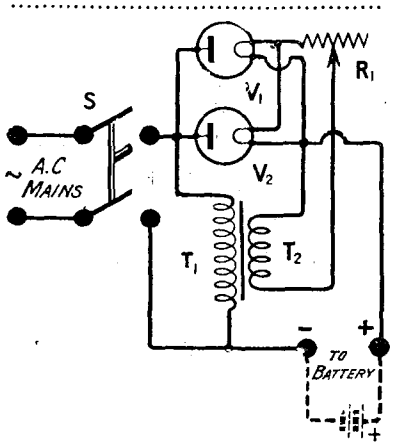


Fig. 1.—The simplified theoretical circuit of the charging unit.

This saturation at comparatively low voltage is of considerable assistance in making up a charging unit of this type, because it renders the device self regulating. The actual circuit adopted is shown in Fig. 1. It will be seen that the A.C. mains are connected direct to the battery to be charged through two of these rectifying valves in parallel. Thus only the positive half of the wave is allowed to pass, so that the current which flows through the battery is uni-directional, and thus charging takes place.

Single Wave Rectification

Single-wave rectification has been adopted for simplicity. Double-wave rectification requires the use of special centre-tapped transformers, and this tends to introduce extra complications. In the present case, therefore, two valves have been utilised in parallel in order that currents of the order of 30 milliamps may be passed to the battery. If necessary, of course, a single valve only can be employed, in which case the charging current is 15 milliamps instead of 30.

The advantage of the saturation of the valves previously referred to will readily be seen by reference to this circuit. We have a certain alternating voltage applied across the unit from the mains, while in opposition to this we have the voltage of the high-tension battery which has to be charged.

AN H.T. CHARGING UNIT FOR HOME USE—*(Contd.)*

General Principles

Now the alternating voltage is constantly varying in value, rising from zero to a maximum and then falling away to zero again. At the next half-cycle, of course, the voltage rises to a maximum in the opposite direction, but during this cycle no current is passed through the rectifying valve, so that we are not interested in this portion of the operation.

Now as long as the voltage on the mains is below that of the battery to be charged, the anode of the rectifying valve will be negative with respect to the filament, and no current can pass. When the voltage rises above that of the battery, current commences to flow and increases in strength until the voltage on the mains is more than 60 to 80 volts greater than that of the battery.

When this point is reached the current through the valve saturates, so that however much the voltage increases no further increase in the charging current will result.

The diagram in Fig. 2 indicates the state of affairs. The full line indicates the manner in which the voltage on the mains is varying. The horizontal line at a definite height above the zero point represents the voltage of the high-tension battery which is to be charged.

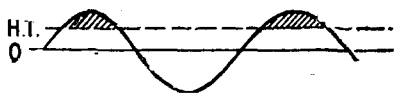


Fig. 2.—The dotted line indicates the voltage of the H.T. battery to be charged.

Charging Conditions

As has just been explained, no charging current will flow through the valves and battery until the voltage on the mains has risen above that of the battery. In the figure therefore, when the curve rises above the horizontal line representing the battery voltage charging current will flow, so that the portion of the cycle during which the valve is operating is illustrated by the shaded portion in the diagram. Consequently, provided this condition is complied with, the battery will be charged, and the charging current will be practically independent of the actual voltage of the high-tension voltage itself because of the saturation effect which has previously been referred to.

In this connection it should be remembered that the maximum voltage with an A.C. supply is nearly 50 per cent. greater than the rated value. With an alternating voltage like this it is necessary to choose some mean value of the voltage, because the actual voltage is varying from moment to moment. In practice the actual mean value is chosen in a slightly complicated manner, but is so chosen that the effect of, say, 100 volts D.C. and 100 volts A.C. upon certain types of apparatus, such as lamps or heaters, etc., shall be the same.

Actually, however, since in the case of alternating current this is only a mean value, the maximum value is somewhat higher, and in practice is between 40 per cent. and 50 per cent. higher. It is therefore possible to obtain satisfactory charging by means of this unit even when the voltage of the high-tension battery is only some 20 or 30 volts below the rated voltage of the A.C. supply mains.

COMPONENTS REQUIRED

One ebonite panel 9 in. by 6 in. by ¼ in. (any good make).
One baseboard 9 in. by 6⅞ in.
One milliammeter 0 to 150 (Sifam). (See the remarks below).
One hot wire ammeter 0 to ·5 (Leslie Dixon and Co.)
One dual filament rheostat (Radio Instruments).
One Utility 2-way dua change-over switch (Wilkins and Wright).
One filament transformer, stepping down the voltage of the mains to 5 volts. The actual instrument used was obtained from Messrs. Burne-Jones and Co., and was equipped for a primary voltage of 200 to 240 and gave three secondary voltages of 3, 5 and 8 respectively. Similar instruments can be obtained from the same source to suit other main voltages.
Two Lotus vibratory valve holders. (Garnett Whiteley and Co.)
Two terminals.
One length of flex with a suitable plug or adapter.
One or two U.4 valves as required.
The whole unit may be housed in a cabinet if required.

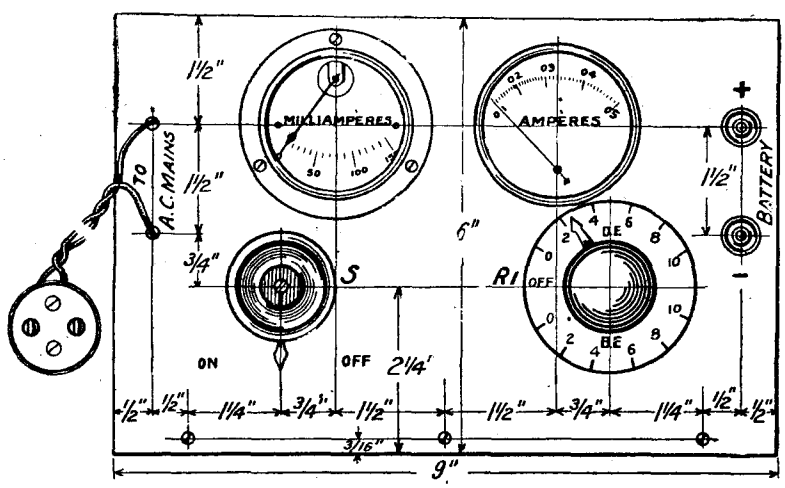
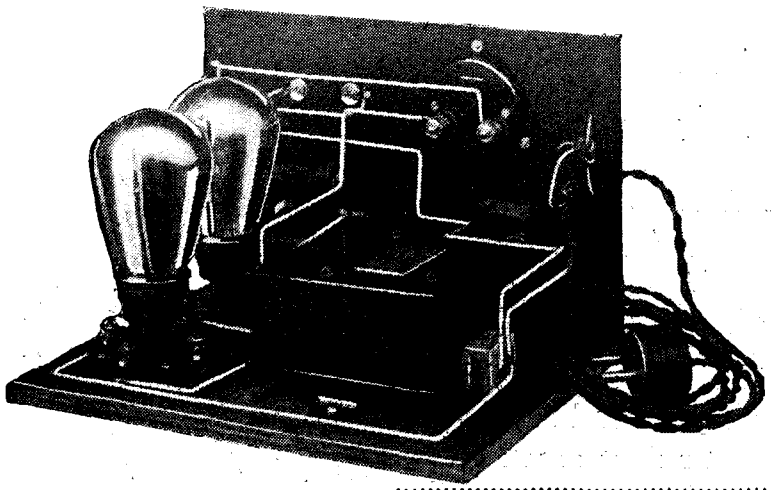


Fig. 3.—The ammeter seen on the right is secured to the panel by means of its two terminal screws.

A SIMPLE H.T. CHARGING UNIT



The wall plug on the right may be inserted into the standard house lighting wall socket.

In practice, therefore, it will be found that the unit gives practically a uniform current of 15 milliamps per valve on any high-tension accumulator of which the voltage is 60 volts or more below that of the mains.

Voltages

For example, working on 240 volt mains an accumulator of 180 volts can be charged satisfactorily. On 200 volt mains, then 140 is about the limit, while if the supply is only 110 then a 60 volt accumulator is all that can be charged. Since the majority of A.C. mains, however, are of the order of 240, the average 120 volt H.T. battery can be charged without any difficulty whatever, and without the necessity for the introduction of any series resistance.

Turning our attention, therefore, to the actual construction of the unit, the components listed will be required.

Instruments

The milliammeter requires some comment. It may be wondered why 0 to 150 milliammeter has been utilised to read a current of 15 or 30 milliamps only. Actually this has been done because the particular type used is a cheap pattern costing only 10s. It is not possible to make this pattern reading below 150 milliamps in inexpensive form.

Vibratory valve holders have been used merely to protect the valves from accidental damage, and of course are not essential, since there is no question of microphonic noise in a unit of this type.

Construction

The actual constructional work is so simple as to require no explanation at all. It will be necessary to cut holes in the panel in order to accommodate the two meters. A large hole will have to be cut on the left hand top corner for the milliammeter, and two smaller holes for the terminals of the hot wire current meter which then becomes a surface mounting instrument. This instrument has

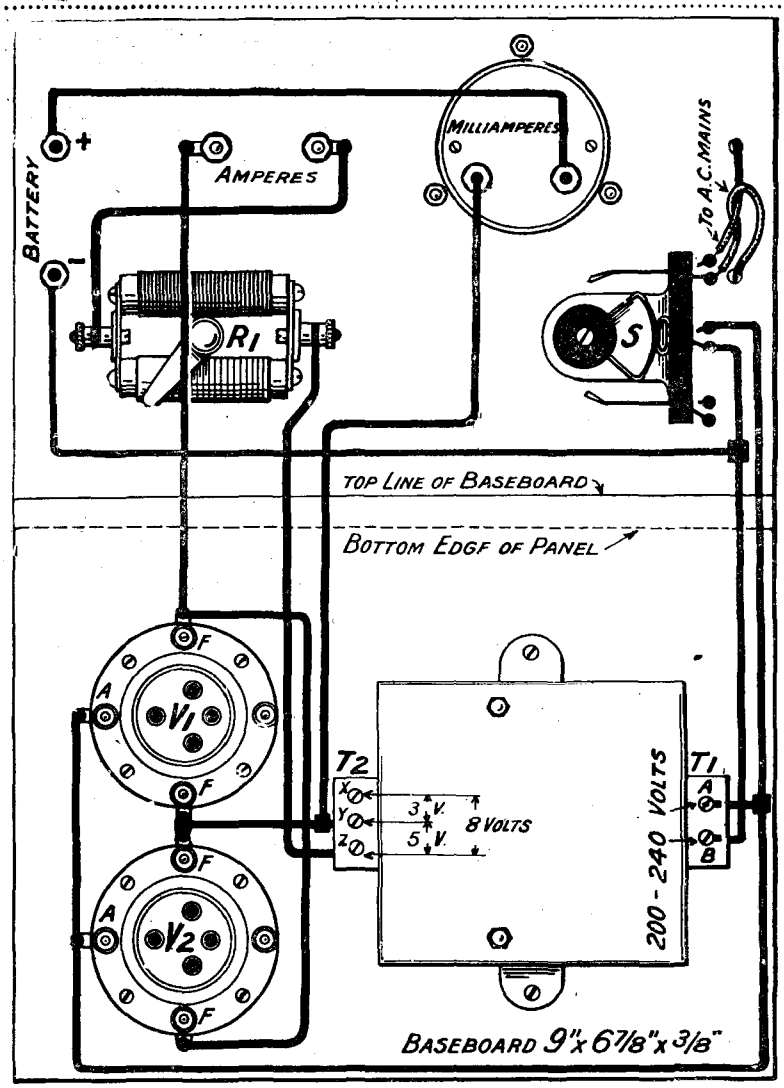


Fig. 4.—The H.T. accumulator to be charged should be joined to the two terminals on the panel marked "battery."

AN H.T. CHARGING UNIT FOR HOME USE—*(Contd.)*

been secured in position by these terminals.

The only other components mounted on the panel are the "On-off" switch on the left, and the filament rheostat on the right,

WIRING INSTRUCTIONS

Join battery + terminal to one side of milliammeter.

Join other side of milliammeter to terminal Y of transformer secondary T2, and thence to one filament contact of V1 and V2.

Join remaining filament contacts of V1 and V2 to one side of ammeter.

Join other side of ammeter to one side of R1.

Join other side of R1 to terminal Z of T2.

Join battery-terminal to middle near-side contact of S and thence to terminal B of transformer primary T1.

Join anode contacts of V1 and V2 together, and thence to remaining side of T1, and remaining middle contact of S.

Join top contacts of S to A.C. mains plug through the two holes in panel (flexible wires).

and the two terminals on the right hand side to which the battery to be charged is connected.

Testing

Having carefully checked the wiring to ensure that no mistake has been made, connect the high-tension battery to be charged on to the two terminal on the right hand side, taking care that the positive terminal of the battery goes to the correct terminal on the charging unit. Next plug the adapter into the lamp socket or heating plug, whichever is used. Place the filament rheostat in the "off" position, and then place the two-way switch to "on."

Now gradually increase the filament brilliancy until the correct current is registered. The milliammeter should then show a charging current of the order of 15 milliamps.

This value of charging current should not be exceeded, as if any heavier current is taken there is a possibility of the valves being softened and consequently damaged. It may be that the hot wire type of ammeter in use is slightly inaccurate to perhaps ·1 or ·2 of an ampere, and it is as well to check this instrument against a standard D.C. instrument if possible.

In any case, the milliammeter registering the charging current is the best guide to the correct adjustment of the unit. The filament current of the valve can safely be adjusted until the unit is passing its correct 15 milliamps per valve (*i.e.*, 30 milliamps with the two valves in use), provided that this only requires a small modification of the filament brilliancy.

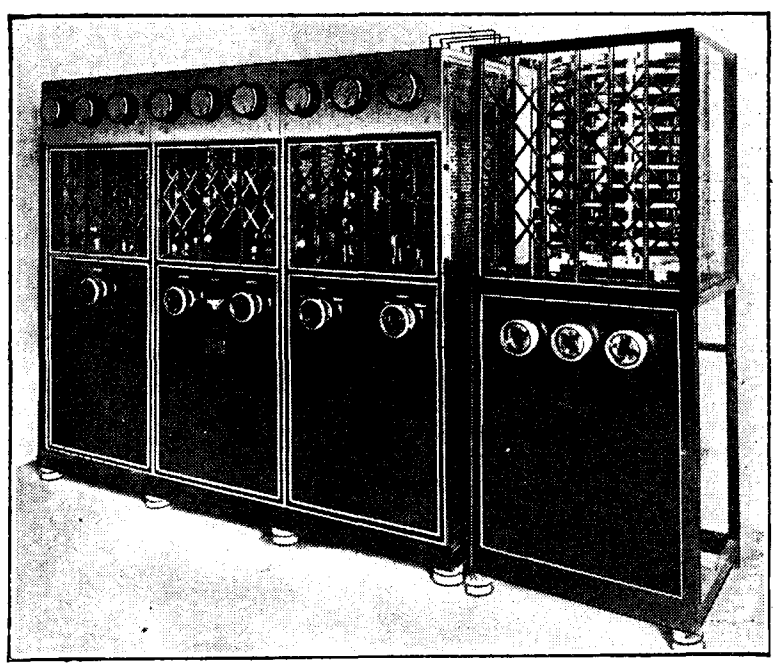
A Warning

If for example the voltage of the H.T. battery was too high for the A.C. mains with which the unit was being employed, then with the filament at or around its normal brilliancy, nothing like 15 milliamps would be passed. In such circumstances it would be possible, by increasing the brilliancy of the filament considerably beyond the normal point, to pass 15 milliamps per valve, or even more, but such an effect would be extremely dangerous and would result in the valve burning out within a very short time.

Under normal conditions, however, the filament brilliancy may be adjusted in order to give the stated current, provided that any variation necessary is within the limits of accuracy of a hot wire ammeter. With the 5 volt tapping it may prove impossible to obtain the required current, in which case the 8 volt tapping should be used.

In operating this receiver a word of warning may be given concerning switching on and off. It is necessary when starting up to switch on the mains before the filament is switched on, that is to say, place the mains switch to "on," and then bring up the current to the required value with the filament rheostat as previously described. Conversely, when cutting out the unit do not switch the set off with the filament still running, but turn the filament rheostat to the "off" position before throwing the mains switch to the "off" position.

It should be observed, that since the mains are connected direct to the high-tension battery, the latter must be completely isolated when placed on charge. That is to say, it must not be left connected to the receiver or in such a position that one side of the battery is earthed.



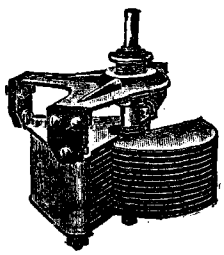
The valve panels at the French "Radio Electrique" station.

Utility

GUARANTEED

COMPONENTS

The recent National Radio Exhibition fully demonstrated the outstanding supremacy of British design and manufacture in Wireless Components and Instruments—and productions of "Utility" origin there displayed received the highest commendation from Wireless Enthusiasts and Dealers alike for their efficiency, precision and care to detail. Although "Utility" Components have been greatly reduced in price, their high standard of quality and our guarantee to replace or repair defective parts free of charge is maintained.



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Low Loss Condensers.

This famous "Utility" Component has been improved. All brass parts are nickel plated, pigtail connections from moving plates, terminals and soldering tags are fitted, and the centre spindle rotates on ball bearings. The Vernier pattern is fitted with a Micro-Dial as illustrated below.

Prices from **13/-**.

"Utility"

No Capacity Change-over Switch.

Made to change over any number of contacts. Design ensures that self-capacity is negligible. Contacts are self-cleaning.

Prices from:

Knob Pattern, 2-pole change over, **3/6.**

Lever Pattern, 2-pole Change Over, **4/-.**

"Utility" Push-Pull Type Switch. Price **4/6.**

"Utility"

Micro Dial.

A handsome 4 in. Dial in which is incorporated Slow Motion Mechanism for obtaining the finest tuning of the Condenser. The dial itself gives coarse adjustment, the Knob fine adjustment and the gear ratio is 70-1. Movement is unlimited. Blacklash is entirely eliminated. It can be fitted to all makes of condensers.

Price **7/6.**

"Utility"

Jack and Plug.

A Jack designed on the same principles as our well-known "Utility" Switch, and similar to our Push-Pull Switch in size. Has many advantages over the ordinary type of Jack. Perfect rubbing contact and low self capacity.

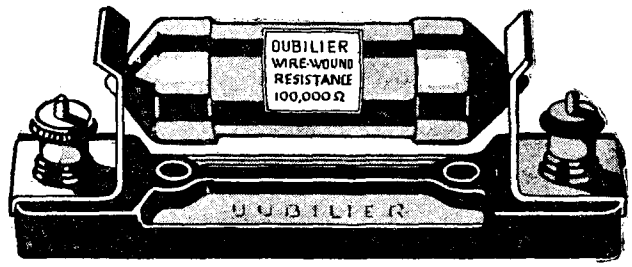
Prices: Jack, **4/6.** Plug, **2/6.**

Your local dealer stocks "Utility," if he is an up-to-date man. Ask him for details.

WILKINS & WRIGHT LTD

KENYON ST. Utility WORKS BIRMINGHAM

A New Dubilier Product



The Dubilier wire-wound resistance

No new Dubilier Product is placed on the market until it has undergone prolonged tests under working conditions.

In this manner you can always be assured of the perfect reliability of any product bearing the Dubilier name.

The new Dubilier Wire-wound Anode Resistances will be found to be ideal for resistance capacity circuits.

Self-induction and self-capacity effects are virtually non-existent, and the resistance values remain constant throughout all variations of climatic conditions.

20, 30, 40, 50, 60, 70, 80, 90 and 100 thousand ohms .... **5/-** each

200 thousand ohms ... . **8/-** each

HOLDERS (as shown, extra) **1/6** each

Specify Dubilier.

REGISTERED DUBILIER TRADE MARK

DUBILIER CONDENSER CO (1925) LTD

ADVT. OF THE DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, N. ACTON, LONDON, W.3. TELEPHONE: CHISWICK 2211-2-3. E.P.S.212

PRESS-MEN TEST THE "SOLODYNE"

(*Concluded from page* 456).

items in every language and snatches of music of every type were picked up on a loudspeaker."

DAILY TELEGRAPH

"A remarkable wireless receiving set with an all-Europe range controlled by a single dial was demonstrated to a party of Press representatives at a demonstration at Elstree last night. . . . It is a five-valve set, and simply by the manipulation of this one dial I heard at least a dozen Continental stations as well as the main British stations. . . . The problem of simple control has thus been practically solved, and, moreover, the set is so constructed that it can be made up by any amateur from components obtainable on the ordinary market."

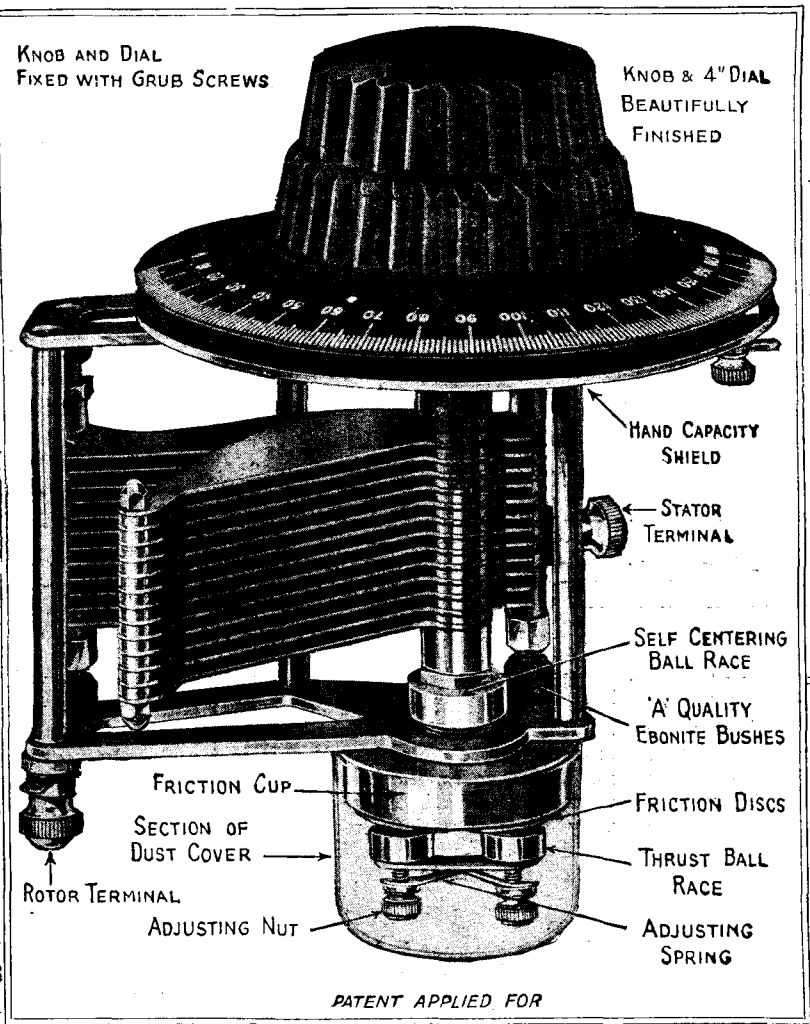
Triple Condensers

Our readers will be interested to learn that the following well-known manufacturers are producing a triple "gang" condenser for use in the Elstree "Solodyne" receiver.

Igranic Electric Co., Ltd.
Ormond Engineering Co., Ltd.
Jackson Bros.
Collinson Precision Screw Co., Ltd.
Wilkins and Wright, Ltd.
Sidney S. Bird and Sons.

In Messrs. Burne-Jones' advertisement of the Elstree "Solodyne" components in last month's issue, the price of B.T.H. Transformers was given as 25/-. This should have read 17/6 each.

It will be of interest to our friends to know that the Ormond Gauged Triple Condenser for the Elstree Solodyne is now in active preparation and will shortly be available.



The Ormond S.L.F. Condenser

Prices: With 4in. Bakelite Knob :—

.0005 microfarad		20/-
.00035	„	19/6
.00025	„	19/-

Prices: With Dual Indicator Dial :—

.0005 microfarad		21/6
.00035	„	21/-
.00025	„	20/6

RATIO 55-1

S.L.F. Condensers are now essential !

This new "Geneva Plan" only hastens your final choice of a condenser.

Thousands of listeners daily, even under the wavelength system, had been changing over to ORMOND CONDENSERS, owing to their remarkable precision and extraordinarily low price. And now that station selection is to be determined by frequency separation, and everyone **should** use S.L.F. condensers, the value to your set of this latest ORMOND S.L.F. Condenser is greater than ever.

The marking of the Ormond dial enables listeners to pick up any station with the minimum of trouble and without any unnecessary calculations. Moreover, the general sound construction of the ORMOND S.L.F. facilitates precise tuning adjustments and noiseless operation. The famous ORMOND SLOW MOTION FRICTION DRIVE (55-1) is incorporated and special ball bearings give liquid-like movement to every turn of the knob. This world-famous component is easy to mount, having one and three-hole fixings with both terminals and soldering tags for connections.

Ask any dealer to show you an Ormond model.

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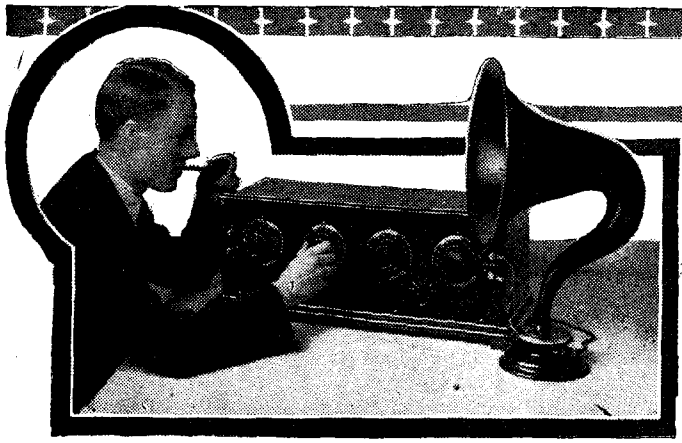


The MEWFLEX

Described by
J.H. REYNER, B.Sc., A.M.I.E.E.

FURTHER HINTS ON OPERATING

Adjustments for Daventry and the Long-wave Stations

FULL constructional details of this receiver were given last month, and also details as to how to operate the receiver. Some few further notes will possibly be of interest. The receiver is really very simple to handle, and the principal difficulty lies in getting used to the tuning controls.

Uniform Tuning

There are three tuned circuits, and although the tuning on each one is not too critical, yet they must all be adjusted together in order to obtain the best results. The conditions of affairs is somewhat similar to a combination lock, and until all dials have been set approximately to the right positions no signals will be heard. For this reason the question of searching when the receiver is first constructed is a matter of a little difficulty, and the following method is best adopted.

How to Tune

Tune in to the local station, and generally make any adjustments which are necessary at this stage. Then move all the dials two or three degrees. Even if no station is heard, the fact that the receiver is in tune will be indicated by a gentle rushing noise. It may be that further stations will be heard at this point, and in fact this is extremely probable, but if this is not found to be the case continue to move the dials one at a time a very small amount, keeping the rushing noise which indicates that the circuits are in tune.

Logging the Stations

In this manner it is possible to go right to the end of the scale, and on the way station after station will be found and can definitely be tuned in and logged. It is advisable at first to log the actual setting of each condenser until the receiver has been thoroughly mastered. It is then a comparatively simple matter to return to the settings for any given station, and no difficulty will be experienced in selecting any required station.

LONG-WAVE STATIONS RECEIVED ON THE LOUD-SPEAKER.

Station.	*Dial Setting.*
Hilversum	28
Soro	42
Koenigswusterhausen	50
Daventry	72
Radio-Paris	81

Method Required

It cannot be too strongly emphasised that any haphazard method of tuning is quite unsatisfactory and will give very disappointing results. Complaints are often made that nothing but the local station can be heard, when the whole time the receiver is in perfect condition, and only requires to be properly handled. At the same time, provided a little care is taken, there is nothing whatever difficult about the operation, but the process is one which takes a little getting used to, and results cannot be expected immediately.

A Common Difficulty

Similar difficulties were encountered with the "Elstree Six." Many readers who have constructed this receiver have had difficulty at first in finding distant stations. They have succeeded in tuning-in to the local station, and have tackled the question of distant reception in a haphazard manner without any success at all. The result is that they hastily misjudge the receiver and go about broadcasting their dissatisfaction. I have personally encountered many such readers who were surprised when I suggested that at least a week was required to get used to the tuning of a modern high-frequency receiver.

Take your Time

My counsel, therefore, is: Do not be in too much of a hurry. Tune-in to the local station, and then very gradually work your way up and down the scale as the case may be,

FURTHER HINTS ON THE "MEWFLEX"—*(Continued)*

and keep in tune with the rushing noise which will be heard to indicate that the receiver is correctly adjusted. In this manner several distant stations can be picked up straight away. Log their positions definitely, so that you can return to those points.

Then, having obtained a setting for a dozen stations all over the dial, you can proceed to look for other stations in between those you have already found, and by this means you will gradually find all the stations which were put in the original test report, if not more.

Neutralising

The neutralising on this receiver is not difficult. The first valve can definitely be neutralised by the usual balancing method. For the benefit of those readers who are not familiar with this method, it is best carried out as follows. Tune-in the receiver to the local station, and then remove the fixed resistor controlling the first valve. Set the neutralising condenser either at the minimum or maximum point, and then retune on the first two circuits to the local station.

Now adjust the neutralising condenser until the signals vanish. It will be found that there is a fairly well-defined point in the middle of the neutralising condenser setting at which signals die almost if not completely away. This is the neutralising setting, and the condenser may then be left in that position and the fixed resistor replaced. The valve must of course be left in its socket during this operation.

The Second Condenser

The setting of the second neutrodyne condenser is a little more difficult, owing to the fact that the balance method cannot be adopted on the second valve, which is the reflex valve. Consequently if this valve is turned out the low-frequency currents are also cut off. If the neutralising condenser, however, is set at approximately the same position as the first one, then it will be somewhere near the correct adjustment, and should the receiver burst into oscillation in the meantime during the tuning-in, this condenser may be slightly adjusted.

Reaction Control

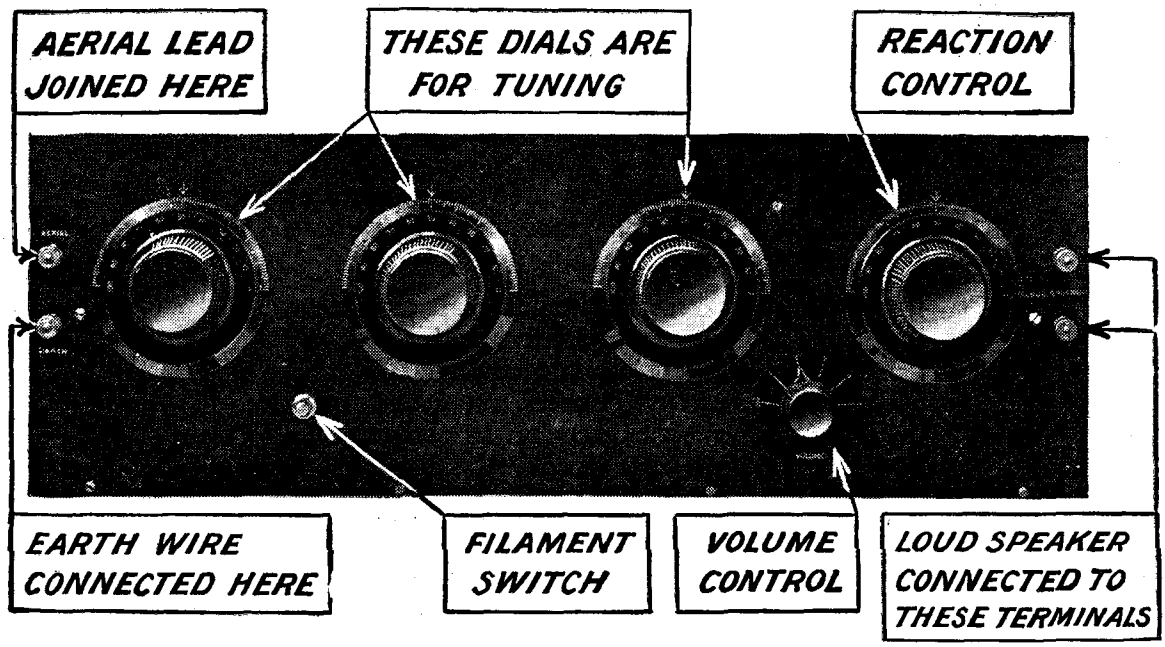
It should be observed, however, that the Reinartz reaction on the last valve will cause the whole of the circuit to become lively. It may be found that when tuning-in a movement of the first condenser will cause the circuit to burst into oscillation. This can very often be checked by reducing the reaction condenser, and it does not follow that the first neutralising condenser is incorrectly adjusted. If you obtain this phenomenon, therefore, do not immediately rush to your neutralising condenser and alter, as you may obtain a worse condition of affairs than before. Try, first of all, the effect of reducing the reaction condenser on the last valve, that is to say, the fourth dial on the receiver, and this will usually be found to maintain the receiver stable.

A Peculiar Effect

If the first neutralising condenser has been adjusted in accordance with the instructions given, it may be taken as correctly set, and should not be altered under normal conditions.

It should not be thought that because the first dial causes the set to oscillate the first circuit is necessarily oscillating. This is not necessarily the case, because it is found that with a neutralised circuit a reaction adjustment on the last valve will liven up the whole of the receiver. If, on the other hand, it is found that with the reaction condenser all out the cir-

(Continued on page 515.)



The front of panel of the "Mewflex," a highly efficient Radio Press Star Set described last month. A reflex circuit is employed, and the receiver is completely stable over a very wide band of wavelengths

A THREE-VALVE TRAP RECEIVER

(*Concluded from page 467*).

Testing Out

For preliminary tests the aerial may be connected to terminal No. 3 or 4 on the screened coil. First insert the valves in their respective holders with the correct filament resistances inserted in the clips. Then connect the L.T. battery and place the plug in jack No. 1. The first two valves should light up, and when the plug is transferred to jack No. 2 all three valves should light. When the plug is withdrawn all valves should be out.

With the valves alight apply a small value of H.T. voltage to both H.T. terminals, and if all is well the correct working values may be used. No difficulty will be found in receiving the local station and the correct value of grid bias may then be found.

Aerial Connection

Now transfer the aerial lead to one of the taps on a Lissen X coil or a similar inductance which is plugged into the coil holder and connect the flexible lead from the neutralising condenser to terminal 3 or 1 on the screened coil. Place the neutralising condenser about half way in. It will now be found that the tuning is ever so much sharper and the local station will only come in over a narrow range on the dials, and it is probable that a little reaction will be required to bring it up to strength. A little practice in the handling of the set is preferably obtained out of broadcasting hours.

For this purpose increase reaction till the set is oscillating gently; it will then be found that when the aerial coupling circuit L_1 C_1 is brought into tune with the grid circuit the set will stop oscillating. Reaction is again increased a trifle and a readjustment of the aerial tuning condenser will again result in the set stopping oscillating. If this stopping of the oscillation is accompanied by a rather loud click it is probable that the coupling is too tight between the two circuits and the value of the coupling condenser should be decreased.

It will now be found that as the two condensers are rotated together the set can be kept in a stable condition. As soon however as one of the circuits gets out of tune with the other the set will oscillate. Since the circuits are out of tune it is probable that little if any energy is radiated, nevertheless care should be taken during broadcasting hours lest interference be caused.

By keeping the two circuits in tune however it will be found that other stations will come in at various settings on the dials and with a suitable degree of coupling they will be received with only a little diminution in signal strength notwithstanding the extra tuned circuit and the loose coupling between the two.

Coils

The best size coil for L_1 was found to be a Lissen No. 60 for all round work, and this also had the advantage of giving nearly the same dial readings as the screened coil, though, on such wavelengths as it was found possible to use a 75, an increase in signal strength was observed as well as rather better selectivity when this coil was employed.

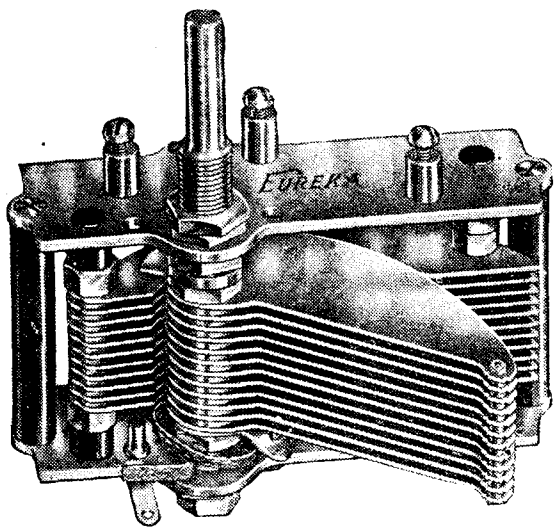
There are three kinds of Variable Condensers

—here are the results you'll get from each

No. 1
Ordinary Condenser

(Straight line capacity)

The ordinary Variable Condenser as used in the vast majority of Wireless sets jumbles together no less than 51 wavelengths (of 10 kilocycles separation) in the first 15 degrees of dial setting; while the remaining 85 degrees of the dial cover only 49 wavelengths. This might have been good enough in the early days when any sort of reception was gratefully received. But science has moved since then and there is no longer any need for your set to remain an obsolete jumble of conflicting and jamming stations.



No. 2
Square Law Condenser

(Straight line Wave-length)

The square law condenser made a serious—if not very successful—attempt to overcome this aerial traffic tangle. But even this type of condenser bundles together into the first 15 degrees no less than 36 wave lengths (nearly 2½ stations to every degree of dial setting) and thus falls far short of solving the tuning riddle with which every ambitious Set user is confronted. As a proof of this it should not be forgotten that square law condensers have been available on the market for more than a year—yet selection has been just as difficult to obtain.

—and the Eureka Ortho-cyclic

NOW comes the new principle of tuning by which, with the Eureka Ortho-cyclic Condenser, a definite separation of wavelengths evenly and exactly over the whole scale is accomplished. By this new principle of design each movement of one degree of dial setting (with 100° dial) gives a definite separation of ten kilocycles over the whole scale.

Thus, instead of 51 conflicting wavelengths in the first 15 degrees, you get exactly 15 wave lengths in 15 degrees. And so on, right through the scale, the same exactitude of station separation is maintained

In this way scrambling and crowding of stations is entirely eliminated; tuning is made easier, more regular and more certain. Vernier plates are rendered obsolete and the danger of stations heterodyning each other at the cost of purity in your reception is materially reduced.

Which kind does your Set deserve?

IF you possess a Set capable of receiving distant stations, that Set deserves Eureka Ortho-cyclics. The true pleasures of distant reception are only possible where the Ortho-cyclic principle of tuning is employed. Take out your obsolete Condensers and replace them with these beautifully made Eureka Ortho-cyclics.

Owing to their compactness they require only a panel depth of 2 inches—they can be fitted in a few minutes by either one-hole fixing or four-point mounting, whichever method you prefer. Ball-bearing—superbly finished—they represent a standard of efficiency far in advance of present-day levels. Ask your Dealer to show you one—you'll be proud to see such an outstanding example of British workmanship.

Prices:
·0003 mfds 14/6
·0005 mfds 15/6

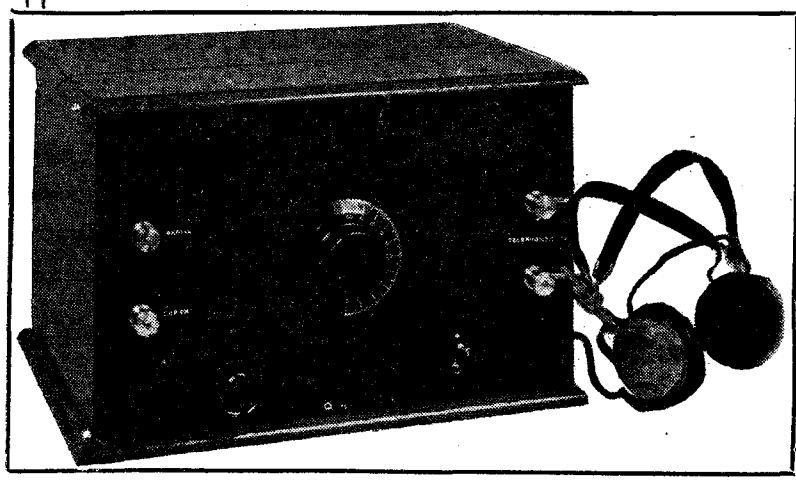
EUREKA ORTHO-CYCLIC

Equip your Set also with Eureka Transformers and Coils.

Manufactured only by Portable Utilities Co. Ltd. (Eureka Radio Products) 8 Fisher Street, W.C.1

AN "EASY TO MAKE" SINGLE-VALVE SET

By JOHN PUGH-PRICE



A simple and efficient little set, specially suitable for the beginner in valve reception. It is easy to construct and to operate, and will receive, in addition to the local station and Daventry, other British and Continental stations in favourable conditions.

"TO begin with a crystal set and progress later to a single-valve receiver," is my advice to the beginner who wishes to make wireless reception his hobby. Do not attempt to run before you can walk is a very sound axiom, and any time spent in constructing and handling a single-valve receiver is time well spent, should time and circumstances later allow of a multi-valve receiver being constructed. With a crystal receiver the listener is tied to reception from the local station, and perhaps Daventry, and inevitably there comes a time when it is desired to reach further afield.

Reaction Control

Ordinary magnetic reaction, obtained by means of a coil in the plate circuit of a valve coupled directly to the grid coil, and employing a swinging arrangement, is now losing its old popularity and the modern tendency is to use some form of Reinartz reaction, obtained by means of a variable condenser. In practice, I have found a modification of this arrangement to give very satisfactory reaction control, adopting a fixed condenser in series with a moving reaction coil, instead of a fixed reaction coil and a variable condenser, the usual choke, of course, being included in the plate circuit. Inspection of the theoretical circuit diagram will make this clear. L1 is an untuned aerial coil, tightly coupled to the grid coil L2 of the detector, which latter is tuned by a straight-line frequency condenser of ·0005 microfarad. The size of the fixed condenser C2 will depend upon the characteristics of the valve and the aerial system and to some extent upon the coils employed. One of ·0003 has been found satisfactory in my case, but where the set tends to oscillate too readily the capacity may be decreased to ·0002 or even to ·0001. Generally ·0003 will be required for Daventry reception. In the plate circuit of the detector valve, the usual radio-frequency choke required with the Reinartz reaction system is incorporated, and this takes the form of a plug-in coil, allowing various sizes of chokes to be tried in order that the best results may be obtained.

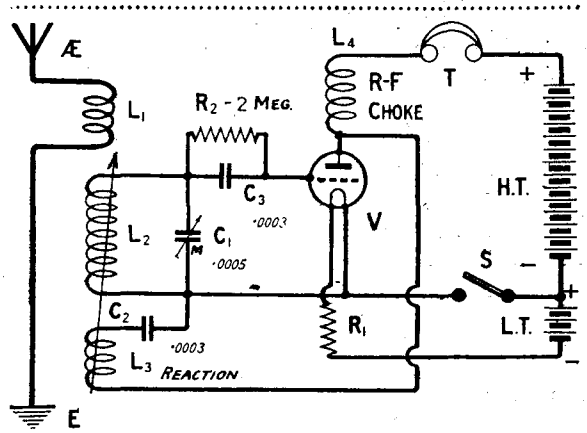


Fig. 1.—The theoretical circuit. L_4 is a plug-in coil of suitable size.

Test Report

On test, upon a good high aerial, about twelve miles south-east of 2LO, the set showed up very well indeed, and was extraordinarily easy to handle. Although only a fixed condenser is employed in the modification of the Reinartz reaction system, the characteristics of this latter were preserved to a pronounced extent, one setting of the reaction coil holding for the major part of the range. Using a resistance-coupling valve with 60 volts H.T., sixteen stations were heard at good telephone strength during an hour's search, among those identified being Nottingham, Frankfurt, Aberdeen, Birmingham, Rome, Newcastle, Dublin, Petit-Parisien, Liege, Toulouse and Hamburg. Signals from 2LO were sufficiently strong to work a loud-speaker at fair strength.

Upon changing coils for the Daventry wavelength, this station was obtained at uncomfortable

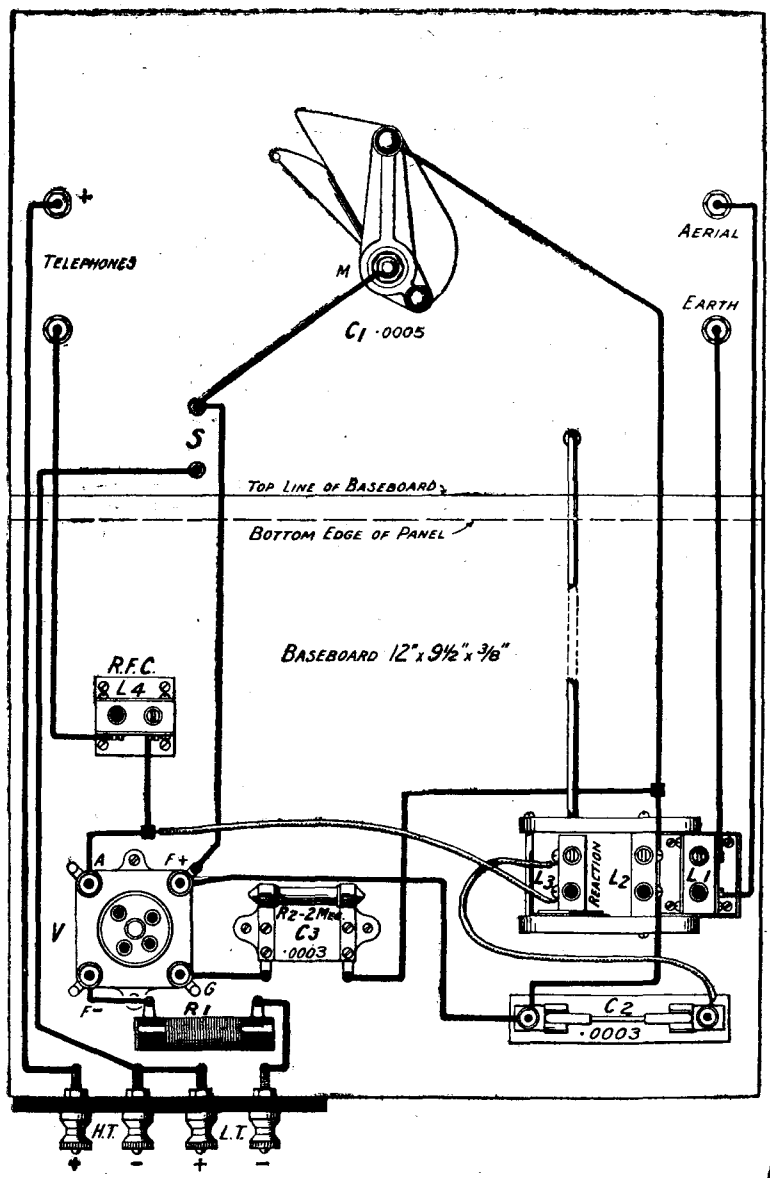


Fig. 2.—L_3 should be kept as small as possible consistent with adequate reaction control. Free Blueprint, No. 179b.

telephone strength and Radio-Paris, completely free from any interference from the former station, was heard at good telephone strength.

Construction and Wiring

The constructional work is so extremely simple that it may be dismissed with a few words. The variable condenser employed is mounted by one-hole fixing, and the only other holes on the panel are those required for the four terminals, filament "on-and-off" switch and one to allow the 2-coil holder handle to pass through. The panel itself is affixed to the base-

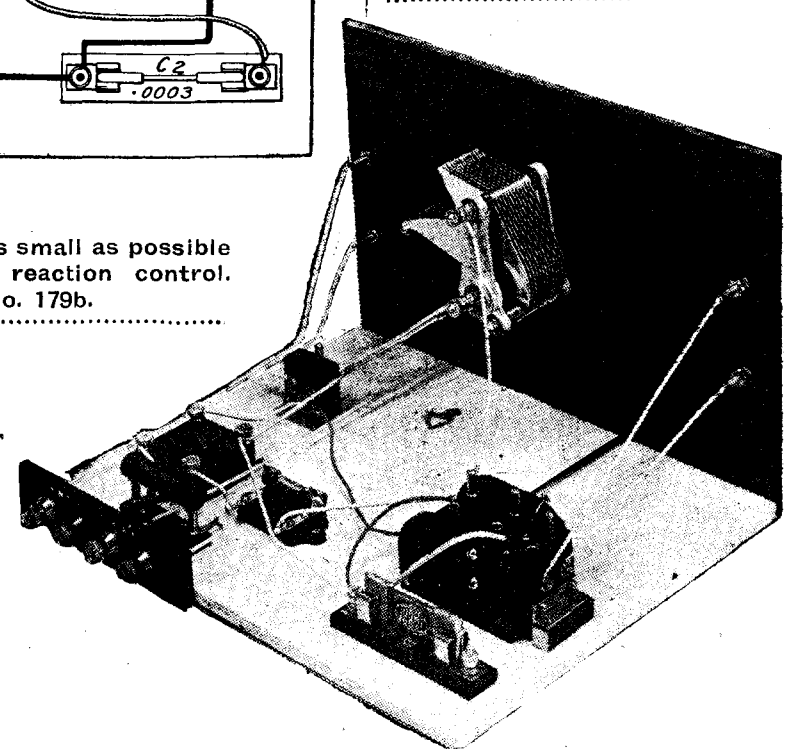
AN "EASY TO MAKE" SINGLE-VALVE SET *(Continued)*

board by means of three wood screws, no brackets being required since the panel is held in position by wooden fillets. The single coil holder, mounted near the fixed block of the two coil holder must be raised to the same height as this latter, which is easily effected by placing a suitable thickness piece of wood underneath the coil block, before this latter is screwed into position.

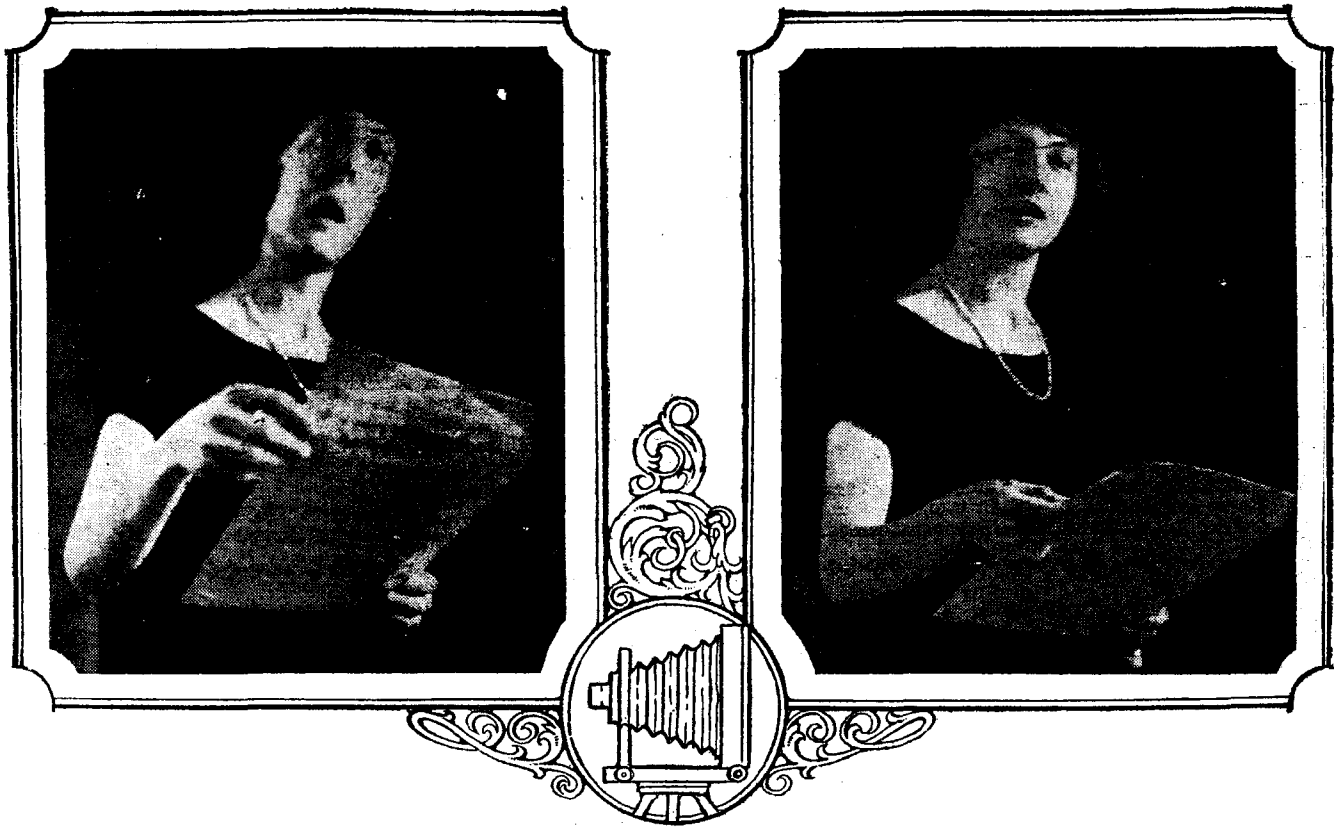
Excepting in the case of the two leads to the reaction coil, all wiring is carried out with Glazite, but for the two reaction leads flexible wire must be employed.

Testing

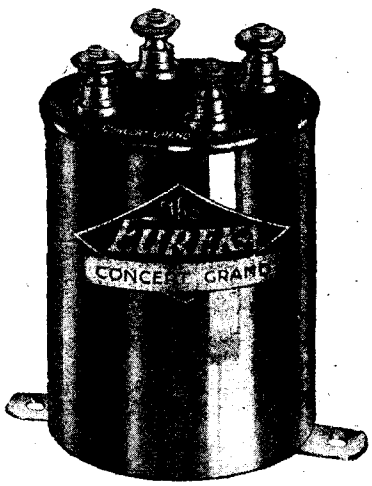
Having wired the receiver the first step is to carry out a preliminary test to ascertain that all is correct. Connect aerial and earth in the normal manner, and in the L1 coil socket place a small coil, that is, if you wish to listen to a station on the lower broadcast band. Here a number 25 or a Gambrell "a" proves suitable. For L2 a number



The components are well spaced and the set is extremely simple to construct.



Just as an inferior lens will create distortion so an inefficient Transformer will distort a voice



The new Eureka Concert Grand

ALMOST any kind of lens will serve to produce an image on a sensitive photographic plate. But no one expects that a simple uncorrected achromatic lens will give such faithful reproduction as an anastigmat. Exactly the same principles apply in wireless. Practically any L.F. Transformer will amplify and give some kind of results.

But if you want to hear the rippling notes of the soprano you must use a Transformer scientifically corrected against distortion. Every Eureka has been scientifically designed by specialists in the science of sound reproduction to give an even amplification throughout its entire frequency range. It does not amplify some notes at the expense of others, but is, in fact, fully corrected against distortion.

And now, through an improved method of "stratum-winding," the efficiency of Eureka Transformers has been still further increased. At no extra cost to you there is now available greater volume and sweeter tone, whilst the possibility of breakdown has been eliminated by the use of interspaced insulation between windings.

These new and exclusive features will place the Eureka again ahead of possible competition. For your next Set, therefore, be sure to use a Eureka—"the Transformer which re-creates the living Artiste."

Types and Prices

Concert Grand	25/-
Ditto for 2nd stage	21/-
Baby Grand (1st or 2nd)	15/-
Eureka Reflex	15/-
Eureka L.F. Choke Unit	25/-

Re-creates the EUREKA Living Artiste

Portable Utilities Co., Ltd., Fisher St., W.C.1.

Gilbert Ad. 5811

AN "EASY TO MAKE" SINGLE-VALVE SET *(Concluded)*

COMPONENTS REQUIRED

One matted ebonite panel 12 in. by 8 in. by ¼ in. thick.
One mahogany cabinet to take above panel and baseboard, 9½ in. deep.
One ebonite terminal strip, 5 in. long by 1¼ in. by ¼ in. thick. (The cabinet and panel used are those catalogued as for the New S.T. 100.) (Peto-Scott Co., Ltd.)
One .0005 S.L.F. variable condenser. (K. Raymond.)
One Lotus two-coil holder for baseboard mounting. (Garnett, Whiteley and Co., Ltd.)
One Frost toggle on-and-off switch. (The Rothermel Radio Corporation of Gt. Britain, Ltd.)
Four 2 B.A. terminals. (Burne-Jones and Co., Ltd.)
One Clearer-tone valve socket. (Benjamin Electric, Ltd.)
One .0003 clip-in condenser and base. (L. McMichael Ltd.)
One .0003 type 600 fixed condenser and 2 megohm grid leak. (Dubilier Condenser Co. (1925), Ltd.)
One fixed resistor and base. The particular resistance will have to be chosen to suit the valve used. (Burne-Jones and Co., Ltd.)
Two single coil mounts. (Burne-Jones and Co., Ltd.)
Four 4 B.A. terminals.
Quantity of Glazite wire and rubber covered flex.
Radio Press panel transfers.

50, Gambrell "B" or its equivalent should be used, whilst for the reaction coil L3 a coil should be chosen by experiment. Here I have utilised a Gambrell "A," buti n numbered makes a 35 or 50 should prove suitable. For the radio-frequency choke RFC a large coil of 250 size or bigger will be necessary. Here for both the lower broadcast range and for Daventry I employ a Gambrell "I" coil.

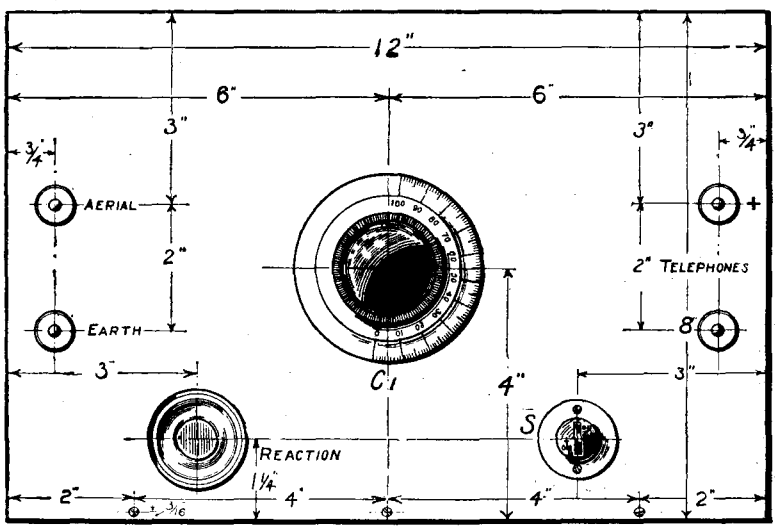


Fig. 3.—A free full-sized Blueprint, No. 179a, of this drilling diagram may be obtained on application.

Having connected telephones in circuit place the valve in position and connect up the L.T. battery only. If when the filament switch is placed in the "on" position the valve lights in the normal way connect a lead from the negative terminal of the high tension battery to the H.T. negative terminal of the set and take a lead from the H.T. positive terminal and tap into a very low voltage of the H.T. battery, for example, 4½ volts, noting whether the brilliancy of the valve is increased. If it is not, increase high-tension and you may proceed to tune in the usual way. Place L2 and L3 as far apart as possible and rotate the grid tuning condenser C1 until the local station is heard. Now bring L3 towards L2, re-tuning slightly upon C1 when signals should increase in strength.

Daventry

If testing upon 5XX L1 should be a number 75 or 100 or a Gambrell "D," L2 a number 250 or Gambrell "F," and L3 should be of the order of a number 200 coil or a Gambrell "D" or "E_1". The choke should be a number 300 or 400 coil.

Almost any type of general purpose valve will work well in a set of this type, but I personally prefer a high impedance type. With most valves suitable H.T. voltages are of the order of 50 and 70.

WIRING INSTRUCTIONS

Join H.T.— to L.T.—, L.T.+ to one side of S.
Join pin of holder for L4 to A of V. Also join pin of holder for L4 to socket of holder for L3 with a flex lead.
Join L.T.— to one side of R1, other side of R1 to F— of V.
Join moving plates of C1 to remaining side of S, same side of S to F+ of V, F+ of V to one side of C2, same side of C2 to socket of holder for L2.
Join one side of C3 and R2 to G of V.
Join other side of C3 and R2 to pin of holder for L2, pin of holder for L2 to fixed plates of C1.
Join remaining side of C2 to pin of holder for L3 with a flex lead.
Join earth to pin of holder for L1.
Join aerial to socket of holder for L1.
Join telephone+ terminal to H.T.+.
Join other telephone terminal to socket of holder for L4.

:: THE DESIGN OF :: LOUD-SPEAKER HORNS

By CAPTAIN H. J. ROUND, M.I.E.E.

In this valuable contribution the author gives some very useful information concerning the shape and dimensions of horns for loud-speakers. It is written in a manner which makes it easily understandable by the non-mathematical reader.

THE development of horn loud-speakers and gramophones has brought to light the basic principles on which the horn works, and has enabled designers very greatly to improve apparatus using horns.

I will run through the general ideas governing the design of these horns before giving some detail figures which will enable design to be carried out.

If we have an oscillatory circuit L C (Fig. 1), and we introduce a voltage in it, a resulting curve of current at all frequencies can be obtained which is called the resonance curve.

By placing resistance in the circuit we can absorb energy, and can produce a more damped resonance curve—the more the resistance the more the damping, until the resonance curve becomes nearly flat.

Fig. 1.—A damped resonance curve will be produced by inserting resistance in this circuit.

Diaphragms

Now, a diaphragm is very similar. Its weight and flexibility give it a resonance curve if forces at different frequencies are applied to it, and any friction will act the same as resistance to damp it down, and by damping it down sufficiently its response can be made fairly uniform to all frequencies.

Obviously, we do not want to do this damping by a wasteful means, as we require the vibration to produce sound, so that the more we can apply the damping usefully, the better.

A very long tube attached to a diaphragm, as shown in Fig. 2*a*, takes energy away from the diaphragm, and the smaller the tube the greater the energy taken away—that is, the more the resistance applied to the diaphragm. Fig. 2*b* shows how a small tube is attached to a diaphragm.

The reason for this application of greater damping by the smaller tube lies in the ratio between the diaphragm diameter and the tube diameter.

If the same vibration of the diaphragm is considered in the cases of both large and small tubes, the same quantity of air is moved; but, of course, it moves faster in the small tube, and the energy

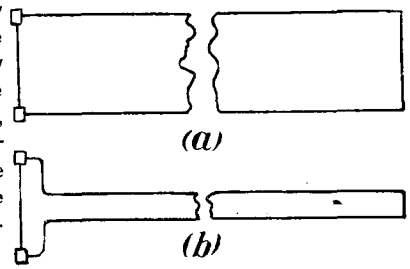


Fig. 2.—A very long tube takes energy away from the diaphragm, the smaller the tube the greater the energy absorbed.

required for the extra speed represents a higher resistance value applied to the diaphragm.

Of course, if the tube is made too small, friction on the side of the tube will enter and waste the energy we wish to send along the tube; but theoretically by altering the size of this tube we can damp the diaphragm just as much as we please.

A long straight tube will act just the same for one frequency as for another one, and this is almost obvious, as there is nothing to differentiate between frequencies.

Reflection

Of course, this long straight tube is of little use to us practically, and to get the energy out into the air we have to end the tube somewhere. If

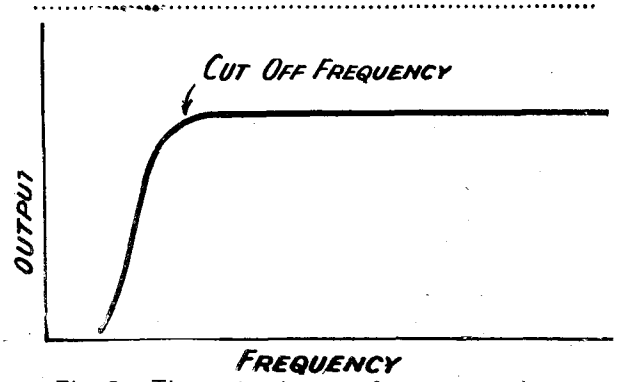


Fig. 3.—The output curve for a percentage horn.

THE DESIGN OF LOUD-SPEAKER HORNS—(*Continued*)

the end is a small one the energy refuses to come out and is reflected backwards, thus thwarting the two objects we are aiming at—

(1) To damp or load the diaphragm;
(2) To radiate the sound out into the room.

It has been found that if the tube is gradually opened out to a large orifice, this reflection does not take place until a certain low frequency is reached. The slower the opening out and the larger the orifice, the lower this limiting frequency is.

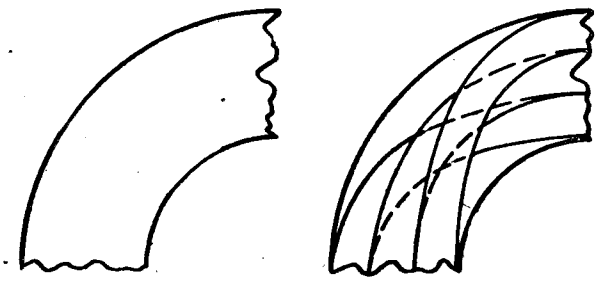


Fig. 4.—How the wide tube may be split up into a number of small tubes with the same length of path for each tube.

This opening out has been determined to be best done on a percentage or logarithmic basis. Every inch the increase of diameter is in the same proportion.

Fig. 3 shows the output curve of such a horn.

Any other way of opening out a horn is likely to produce unexpected results, except possibly the straight cone, which has been fairly well tested out and its properties determined.

Size of Opening

The final size of the opening is a matter of great difficulty to contend with. This opening can hardly ever be made big enough if we want to get the very low tones out properly.

In general we can say that to get all we want with a horn—

(1) Its input orifice must be small unless the diaphragm is a specially large one of small weight;
(2) The length of the horn must be great;
(3) The open end of the horn must be large.

Length of Path

Long horns will be unpractical to have in a house, and recent work has indicated how they can be confined into a small space.

Imagine a sound wave having to go round a bend in a tube like horses round a race track.

If the tube is of narrow diameter there is not much trouble, because there is not much difference in the length of path the wave has to travel between the inside and the outside of the track, but in the big tube the difference of length of path is considerable (Fig. 4*a*), which will result in a considerable mixing up of effects at the bend—the outside horses have little chance—but if we split up the wide tube into a lot of small tubes, providing we make the length of path the same for each tube, the effects will not be mixed. Fig. 4*b* shows how this might be done at any one bend.

Various methods of doing this in a partially effective way have been adopted in gramophones. Where the horn is still small it is bent about as required—when it gets fairly big it is split into two or sometimes four sections, each section wrapped up as required and keeping each section the same length. They are then all joined up into the final orifice.

Fig. 5 shows one means which has been adopted of carrying this process out.

Diagram of Horn Shape

The diagram in Fig. 6 will give all the necessary dimensions for constructing various horns.

I have neglected entirely the question of whether the horn is square in section or circular, as it will not be of great importance.

From this table you can choose a horn which is convenient in both length and diameter of orifice, and which will give a suitable curve of frequency.

Then a scale drawing can be made from the figures given, and the horn constructed of wood or metal.

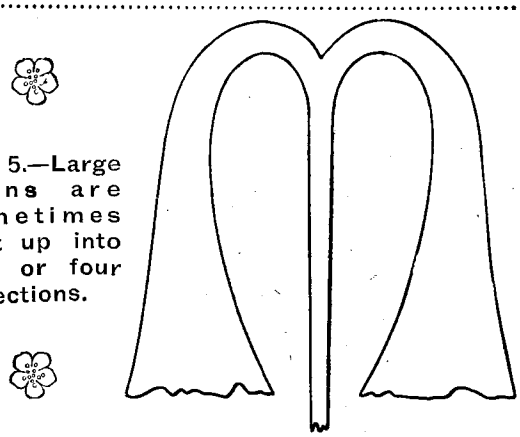


Fig. 5.—Large horns are sometimes split up into two or four sections.

The top line of figures gives the diameter of the horn at the distances from the small end read off from the chosen scale below.

An Example

For instance, we want to construct a horn which reproduces well down to 200 frequency. The

THE DESIGN OF LOUD-SPEAKER HORNS—*(Concluded)*

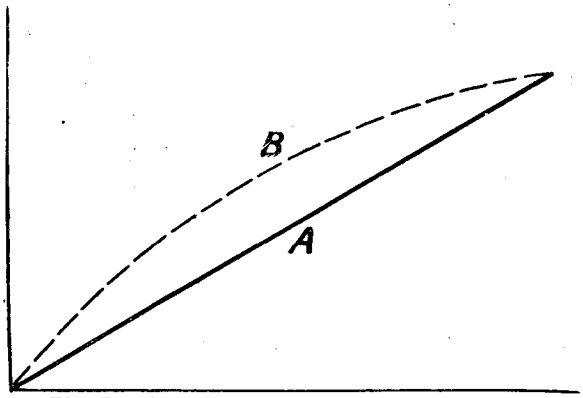


Fig. 7.—The curves for straight horns with large and small input orifices.

scale of lengths is read off opposite the left vertical scale marked " Frequency, etc.," The diameters of the horn at different distances along can be read off from the extreme top scale. Thus, at 100 cms. from the small end the diameter is 10.9 cms.

The curved line represents the full length of the horn, which in this particular case will be 160 cms., and the right-hand vertical scale indicates the open end orifice will be 42 cms.

A 50-cycle cut-off horn will be very large ; thus its length is 850 cms. (28 ft.) and its big diameter 168 cms. ($5\frac{1}{2}$ ft.).

The Small End

If the small orifice is kept at about 1-5th of the diaphragm diameter, a practical limit is reached in the amount of damping that can be usefully applied to it. Special light diaphragms have been constructed to avoid this small horn opening, but they have not been generally used yet.

In making up these horns it is rather wise to make the narrow end in short lengths, which can be moved to test the effect of a shorter horn with a larger input orifice on one diaphragm. The smaller the orifice the better the damping, but other considerations, such as air friction and the depth of the compression chamber, also enter, and these effects are usually too complicated to work out other than experimentally.

The output orifice is very difficult to contend with, and in the diagram I give the output diameter necessary to give not more than 35 per cent. reflection at the cut-off frequency.

To those experimenters building horns I suggest that they build them of square section of thin wood. I find 3- or 5-ply useful for this purpose, but sheet iron is quite satisfactory, and of course much easier to make wrapped-up horns with.

The influence of the material of the horn has been very much exaggerated.

Straight Cones

Straight cone horns are peculiar in their properties.

If the input orifice is considered to be very small, then the curve of the straight model horn is like Fig. *7a*, but if the input orifice is large the curve tends to be like Fig. *7b* —never quite as level as the percentage horn.

Many engineers are of the opinion that the straight-sided horn gives better effects

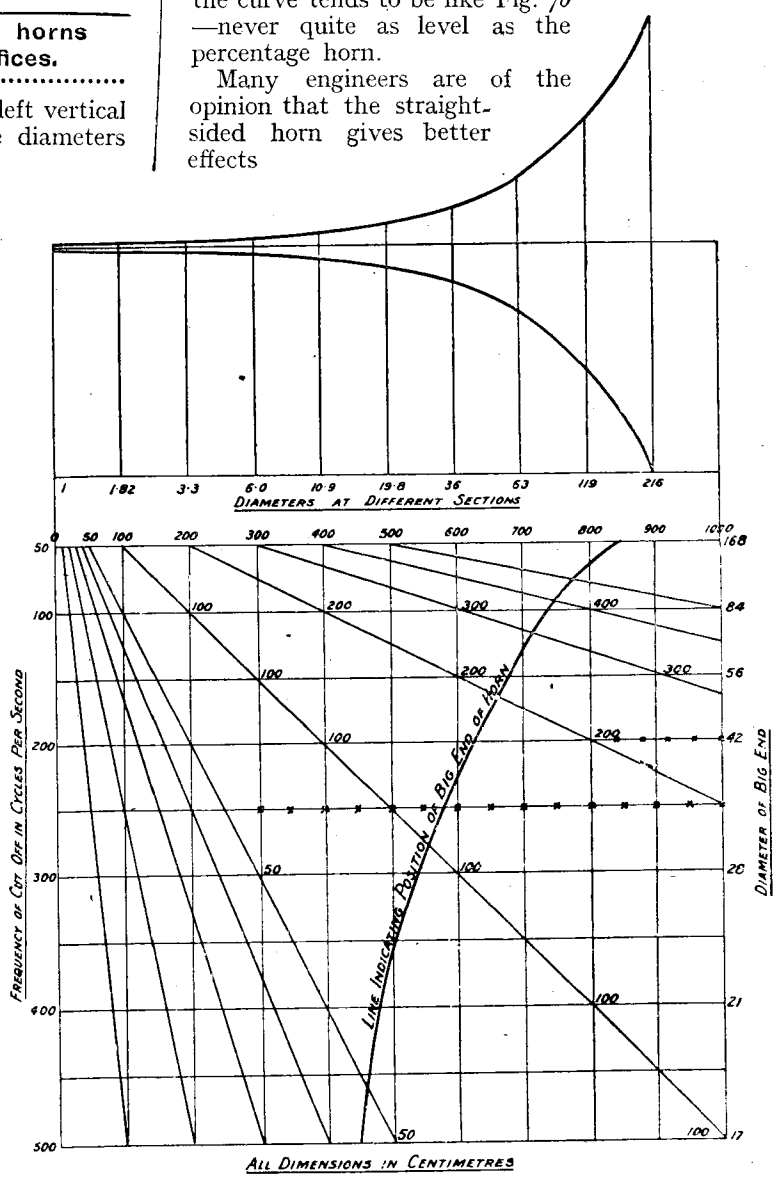


Fig. 6.—A useful set of curves from which it is a simple matter to obtain the necessary details for the construction of a horn.

News from Advertisements

A NEW Dubilier product in the form of a wire wound resistance has now been placed on the market.

* * *

The London and Provincial Radio Co., Ltd., are advertising an indicating dial for fitment to their well-known universal coil-holder.

* * *

A Lotus Grid-Leak and buoyancy Valve Holder is advertised by Garnett Whiteley, Ltd.

* * *

The Igranic - Pacent Triple Gang Condenser is announced by Messrs. P. Igranic Electric Co., Ltd.

* * *

Readers with A.C. current in their houses will note with interest the "Z" Filamentless Vacuum Tuble Rectifier, marketed by Economic Electric, Ltd.

* * *

Crossword enthusiasts should turn to the advertisement of Messrs. The New London Electron Co.

* * *

"Elstree Six" or "Solodyne"?

We have received many queries as to which of the two sets, the "Elstree Six" or the "Solodyne" is the better. Some readers are apparently delaying building one or the other of these receivers because they are of the opinion that one of the designs must be superior to the other. The truth is that neither set is better than the other. The "Elstree Six" employs six valves and has three stages of high-frequency amplification as against the two stages used in the "Solodyne." For this reason the "Elstree Six" may be made to give longer range and a little more selectivity. On the other hand, there are four controls against the one control of the "Solodyne," which, in addition, utilises screened coils. The selectivity of the "Elstree Six" may be enhanced by the use of smaller anode coils when close in to a broadcasting station. Alternatively its sensitivity, at the expense of selectivity, may be increased by the use of larger anode coils. Numerous other examples could be taken and we would impress on readers that the matter is one solely for individual choice. Each is a Radio Press Star set and is the best of its class.

IN PASSING

(*Concluded from page 443.*)

unkind things were said about us by our first two customers that for a time our new venture languished. It must not, however, be imagined that business was completely at a standstill. Far from it; one day we sold a 4BA nut to Bumpleby Brown, and on the very next day Gubbsworthy paid us threepence in hard cash for half-an-hour's hire of a pair of wire cutters which we had borrowed from Dipplesswade. Then one fine day things began really to look up. The General arrived staggering under the weight of his five-valve set. He had heard, he said, that our repairing department was not prospering as it deserved; so to give a helping hand he had brought a job for us to do. There was one little nut in an obscure corner which required to be tightened down and he had no spanner that would reach it.

The Job

It was a jolly awkward little nut to get at; in fact, to do so we found it necessary to remove both the wiring and the components of the high-frequency circuits. This enabled us to examine the set thoroughly, and we found that there were quite a lot of things that wanted doing. In a week's time it went back to the General accompanied by a bill neatly written out by the Professor.

	£	s.	d.
To tightening up loose nut	0	0	1
To re-wiring H.F. circuits	1	2	6
To re-designing and improving ditto	3	11	1
To replacing faulty valve-holder	0	6	6
To re-winding coils ...	0	17	4
To adjusting variable condensers	0	9	8
To cleaning gridleak ...	0	0	4
To renewing worn-out power-valve	1	2	6
To re-soldering 86 joints at 6d.	2	3	0
To removing beer stains from cabinet	0	7	6
To supplying and fitting 5 fixed resistors ...	2	10	0
Total	£12	10	6

We added that an early settlement would oblige. So far, I regret to say, it has not. Some people are very hard to please.

SOME PROBLEMS IN "GANG" :: CONTROL ::

Some of the Difficulties encountered in Designing the ELSTREE "SOLODYNE"

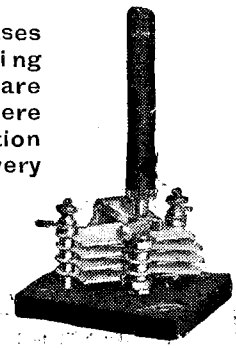
FROM a mechanical point of view, it is a comparatively simple matter to construct a receiver having three tuned circuits, and to arrange to operate all the tuning condensers from the same control. Moreover, when such an arrangement is first connected up, the local station is usually received quite well, and possibly one or two other stations may force their way through.

Matching

The best results, however, obviously cannot be obtained until some definite method of matching up the various circuits has been incorporated. There are several methods whereby this may be done, some of which are not satisfactory, while others can be used with success. It is proposed in this article to discuss some of the methods which were tried in evolving the Elstree "Solodyne" and to explain some of the difficulties which were encountered in the process.

The First Method

During the first preliminary experiments small neutralising condensers were connected in parallel with each of the three variable condensers. The skeleton circuit (omitting such things as batteries and other details unnecessary to the present discussion) is shown in Fig. 1. The three coils, L_1, L_3 and L_5 are all wound to the same dimensions, so that they can be considered as commercially matched although actually they were not quite of the same inductance.



In some cases neutralising condensers are useful where the correction required is very small.

With similar coils like this the settings of the last two condensers are reasonably similar, but of course the reading of the aerial dial is considerably different unless special precautions are taken.

The Aerial Circuit

With the aerial circuit we have the difficulty of the aerial capacity to contend with. If the aerial circuit were connected across the whole of the first coil, then we should have a capacity of the order of .0002 permanently connected across this coil. Obviously, therefore, some special arrangement must be made in this case if the aerial tuning condenser is to be controlled on the same knob as the other two.

Tight Coupling

The effect of the aerial may be considerably diminished and also the selectivity of the whole arrangement enhanced, by utilising the common form of tapped aerial circuit. The aerial is connected across a small portion at the earth end of the coil only, so that the

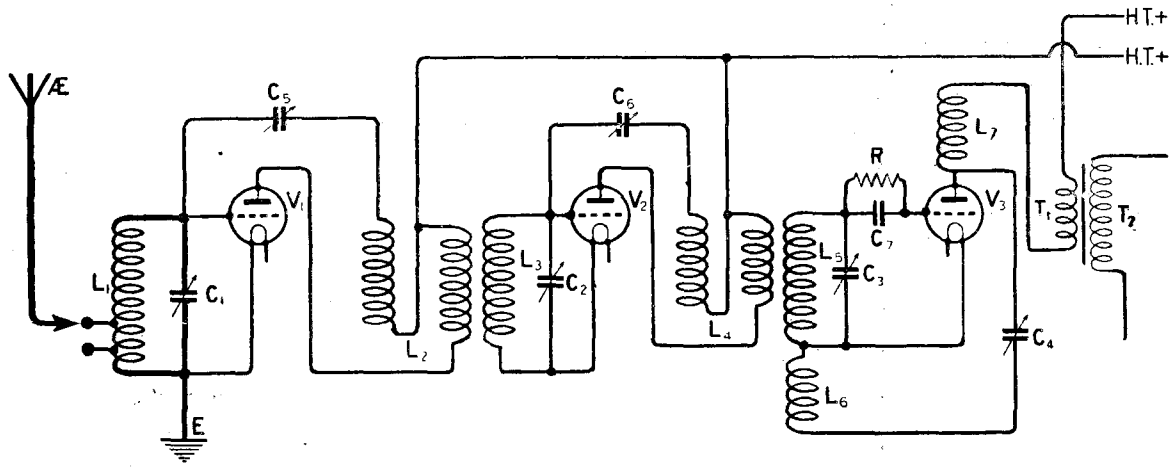


Fig. 1.—In the Elstree "Solodyne" the three circuits controlled by one adjustment are L_1, L_3 and L_5.

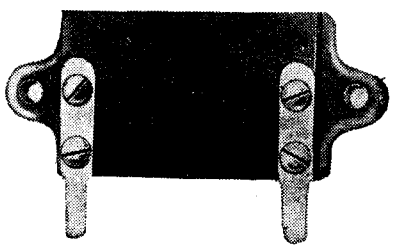
SOME PROBLEMS :: IN :: "GANG" CONTROL (*Continued*)

secondary circuit proper which is tuned with a condenser is really tightly coupled to the aerial circuit.

This is quite a common form of aerial circuit, and if this method is adopted, the effective capacity across the secondary circuit is very considerably reduced. Experiments showed that with the order of tapping which is usually employed in such circuits, the effective capacity across the secondary was reduced to something of the order of 50 micro-micro-farads or less.

Two Methods

We now have two alternatives. Either we can connect a similar



Connecting a small fixed condenser across two of the tuned circuits is one method of balancing out the effect of the aerial.

fixed condenser across both the other two tuning condensers, so that they also have a small parallel capacity of about 50 micro-micro-farads, or we can reduce the inductance of the aerial circuit until it tunes at the same point on the tuning condenser as the other two circuits. It is interesting to examine these two methods in a little greater detail.

The frequency to which any particular circuit will tune depends upon the product of the inductance and the capacity. For any given setting of the triple condenser, the capacities of the three individual condensers will be approximately the same. Let us assume that at one point the capacity of each condenser is 100 micro-micro-farads, (.0001). Let us also assume that

SOME PROBLEMS IN "GANG" CONTROL—*(Contd.)*

the inductance of the last two coils is 200 micro-henries.

Reducing the Inductance

In the case of the last two circuits therefore the product of L and C is 200 x 100=20,000. In the first circuit, however, we have a fixed capacity of 50 micro-micro-farads connected across the tuning condenser due to the effect of the aerial. Our total capacity here, therefore, is 150 micro-micro-farads, and we must reduce the inductance of the first coil accordingly, so that its product with this value of capacity is also 20,000. This requires a value of approximately 133 micro-henries.

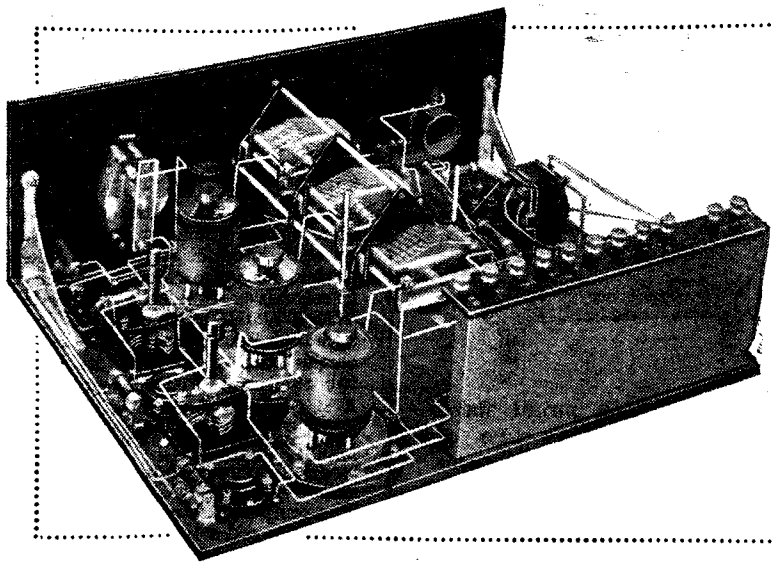
Let us now consider a point further up the scale where the tuning two, because the small parallel capacity is only a small proportion of the total capacity in circuit, whereas down towards the bottom of the scale the effect of the parallel capacity becomes very important, and the inductance has to be altered to a considerable extent.

Fixed Condenser Method

This leaves the other alternative which is that of connecting a small fixed condenser in parallel with the other two condensers and adjusting this until a satisfactory balance of all three condensers is obtained. This method has the advantage that it may also be utilised to correct minor variations existing in the condensers themselves.

slight difference between two of the coils we cannot correct for this by connecting a small parallel capacity across one of the circuits, because the value of this small correcting capacity would have to increase as we increased the total capacity in use. Due to this effect, therefore, it was found that the minor corrections which had to be made in the experimental model of the receiver did not hold good over the whole of the scale and some slight re-correction was necessary at different points of the scale. This of course defeated the whole object of the receiver, and other methods were therefore attempted.

The difficulty was due to minor variations in the inductances of



In the Elstree "Solodyne" a special triple condenser is employed, which utilises a method of coupling whereby the relative positions of the moving vanes may be varied.

capacity is, say, 250 micro-micro-farads. The product of L and C in the last two circuits is then 50,000. The tuning capacity in the first circuit is 250 plus the 50 micro-micro-farads in parallel, which makes a total of 300 micro-micro-farads, and if the product of L and C is again to equal 50,000 we then require an inductance of 166 micro-henries.

It will be clear from this that the method of reducing the value of the first inductance coil in order to compensate for the aerial capacity is not a practicable one, because the value of inductance required is different at different points of the condenser scale. At the top of the scale the inductance requires to be practically the same as the other

We have just considered an extreme case where the capacity of one condenser differed by a fixed amount from that of the others. We saw that in order to correct for this it was necessary to vary the inductance by an amount depending upon the actual value of the capacity in circuit. It will readily be seen that in accordance with this principle, that if we vary the *inductance* of the circuit by a fixed amount, then we can correct for this by a variation in the capacity, but, as in the previous case, the correction required will depend upon the total amount of capacity in circuit.

Other Methods Tried

This means that if we have a

the various coils, and the next step therefore was to attempt to alter the inductances within a small amount so that they could be balanced up at will to equal values.

Variometers

The next step in the development, therefore, was the inclusion of small variometers in series with the tuning coils, with the idea of enabling the inductances of the various circuits to be balanced up within a small amount. The variometers themselves consisted of small 2 in. diameter tubes containing three turns only, with similar rotors of slightly smaller diameter inside them, and for convenience these were mounted

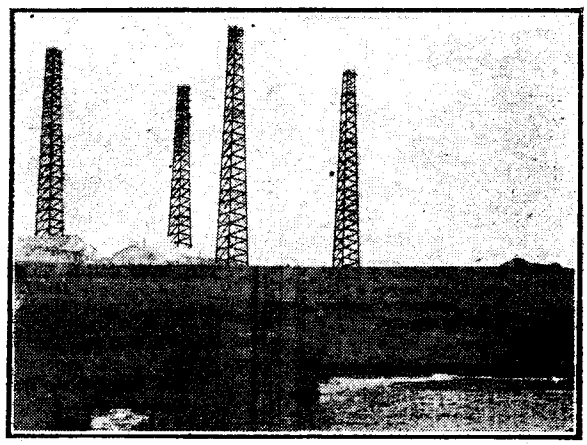
SOME PROBLEMS IN "GANG" CONTROL—*(Contd.)*

on the baseboard outside the screens.

The amount of coupling which would exist between such very small inductances would not be thought to be appreciable at first sight. Yet it was found in practice that the circuit became completely out of control when these variometers were incorporated. It was quite impossible to balance up the inductances of the various circuits because any alteration to the variometers simply varied the coupling between the circuits and either threw them into oscillation or introduced other undesirable effects.

A Vital Point

If this method is to be used therefore it is essential that the variations of inductance shall be carried out on the actual coil itself, inside its screening case. The question of making small variometers as part of the coils themselves was considered, and discarded as being too complicated and only to be adopted as a last resource.



The masts of the Marconi high-power station at Newfoundland. The reception of this station was the amateur's ambition in the crystal days.

The question was then tackled from another angle. By investigating the problem of the amount of correction necessary in the various circuits from a mathematical standpoint, it can easily be shown that in order to compensate for slight differences between the various circuits it is necessary to have a correction which increases directly as the capacity itself increases. In other words we must link up some small correcting condenser on the same spindle as the actual tuning condensers themselves.

Rocking the Rotor

On looking into the matter further, however, it was found that the same effect as this could be obtained by altering the settings of the various condensers relative to each other, provided

SOME PROBLEMS :: IN :: "GANG" CONTROL *(Concluded)*

a certain type of condenser was employed.

The Method Adopted

This is the method which has actually been adopted in balancing up the Elstree "Solodyne."

Similar results could, of course, be obtained with a condenser in which arrangements were made to vary the position of the stator or fixed plates instead of adjusting the moving plates. Which of the two methods is adopted is immaterial, but in the particular case of the Elstree "Solodyne" the adjustment was obtained by a relative movement of the rotors of the condensers.

Aerial Capacity

This method therefore is satisfactory for balancing up individual discrepancies, but there still remains the question of the aerial capacity. It will be remembered that this problem was overcome previously by connecting a small fixed capacity across each of the remaining two condensers. This, however, necessitates two extra adjustments which have to be balanced up when the set is first installed. If we are arranging for independent variation of the several condensers, it would be very desirable if we could make this method suffice for correcting the aerial capacity also.

Experimental Results

Experiments were therefore tried with a view to accomplishing this. Instead of connecting small parallel capacities across the remaining two condensers, the rotor of the aerial condenser was retarded so that the first circuit came into tune with the others at some given point.

Actually a point in the middle of the condenser range was chosen, and the last two circuits were tuned accurately to this frequency. The aerial condenser was then tuned independently to the same frequency and the three condensers finally locked in position. It was found that this method succeeded in correcting the aerial capacity to a satisfactory degree.

FURTHER HINTS :: ON THE :: "MEWFLEX"

(*Continued from page* 490.)

cuit still oscillates, then it is probably the second neutralising condenser which is causing the trouble, and a slight readjustment at this point will probably cure the trouble.

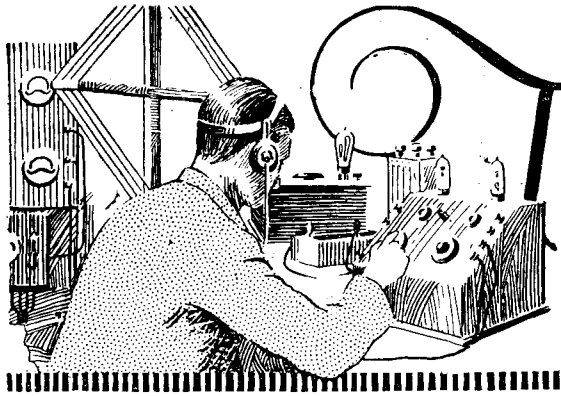
Capacity Coupling

A difficulty which is experienced in this type of circuit is due to the fact that there is capacity coupling existing between the primary and secondary of the transformers. This usually manifests itself by causing the neutralising points to be very sharp and critical. The ideal arrangement, of course, is for the circuit to be stable over a fairly wide band of the neutralising condenser, so that if some slight error or mis-adjustment is made, the receiver is still stable. With this particular circuit the neutralising condenser is somewhat critical of adjustment, and consequently a little care is required at first when the receiver is being tested out.

Long-Wave Coils

Reception on the longer wavelengths can be accomplished quite easily by merely removing the screens from their sockets, replacing the low wave coils by the long wave coils, and reinserting the screen. It will be found that no readjustment of the neutralising condensers is normally necessary, and all that is required is to tune the circuits in exactly the same manner as is adopted on the lower wavelengths. The test report which is given on page 488 shows the approximate settings obtained on several of the stations in this wavelength band, and this will serve as a guide in tuning.

These coils, however, differ slightly, according to the make, so that the figures given should not be taken as necessarily correct to one or two degrees. They will serve, however, to show the approximate positions at which the stations may be expected on the dial. As long as the condensers are tuned together in a similar manner to that adopted on the lower ranges no difficulty will be experienced in picking up the various stations.



Tested by Ourselves

A SAMPLE of their Acton Glass case accumulator has been submitted by Messrs. C. A. Vandervell and Co. The unit supplied was a 6 volt 48 ampere hour battery, each of the cells being provided with a glass container in place of the usual celluloid or ebonite. The three cells were mounted in a stout carrying case provided with a leather strap.

No separators were provided between the plates, the glass of the cells being moulded to keep the plates apart. By this construction it is claimed that any undue internal resistance in the battery is completely eliminated, that the battery will maintain its charge even when it is not used for some period, and will stand up to rougher treatment than normal.

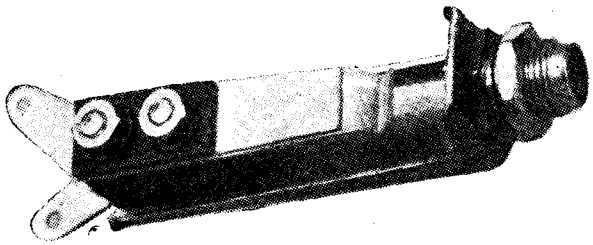
We have had the battery in intermittent use now for over two months. During the majority of the time it was used for about two hours a week at the end of which it was put on a steady discharge at a current of 1·5 amperes, and was found in all to give well over its rated capacity.

Despite the extremely irregular use of this unit, therefore, it gave a full discharge, and the plates were in a thoroughly healthy and free condition at the end. There was an entire absence of any sediment at the bottom of the cells, due to disintegration, and as far as can be seen, the battery should give excellent service under rough conditions. We can thoroughly recommend it to our readers.

Plugs and Jacks

WE have received several of their Plugs and Jacks from Messrs. Bowyer-Lowe Co., Ltd., for test.

The jacks are constructed on the girder principle, and the soldering tags to the spring contacts are set to either side so as to facilitate soldering connections to them. An excellent feature is applied in the method of fixing, which is of the usual one hole type. The bush itself is fixed, and a nut is employed to fasten this component on the panel. This obviates the need for any special spacing washers, and makes sure that the reach of the plug be correctly set, no matter what thickness panel is employed.



An example of the Bowyer-Lowe jack.

These jacks are made in various types both for single and double circuits and for filament control. They are robustly constructed and are efficient in use, while the insulation between adjacent contacts was found to be infinity.

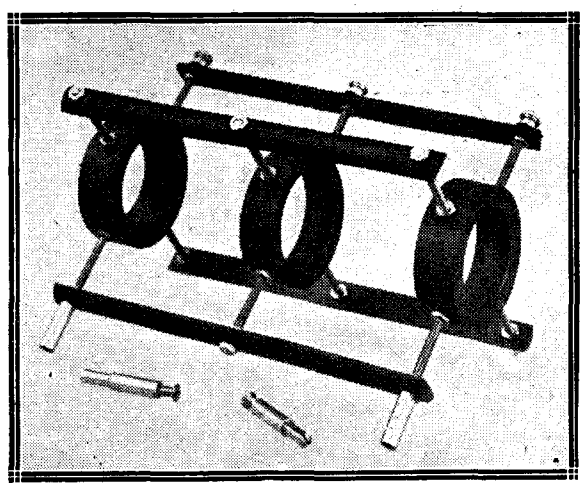
The plug for use with these jacks is constructed throughout of brass as regards the metal portion, while the fixing screws provided allow either of round tags or flexible wire being fastened. The insulated cover is highly polished, and the component has a neat appearance.

We can recommend these plugs and jacks for all wireless purposes.

Low Loss Coil Former

WE have received a Low Loss Coil Former from Messrs. The Jewel Pen Co., for test and report.

This former is of the skeleton type and consists of three ebonite rings to which four lengths of threaded rods are fitted. The four ends of these threaded rods carry strips of ebonite which are threaded so as to allow the windings of the coil



The coil former submitted by Messrs. The Jewel Pen Co. is provided with plugs and sockets for mounting purposes.

TESTED BY OURSELVES—(Contd.)

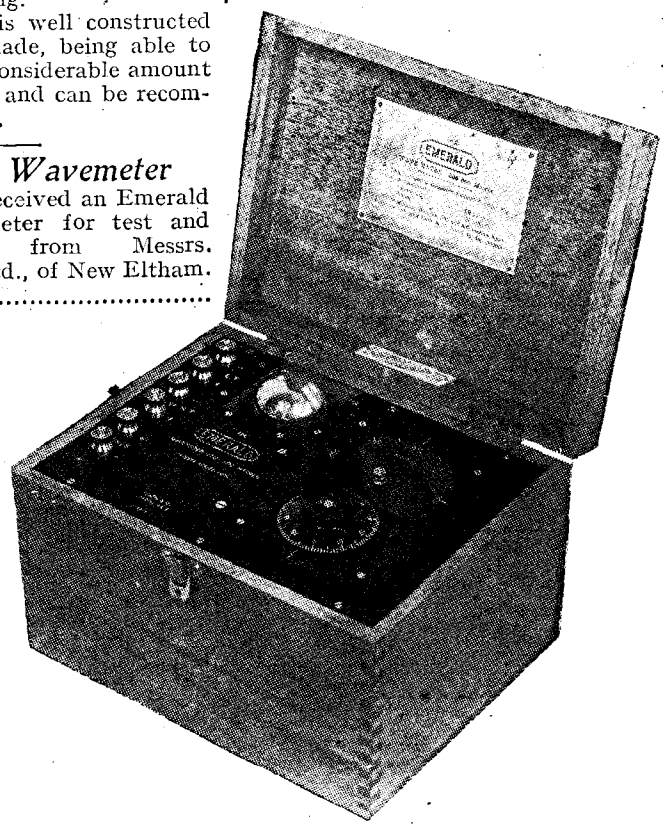
to be spaced. Two plugs and sockets are provided, one to each end of the former for mounting purposes. By this means it is possible to wind different coils for different purposes, and to change them as desired, an advantage over the usual low loss former which is generally a fixture in the set in which it is used. Three terminals and soldering tags are provided to enable connections to be made with the winding.

This former is well constructed and strongly made, being able to stand up to a considerable amount of rough usage, and can be recommended for use.

Emerald Wavemeter

WE have received an Emerald Wavemeter for test and report from Messrs. Heath & Co., Ltd., of New Eltham.

The Emerald wavemeter gives direct dial readings in metres. The small operating dial is divided into metre divisions, whilst the larger dial is marked off at every 50 metres.



This instrument is housed in a handsome mahogany box, clearly marked terminals being provided for connecting the batteries. The valve, which is carried within the wavemeter itself, is sunk below the panel so as to protect it from injury. The range of this instrument is from 200 to 600 metres, and two dials are provided, the main dial being divided in 50 metre divisions, and the smaller dial, which is geared to the main dial and actuated by the operating knob itself, is divided into metre divisions. It is claimed that this instrument is accurate within one metre, and when checked against our standard instrument the largest discrepancy obtained was ·67 of a metre.

The instrument is so designed that a variation in high-tension potential of five volts either side of the recommended value will not affect the calibration.

We can thoroughly recommend this wavemeter. It is simple to use, gives accurate results, and the workmanship of the whole instrument is exceedingly good. The price, including valve, is only £7 4s.

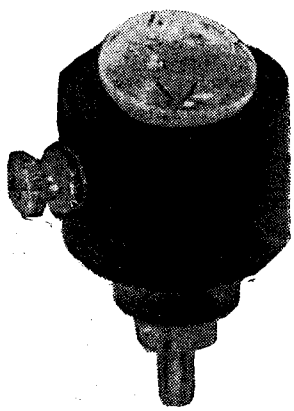
Safety Lead-in

MESSRS. PRESSLAND have sent us one of their Safety Lead-in tubes for test. This component is intended to provide a lightning arrester device which is permanently connected to earth, so that the disconnection of the aerial to the set and the earthing of the set inside the room are thus made unnecessary.

The lead-in of the aerial is attached beneath a heavy terminal, fixed at one end of a length of brass

TESTED BY OURSELVES
(*Continued*)

screwed rod. This rod passes through the centre of a small brass ring to which an earth external to the building is connected. There is only a small gap between the screwed rod and this brass ring, so that in the event of a high static charge collecting on the aerial it is claimed that it will discharge straight to the earth across this gap rather than go through the set. The rest of the brass rod passes through an ebonite tube, provided at one end with a hole for ventilation purposes, and a stout terminal at the far end is provided for connecting the lead in to the set itself. The safety gap is



The Hunt safety wander plug incorporates a small flash lamp bulb.

totally enclosed so as to prevent leakage occurring owing to rain.

When placed on test it was found that the insulation resistance was infinity, while the capacity between the lead in and the earth ring was found to be negligible. An insurance guarantee is supplied with each of these components, under which damage to personal property or third party will be paid up to £100.

Safety Wander Plug

MESSRS. A. H. HUNT, Ltd., have sent us one of their safety wander plugs for test. This wander plug consists of a small screw lamp holder which is provided with a plug fitting to enable it to be inserted in the usual high-tension battery. On the side is a small terminal under which the lead itself

TESTED BY OURSELVES — *(Continued)*

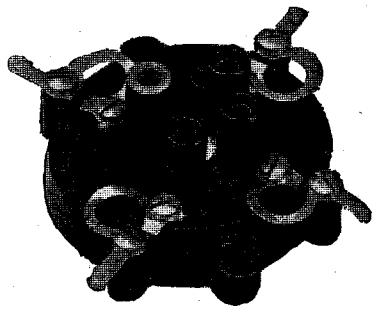
may be fixed. A small flash lamp screws into the holder and acts as a fuse, thus preventing the valve from burning out should a short take place.

When placed on test it was found that when this wander plug was placed in series with the H.T. lead and the battery then shorted across a .06 valve, the safety lamp burnt out without the valve being damaged in any way.

This is a well-finished and useful accessory which commends itself to many amateurs as a simple means of protecting valves from being burnt out.

Anti-Microphonic Valve Holder

MESSRS. HARLIE have sent us one of their anti-microphonic valve holders for test. This component is built on anti-capacity lines, the valve legs all being spaced apart, while each is surrounded by a thin sheath of insulating material. The metal parts of the sockets are sunk beneath the top of these insulating sheaths, so as to safeguard the valve if any attempt is made to insert it incorrectly. In order to obviate even that, the anode pin is marked with a red ring so that no mistake shall be made.



The Harlie anti-microphonic valve holder.

The valve legs are carried on a round disc of insulating material, a hole being drilled through the centre of this still further to reduce the capacity of the valve holder. This base is supported by means of flat leaf springs on a thin shell of insulating material which may be fixed to the baseboard, and it has a definite limit to its travel either upwards or downwards. Connections may be made by means of screws or soldering tags, and the general finish of the component is good, although the construction is somewhat on the light side.

Several valves were tried in the holder, and all were found to be a good tight fit, assuring that good electrical contact be made to each of the pins. The insulation resistance between pin to pin was found to be infinity in each case, and it is clear that considerable care and thought have been expended on its construction. We have no hesitation in recommending this component for use.

High-tension Accumulator

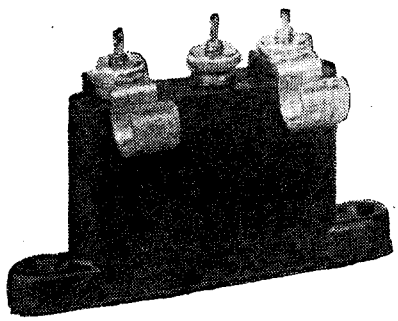
MESSRS. THE TUNGSTONE ACCUMULATOR CO., LTD., have sent to us one of their standard 60-volt 3-

TESTED BY OURSELVES—(Concluded)

ampere-hour high-tension batteries. This battery is contained in a polished teak box. Considering the capacity of this accumulator, it is not only reasonable in its dimensions, but also in its weight. The size of the container is 5 in. high, 9¼ in. wide and 12 in. long, while the weight of the complete battery with acid is just under 26 lb.

The battery is sent out with its first charge, but in a dry condition. On receipt the battery was filled with acid, and given a further charge, and then left to stand for two months, after which the voltage was found to be 63 volts. It was then put into use, and a heavy current taken from it, and it was also short-circuited on several occasions. It was then kept in use for about two months, current being taken from it at rates varying from 12 to 30 milliamps. At the end of this period it showed a voltage of 53 volts overall, and even then did not show any serious voltage drop when under load.

This battery is of robust construction and reliable in use, while a great convenience is afforded by the provision of inter-cell tappings, by means of which it can be tapped off every 2 volts. Further,



The T.C.C. grid condenser enables two different arrangements of the grid leak to be employed.

a perforated insulating sheet which slides into two grooves above the cells is marked with the voltage of each tapping.

Grid Condenser

WE have received a grid condenser for test from Messrs. The Telegraph Condenser Co. Ltd.

This is similar in construction to their well-known components, a different terminal arrangement, however, being provided.

Instead of this component being provided with only two terminals, three are provided, which in conjunction with their grid leak clips enables it to be used either for series or parallel arrangement of the grid leak. Each condenser is accompanied by an explanatory leaflet showing how the desired connections can be obtained.

Rated at a capacity of .0002, its actual value was found to be .000193, giving an accuracy within less than 5 per cent.

The arrangement provided widens the scope of this component, which can, apart from its general utility, be recommended for its accuracy.

A SCREENED-COIL SUPER-HETERODYNE

(*Continued from page* 441.)

remove the chokes, solder one end of the wire to the appropriate point upon the valve socket, replace the choke and make the other joint.

Just one other point in connection with the wiring should perhaps be mentioned. It will be observed that there is a twin twisted lead for the connections between the anode of the last valve and H.T. plus, through the appropriate contacts upon the jack. This is a rather important point, and some care should be taken to run the lead exactly as seen in the wiring diagram and photographs.

Operating Details

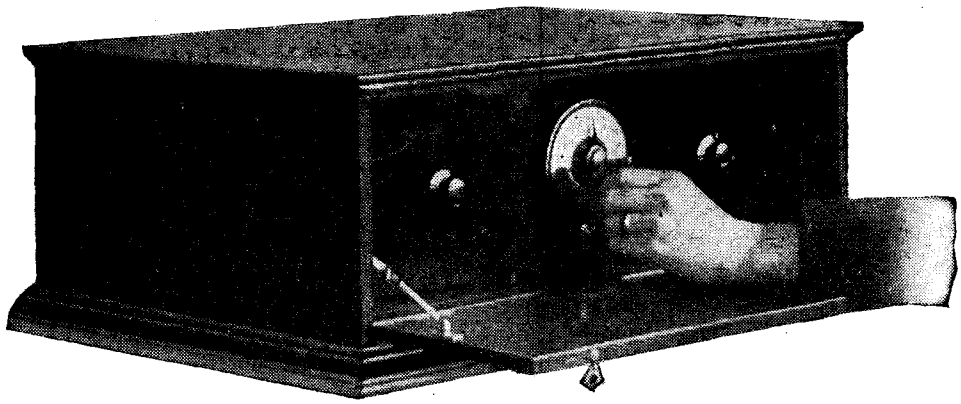
Full operating details, notes on how to get the best from the receiver, and so on, will appear next month. Meanwhile it may be desirable to give a little information as to valves and voltages, etc., in order that those who have not had much previous experience of super-heterodynes may be in a position to get the instrument working satisfactorily.

As regards valves, it will be found that the high-impedance, high-amplification-ratio types originally intended for resistance-capacity low-frequency amplification will give particularly good results in all positions in the set except the two low-frequency amplifiers, which should be of the low-impedance power type. For the oscillator, almost any type of valve will do, one of the fairly freely oscillating type being perhaps slightly preferable.

As a general guide, it will be found that about 40 volts upon the H.T. + 1 terminal, 60 upon H.T. + 2, 80 or 90 on H.T. + 3, and about 100 or 120 upon H.T. + 4 will give good results.

Operating Hints on the Elstree Solodyne

(*See page* 471)



YOU MAY WIN

THIS WONDERFUL FIRST PRIZE

A COMPLETE

ELSTREE SOLODYNE

SECOND PRIZE: A Complete Elstreflex Receiver

THIRD PRIZE: A Complete Razor-Sharp Wavemeter

THE Mystery Number of WIRELESS, on sale Tuesday next, will give every reader the wonderful opportunity of winning an equally wonderful receiver—the Elstree "Solodyne."

So great was the enthusiasm shown for this receiver at the recent Exhibition held at Olympia, that we have every reason to believe this issue will have record sales.

Copies of the Mystery Number may be difficult to obtain except on the day of publication. You may avoid any disappointment by giving your newsagent instructions *to-day* to deliver your copy.

EVERY reader and each of his friends should try to be the fortunate winner of one of these wonderful prizes. Full details of the conditions of entry will be published in the issue of WIRELESS dated October 9th, on sale Tuesday next.

The Elstree "SOLODYNE"—the first prize—is the famous Five-Valve Receiver on which no fewer than fifty stations were received on the loud-speaker on one dial.

Buy your copy of WIRELESS early.

In addition this issue will contain many interesting articles:—

MYSTERY ARTICLE *by a well-known Radio Personality.*

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❖

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Buy "Wireless" on the way home

Tracing Trouble

By JOHN UNDERDOWN

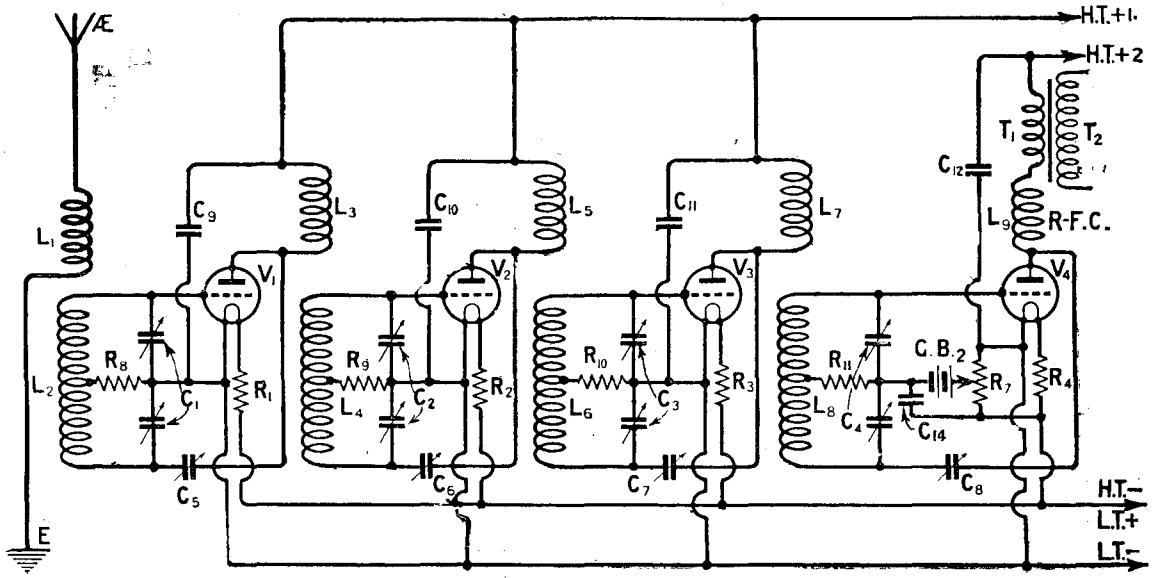
Some helpful hints on diagnosing faults in H.F. circuits of the neutralised split-secondary type.

IT is intended, from time to time under this heading, to review various faults, in order that the symptoms may be recognised by readers in trouble, and remedies may be available. This month, it is thought by the writer that faults in a particular arrangement rather than general troubles will be of interest, and an account will be given of symptoms observed when deliberate faults were placed upon an "Elstree-Six" type set. This particular receiver has been chosen, since it has made an extraordinary appeal to the listener, and as with every popular receiver a few readers are bound to experience difficulty, owing to various reasons such as alterations to components and layout or to insufficient attention being paid to published instructions.

The "Elstree Six"

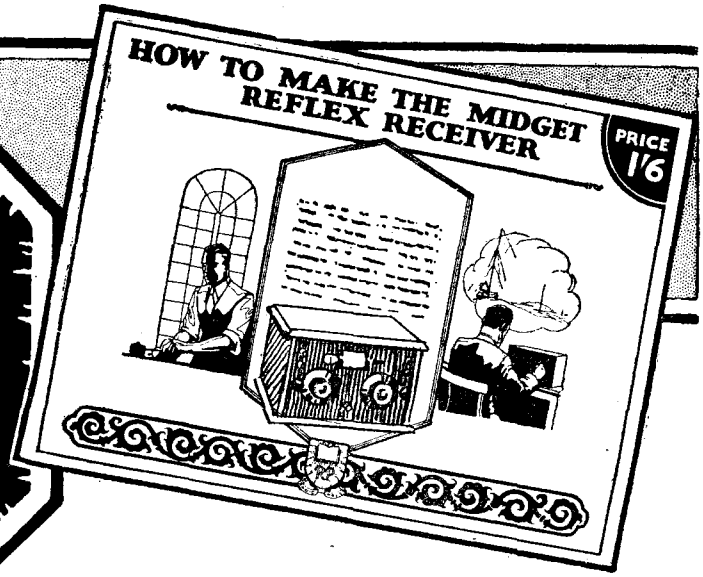
The H.F. and detector circuit arrangement of the receiver is reproduced in the figure for the purposes of reference, the actual components being lettered as in the original set. Combinations of Dimic coils and of ordinary plug-in coils are utilised to form neutralised transformer couplings, and here it is specially important to preserve the spacing between primaries and secondaries, if the results given in the article are to be duplicated. Tight coupling between the primaries and secondaries is necessary if the full signal strength of which the set is capable is to be obtained, and the spacing given on the blueprint must be followed exactly. If this is not done lack of signal strength may be noticeable. The primary coils L_3, L_5 and L_7 should be Nos. 50 or 60, the former giving the higher selectivity and the latter slightly better signal strength, although there is not a great deal to choose. Types of coils, which approximate in diameter to the Dimics used, are to be preferred here, although most makes of plug-in coils function satisfactorily. There is, however, upon the market at least one make with which the sense of the winding is reversed to that normally considered standard, and if such coils are employed it will be necessary to reverse the leads to the primary coil blocks.

If coils which are too large are employed for the transformer primaries, some little difficulty may be experienced in stabilising the receiver, and in such cases it is to



In a circuit of this type, if the primary coils L_3, L_5 and L_7 are too large, some little difficulty may be experienced in obtaining stability.

Another FREE GIFT for every reader



READERS of "THE WIRELESS CONSTRUCTOR" will receive with the November issue another wonderful FREE GIFT, "How to build the Midget Reflex Receiver."

This will take the form of a constructional envelope, the contents of which will be similar to that of the famous Radio Press Envelopes, known to every home constructor.

Since this issue of "THE WIRELESS CONSTRUCTOR" will also be a Special Birthday Number you will be best advised to place an order with your newsagent to-day, otherwise you may have great difficulty in securing your copy.

November Issue on Sale October 15

J. H. REYNER, B.Sc. (Hons.), A.M.I.E.E., who describes the "Invalid's Three."

Other contents of this issue include :

A STABLE TWO-VALVE SET
by G. P. Kendall, B.Sc.

A further article on the "DISTAFLEX TWO," one of the Radio Press Star Sets described in the October issue.

Notes on the "NIGHT HAWK," another Radio Press Star Set, by Percy W. Harris, M.I.R.E.

Also many other interesting articles by well-known writers.

The Wireless Constructor

SIXPENCE MONTHLY

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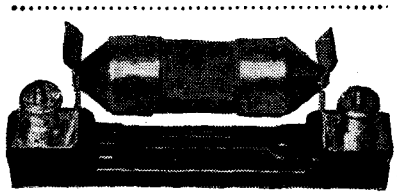
From the nearest newsagent

TRACING TROUBLE—(Concluded)

be advised that one of the primary coils be decreased in size, preferably the centre one, namely L_5.

The Anode Resistances

The effect of a broken down anode resistance, that is R_8, R_9, R_{10} or R_{11}, is a problem which I have investigated, by substituting a defective resistance which on a megger gave an infinity reading in each of these positions in turn. The symptom obtained with this defective component in the R_8 position was a high pitched continuous whistle, whilst in the R_{11} position, that is in the grid circuit of the detector valve, the familiar bubble, bubble, bubble usually obtained with a break in a grid circuit, was present. In the R_{10} position the defective anode resistance merely gave rise to distortion and loss of signal strength.



In split-secondary circuits it is important to use anode resistances of reliable make.

A Useful Test

It will be gathered from these experiments that a break in an anode resistance in the various positions may give rise to somewhat differing symptoms and it is worth while, when trouble is experienced, to roughly test these components with telephones and a dry cell for continuity.

Detector Grid Bias

Correct adjustment of the grid bias to the detector valve has considerable bearing on the stable working of the L.F. side, and here with ¼-ampere type valves, 1½ or 3 volts with 60 volts H.T. generally proves satisfactory, and the adjustment of the potentiometer is found to be fairly sharp. With incorrect adjustment a note howl or whistle may be obtained.

Neutralising

With ¼-ampere type valves and certain H.F. types in the H.F. stages the receiver is particularly easy to neutralise, and it is generally found that a setting which will give stability is with the neutralising condensers moving vanes about one third in. I have come into contact, however, with a number of cases where complaints have been made that the set could not be neutralised, and in all cases this has been due to inattention being paid to the published instructions and not to an actual fault. A few words therefore on the subject of neutralising should prove helpful.

A Simple Method

The simplest method to adopt is to set the reaction condenser at zero and all four tuning condensers to the setting for the local station, which may be obtained from the tuning chart given in a previous article, and to extinguish the first valve by removing the first Amperite, or fixed resistor. When this is done the first neutralising condenser, C_5, may be adjusted until the signals completely disappear or are reduced to minimum strength. It is essential when this is done that the tuned circuits on either side of the valve concerned are correctly adjusted for the reception of the given station, *e.g.*, in the case of V_1 C_1, L_2 and C_2 L_4, although if a silent minimum point cannot be found when adjusting the neutralising condenser, one of the other circuits may be detuned until the desired silent point is obtained. Unless the adjacent tuned circuits are correctly adjusted, the neutralising will not be exact.

When the first valve has been correctly neutralised the procedure to adopt is to replace the first filament resistor or Amperite, R_1, and to remove R_2, the neutralising process then being carried out on C_6. This process should be carried out until all valves are stabilised.

With ¼-ampere type valves, or others with similar characteristics, it will be found that the neutralising setting is not particularly critical and a few degrees on either side of the correct point will still allow the receiver to remain stable.

Other Valves

Should 60 milliampere type valves be employed in the H.F. stages, some little difficulty may be experienced in neutralising, since the capacity of these types between plate and grid is much less than that of the others previously mentioned, and it may be found that the plates of the neutralising condensers will have to be all out or near this position before the set is stabilised.

Index to Advertisers