RADIO REVOLUTIONISED! BY JOHN SCOTT-TAGGART, F.Inst.P., A.M.I.E.E.

MODERN WIRELESS

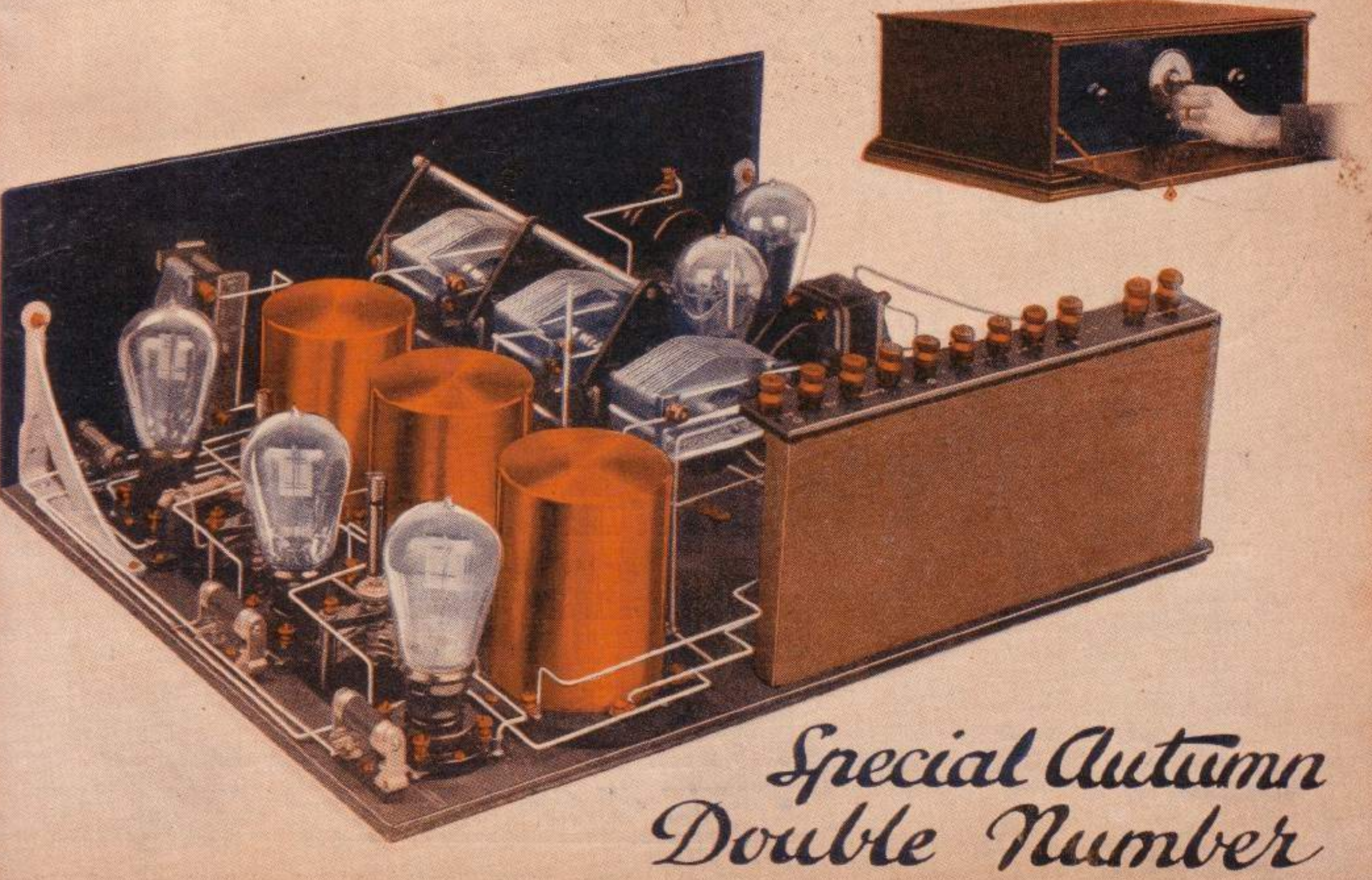
1/6

RADIO PRESS

Vol. VI. No. 4. SEPTEMBER, 1926.

The ELSTREE SOLODYNE

5 VALVES
ONE DIAL
50 STATIONS



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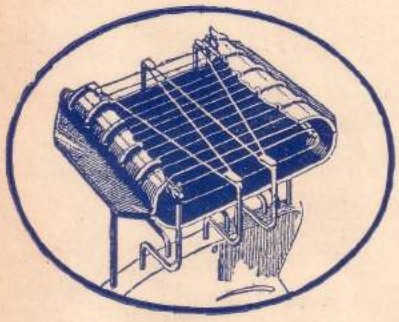

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Mullard

THE·MASTER·VALVE

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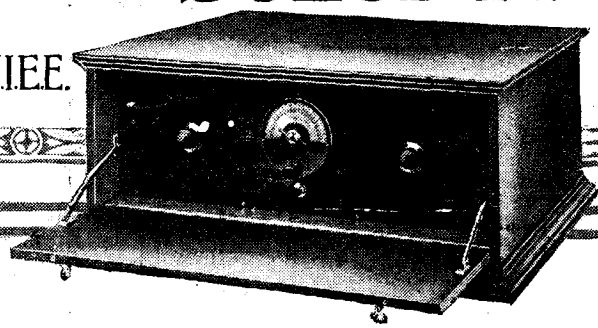
VOL. VI. MODERN WIRELESS No. 4

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

RADIO PRESS LTD., BUSH HOUSE, STRAND, LONDON, W.C.2. *Telephone:* City 9011

The ELSTREE "SOLODYNE"

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



A DREAM FULFILLED!

Five Valves—One Dial—Fifty Stations on Loud-Speaker!

ELSTREE'S LATEST ACHIEVEMENT

How Stations Hundreds of Miles away come in like the Local One by Adjusting a Single Dial.

In this unique receiver the Elstree engineers have at one stroke solved a problem as old as radio itself. Here at last is the ideal one-dial set. Hitherto, inferior range and selectivity have accompanied attempts to reduce the number of controls. The demonstrated results of this set, however, show that stations hundreds of miles away will come in on the loud-speaker by turning a single dial. Every modern device is embodied in this set, which sacrifices nothing in order to get simplicity of control. From a constructional and wiring point of view this set is, if anything, simpler than the ordinary modern set.

You can cover any wavelength band by merely changing the screened transformers, and the precision manufacture of these single-layer coils has contributed to the possibility of single control without special matching. This receiver is the first of its kind to be developed in this country, and as it is published as a standard "star" set for the coming year, it is anticipated that thousands will be built all over the country.

THE idea of being able to tune in a large number of stations by the simple adjustment of one dial has always fascinated the radio amateur since the very beginning of broadcasting. The difficulties of such a procedure are, of course, very large, because, owing to the number of stations which are working to-day, it is necessary to obtain a high degree of selectivity if reasonable freedom from interference is to be experienced.

The recent developments in high-frequency amplifiers have enabled us to obtain very selective and sensitive receivers, and one of the features of these receivers has been the fact that the dial readings of the various tuned circuits corresponded to a large extent. In fact, were it not for this aid, the tuning of multi-valve receivers would be a matter of considerable difficulty.

Gang Control

It would appear, therefore, to be a comparatively simple matter to link all the tuned circuits on one dial, and so to obtain an arrangement which would tune in to the various stations on one knob. This, however, is by no means such an easy matter as would appear at first sight, and in fact some considerable research work was necessary before a satisfactory solution of the problem was ultimately obtained.

Some of the problems which have been encountered during the experimental stages will be detailed in another article appearing next month, and it will suffice to point out here that the various difficulties have been overcome, and for the first time in the history of wireless in this country a satisfactory single-dial receiver has been produced.

Screened Coils

The success of the model is attributable to two main components. In the first place all the tuning

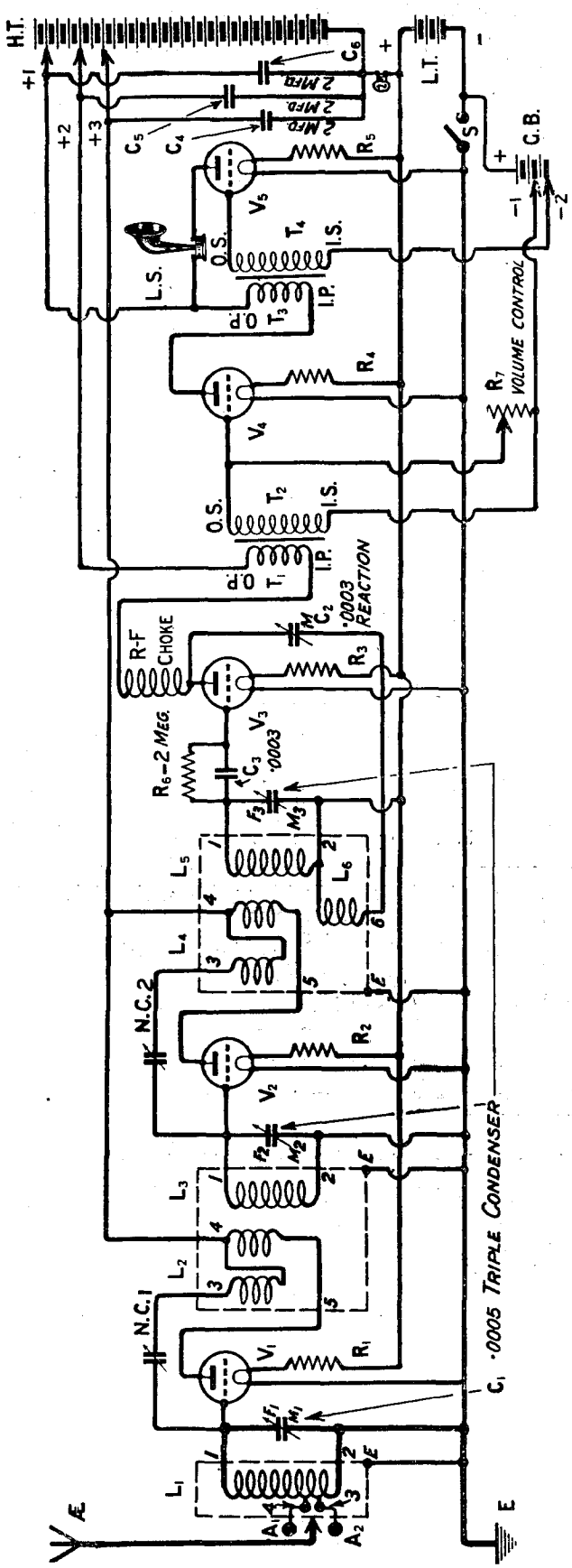


Fig. 1.—The "Solodyne" circuit. For the sake of clearness the triple tuning condenser C_1 is shown as three separate condensers indicated by the arrows.

THE ELSTREE "SOLODYNE" *(Continued)*

coils utilised in the receiver are enclosed in screening cases, so that any magnetic and capacitive interaction between the various circuits is reduced to the absolute minimum. By the use of suitable neutralising adjustments, therefore, the circuit remains stable over the whole of the range, and even if the coils are changed for those for the Daventry range.

As was stated last month, the efficiency is further considerably improved by the use of special coils employing Litzendraht wire for the tuned circuits. This wire, as is well-known, consists of a series of fine wires stranded together in such a manner that each individual wire in turn takes up a position on the outside of the cable. Since at high-frequencies the currents all tend to crowd towards the edge of the wire, each strand of the wire will carry its due share of the current.

Although many attempts have been made to utilise this type of wire for radio circuits, there are several difficulties in the way. After considerable research, however, a satisfactory type of coil has been ultimately produced by the London Electric Wire Company in conjunction with the Elstree laboratories.

The Triple Condenser

The other factor which contributes to the success of this arrangement is the triple condenser which is employed for tuning the circuits. This consists of three standard variable condensers mounted on a framework with the spindles all coupled together. The rotation of the end spindle therefore causes all the condensers to rotate in unison, thereby tuning the three circuits at once.

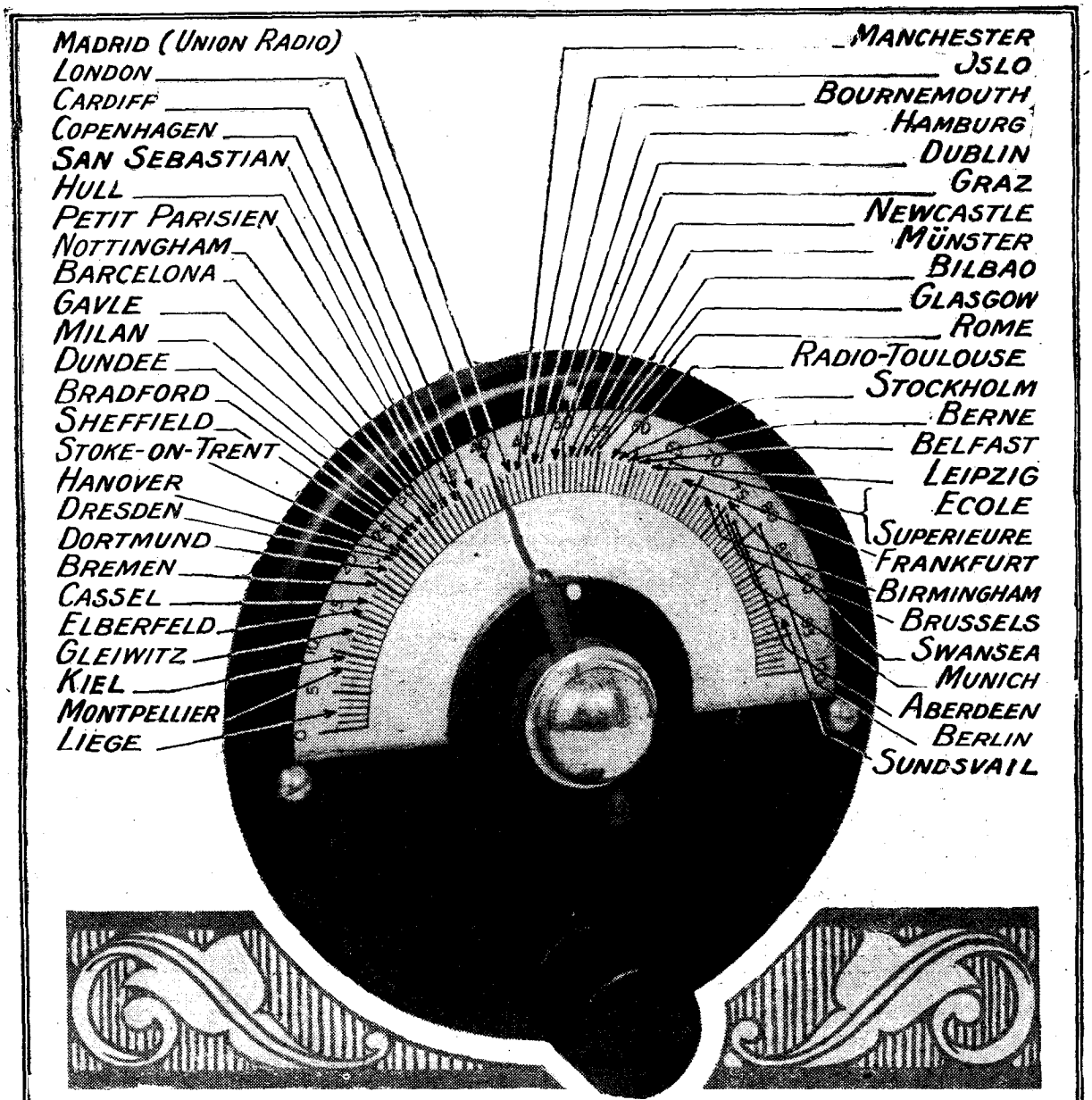
There are several mechanical difficulties in the construction of a condenser, such as this, one of the principle ones being that, unless great mechanical rigidity is obtained, there is a danger that the spindles of the condenser will not line up properly, and the whole arrangement may tend to bind as it is rotated.

Special Couplings

This difficulty has been overcome

ONE-DIAL TUNING—FIFTY STATIONS

HOW THEY COME IN ROUND THE DIAL



Above is depicted the tuning control of the Elstree "Solodyne" with the settings for the various stations received on the loud-speaker. Next month the readings for the long wave broadcasting stations will be given.

THE ELSTREE "SOLODYNE"—*(Continued)*

in the present model by the special Oldham couplings between the various condensers. At the same time arrangements have been made whereby these couplings may be so adjusted that the various condensers can be set at different angles relative to each other.

By this means therefore it is possible to balance up the circuits with a minimum of trouble, and once this operation has been performed no adjustment is required, the reception of the various stations being accomplished by rotation of the spindle which moves all three condensers in unison.

Components

The components required will be as listed.

The Circuit

The circuit of the receiver is shown in Fig. 1. It will be seen to be similar in many respects to the "Magic Five" circuit which was described some time ago in *Wireless* and which has proved so successful. In this arrangement the whole of the secondary circuit is tuned, stabilising being effected by a special neutralising winding which is wound on the same former as the primary winding. This method of neutralising was developed after considerable experiment, and has proved to be a very satisfactory type of circuit.

It possesses the advantages that the whole of the available voltage is applied across the grid and filament of the valve, while it is particularly easy to handle and adjust in the first place, so that it is an eminently suitable type of circuit for this class of receiver. In addition several modifications have been made as a result of recent research work.

Reaction Control

The principal difference between the circuit adopted and that employed in the "Magic Five" lies in the fact that a definite reaction circuit has been provided on the last valve, the extent of the reaction being controlled by a variable condenser in series with the reaction coil on the well-known so-called Reinartz system. I have found as a result of considerable experiment that this type of reaction gives definitely better results than the quasi-reaction which is produced by upsetting the balance of the neutralising condensers.

As was pointed out in these columns last month, the actions which are involved in an ordinary neutralising circuit are not

"A WONDER SET."

Elstree
August 11/1926

If I were asked which receiver of those we have designed at Elstree was the most meritorious and original, I should at once say: "The Solodyne" My only fear is that the set seems too good to be true! It is really a 1928 model and embodies every device for getting range selectivity and simplicity which we have developed at Elstree.

It is a wonder set and, for five valves, is a remarkable "distance getter". We intend to demonstrate and prove its capabilities publicly, and believe that it will achieve extraordinary popularity.

John Scott-Taggart.

Technical Director.

Build the "Solodyne" and Get These Advantages.

1.—In the evening fifty odd stations, including all those of the B.B.C., can be received on the loud-speaker. The daylight range is also great.

2.—Only one dial is adjusted for wavelength tuning. You simply set your dial to the reading we say, and the station you want comes in at once.

3.—Only five valves are used and the cost of this set is reasonable.

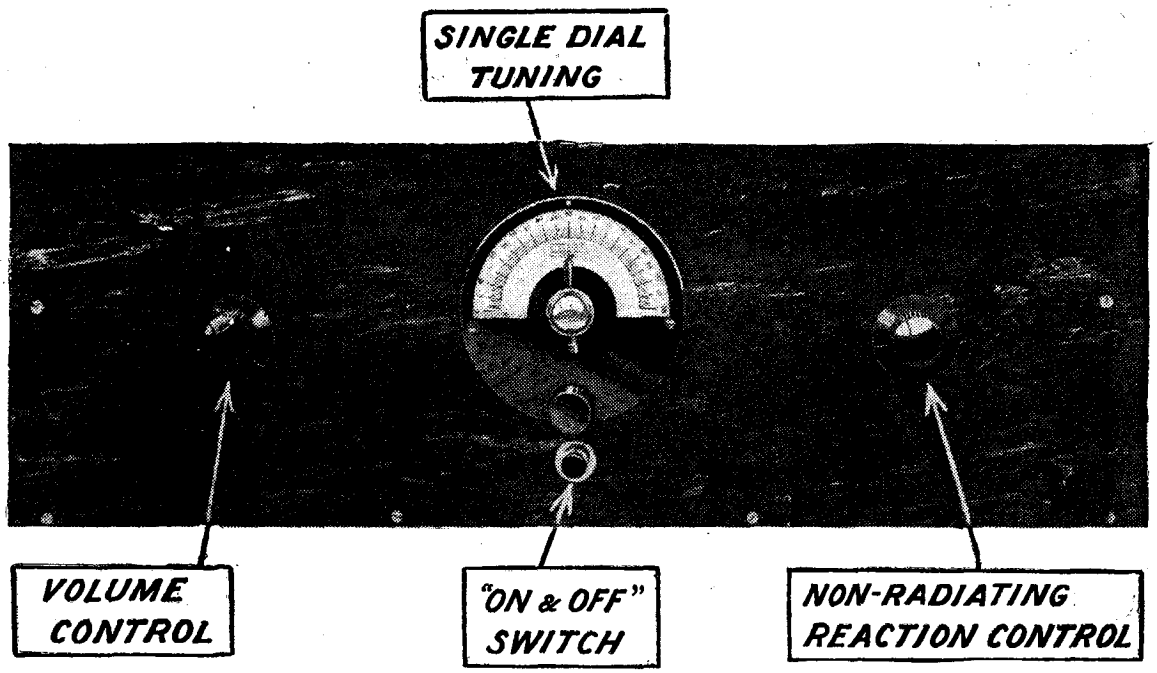
4.—Two small volume controls are provided. One is a resistance device for cutting down strength on the nearer stations, owing to the powerful results given by the receiver. The other volume control adds reaction and is used for bringing up to loud-speaker strength the weaker stations. Both adjustments are refinements and do not affect tuning.

5.—Two stages of high-frequency amplification are employed and excellent selectivity combined with range is a feature of the set. Screened high-frequency transformers are employed and the local station can be cut out with the greatest ease.

6.—There is no bother about matching. You buy your "Solodyne" condenser and the transformers are accurately standardised to Elstree specification.

7.—There is nothing half-boiled about the design. It has taken months to develop, and is placed in the category of "star" sets which have been standardised for this year.

FIFTY STATIONS ON LOUD-SPEAKER



A perfectly symmetrical layout is a notable feature of the front of panel design.

quite as simple as they appear, and a somewhat subtle change takes place as the actual balance point is passed through. It will be appreciated that with a more or less unstable condition like this, the full reaction effect cannot be obtained by simply unsetting the neutralising condenser. This has definitely been found to be the case in practice, so that in this instance a separate reaction circuit has been provided.

Volume Control

A volume control has been provided on the first transformer. The particular unit used has a resistance of 1 megohm, and for this reason it has been placed across the secondary of the first transformer of the note magnifier. As this resistance is decreased, so the volume can be cut down to reasonable strength without upsetting the quality of reception in any way.

General Layout

The layout of the panel of the receiver therefore is extraordinarily simple. We have, firstly, and principally, the dial controlling the three condensers which are rotated in unison and tune the high-frequency circuits. On the right of this dial we have the small knob operating the reaction condenser. This is not necessary as a critical adjustment in finding the stations, but serves simply to increase the strength of some of the weaker stations as required.

On the left of the main dial we have a similar knob, this time controlling the volume. The only other knob on the panel is that of the "On—off" switch, which is

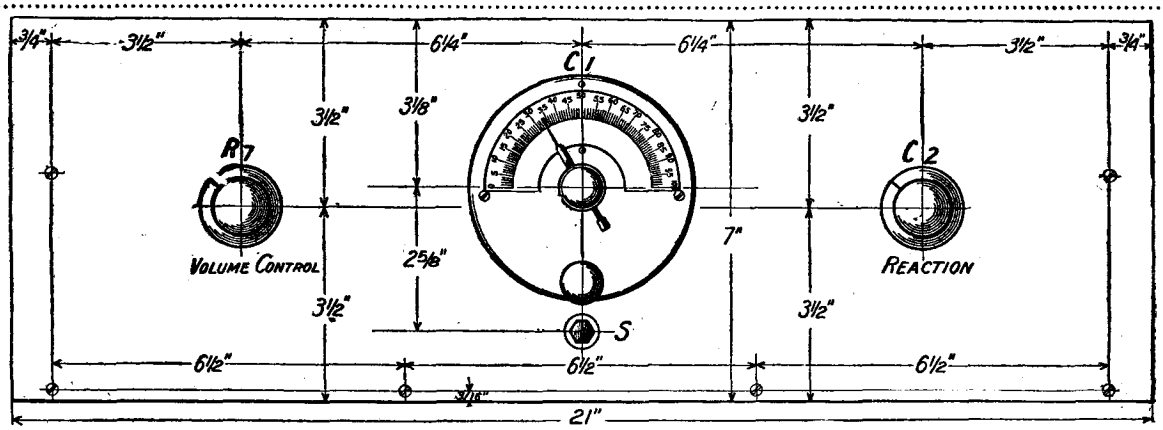


Fig 2.—The extreme simplicity of control also makes the drilling task very easy. A full size Blueprint, No. 177a, may be obtained free.

THE ELSTREE "SOLODYNE"—(Continued)

situated immediately underneath the main tuning dial. The panel, therefore, is simplicity itself, and if a polished panel either of black or grained finish is employed, the result is very pleasing.

Wiring

The layout of the components at the back of the panel departs from the usual in several particulars. As will be seen from the photograph and diagram, the three tuning condensers are mounted centrally in the layout. This necessitates, therefore, that the high-frequency circuit shall be placed one side, while the low-frequency circuits are placed on the other. This is the only arrangement which will give short lengths of wiring.

No little thought was expended on this layout in order to obtain the shortest possible length of wiring and the simplest arrangement, and that finally adopted has proved very satisfactory. The aerial coil, in its screen, is placed at the rear of the set and is tuned with the end condenser of the triple unit. The first and second

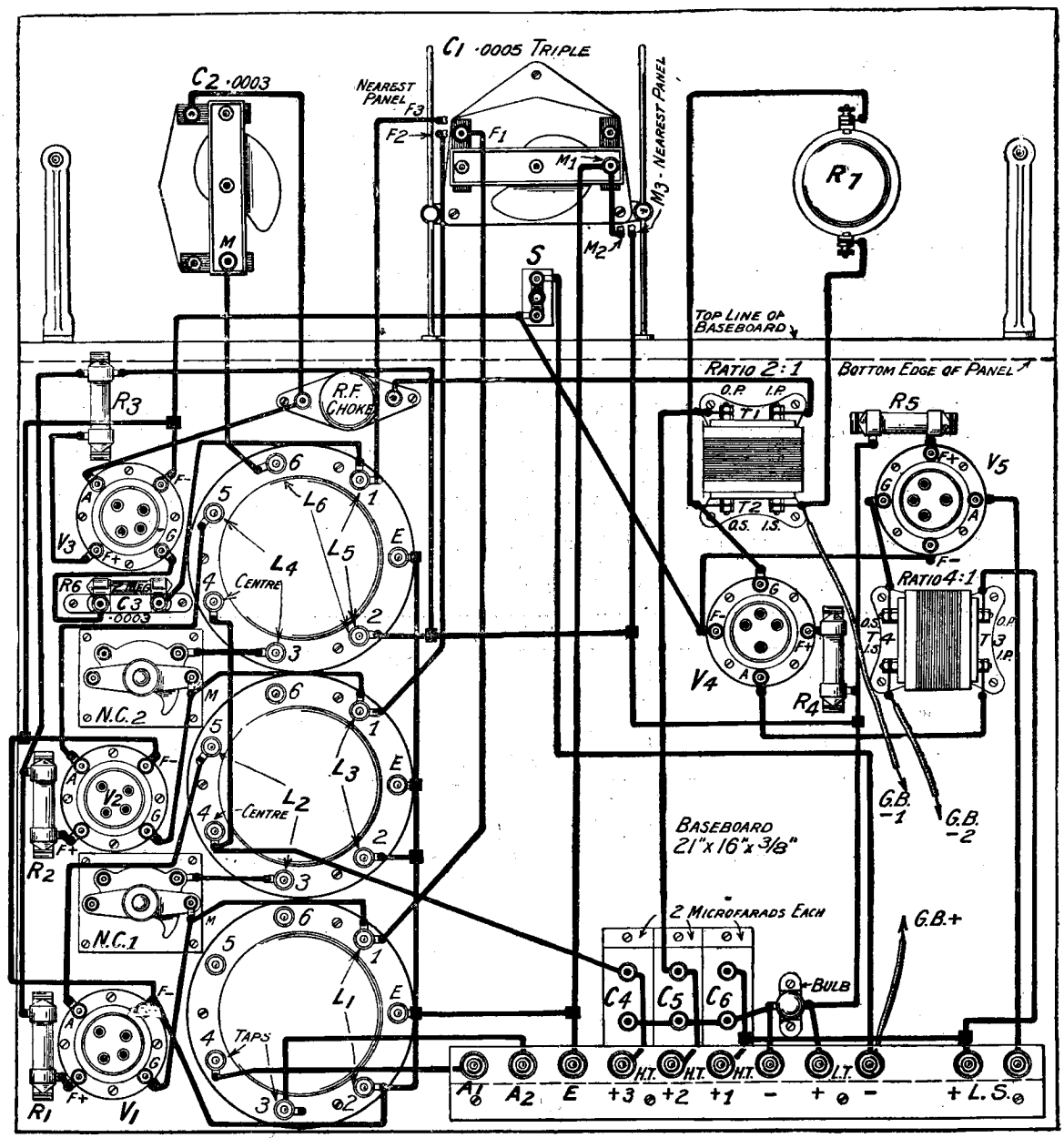


Fig. 3.—From this complete wiring diagram it will be observed that the connections are well spaced throughout. Special care, however, should be devoted to the coil connections. (Blueprint No. 177b free on application.)

EASY TO CONSTRUCT

high-frequency circuits are then placed in sequence coming towards the front of the panel, and are tuned with the middle and front condensers respectively. The valves and neutralising condensers associated with the high-frequency side are also placed on this side of the baseboard in their appropriate positions.

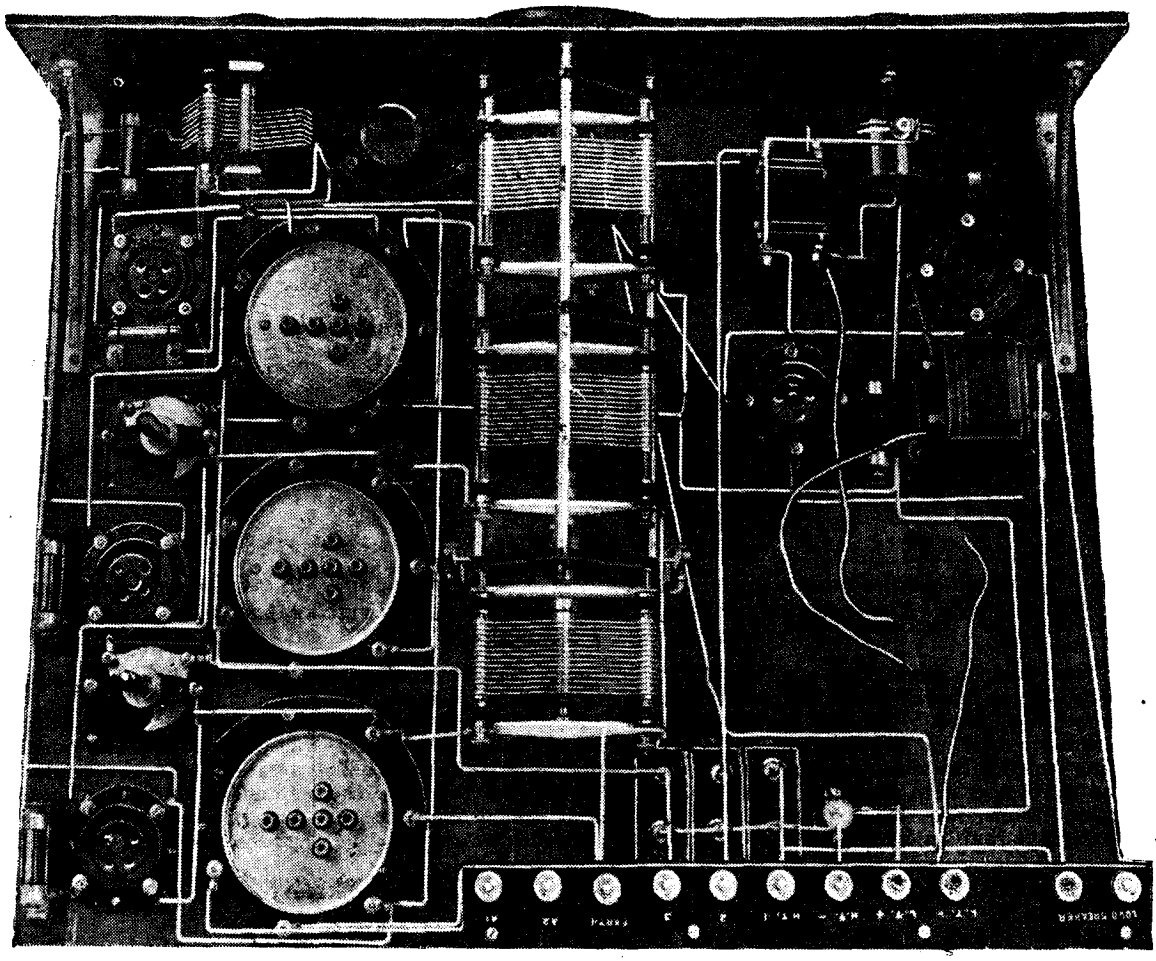
The L.F. Side

The construction of the low-frequency end is straightforward and requires no comment. It should, perhaps, be observed in passing that the low ratio transformer, in this case a 2 to 1, comes first, *i.e.*, following the detector valve, while the high ratio is

While this flash lamp bulb is in circuit it is impossible to burn out the valves, or to short-circuit the H.T. battery, since this lamp acts as a small fuse, and will burn out if the H.T. current rises seriously above the normal amount.

Constructional Work

The first problem is that of



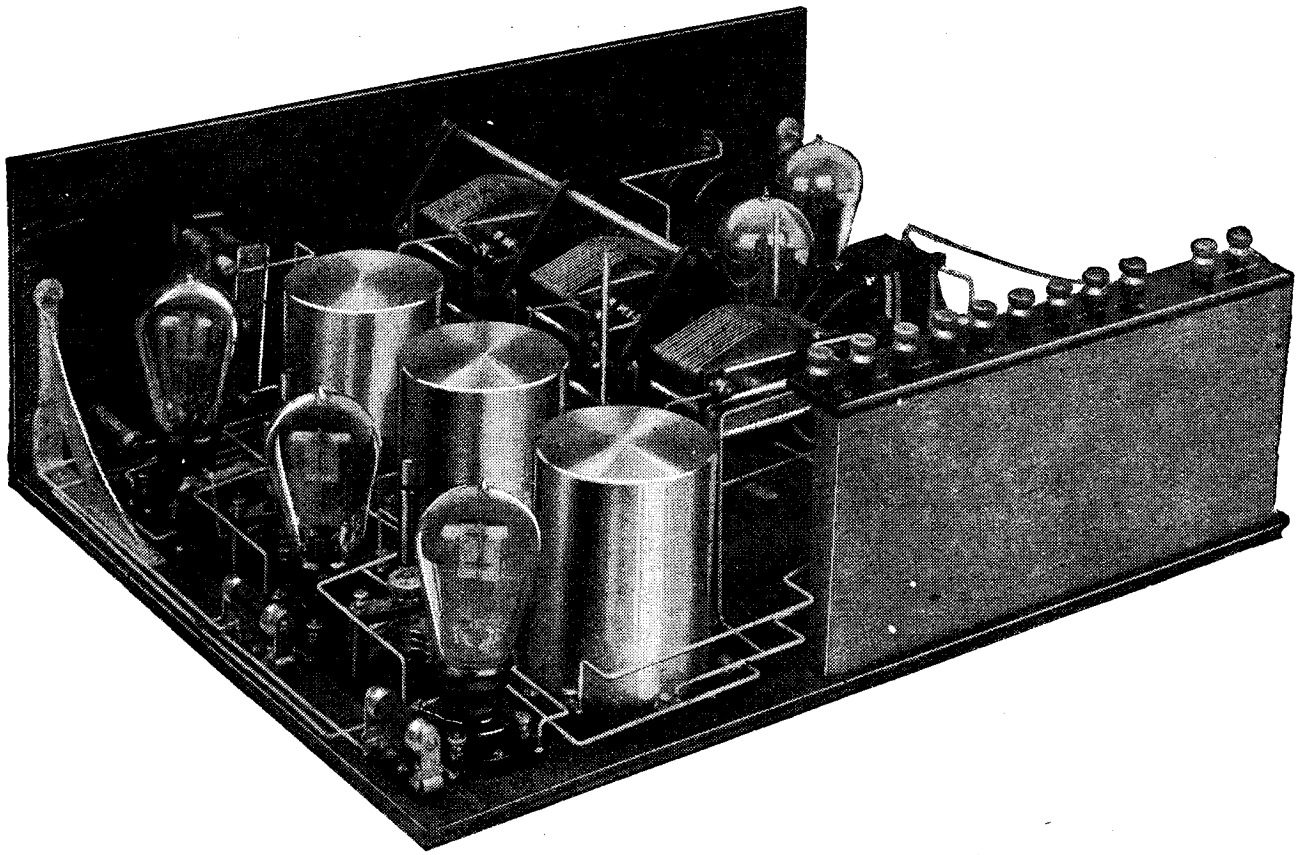
In this back of panel photograph the coils and their screens have been removed, and the formation of their sockets may be observed.

From the anode of the detector valve a lead is taken through a high-frequency choke to the other side of the set. This high-frequency choke therefore tends to keep the high-frequency currents all to one side of the receiver, so that it is practically only low-frequency which passes along the connecting lead through to the other side of the set where the note magnifiers are situated.

utilised in the second stage. The grid-bias batteries are housed in the space at the back of the note-magnifiers, while the extreme rear of the set carries the three 2-mfd. condensers which are connected across three high-tension battery tappings, and also the small flash lamp bulb, which is inserted in the negative lead of the receiver as a precaution against an accidental wrong connection.

drilling the panel in accordance with the details given in the accompanying diagram. The single variable condenser, the tone control, and the "On–off" switch can then be mounted on the panel, and finally the triple condenser may be assembled in position by means of the three fixing screws provided. This part of the receiver may then be placed on one side while the baseboard is laid out.

THE ELSTREE "SOLODYNE"—*(Continued)*



The tuning condensers are mounted in a special manner with their spindles coupled together. The method employed makes it an easy matter for the circuits to be balanced up.

From the diagrams and photographs given little difficulty will be experienced here. On the high-frequency side of the receiver a little care is required in spacing the parts correctly, as very little waste room has been allowed. If the layout given is followed carefully, however, there should be no difficulty whatever. Before the parts are finally screwed down, the panel should be placed in position in order to ensure that there is ample clearance between the components mounted on the panel and those on the baseboard.

Condenser Supports

In particular, when this operation is carried out, the position of the two feet for the triple condenser should be noted. These supports are of considerable assistance in preventing undue strain from being

COMPONENTS REQUIRED

One ebonite panel, 21 in. by 7 in. by ¼ in. (Ebonart Mahogany finish).

One cabinet (fall front type) with baseboard 16 in. deep and two angle brackets (Camco).

One single-control triple condenser, three .0005 (Bowyer-Lowe Co., Ltd.).

One .0003 variable condenser (Bowyer-Lowe "Popular").

Three coil screens (London Electric Wire Co.).

Two split primary H.F. transformers (London Electric Wire Co.).

One aerial coil to suit (London Electric Wire Co.).

Two L.F. transformers, 2 to 1 and 4 to 1 ratios (B.T.H. Co.).

Five vibratory valve holders (Lotus).

Five fixed resistors and mounts, "Temprytes" (Sydney S. Bird).

One volume control (Igranic).

Three 2 mfd. fixed condensers (T.C.C.).

One .0003 fixed condenser (T.C.C.) with 2 megohm grid leak (Dubilier).

One ebonite strip, 12 in. by 1½ in., carrying 11 terminals.

One H.F. choke (Lissen).

Two neutrodyne condensers (Peto-Scott).

One miniature screw cap bulb holder and flash lamp bulb.

Two small knobs to suit reaction and volume controls (Burne-Jones).

One on-off switch (A. F. Bulgin).

THE ELSTREE "SOLODYNE"—*(Continued)*

WIRING INSTRUCTIONS

Join terminal A1 to terminal 4 of L1.

Join terminal A2 to terminal 3 of L1.

Join terminal 2 of L1 to F– of V1 and thence to F– of V2, F– of V3, one side of switch S, F– of V4, and F– of V5. Join terminal 2 of L1 also to terminal E on same base, terminal E on remaining coil bases, and terminal 2 of L3. Terminal E on L1 base to earth terminal and thence to M1 and M2 of C1.

Join remaining side of switch S to L.T.–. From L.T.– take the G.B.+ flex lead.

Join terminal 1 of L1 to F1 of C1, and to N.C.1 moving plates and G of V1.

Join A of V1 to terminal 5 of L2.

Join H.T.+3 to one side of C4, and thence to terminal 4 of L2 and terminal 4 of L4.

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

Join terminal 1 of L3 to F2 of C1, and to moving plates of N.C.2 and G of V2.

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 F3 of C1, to one side of C3 and R6, and other side of C3 and R6 to G of V3.

Join A of V3 to one side of R.F. choke and thence to fixed plates of C2.

Join other side of C2 to terminal 6 of L6.

Join other side of R.F. choke to I.P. of transformer T1 T2.

Join O.P. of T1 T2 to one side of C5 and thence to H.T.+2.

Join O.S. of T1 T2 to G of V4 and to one side of R7.

Join other side of R7 to I.S. of T1 T2. From latter point take G.B.—1 flex lead.

Join A of V4 to I.P. of transformer T3 T4.

Join O.P. of T3 T4 to L.S.+, and thence to H.T.+1 and one side of C6.

Join O.S. of T3 T4 to G of V5.

From I.S. of T3 T4 take G.B.–2 flex lead.

Join A of V5 to remaining L.S. terminal.

Join H.T.– to remaining sides of C4 C5 and C6, and thence to one side of bulb holder.

Join L.T.+ to other side of bulb holder, and thence to the following points:—One side of R4, one side of R5, M3 of C1, terminal 2 of L5, and one side of R3, R2 and R1.

Join remaining sides of R1, R2, R3, R4 and R5, to F+ of V1, V2, V3, V4, and V5 respectively.

placed on the panel, and if the actual position for the feet is marked, then holes may be made with a brad-awl for the screws, so that all is ready to fix the condensers in position when the time comes.

Wiring Up

The wiring up may now be commenced, and owing to the somewhat compact layout employed, it is helpful to proceed in the following manner. First remove the triple condenser from the front panel for the time being. Now place the panel in position in front of the baseboard and join up the easier connections. With the triple condenser removed the "On–off" switch will be found to be perfectly accessible, and no difficulty will be experienced over this part of the wiring. Fixed resistors have been employed for simplicity. If any reader, however, prefers to use barretters, such as were employed in the "Elstree Six," this may be done.

The triple condenser may now be inserted in its correct position, and definitely screwed down to the baseboard, the feet already mentioned being fixed in position, thus making the whole job rigid. The remainder of the wiring may then be completed in accordance with the diagram and no further comment is necessary on this score.

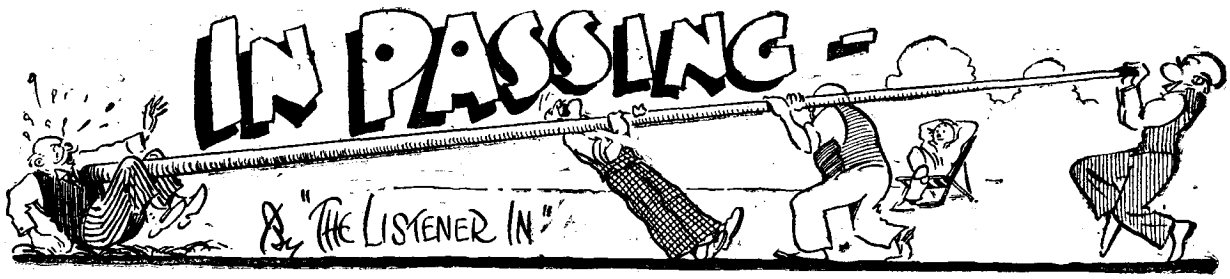
The neutralising condensers adopted are the new low-minimum type made by Messrs. Peto-Scott, Ltd. The moving plates are taken to the terminal marked x on the condenser and care must be taken to see that these units are placed the right way round.

(*Concluded on page 409*)

Stations Received on Elstree "Solodyne."

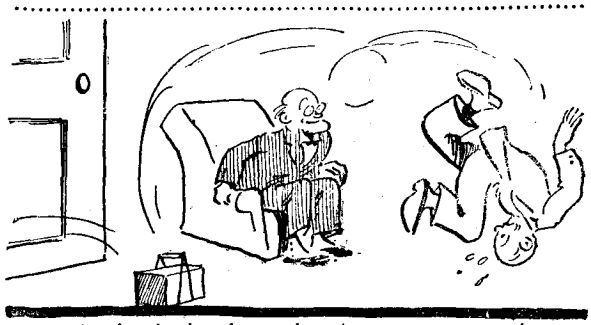
(*The long wave stations will be given next month.*)

Station.	*Dial Setting.*	*Station.*	*Dial Setting.*	*Station.*	*Dial Setting.*
Liege	2·5	Nottingham	31·5	Glasgow	54
Montpellier	8	Petit Parisien	32·5	Rome	55
Kiel	9·5	Hull	33	Radio-Toulouse	57
Gleiwitz	13	San Sebastian	34·5	Stockholm	58
Elberfeld	15·5	Copenhagen	35	Berne	59·5
Cassel	17	Cardiff	37	Belfast	61
Bremen	19·5	London	40	Leipzig	63
Dortmund	21·5	Madrid (Union Radio)	42·5	Ecole Superieure	65
Dresden	23	Manchester	43·5	Frankfurt	68
Hanover	24	Oslo	45	Birmingham	72
Stoke-on-Trent	24·5	Bournemouth	46	Brussels	74
Sheffield	26	Hamburg	47	Swansea	75
Bradford	27	Dublin	49	Munich	76
Dundee	28	Graz	50	Aberdeen	77·5
Milan	29	Newcastle	51	Berlin	80
Gavle	30·5	Munster	52	Zurich	85
Barcelona	31	Bilbao	53	Sundsvall	93



Gentlemen Dislike Bonds

WHEN a gentleman like I has just been reading a classic work by a girl who writes books called Anoda Loose, he finds it very hard not to fall into her intreeging style. I mean you just sort of hold your pen and think and it runs over the paper quite by itself in a quite fascinating way. I mean that you don't have to really think at all, if you see what I mean. So this just suits me because I always think that it seems rather hard for a gentleman who writes to have to do anything that seems like work, because work is such an unpleasant word especially in hot weather, and it is really quite a coinstance that it is quite hot just now. So now I will just give you a few pages from my diary, so you will be able to see what we have been doing at Little Puddleton, because I am really feeling quite tired, because it is very, very hot here, and when it is very, very hot it is a funny thing that I seem to never really feel like doing anything that really seems like work.



He had admired my jyratory movements.

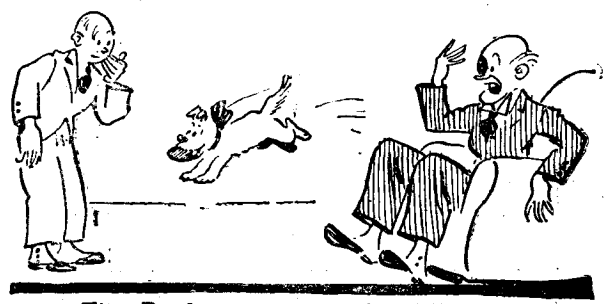
Some People are so Critical

So when I went to see the Professor the other day I found that he had been reading the book too. So then he said that he thought it was the most awful bilge, which is a slang word that he has got from Poddleby, who will never really be quite refined. Because the Professor had read it three times, because he says that you don't really grasp a book the first time you read it, so he read it three times just to really make sure that he really didn't think it worth reading.

I mean that Professor Goop never seems to really and truly appreciate modern masterpieces, because he says that writers like Dr. Johnson and Shakespeare are the best, though he never seems to really read them very often. So I found that he was very worried over the new B.B.C. pronunciations. Because it seems that the B.B.C. is sending its announcers to school under a committee composed of actors and professors which meets every three months and then tells us that we ought to say obliggatory and things like that. So Professor Goop has been saying much worse things about them.

What a Girl Can Do

So when I asked him if it was really obliggatory for him to put his accumulator just inside the door of his study, where I should fall over it, he said that he had rather admired my jyratory movements on entering. So I picked it up and threw it at him, because I always think that a gentleman should stand up for himself even if he has to completely knock out another gentleman by slinging an accumulator at him. So then Mrs. Goop came in and applied a raw beefsteak to his right eye because it would never do for a gentleman like he to walk about Little Puddleton with a black eye. I mean that when gentlemen have a difference of opinion a raw beefsteak often saves appearances. So a girl like Mrs. Goop can often save the situation by being quick about it, if she is not a vegetarian or a Christian Science. Because a tomato is no good at all, and it is no good at all to say that a gentleman friend did not hit you in the eye with an accumulator if he did.



The Professor stopped holding the steak to his eye.

Poddleby is so Soothing

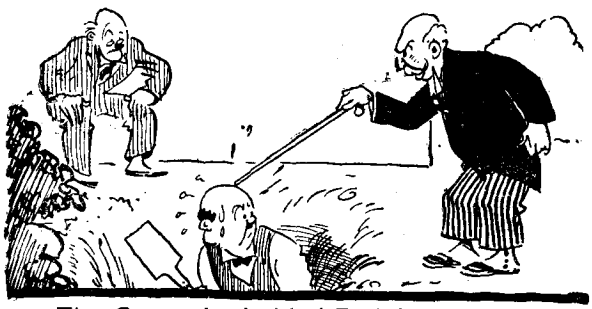
So when things had settled down a little I telephoned for Poddleby to come round, because even if he is unrefined he does help a gentleman at times when relations are a little strained with another gentleman, like I and Professor Goop. So then Poddleby came in and he fell over the accumulator too, because it was still lying on the hearthrug, because I and Mrs. Goop had been so busy with the Professor that we did not seem to have had time to move it. I mean when a gentleman is doing first aid work he can't be expected to think of everything. So Poddleby said a lot of words whose pronunciation is not given in the B.B.C. list of correct words, because when you come to think of it there are not many really useful words in the list. I mean you don't say autojiro or fynis when you burn out five valves or become shocked by the high-tension battery. So then Poddleby asked the Professor if he had been inventing

IN PASSING—*(Continued)*

anything lately, and the Professor said that it rather cramped your style when the air was thick with flying accumulators. So Poddleby said that so far as he could remember it had been thick with flying Poddlebys and the Professor said that they were just as decomposing.

Inventing is Really Easy

So then I and Poddleby thought that something really ought to be invented. I mean when gentlemen have just gone through a crisis gentlemen's brains are usually very active; so it seemed a pity that the Professor should do nothing but sit and hold the beefsteak to his eye. Because when you have a brain like a good scout like Professor Goop it ought to be doing its good deed every day. So I and Poddleby said that it was up to a gink like he to tell the world how to prevent howling. Because Captain Chuckersley has kept on saying Please Don't Do It, and gentlemen still go on chirping and squealing and moaning. I mean if you give a gentleman a knob to twiddle he twiddles it for all he is worth, because he does not see why he should not twiddle a knob that is simply asking to be twiddled. So Professor Goop said that the best way of stopping howling was to give gentlemen sets without any knobs. So he said that he would at once design the Goop Knobless Receiver. I mean he quite meant to do it but just then he thought of something else, and when a gentleman like Professor Goop thinks of something else then other gentlemen must not hamper him by reminding him that they must remind him that he had ought to come to earth instead of hitting the high spots.



The General plodded Poddleby's head with a stick.

Steak is Devine

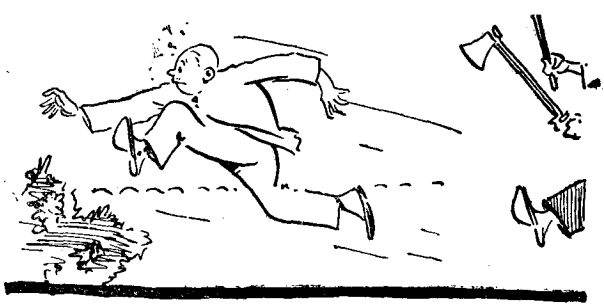
So just then his little dog pushed the door open with its nose which is called little Bingo and came in. And little Bingo jumped on to Professor's knee, so the Professor stopped holding the steak to his eye. Because a gentleman can't really hold a steak to his eye when it is inside a dog like little Bingo. So the Professor became very very angry again, because when he had first become hit with the accumulator he became angry, and then he cooled down and stopped squealing, but when little Bingo scoffed his steak it began all over again. So he spanked little Bingo and he bit Poddleby, because when a gentleman spanks a dog he becomes confused and does not always know which gentleman is spanking him, especially if another gentleman tries to rescue him. So I told Poddleby that now little Bingo had got a taste for steak he had better keep away. Because there is a lot of Poddleby that would make very nice steaks for a dog.

Discretion is the Better Part

And then the Professor said that he wanted to improve his ariel. So he asked Poddleby and I to help him. So I said I would go and get Snaggsby too, because when a gentleman wants two gentlemen to help with an ariel I always seem to like to be the third. I mean it is much more fun to watch and tell them how to do it than to do it yourself, because poles take quite a lot of heaving and wire tangles up quite a lot and you can tell them how to do it from a deck chair in the shade. I mean that improving ariels when it is very hot is very very much like work. Then I went round to the gentleman's house called Snaggsby and I and he thought that we had better get General Blood-Thunderby and Admiral Whiskerton Cuttle too. Because then they could work in shifts, and they are both experienced men, because General Blood-Thunderby had quite a lot of experience with ariel poles in the amusement park at our garden fete, and the Admiral is very good at belaying and splicing and halliards and things. I mean naval gentlemen always know the ropes.

Marrows are Deceaving

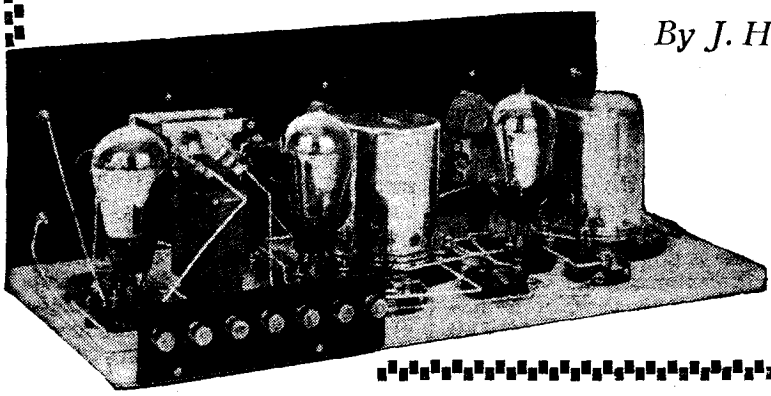
Then I and the others went back to the Microfarads and we found the Professor showing Poddleby how to dig a hole for the mast. I mean he was standing on the marrow bed talking and Poddleby was in the hole. So then the General, who is shortsighted, told Professor Goop that he was sure to win the prize for marrows at the flower show, because Poddleby's bald head looks quite like a marrow if a gentleman has not got his glasses on. So the General prodded Poddleby's head with his stick, and Poddleby prodded the General's shins with his spade. So when we had dusted them down we held a conference about the ariel. I mean gentlemen do get quite dusty when they have a difference of opinion on a marrow bed. Because we thought that we ought to plan things out before we began to do things. So I said I would be foreman. And it was really quite a coinstance that all the others said that they would be foreman. Because every gentleman knows how to tell other gentlemen how to erect ariels. So we tossed up for who should be foreman. So



It was really too hot to argue.

(Continued on page 412.)

STANDARD TYPES OF SCREENED COILS



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

Full details of the windings and connections of the pattern now standardised

IN an article in last month's MODERN WIRELESS some details were given as to the use of the new types of screened coil. It was pointed out in that article that this component had now been standardised as far as the principal details were concerned, so that the six-pin base, and the connections to the terminals were the same with all types of coils, although individual manufacturers were allowed latitude in their actual make-up of the component.

One of the original reasons for the adoption of the six-pin base was that it would be flexible and would allow of a large number of circuits being incorporated in the same screen by simply utilising different plug-in coils having different connections.

Standardisation

This has proved extremely useful during the development stage, and various combinations of windings have been attempted for various experimental purposes. If these coils are to become popular, however, it is necessary to obtain some form of standardisation in order that they may be manufactured cheaply and accurately by the various firms who supply them.

Moreover, if these coils are used to any considerable extent, it is obviously not practicable to give the actual details of the windings on the coils and transformers employed on every occasion. It is much better to obtain some standard types of windings and connections, and then simply to specify this particular type of coil for use in the particular circuit in question.

Four Types

After due consideration, therefore, it has been decided to reduce the number of types of coil to four and to make these coils of such a type that it is possible to utilise them in a variety of different circuits. By this means a good deal of the possible confusion which now exists will be avoided.

The researches which have been conducted in the past few months have evolved two principal types of high-frequency amplifying circuit. In the first case we have the well-known "Magic Five" circuit, which was one of the first circuits employing the new screened coils in the early stages of their development.

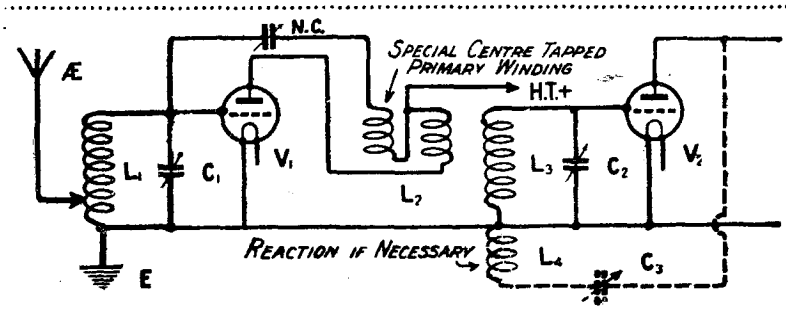


Fig. 1.—The "Magic Five" receiver employed screened coils with split-primary windings. The above skeleton diagram illustrates the method of neutralising used

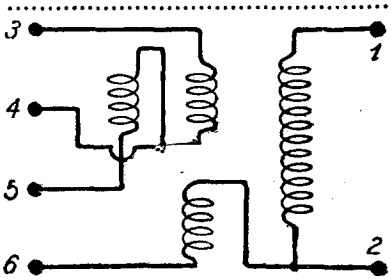


Fig. 2.—The connections to the split-primary type of transformer.

Method of Winding

This circuit is shown in Fig. 1, from which it will be realised that the neutralising is effected by a centre-tapping on the primary winding of the transformer, while the whole of the secondary is tuned. Actually the experiments when this type of circuit was being produced showed that to obtain the correct results a simple centre-tapped winding was not satisfactory for the primary, and it was necessary to wind the two halves of the primary, that is to say, the primary proper and the neutralising winding, one over the other.

A Satisfactory Method

Actually, results showed that the best results were obtained with the neutralising winding wound on the former first, and the primary winding wound over the neutralising winding, so that it came nearer to the secondary winding. Subsequent experiments have shown that this type of circuit gives very satisfactory results, and there is every indication that it will be used to a considerable extent.

STANDARD TYPES OF SCREENED COILS—(*Continued*)

Split-Primary Type

The first type of screened coil that we require, therefore, is one suitable for this type of circuit, and for convenience this class has been designated the *split-primary type*. There are in this class two types of coil, one for the 250 to 550 metres wavelength band, covering all the usual broadcasting, and the second covering a range of 1,000 to 2,000 metres, suitable for the reception of Hilversum, Kœnigswusterhausen, Daventry, Radio-Paris, etc. The coils are designed to tune with a .0005 variable condenser.

The details of the windings required on these coils are as follow :—

250-550 Metres

Secondary Winding.—90 turns of 30 D.S.C., spaced 40 turns to the inch and wound on a 2 in. diameter former.

Neutralising and Primary Windings.—Each 20 turns of 30 D.S.C. wound on a 1⅝ in. diameter former placed inside the secondary. The winding is so arranged as to come in the centre of the secondary winding.

A diagram of the connections of this transformer is given in Fig. 2. The method of connecting the windings on this transformer is of the utmost importance.

Connections

The start of the neutralising winding is connected to pin No. 3. The end of this winding is taken to pin No. 4. A small layer of Empire cloth is then placed over the neutralising winding, and the primary winding is wound on, the start of this second winding being immediately above the start of the previous winding. The same number of turns is placed on this winding, the beginning being connected to the end of the neutralising winding underneath, namely, to pin No. 4, while the end of the primary winding is connected to pin No. 5. The important point to note is that the neutralising winding is wound on first, and the primary winding is then wound on afterwards in the same direction.

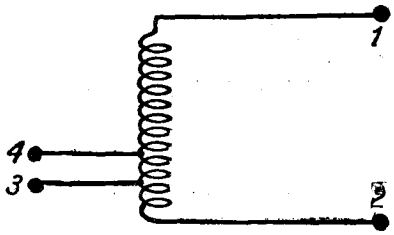
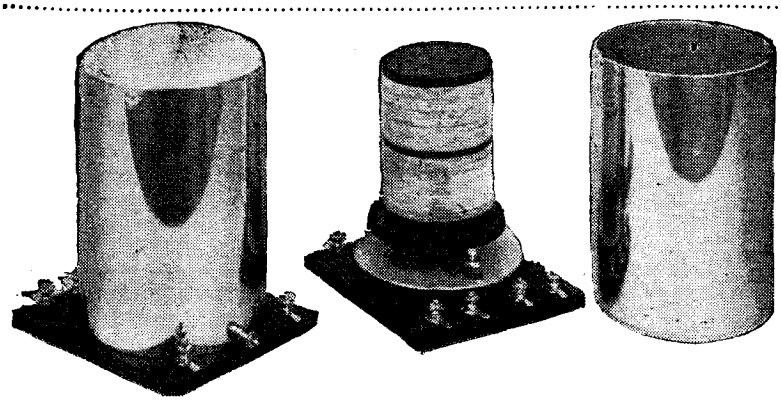


Fig. 3.—The connections to the aerial coils used in conjunction with split-primary transformers.

Reaction Winding

In some circuits it is desirable to have a reaction winding. This is wound on the same former as the primary and neutralising windings. In order to simplify the number of possible patterns, this reaction winding has been incorporated in all types of H.F. transformer, the winding merely being left idle if not required.

The reaction winding consists of 25 turns of 30 D.S.C., wound on the primary former below the neutralising and primary windings, and so connected to be a continuation of the secondary winding. It is thus wound in the same direction as the secondary, the beginning of the winding being connected to the end of the secondary winding which goes to pin No. 2, while the end of the reaction winding goes to pin No. 6.



The bases of the coil screens are numbered to facilitate wiring up.

1,000 to 2,000 Metres

The coils of this split primary type for the upper wavelength range are wound in an exactly similar manner, except for the fact that the turns are different. The secondary consists of 300 turns of 40 S.S.C. wire. The neutralising and primary windings each consist of 75 turns of 36 D.S.C. wire, while the reaction winding in this case consists of 100 turns of No. 36 D.S.C. All windings here are unspaced.

Aerial Coils

Associated with these split-primary transformers, it is necessary to have aerial coils to suit, and these are made with tappings similar to the well-known X coils. For the lower wavelength band, 250 to 550 metres, the coils consist of 90 turns of 30 D.S.C. spaced 40 turns to the inch, with tappings at 10 and 15 turns from the bottom end of the coil.

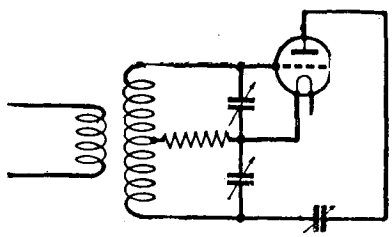


Fig. 4.—The "Elstree Six" utilises the split-secondary type of winding.

For the upper wavelength range the coil consists of 300 turns of 40 S.S.C. unspaced, with tappings at 30 and 50 turns. The connections to this type of coil are given in Fig. 3.

Split-Secondary Type

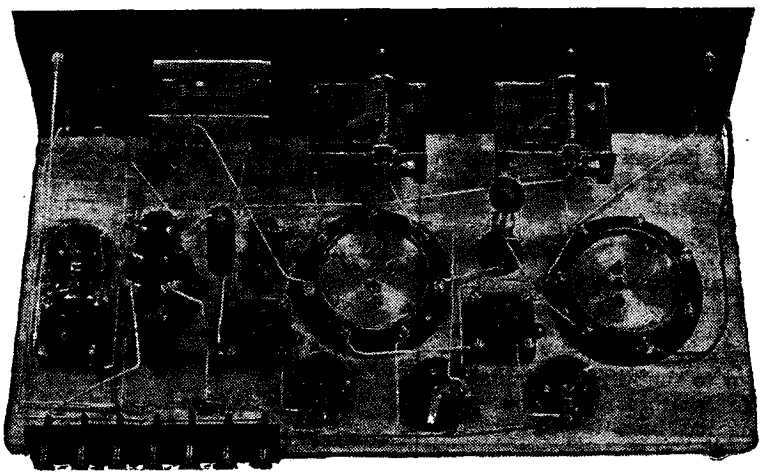
In addition to this type of circuit; we have the "Elstree Six" type of circuit, utilising a split-secondary coil. In this case the tuned winding which is connected to the grid is centre-tapped, and this centre-tapping is taken to the filament of the valve, while the remote end of the winding is connected through a neutralising condenser to the anode of the valve.

In the "Elstree Six" type of circuit, a dual condenser is employed which is of value in eliminating

STANDARD TYPES OF SCREENED COILS—(Concluded)

the tendency to parasitic oscillation. The same coil, however, may be utilised where an ordinary centre-tapped coil, tuned with a single condenser, is employed, there still being several types of circuit in which such a coil is required. Figs. 4 and 5 illustrate briefly the types of circuit for which this split-secondary transformer is useful.

This type of transformer is also made up in two ranges, one for the lower broadcasting band, and the other for the Daventry band. The coil is primarily intended to tune



The use of screened coils of the types standardised permits an exceedingly compact lay-out to be adopted.

with a ·0005 dual condenser, and the wavelength range is worked out on this basis. If a single condenser is used it should be of ·00025 capacity only. The details of the windings are as follows :—

250 to 550 Metres

Secondary Winding.—130 turns of 28 D.S.C. wire wound unspaced on a 2 in. former. The winding is made up in two portions of 65 turns each, completely isolated from each other, the connections being as shown in Fig. 6.

Primary Winding:—Twenty turns of 30 D.S.C. wire wound on a 1⅛ in. diameter former placed inside the secondary and mounted centrally. Connections for this will again be clear from Fig. 6.

It is sometimes useful to be able to use the two halves of the winding separately, as there are several circuits in which an arrangement of this sort is required, while for a simple centre-tapped arrangement 4 and 5 are strapped together.

1,000—2,000 Metres

Secondary Winding.—This is similar to the last, except that the winding consists of 430 turns of 40 S.W.G. enamelled wire. An equivalent two-layer winding may be used if it covers the wavelength band.

Primary Winding.—75 turns of 36 D.S.C.

The aerial coil for the split secondary method is the same as the H.F. transformer. In this case the primary winding is utilised as a tight-coupled aerial coil, and this method has proved satisfactory in practice. A separate aerial coil is therefore not required with this series.

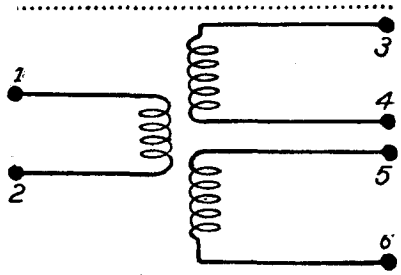


Fig. 6.—The connections for the split-secondary type of winding. 4 and 5 are joined together in circuits using a centre tap.

Reaction

In many cases it is desired to produce a definite form of Reinartz-controlled reaction, and provision has been made for this with a special coil.

The Reinartz coil consists of one half of a split-secondary type of transformer, the other half of the

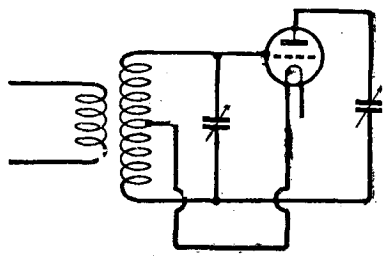


Fig. 5.—Split-secondary coils may be used in the circuits of the type shown above.

winding being replaced by a reaction winding. The coil is provided with a primary winding, so that it can be used as an H.F. transformer with reaction, while, if desired for use as a simple Reinartz circuit, the primary winding may either be ignored, or may be used as an aperiodic aerial winding. The coil is designed to tune with a ·0005 single condenser.

Reinartz Coils

The details of the windings are therefore as follow :—

250 to 550 Metres

Tuned Winding.—65 turns of 28 D.S.C. unspaced.

Reaction Winding.—25 turns of 28 D.S.C. unspaced and wound in same direction.

Primary Winding.—20 turns of 30 D.S.C. on a 1⅛ in. former. The connections to this coil are the same as with the H.F. transformer, 3 and 4 being the tuned winding and 5 and 6 the reaction coil.

1,000 to 2,000 Metres

Tuned Winding.—215 turns of 36 D.S.C. wound in two layer fashion as with the split-secondary type of transformer.

Reaction Winding.—100 turns of 36 D.S.C. wire.

Primary Winding.—75 turns of 36 D.S.C. as previously. The connections to this are exactly the same as with the lower range coil.

These, therefore, are the four types of screened coils which have been standardised, and, as far as possible, the circuits utilised during the next few months will make use of one or other of these different types of coil.

A SET TO SUIT ANY LOUD SPEAKER

By C.P. ALLINSON. A.M.I.R.E.

This Selective Four-Valve Receiver possesses a tone control which may be adjusted to obtain the best quality from any loud-speaker with which it is used.

I WONDER if you have compared different loud-speakers on the same set? If you have, you will no doubt have noticed how they vary in tone. In fact, they do so to a surprising extent. One instrument will be much lower in pitch than another, bringing out the low notes and overtones in a way that another will not. On the other hand, the loud-speaker that brings out these low tones so well will probably be somewhat deficient in the higher register.

Take that same loud-speaker, however, and test it on another receiver, and you will notice that the pitch or tone of the sound given out by it has changed. The ideal arrangement is, of course, to be able to pick your loud-speaker out of a number, so that when used with a particular set the greatest purity of tone will result.

Tone Control

It is only a privileged few who can do this, however, and I therefore decided to see if it were not possible to incorporate some simple arrangement in a receiver by which the tone or pitch might be varied so that the best results might be obtained under varying conditions. The results of the work undertaken are included in the set to be described.

Results

When tested on a short single wire aerial (only 20 feet long) at less than 2 miles from 2LO it was found that Bournemouth could be received with only a faint trace of this station in the background. A French station just above was received quite free of 2LO. A number of stations were received on the loud-speaker and phones, among them being Newcastle, Belfast, Dublin, Birmingham, Nottingham, Hamburg, Union Radio Madrid, Cassel, Elberfeld, Muenster, Radio-Toulouse, Radio-Berne, and Radio-Belge.

Notwithstanding the fact that only two stages of choke-coupled amplification were employed, many of these came through at quite respectable loud-speaking, while many more stations were heard which it was impossible to identify save by wave-meter.

Reaction control was found to be delightfully smooth and the variable grid leak had a marked effect on signal strength and quality. As regards the tone control, on one occasion the quality of an item from 2LO was found to be decidedly drummy. A turn of the switch, however, soon cured that, while the volume control was used

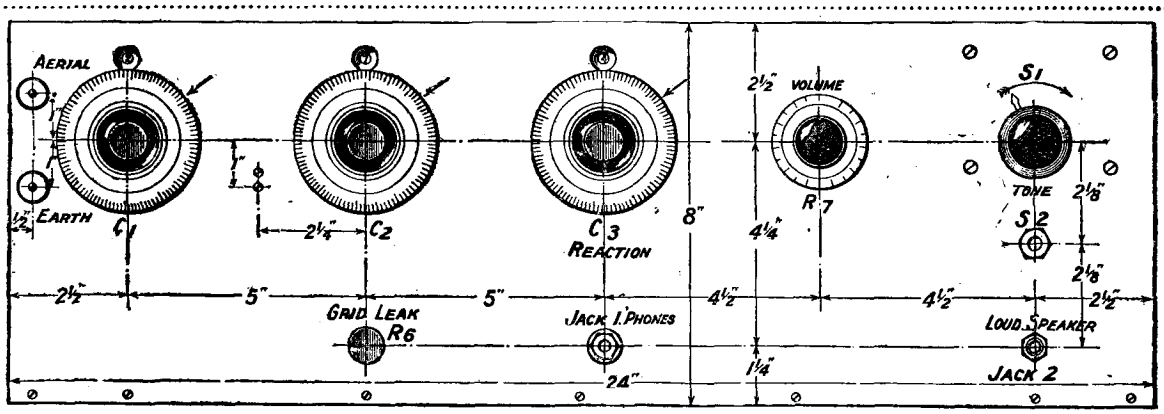


Fig. 1.—The marking of the panel for drilling is rendered simple by the form of lay-out adopted. (Blueprint No. 176a free.)

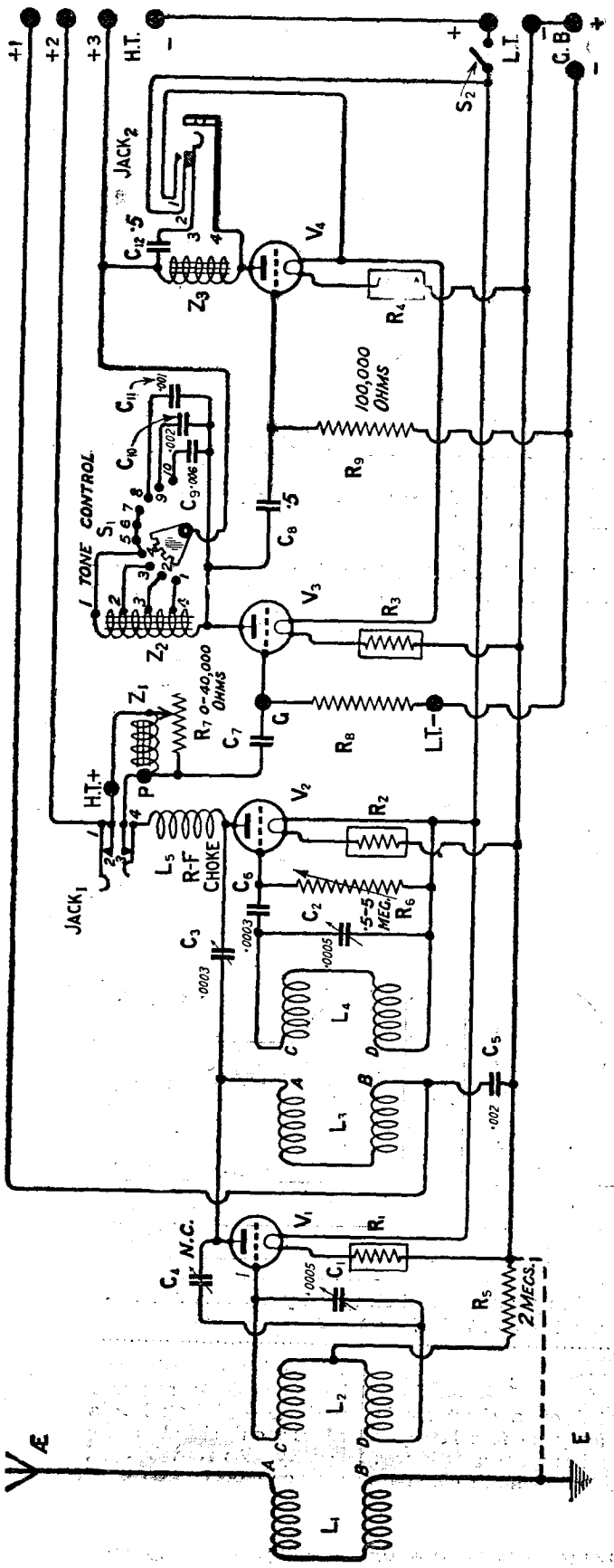


Fig. 2.—This complete theoretical diagram shows clearly the tone-control arrangement. The connection shown dotted on the high-frequency side may be omitted for experiment, and the effect noted.

A SET TO SUIT ANY LOUD-SPEAKER (*Continued*)

to cut the strength down to the most suitable value for the room in which the set was being operated.

Details of Layout

As will be seen from the photographs of the complete receiver this is pleasing in appearance, the minimum number of controls being visible on the panel. The three condenser dials on the left of the panel are two tuning controls and one for reaction. The next dial is a volume control which will be found of particular use on the local station when it is desired to cut down the signal strength. On the right is the tone control by means of which the pitch may be raised or lowered either to suit the experimenter's personal taste or according to the loud-speaker in use and the kind of programme, music, either instrumental or vocal, or speech, being listened to.

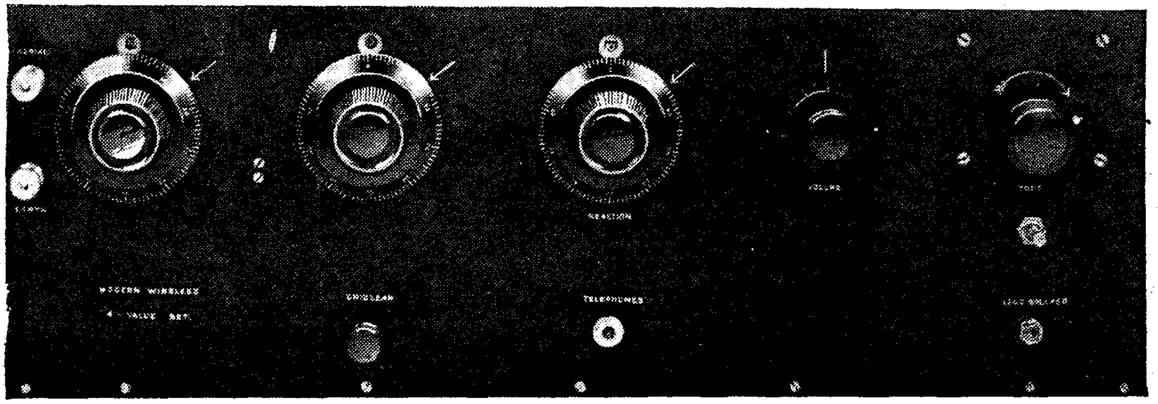
Immediately below this knob is the low-tension switch which enables the receiver to be left set and switched on and off by individuals who do not possess the necessary skill to handle the set. Below this again is the loud-speaker jack, while on its left, beneath the reaction condenser, is a jack by means of which phones may be inserted in the plate circuit of the detector valve for reception on the headphones. To the left of this is a small knob controlling a variable grid leak, a refinement well worth incorporating in a receiver since it enables maximum signal strength and purity to be obtained on local or distant stations.

The Circuit

The full theoretical circuit diagram is shown in Fig. 2, and though it may seem a little complicated at first sight, a short examination will show it to be a straightforward circuit in its essentials. As will appear from this circuit, as well as from the views of the back of the set, fieldless coils have been used for the H.F. circuits, and where it is desired to operate this receiver in close proximity to a broadcasting station it will be found that a marked improvement in selectivity is obtained by their use.

A SET TO SUIT ANY LOUD-SPEAKER—*(Continued)*

In the experimental model of this set the circuit shown was first tried with ordinary inductances, but it was found that the direct pick-up on them at two miles from 2LO swamped everything. So bad was it that Birmingham, even, could not be received without interference. With the fieldless coils, however, a station just above Bournemouth could be received without any sign of the local station in the background.



The only terminals mounted on the panel are those for aerial and earth, seen on the left.

Reinartz Reaction

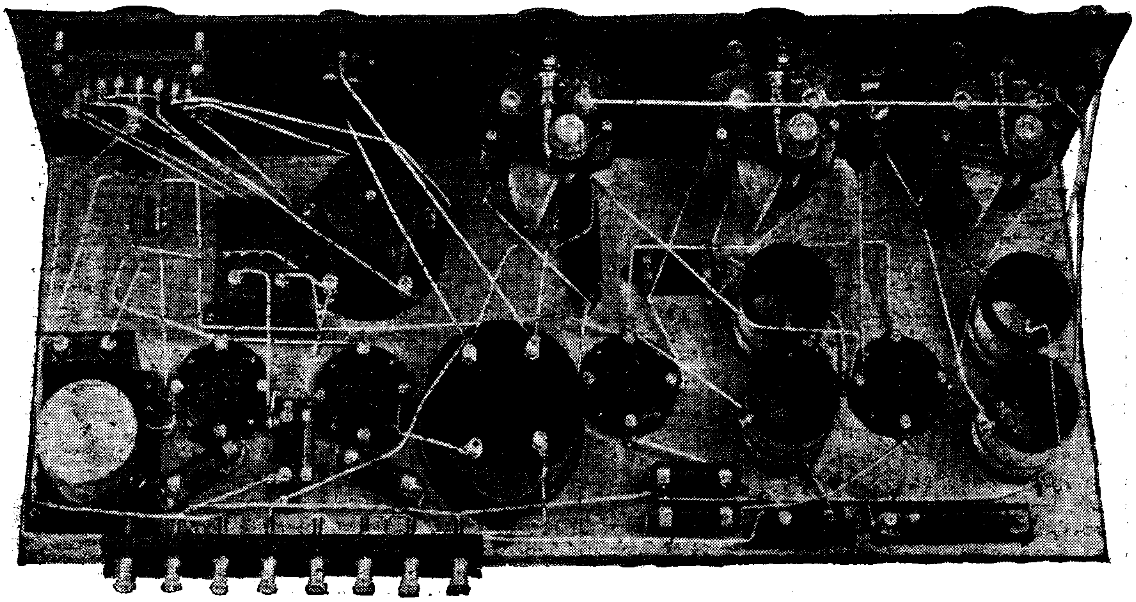
A form of Reinartz reaction is used that gives delightfully smooth control. The anode coil L_3 of the H.F. valve is made to perform two functions, namely, as primary of the H.F. transformer and as reaction coil, a choke L_5 being provided in the anode circuit of the detector valve, while the reaction condenser is shown at C_3.

Stability on the H.F. side is obtained by means of the split grid coil method, the condenser C_4 being the neutralising capacity. A high resistance R_5 which is connected between the centre of the grid coil and L.T. prevents the grid of the H.F. valve from choking.

It will be seen that with this circuit both sides of the tuning condenser C_1 are at high H.F. potential, as incidentally is the case with the reaction condenser. Since the variable condensers used in this receiver are provided with small metal shields, these have been made use of and connected to earth, thus totally eliminating all hand capacity effects, which, though not serious, were certainly present to a slight extent.

The L.F. Side

To turn to the L.F. side, choke-capacity coupled amplification has



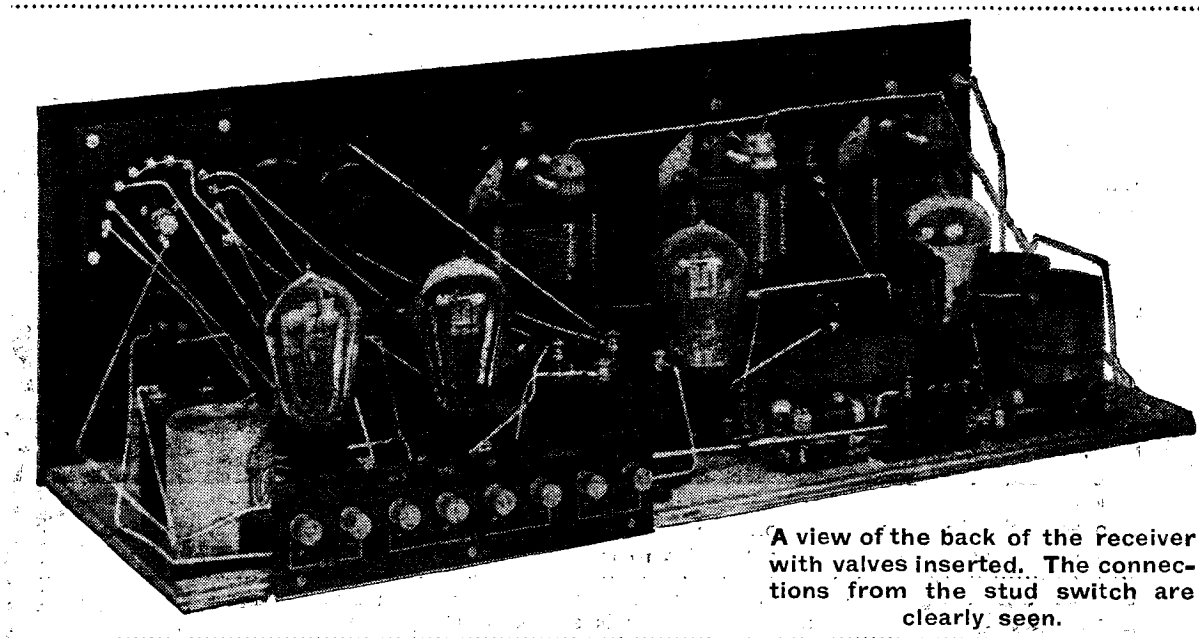
Used in conjunction with the wiring diagram, this photograph will prove of great value in wiring up.

A SET TO SUIT ANY LOUD-SPEAKER—*(Continued)*

been employed, for not only is it capable of giving extremely good quality music but it also gives quite a fair degree of amplification, though not up to two stages of transformer coupled, needless to say. The quality obtainable is, however, well worth the slight drop in volume, and is still further enhanced by the special tone controlling feature.

The first stage of choke amplification is contained in one unit, this consisting of the choke Z_1, the coupling condenser C_7, and the grid leak R_8, as shown in the diagrams. The variable resistance R_7 which acts as a volume control is external to this, however.

The second stage of L.F. incorporates the tone control feature, which will be seen to consist of a tapped L.F. choke and three fixed condensers, C_9, C_{10} and C_{11}. A special switch S_1 enables the pitch to be raised or lowered by reducing the amount of the choke Z_2 which is in circuit, and when the full amount is in use the switch progressively shunts larger values of capacity across it. When the switch is right over to the left the least amount of the choke will be employed, and therefore the lower notes will not be amplified to the same extent as the higher ones. Then as the switch is moved to the right the lower tones will be amplified more and more.



A view of the back of the receiver with valves inserted. The connections from the stud switch are clearly seen.

COMPONENTS REQUIRED

One Radion panel (black polished) 24 in. by 8 in. by 3/16 in. (American Hard Rubber Co., Ltd.).
One Cabinet for same (Peto-Scott Co., Ltd.).
Two variable condensers .0005, geared type and one variable condenser .0003, geared type (Collinson Precision Screw Co., Ltd.).
Two Fieldless coils (Lissen, Ltd.).
Four Lotus Buoyancy valve holders (Garnett, Whiteley and Co., Ltd.).
One Auto-audio Amplifier (Bretwood, Ltd.).
One tapped L.F. choke (Beard and Fitch, Ltd.).
One super L.F. choke (Beard and Fitch, Ltd.).
One H.F. choke.
One Neutrovernia condenser for back of panel mounting (Gambrell Bros.).
One fixed condenser .0003.
One fixed condenser .001.
Two fixed condensers .002.
One fixed condenser .006 (Dubilier Condenser Co., Ltd.).
Two fixed condensers .5 (Telephone Condenser Co., Ltd.).
One variable grid leak (Beard and Fitch, Ltd.).
One 100,000 ohm leak and clips (Dubilier Condenser Co., Ltd.).
One 2 megohm leak and mounting (L. McMichael, Ltd.).
Four "Temprytes" and clips (Sidney S. Bird).
One double circuit jack (Igranic Electric Co., Ltd.).
One single circuit single filament control jack (Bowyer-Lowe Co., Ltd.).
Two plugs (Igranic Electric Co., Ltd.).
One special four finger ten point switch (Radio Instruments, Ltd.).
One 0-40,000 ohm variable resistance (Marconiphone Co., Ltd.).
One Connecticut on-off switch (Rothermel Radio Corporation of Great Britain, Ltd.).
One terminal strip.
Two large lacquered brass terminals (Burne-Jones and Co., Ltd.).
About 16 lengths of Glazite.
One set Radio Press panel transfers.

A SET TO SUIT ANY LOUD-SPEAKER—*(Continued)*

When the first shunting capacity is switched in a portion of the very high frequencies will be by-passed by the condenser, thus lowering the pitch, and each added capacity will further reduce the higher notes.

The Filter Circuit

It should be noticed that the loud-speaker output is via a filter circuit so that the H.T. current is kept out of the loud-speaker windings, thus protecting this instrument either from burning out or from magnetic saturation where a power valve carrying a heavy plate current is used in the last stage.

Components

The parts given in the list will be required for the construction of the receiver, but of course it is not necessary to use the exact makes mentioned provided that others of proved reliability are employed.

Construction

Before starting the constructional work it is as well to examine the panel lay-out and back of panel wiring diagrams carefully and get the general lay-out of the set in mind. Though at the first glance the wiring may appear a trifle involved, it is actually easy to complete, and such precautions as may be necessary will be dealt with in due course.

Practically all the components used allow of connections being made to them without soldering, the only ones that require this being to the jacks, grid condenser and fixed condensers for the tone control. These only are not provided with nuts or terminals.

Tone Control Switch

The tone-control switch is fixed to the panel by means of four 4 B.A. screws and nuts, the screws having countersunk heads, while four short lengths of brass tubing which just slide easily over these fixing screws space the switch half an inch from the panel. This gives ample clearance for the switch arm and the stops. Washers from variable condensers can be used here, and three or four on each screw should give the necessary clearance. The neutralising condenser is fixed behind the panel by means of a small metal bracket, this in turn being fixed to the panel by two 6 B.A. screws. The bracket itself will enable the positions of these screws to be determined.

Mounting the Components

The components may now be fixed to the panel and the panel transfers put on.

The panel should now be fixed to the baseboard and all the components, bar the fieldless coils. Care should, of course, be taken to leave room for the inclusion of these parts later on, and particular care should be taken when

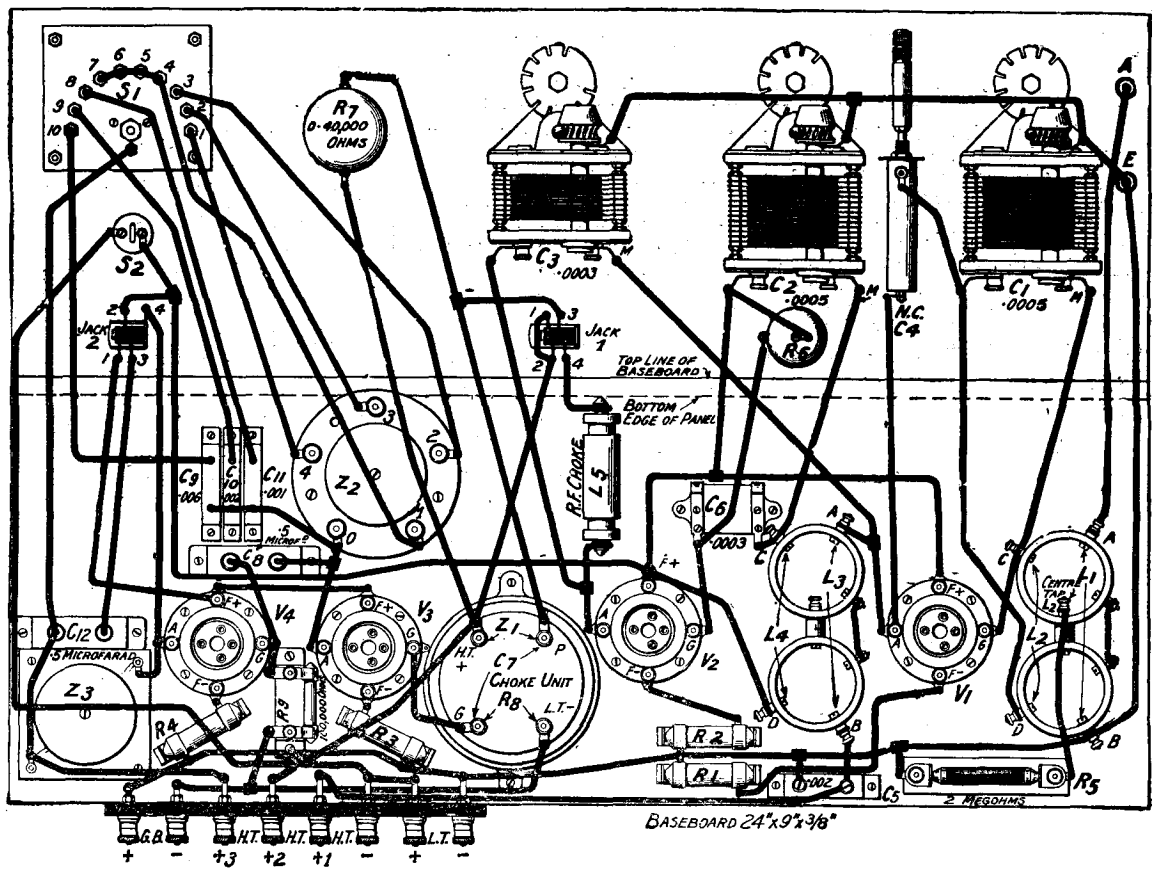


Fig. 3.—The practical wiring diagram. Special care is required when wiring the tone-control components. Blueprint No. 176b may be obtained free.

A SET TO SUIT ANY LOUD-SPEAKER—(*Concluded*)

carrying out the wiring not to run any leads which may foul any of these components.

Wiring Up

As much of the wiring as possible should now be completed, and for this purpose, and also that of fixing the necessary parts on the baseboard, the wiring diagram given in Fig. 3 should be consulted.

Having completed the wiring as far as possible on the H.F. side without the fieldless coils being in position, these should be mounted next and the connections to them completed.

The remainder of the connections should now be made.

Operation

Everything being in order the set will now be placed on aerial test. Connect the right values of H.T. to the respective terminals (say 60-90 volts for the H.F. valve, 20-30 for the detector and 100-120 for the L.F.), aerial and earth leads, and plug a pair of phones into jack No. 1 and tune for the local station. Assuming that both tuning dials have been correctly set on their spindles, it will be found that stations on the lower broadcast waveband, *i.e.*, from 300 to 500 metres, will come in with both dials reading approximately the same. Since tuning is fairly sharp on this set the dials should be turned slowly if the local station is more than a few miles away.

Neutralising

Having tuned this transmission in the set may next be correctly stabilised. This is done by tuning in the station to full strength and then turning out the H.F. valve by removing the fixed resistance controlling its filament current. The neutralising condenser is now turned till a point is found at which the signals are entirely inaudible or weakest. At this point the valve capacity is completely neutralised. Since, however, a certain amount of damping is introduced into the grid circuit of the H.F. valve by the aerial, it will be found not only possible, but an advantage in most cases, to work with a somewhat smaller neutralising capacity than that indicated by the procedure described. The reduction in the value of this condenser should, however, be done judiciously, since if it is carried beyond a certain point no increase in signal strength will result, but neighbouring listeners will be disturbed if reaction is used to make the set oscillate.

Tone Control

Having stabilised the set the signals may be transferred to the loud-speaker by plugging this into jack No. 2 and removing the phone plug from the first jack, and, with the tone control switch placed central, the grid bias should be adjusted to give the best signals. Rotating the tone switch will now cause a variation in pitch to be noticed, and this may be employed to give the tone which most appeals to the listener to various items on the programme.

In cases where the output from the set is too great the volume control should be turned to the left and a reduction will result, but for most long distance work the reading on its dial should be the maximum so that the loudest signals may be obtained.

WIRING INSTRUCTIONS.

Join aerial terminal to terminal A of L1.

Join screens of C1, C2 and C3 to earth terminal, and thence to terminal B of L1, one side of R5, one side of C5, one side of R1 and R2, L.T.−, one side of R3, one side of R4 and G.B.+ respectively.

Join centre tapping of L2 to remaining side of R5.

Join terminal C of L2 to G of V1 and to moving plates of C1.

Join terminal D of L2 to other side of C1 and thence to top end of C4.

Join other end of C4 to A of V1, and thence to moving plates of C3 and to terminal A of L3.

Join terminal B of L3 to remaining side of C5, and thence to H.T.+1.

Join terminal C of L4 to one side of C6 and to moving plates of C2.

Join other side of C6 to G of V2 and to one side of R6.

Join other side of C2 to remaining side of C2 and thence to F+ of V1. Same side of C2 also to F+ of V2, and thence to terminal D of L4. F+ of V2 also to contact 2 of jack 2 and one side of switch S2.

Join other side of S2 to terminals L.T.+ and H.T.−.

Join A of V2 to one side of R.F. choke, and thence to remaining side of C3.

Join other side of R.F. choke to contact 4 of jack 1.

Join contact 3 of jack 1 to P of choke unit, and thence to one side of R7.

Join H.T.+2 to H.T.+ of choke unit, and thence to contacts 1 and 2 of jack 1 and to other side of R7.

Join G of choke unit to G of V3.

Join L.T.− of choke unit to G.B.− and thence to one side of R9.

Join A of V3 to terminal 0 of Z2, and thence to one side of C8, and to one side of C11, C10 and C9.

Join terminal 4 of Z2 to stud 1 of S1.

Join terminal 3 of Z2 to stud 2 of S1.

Join terminal 2 of Z2 to stud 3 of S1.

Join terminal 1 of Z2 to studs 4, 5, 6 and 7 of S1.

Join stud 8 of S1 to remaining side of C11.

Join stud 9 of S1 to remaining side of C10.

Join stud 10 of S1 to remaining side of C9.

Join contact arm of S1 to one side of Z3 and thence to H.T.+3.

Join same side of Z3 also to one side of C12.

Join other side of C12 to contact 3 of jack 2.

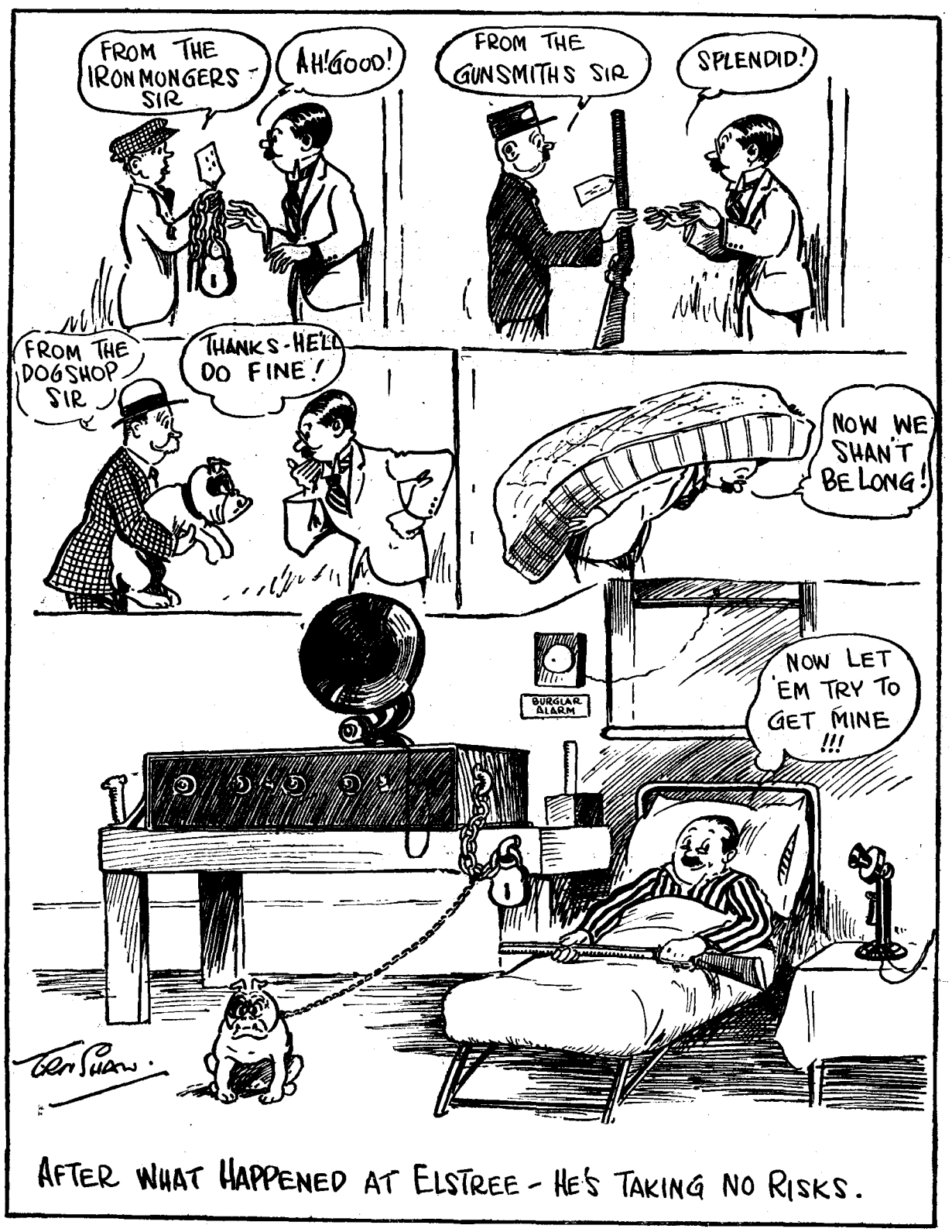
Join remaining side of C8 to G of V4 and thence to remaining side of R9.

Join A of V4 to remaining side of Z3 and to contact 4 of jack 2.

Join contact 1 of jack 2 to F+ of V4 and thence to F+ of V3.

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

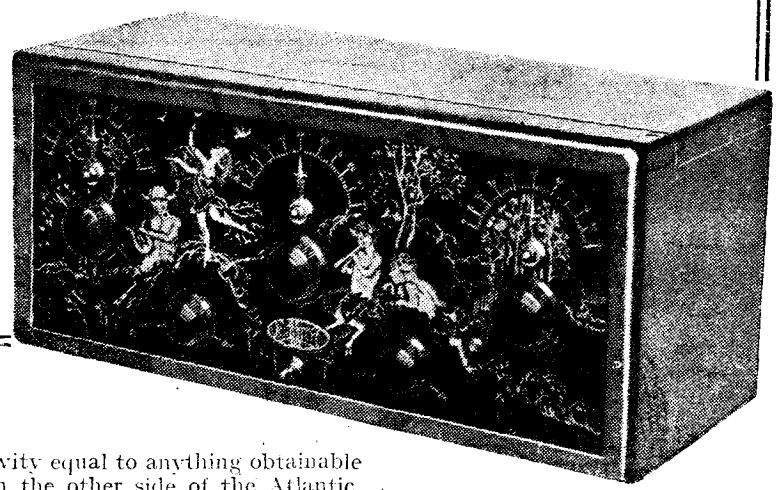
AN "ELSTREE SIX" OWNER'S PRECAUTIONS



AMERICAN OR BRITISH?

Who will Lead in Receiver Design?

By
PERCY W. HARRIS, M.I.R.E.



A GOOD experience of American radio set designs, both factory built and for the home constructor, and a good knowledge of what is being done in this country, particularly in the Radio Press Research Laboratories, is inevitably leading me to the conclusion that within twelve months England will lead in the matter of wireless receivers, and will stand a good chance of capturing the cream of the world's markets for broadcast receivers. In their efficiency and in maintaining a uniformity of quality, British valves are now unequalled. The quality of reproduction obtainable with British receivers is on the average considerably higher than in America.

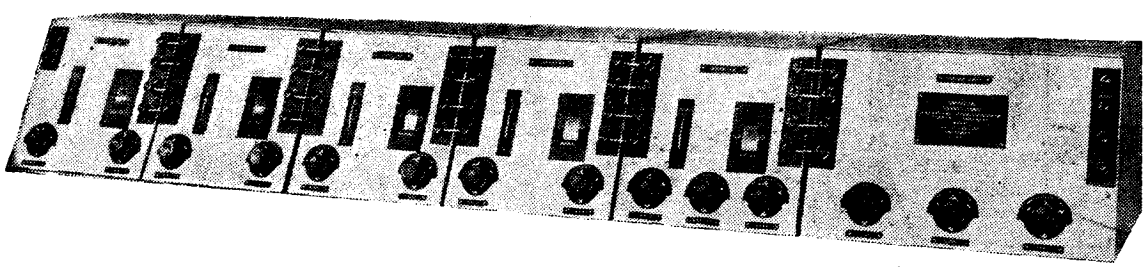
Simplicity and Selectivity

Where, in the past, we have fallen down badly on comparison is in the radio-frequency end of our sets and in the design of our instruments for selectivity and simplicity of control. We are now gaining ground very rapidly in sets for the home constructor, and it is already possible to build receivers from all British parts, easily obtainable, giving sensitivity and selectivity equal to anything obtainable on the other side of the Atlantic. That the public appreciate this is shown by the remarkable success of the "Elstree Six," and I venture to predict the similar success which will attend the publication of the designs in this particular issue.

THE rapid progress in receiver design on this side of the Atlantic has come as a surprise to the Americans who have led for so long in matters of selectivity and sensitiveness in their receiver designs. Having carefully studied the trend of receiver designs from all angles, Mr. Harris is able to give some interesting opinions on the future.

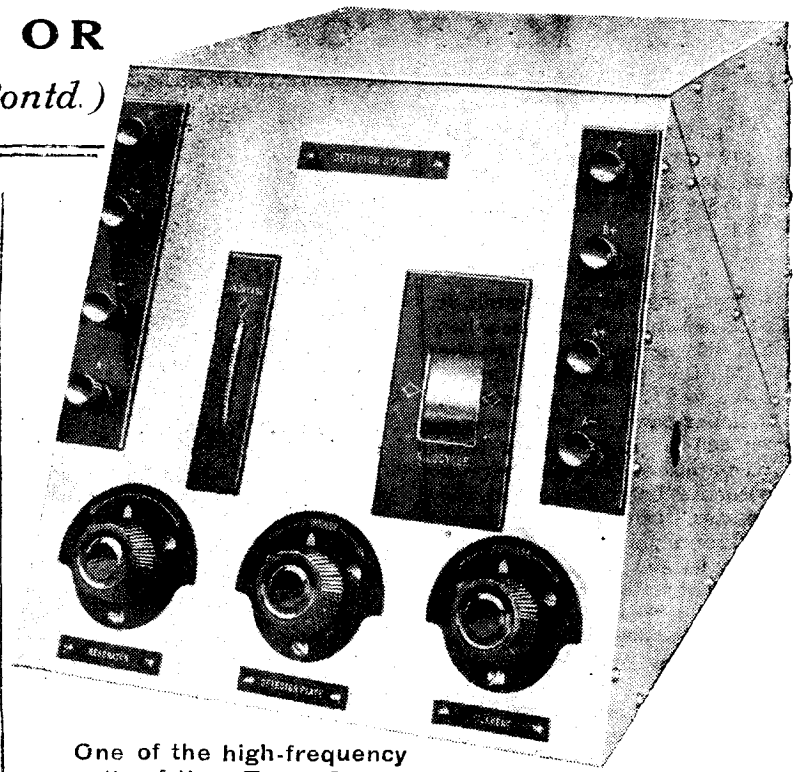
Shielding

At the same time, we must still study carefully the progress of design in America, and in this article I propose to deal with a few interesting instruments, particulars of which I have recently received. Shielding, which has been so carefully worked out and explained by Mr. J. H. Reyner in this country, is fast becoming a feature of both home and factory built receivers in the United States. In the familiar line of neutrodyne receivers made by a dozen or more manufacturers, the interaction of fields has been nullified to a large extent by the particular angle of coil mounting which is a feature of the Hazeltine Neutrodyne instruments. However, in adding a further stage of radio-frequency to the two already existing in such sets, this angle has been found to be insufficient protection, and so we find in the Stromberg-Carlson the elaborate shielding to which I referred in the June issue of MODERN WIRELESS. A form of screening is used which effectively prevents this interaction, screening the valves as well as the coils being found necessary.



The "Universal Trans-Oceanic" receiver has four stages of tuned high-frequency and three stages of low-frequency amplification.

AMERICAN OR BRITISH?—(Contd.)



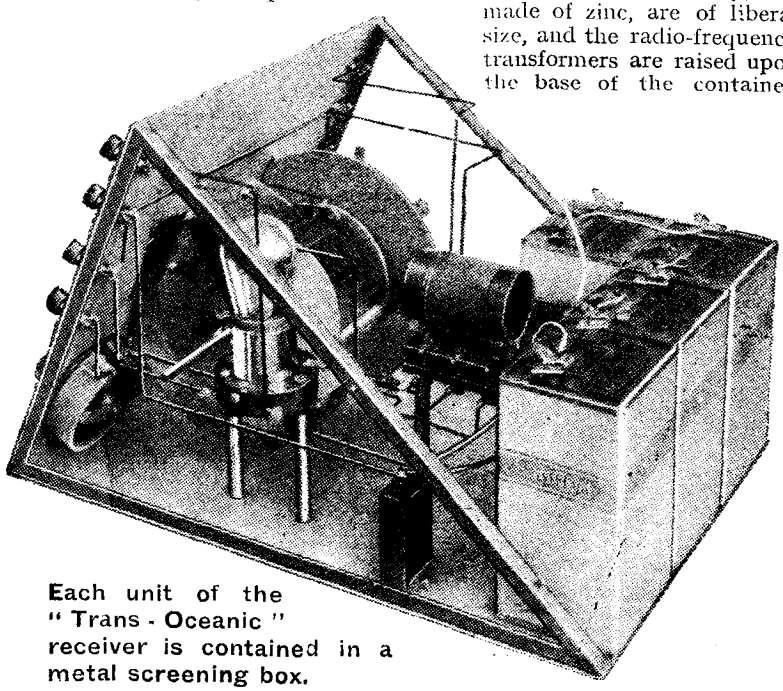
One of the high-frequency units of the "Trans-Oceanic" broadcast receiver. The condensers are placed edgewise.

An Interesting Set

A particularly interesting receiver, in which the principle of screening has been carried out very thoroughly, is the new "Universal Trans-Oceanic" broadcast receiver, brought out by the Golden-Leutz Co., of Long Island City, New York. This has four stages of tuned radio-frequency amplification, a detector and three stages of audio-frequency, and displays so much ingenuity that it is thought worth while to reproduce a photograph here. Local stations can be received on this instrument by a pick-up effect of the aerial terminal only, but to prove that the screening is really effective, if this terminal is earthed, no signals can be received even from stations next door.

Details of Construction

The complete receiver is rather a cumbersome looking affair, and would appear at first glance to be very complicated to operate. However, owing to the edgewise placing of the condensers, it is possible to single tuning control. The metal containers which, incidentally, are made of zinc, are of liberal size, and the radio-frequency transformers are raised upon the base of the container,



Each unit of the "Trans-Oceanic" receiver is contained in a metal screening box.

run a shaft continuously through several of the boxes, so that once the various radio-frequency units have been calibrated, the shafts can be connected together, giving a on bakelite bases, and thus are practically centred in the containers. By using interchangeable coils, very similar in size to those designed by Mr. J. H. Reyner a wavelength range af 35 to 3,600 metres is obtained.

Short Wave Reception

A very interesting and, so far as a short wave is concerned, a very important point, is that each radio-frequency stage contains its own high-tension battery, this greatly simplifying the wiring and the shortening of the length of leads. It is claimed that on KDKA's short wave, and the short wave used by WGY, very good radio-frequency amplification is obtained.

A Point to Note

As will be seen on examining the photograph, the method of raising the radio-frequency transformer and valve bases enables the leads (obviously very short) to be taken between the transformer and the valves by the shortest possible route, and what is more important, the wires themselves are kept well away from the shielding container.

All variable condensers are of the same size, namely, ·0005. The plates are of brass, and the rotor and stator plates are respectively soldered to their supports. The plates have been shaped so as to give a good separation of wavelengths on the indicating dial. From this it does not necessarily

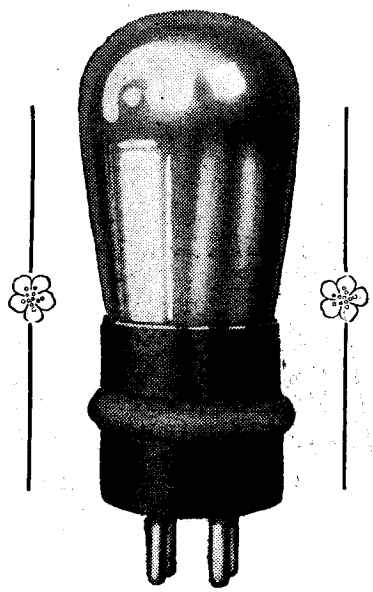
AMERICAN OR BRITISH?—(*Continued*)

follow that they are either straight-line frequency or straight-line wavelengths, and it is possible that the combination of the two shapes has been adopted.

Tuning

On examining the photograph, it will be seen that each condenser has a milled disc projecting through the front of the panel for tuning purposes, and as an indicator a semi-circular band, on which wavelengths can be inscribed for calibration purposes. A small vernier condenser for balancing called the "Resonator," can be seen on front and back-of-panel photographs.

It is sometimes imagined by the British reader that all the commercial radio sets in the United States are of the neutralised variety, but a very large number of makes consist of two stages of radio-frequency, a detector and two stages of audio-frequency, in which stability is obtained not by the neutralising method, which has been so fully discussed in this country within the last few months, but by the simple expedient of introducing in either the grid or the anode circuit of one or both of the radio-frequency valves, a winding of resistance wire. By winding low-loss inductances, arranging the angle and suitably spacing the coils adequately and at the same time proportioning the primary and secondary windings, so that the coupling is loose enough to prevent much feed back, stability can be obtained by introducing a relatively small amount of resistance in the circuit.



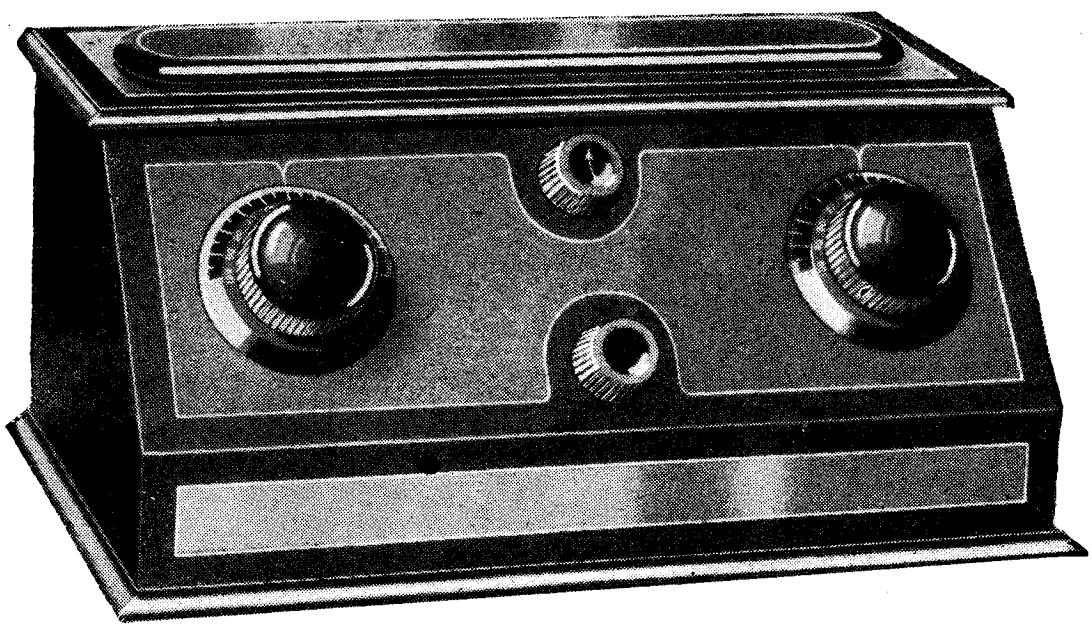
One American manufacturer reduces microphonic noises by incorporating a ring of spongy rubber in the valve base.

A Disadvantage

The disadvantage of this method is, however, that if sufficient resistance is inserted to stabilise the set at the lower end of the scale where very little capacity is shunted across the coil, a quite unnecessary reduction of sensitiveness is obtained at the upper end. In one receiver, the Zenith, this effect is compensated by a kind of variometer attached to the condenser shaft, which increases the coupling as the capacity of the condenser is increased. In this way fairly uniform amplification over the whole scale is obtained, and the circuit is stabilised by the introduction of resistance in the anode circuit.

Prices

Of course, the manufacturing facilities in the United States enable sets to be turned out quite cheaply, but a very large number are of the most shoddy variety, and relatively inefficient. A well-made, well-designed and efficient receiver still commands a good price, and so far as I can see will continue to do so.



An inexpensive two-dial receiver utilising one H.F. stage—the Crosley 4-29.

Single Control

In my previous articles I have shown the tendency towards a single control in the commercial

AMERICAN OR BRITISH?—*(Concluded)*

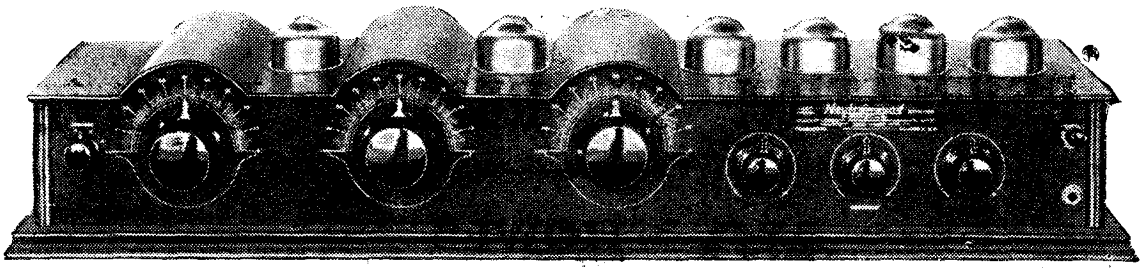
radio receivers, but many still retain three dial controls and a number have simplified matters to a compromise using two dials. A good example of a very inexpensive two dial set, using one stage of radio-frequency, a detector and two of audio-frequency, is the Crosley 4-29, a photograph of which is reproduced in this article. This is one of the types of receiver in which reaction is used on the detector. This set, which is one of the most inexpensive in America, sells for 29 dollars, or roughly £6!

Elaborate Sets

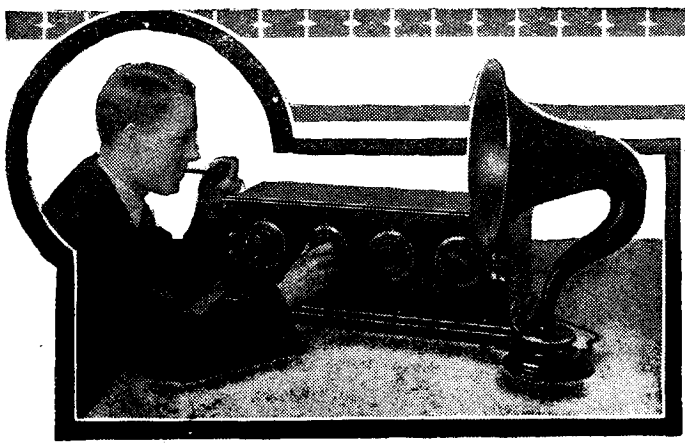
At the other end of the scale, we can find in America, and particularly in New York, a number of elaborate radio receivers, selling for as much as £500 each, while £100 for a cabinet instrument is by no means an unusual price.

Valve Holders

American valves are still very microphonic, and many American receivers, otherwise very efficient, are most annoying in use owing to the ringing effect caused by any vibration in the room. It is very surprising in the circumstances, that the anti-vibratory type of valve holder which has attained such popularity, and incidentally efficiency, in this country, is very little known in America. One attempt to remedy the trouble is that of a valve manufacturer who has made a spongy rubber cushion into the base of the valve itself, giving a kind of rubber-tyred effect, which, it is claimed, removes all of the "ponging." Seeing that British valve manufacturers are now turning out valves the electrical equivalent of the American types, which are quite devoid of microphonic effects, and which indeed can be used just as satisfactorily with the older type of holder, it would appear that we on this side are making progress in details much more rapidly than are the Americans.



An unconventional receiver—the "Neutrowound." Complete valve shielding is employed, as shown in the photograph.



The MEWFLEX

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

A REVELATION IN REFLEX RECEIVERS

NO HOWLS WHISTLES RADIATION

ANOTHER STAR SET IN THE ELSTREE CONSTELLATION

Three Valves—No Crystal

THE outstanding success of the "Elstree Six," employing as it did a special circuit, which was the outcome of several months of research work, resulted in numerous inquiries as to the possibility of utilising this type of circuit in receivers of less pretentious size. The principal feature about the "Elstree Six" was that it remained perfectly stable even though three stages of high-frequency amplification were employed, but of course there is no reason why a smaller number of high-frequency valves should not be used.

Some experiments have been conducted therefore recently, with a view to the production of a receiver employing two stages of high-frequency amplification only, the idea being to obtain the greatest efficiency with the minimum number of components, while at the same time retaining the simplicity of operation which was a distinctive feature of the "Elstree Six."

Reflexing

During these developments the possibility of economising valves by reflexing was considered, and as has previously been pointed out in these columns and elsewhere, the particular type of circuit incorporated in the "Elstree Six" renders itself very particularly to reflexing.

The basic circuit utilised in the "Elstree Six" employs a split condenser method of tuning, and in order to stabilise the grid of the valve, a high resistance is connected between the centre point of the coil, and a centre tapping on the condenser.

General Principles

It will be obvious that these two points across which the resistance is connected are at the same high-frequency potential, and this was indeed one of the principal features of the "Elstree Six" circuit, in that the resistance which serves to stabilise the steady potential of the grid, did not introduce any extra damping into the circuit, since it was connected across two points at the same high-frequency potential.

Such a condition of affairs is highly desirable in reflex circuits, and if we could arrange to connect the secondary of the low-frequency transformer across these points, then we should go a long way towards the separation of the high-frequency and low-frequency components of the current, which is one of the vital principles in reflexing.

This principle has been followed up with the result that a very simple method of reflexing has been developed. The success of the method may be judged from the test report which accompanies this article, from which it will be seen that over 40 stations were received all on the loud-speaker, and the simplicity of operation was such that only one hour was occupied

AN ELSTREE STAR SET

DO THESE FEATURES APPEAL TO YOU?

1. Loud Speaking from near and far on three valves.
2. Selectivity of a high modern standard.
3. Can be used near the local station for distance work.
4. Stability previously unknown in reflex sets.
5. Full reaction amplification without "squawking."

THEN BUILD THE "MEWFLEX" NOW!

in tuning in and identifying this number of stations.

The Coils

A new departure with this circuit, which is incorporated in the receiver described, is the use of screened coils. Not only does this reduce inductive and capacitative coupling between the high-frequency stages, but it also enables the receiver to be built more compactly.

An Early Difficulty

When these screened coils were first used with the circuit, a considerable amount of difficulty was experienced in obtaining complete stability, and much work was devoted to the various constants of the circuit with regard to this point. The results of the work undertaken in this connection indicated that the stray magnetic coupling between the various circuits had been rather greater than was at first thought. The elimination of this coupling therefore introduced a new problem which necessitated a considerable amount of detail work, for coupling of this description frequently introduces reverse reaction, thus helping to promote stability.

In the detector circuit a special coil is used which allows the conventional Reinartz reaction method to be employed. This method gives better results than can be obtained by the more usual method of increasing the setting of the neutralising condensers. The detector grid coil is tuned therefore by a single condenser, while a variable condenser of the usual type gives the required reaction effects.

Blasting

When the final experimental model had been completed, no difficulty was experienced at all in

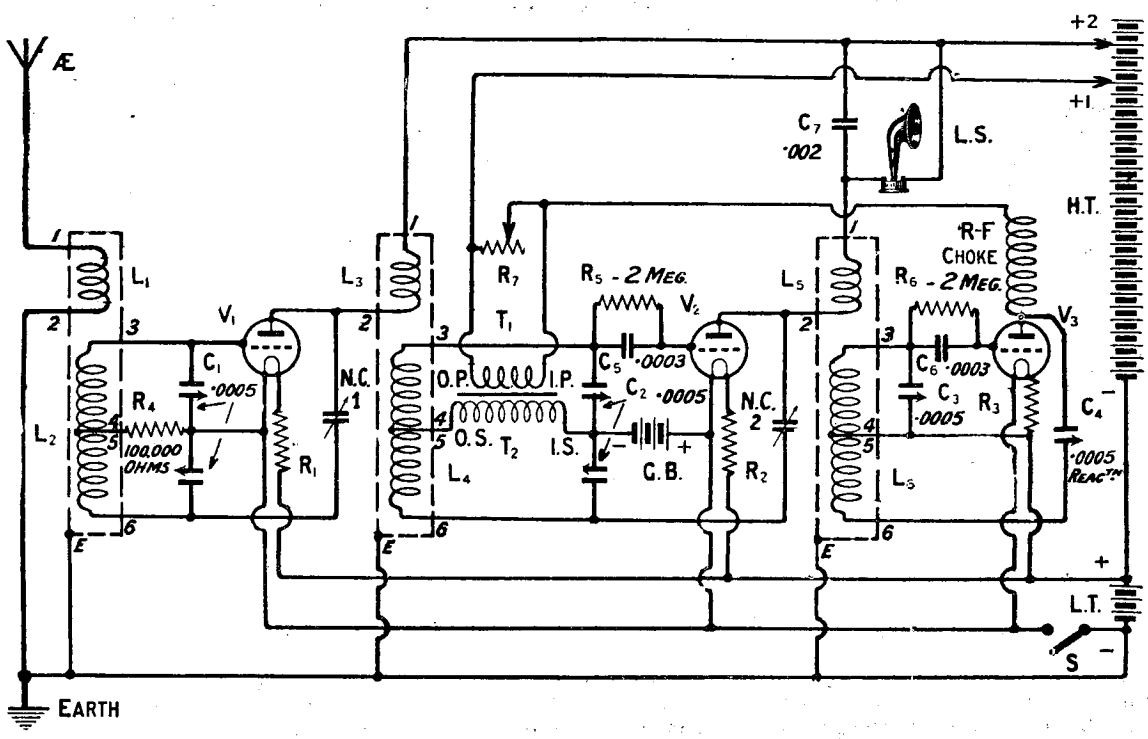
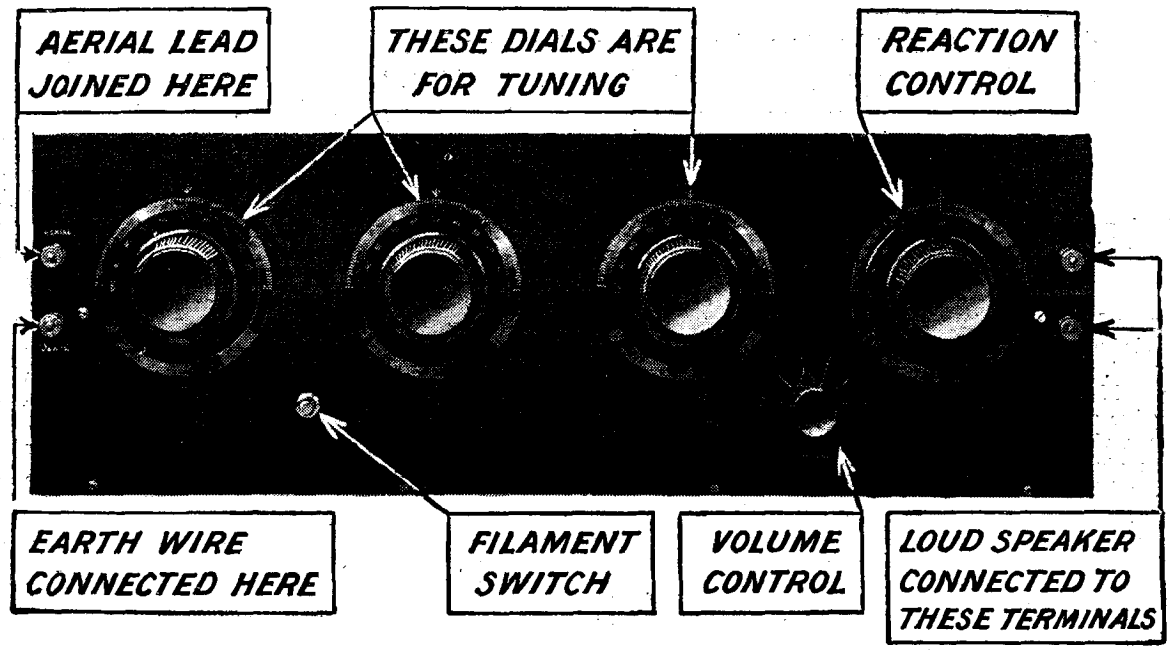


Fig. 1.—The circuit employs split-secondary screened coils. The grid condenser and leak, C_5 R_5 prevent blasting when receiving very strong signals.

THE "MEWFLEX"—(Continued)

receiving distant stations, and the high-frequency side of the receiver was found to function satisfactorily in every way. When, however, the set was tuned to the local station, another problem presented itself. the set into oscillation, and at that stage of the development of the receiver it was found that the only means of preventing this was to employ a valve with a very long characteristic in the reflexed stage. a grid-condenser and leak as shown at C_5 and R_5. This acted as a limiting device, and prevents this valve from being overloaded.

By this means the local station could be received at full strength



The three tuning dials give practically the same readings, while the reaction control enables smooth and full reaction amplification to be obtained.

Owing to the efficiency of the circuit the load on the second high-frequency valve which had to deal not only with high-frequency, but also low-frequency currents, was found to be so great that blasting and distortion resulted.

In fact the power of the local transmission was so great as to force

A Limiting Device

This was not thought to be desirable and efforts were made to obtain satisfactory working with a reasonably low impedance valve of a different type.

A solution to the difficulty was eventually found by the inclusion of

without blasting or self-oscillation occurring, and it further had the effect of noticeably improving the quality of reproduction. Actually the full volume on the local station is more than is required for comfort so that a volume control is provided to cut the strength down to a reasonable value.

COMPONENTS REQUIRED

One ebonite panel, 24 in. x 8 in. x ¼ in. (British Ebonite Co., Ltd.).
One cabinet for same with baseboard 14 in. deep. (Peto-Scott Co.)
Two .0005 dual condensers. (Igranic Electric Co., Ltd.)
Two .0005 single variable condensers. (Igranic.)
One "on-off" switch. (Igranic.)
Three coil screens. (Peto-Scott Co.)
Two H.F. transformers. (Split secondary type.)
One Reinartz coil.
One low-frequency transformer. (Eureka 1st stage.)
Two baseboard mounting neutrodyne condensers. (L. McMichael, Ltd.)
Three valve holders. (Etherplus.)
One volume control. (Magnum.)
One fixed resistance, 100,000 ohms. (Varley.)
One high-frequency choke.
Two .0003 fixed condensers. (Dubilier.)
Two 2-megohm grid leaks. (Dubilier.)
Three fixed resistors. (Burne-Jones & Co., Ltd.)
One .002 fixed condenser. (Dubilier.)
One piece of ebonite for terminal strip.
Five 4 B.A. terminals.
Four large lacquered brass terminals.
Quantity of Glazite for making connections.
One packet Radio Press panel transfers.

A HIGHLY EFFICIENT REFLEX RECEIVER

Having satisfactorily solved this problem, a number of different makes of low-frequency transformers were now tried in the circuit, and it was found that the circuit was not in any manner critical as to the actual make employed, provided that this was of good construction.

Results

In the course of a short test which was carried out at night at our Elstree Laboratories, the stations given in the test report on this page were all received on the loud-speaker. A number of other transmissions were also heard, but these were only strong enough to be heard on the telephones, and have not been included in our test report.

In daylight a number of B.B.C. stations have been received at loud-speaker strength, among these being Bournemouth, Manchester, Birmingham, Cardiff, Nottingham, and Hull, while among some of the foreign stations which have been received on other occasions are Radio Ibercia, San Sebastian, Oslo, Breslau, and Radio Lyons.

STATIONS RECEIVED ON THE LOUD-SPEAKER

(The figures represent the dial settings).

Kiel	16	Leeds	39	Glasgow	59.5
Helsingfors	17	Barcelona	40	Rome	61
Säffle	19	Nottingham	40.5	Radio-Toulouse	62
Gleiwitz	21	Petit Parisien	41	Berne	63
Elberfeld	23	Hull	42	Belfast	64
Malmo	25	Cardiff	44	Leipzig	66
Cassel	27	London	46	Ecole Superieure	67
Dortmund	30	Manchester (clear of 2LO)	50	Linkoping	68
Dresden	32	Bournemouth	52	Frankfurt	69
Hanover	33	Hamburg	53.5	Birmingham	70
Stoke	34	Dublin	55	Radio Belge	72
Bradford	37	Newcastle	56	Aberdeen	74
Milan	38	Munster	57	Zurich	78

Components

Given on the previous page is a list of the components required for the construction of the receiver, and for the guidance of those who wish to copy the receiver in every detail, the makes of the components are given in each case.

Construction

The first stage in the construction of this receiver is to mount the components on the panel, and the dimensioned layout given should be consulted for this purpose. If the condensers specified are used in this receiver it will be found that the makers provide templates for fixing them to the panel, and this part of the work will be found quite simple and straightforward.

The terminal strip should next be fixed on the baseboard and the remaining components mounted thereon. The positions for these are indicated in the back of panel wiring diagram.

Having completed the connections, these should be checked over to make sure that no error has crept in at any point, and the set should then be given a preliminary test.

Connecting Up

Fixed resistances suited for use with the particular valves and batteries employed should be placed in position in the clips, the valves inserted, and the L.T. batteries connected. The set should be switched on and the valves examined to see that they are

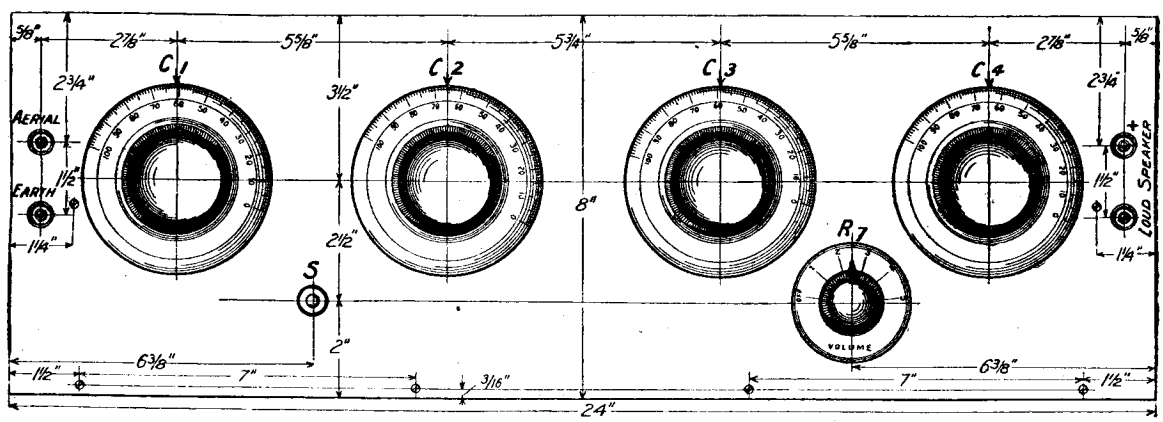
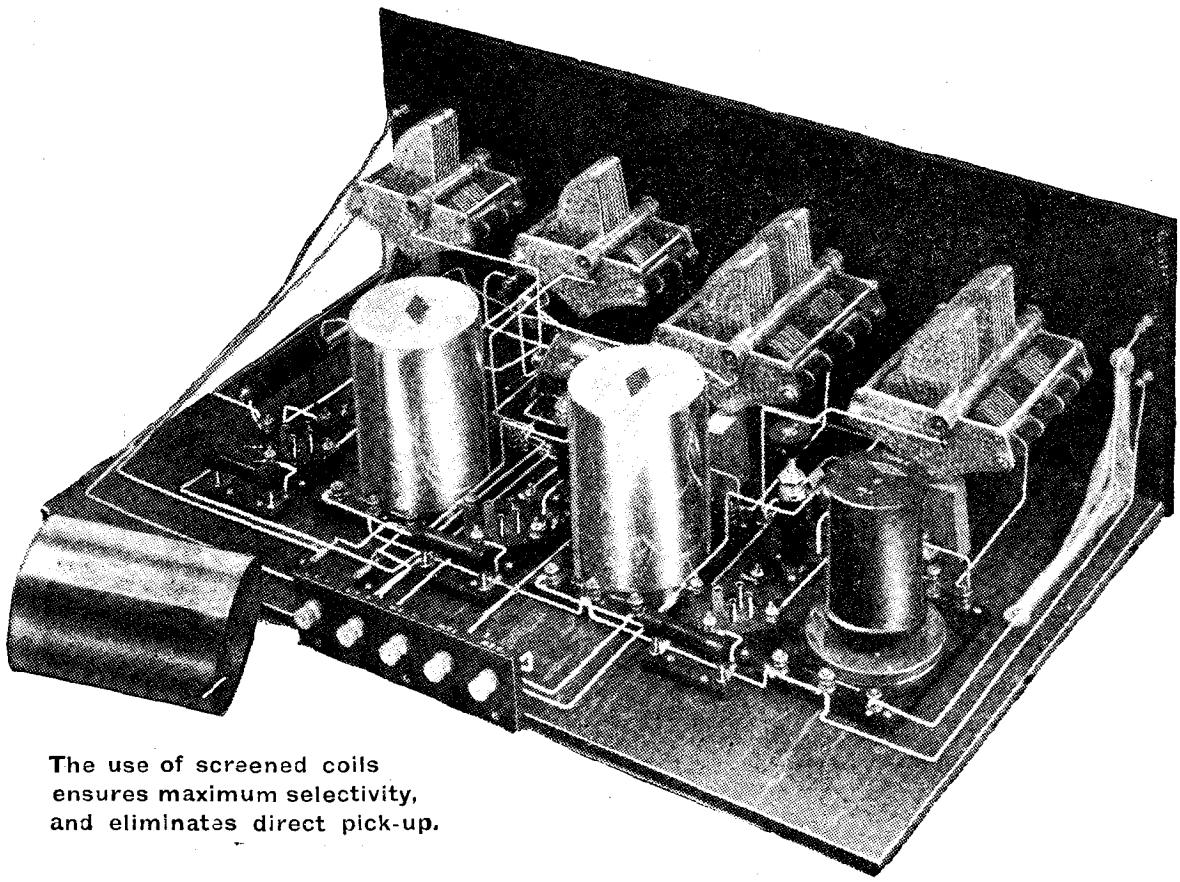


Fig. 2.—The volume control R_7 enables loud signals to be reduced to comfortable strength. Blueprint, No. 178a, may be obtained free.

THE "MEWFLEX"—*(Continued)*



The use of screened coils ensures maximum selectivity, and eliminates direct pick-up.

WIRING INSTRUCTIONS

Join aerial terminal to terminal 1 of L1.

Join earth terminal to terminal E on L1 L2 base, thence to terminal 2 of L1, terminal E of L3 L4 base, and terminal E of L5 L6 base respectively. Join L.T. – to a point on latter wire, and thence to one side of switch S.

Join terminal 3 of L2 to G of V1 and to fixed plates of C1 remote from panel.

Join terminals 4 and 5 of L2 together and to one side of R4.

Join other side of R4 to remaining side of switch S, moving plates of C1, F – of V1, and to F – of V3, F – of V2 and G. B. + flex lead.

Join terminal 6 of L2 to lower tag of N.C.1 and to remaining fixed plates of C1.

Join A of V1 to remaining side of N.C.1 and to terminal 2 of L3.

Join terminal 1 of L3 to H.T. +2, thence to one side of C7, and thence to L.S.+ terminal.

Join terminal 3 of L4 to one side of C5 and R5, and to fixed plates of C2 remote from panel.

Join other side of C5 and R5 to G of V2.

Join terminals 4 and 5 of L4 together and to O.S. of transformer T1 T2.

Join I.S. of transformer to moving plates of C2. From a convenient point on this connection take the flexible G.B. – lead.

Join the remaining fixed plates of C2 to terminal 6 of L4 and thence to lower tag of N.C.2.

Join remaining side of N.C.2 to A of V2 and thence to terminal 2 of L5.

Join terminal 1 of L5 to remaining side of C7 and thence to remaining L.S. terminal.

Join terminal 3 of L6 to one side of C6 and R6, and to fixed plates of C3.

Join other side of C6 and R6 to G of V3.

Join other side of C3 to terminals 4 and 5 of L6, and thence to one side of R2 and one side of R3 respectively. Same side of R2 also to L.T.+, H.T. –, and one side of R1 respectively.

Join terminal 6 of L6 to moving plates of C4.

Join other side of C4 to A of V3, and thence to one side of H.F. choke.

Join other side of H.F. choke to I.P. of transformer, and thence to one side of R7.

Join other side of R7 to O.P. of transformer and thence to H.T.+1.

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

AN ELSTREE STAR SET

burning correctly. Next strap together terminals H.T.+1 and 2 and connect the H.T. battery, first employing a potential of only 6 volts. If then the H.T. battery should happen to be shorted across the valves, this will be indicated by the filaments burning somewhat brighter and the mistake can be rectified without any serious damage having been done to the valves.

The receiver may now be connected to the aerial and the correct values of high-tension applied to the appropriate terminals. A suitable value for H.T.+2 is from 100 to 120 volts, while H.T.+1 may be from 40 to 60 volts in most cases. If a high-impedance valve of the resistance-capacity coupling type is employed, then it may be found desirable to increase the voltage up to 80 or 100 volts. This, however, is a matter for personal experiment, and the best values should be found under working conditions.

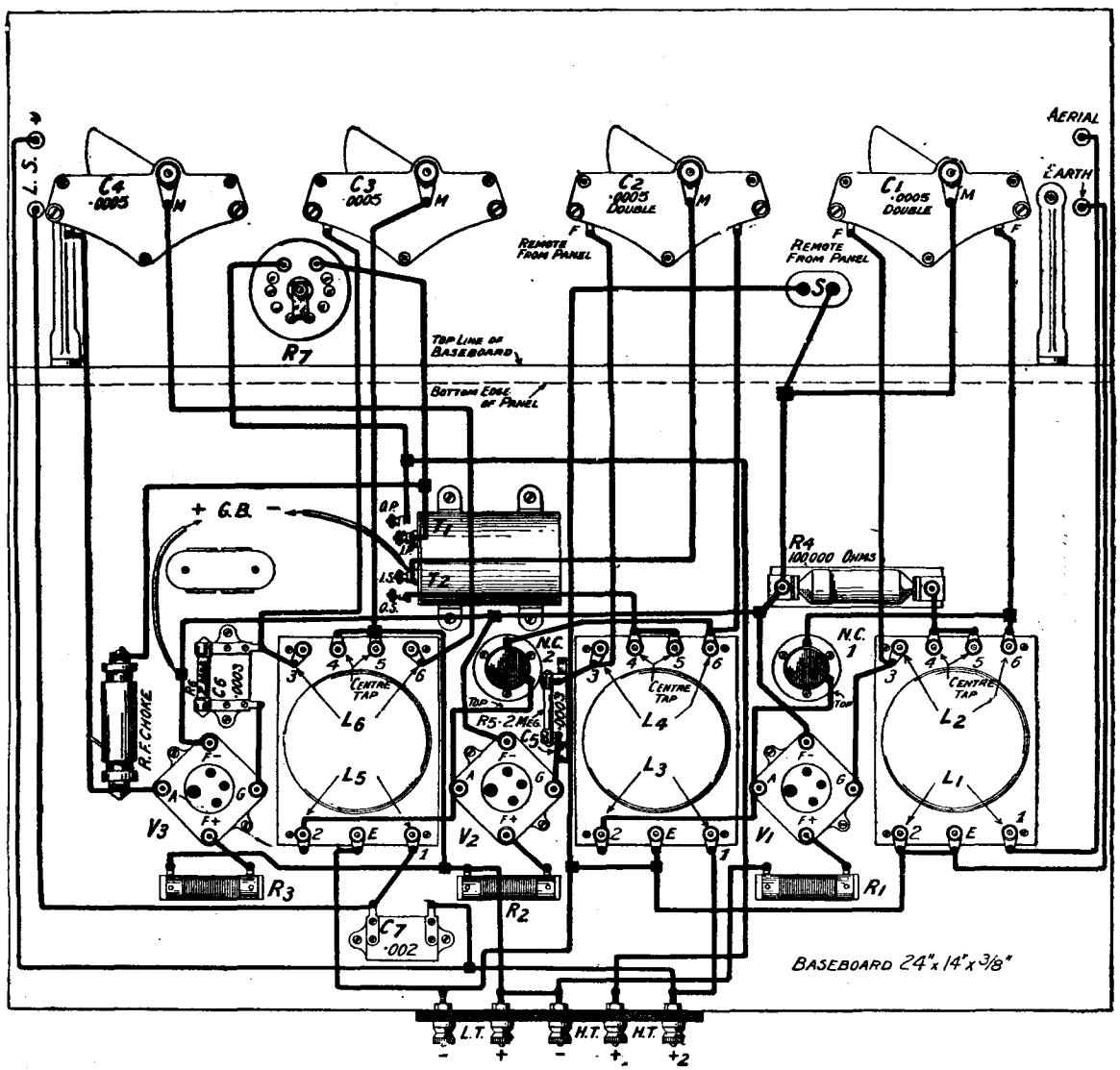


Fig. 3.—The simple wiring makes the construction an easy task. A full-sized Blueprint, No. 178b, may be obtained free of charge.

Neutralising

The first thing to do is to neutralise the set correctly, and as a guide the following approximate settings of the neutralising condensers may be employed: With valves of the 5 volt ¼ ampere type, they should be placed about half way in, since these valves have a fairly high self-capacity. Valves of the P.M. type will require only a quarter or third of the capacity available, while if it is intended to use valves of the .06 type, these condensers will need to be set almost at their minimum value.

Preliminary Tests

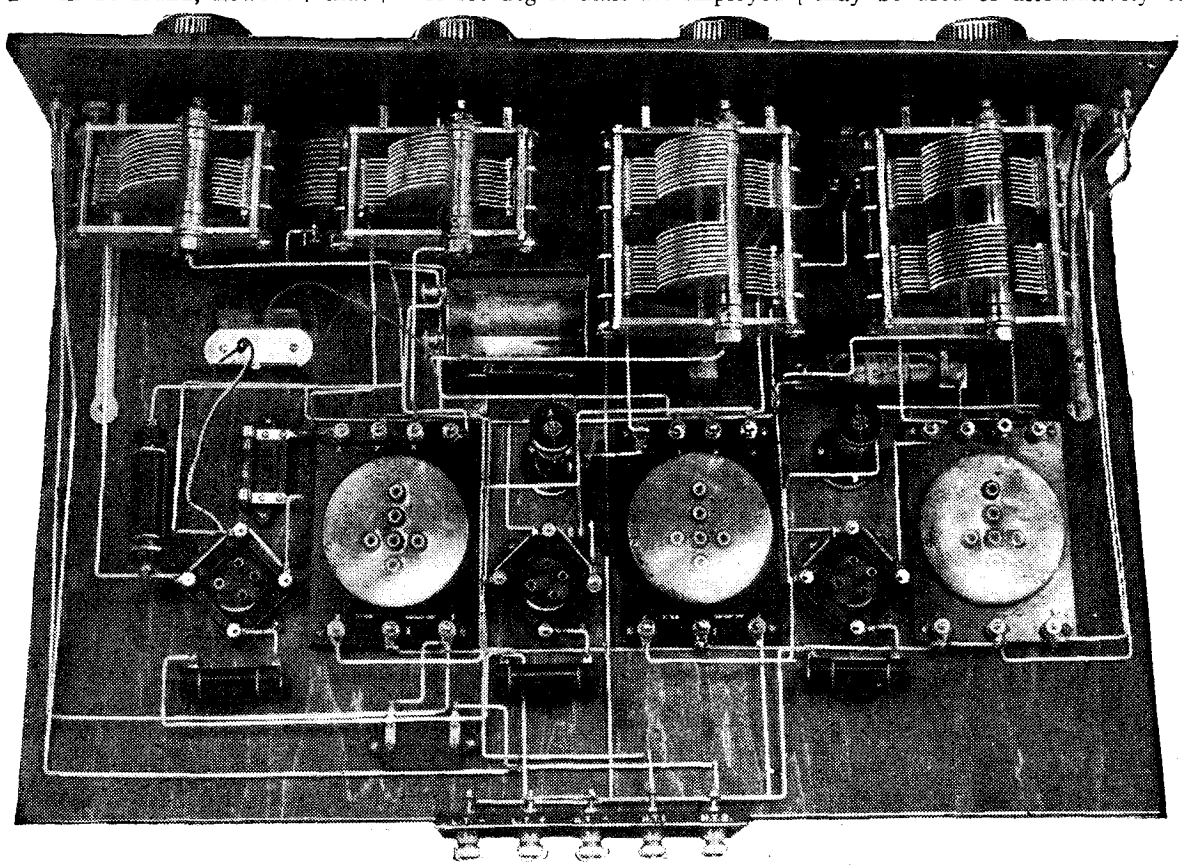
Having made the preliminary

THE "MEWFLEX"—(Concluded)

adjustments to these condensers, the local station should be tuned in, and the first valve neutralised by the usual method of turning out the filament, and rotating the appropriate neutralising condenser until the minimum signal is heard.

Since the second valve is acting in a dual capacity as H.F. and L.F. it is obviously impossible to neutralise it by this method, since if the valve is turned out, signals will be cut off entirely, owing to the fact that the L.F. circuit will be broken.

It will be found, however, that this stage will be liable to oscillate unless the neutralising condenser is correctly set much more so than a straight H.F. stage in fact. The tuning condenser C_2 should therefore be swung backwards and forwards while small adjustments of the neutralising condenser NC_2 are made until a position is found at which the set is perfectly stable. Needless to say all such adjustments should be made with the reaction condenser C_4 set at zero.



The coils employed are interchangeable and enable a wide range of wavelengths to be covered.

Final Adjustments

Having stabilised the receiver on the local station, all three tuning condensers should be set to a small value, say, at 20 degrees, in order to find out whether the set is stable at this setting. Should there be any tendency to oscillate, the condenser which is the most likely to require adjustment is the second neutralising capacity and when this is correctly set the receiver will be found to be perfectly stable over the whole band of wavelengths covered by the tuning condensers.

If 100 degree dials are employed the correct setting for the local station may be obtained from the list of stations received given in the test report, and it will be found that all three condensers will read approximately alike. When tuned to the local station the value of grid bias used on the reflex valve should be adjusted to give the maximum purity and signal strength, after which distant stations may be searched for.

Suitable Valves

It may be of interest here to discuss what types of valves are most suitable for use in the various stages of this receiver. For the first high-frequency stage which is dealing purely with a high-frequency current, a high-impedance valve is preferable. Since the second H.F. valve has also to deal with low frequency, a low impedance valve will give the best results in this position, a suitable value being between 4,000 and 7,000 ohms.

For the detector valve one of the resistance-capacity coupled type may be used or alternatively one of the special detector valves now on the market.

NOTE.—The details given in this article fully describe the construction of the receiver. The constructor can go ahead and both build and operate the set from the information given. In our next issue, which will be on sale at the usual price of one shilling, further hints will be given on the operation of the receiver together with the coil sizes and dial readings for the long wave broadcasting stations.

FROM READERS WHO HAVE HEARD THE "ELSTREE SIX"

"Simply Astounding"

SIR,—I was very pleased to take advantage of your very kind invitation to a demonstration of your receiver the "Elstree Six." I may say that the results obtained with this receiver are simply astounding, and I have no hesitation in personally verifying that the claims put forward for the results with this receiver are in no wise exaggerated. The ease with which the receiver is completely stabilised and furthermore the ease of operating the set are remarkable to a degree. I have previously constructed the "Special Five" as designed by Mr. Percy Harris, and would like to take this opportunity of giving my unqualified appreciation of the Radio Press designs; and in the design and construction of the "Elstree Six" I consider you have excelled yourself.—Yours truly,

W. FOLDS.

Wanden End, Nr. Luton.

"Really Remarkable"

SIR,—On the 15th June I had the pleasure of paying a visit to the Radio Press Research Laboratories at Elstree and have no doubt but what you will be pleased to hear of the impressions then formed, particularly with regard to the "Elstree Six," with which my visit was primarily concerned.

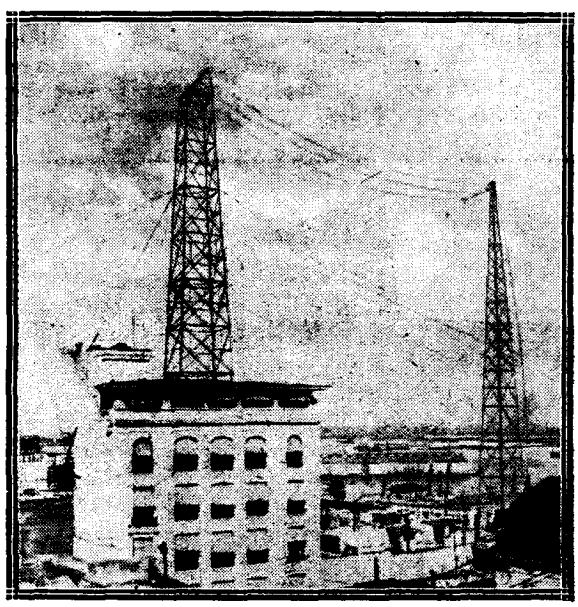
There is a saying that first impressions are usually lasting ones, and to be perfectly candid, I must say that my first impression of the Elstree Six—that is in so far as its performance is concerned—was not a very favourable one, as when an attempt was made to bring the set into operation, nothing happened, a state of affairs which continued for several minutes. Fortunately, however, for the reputation of the set and of Radio Press, Ltd., this did not last very long, Mr. Tingey discovering after a systematic search that what had been some two hours earlier a perfectly good and apparently reliable high-tension battery had gone on strike with the inevitable result. A change of H.T. immediately effected a remarkable change, and what had been an unresponsive instrument suddenly sprang to life with such effect that the unfavourable impressions were dissipated one by one as station after station both British and foreign were tuned in with remarkable ease and clarity on the loud-speaker. Stations asked for were tuned in both by means of a wavemeter and by direct searching, the time required by the latter method being scarcely longer than the former.

The sensitiveness and selectivity of the receiver are really remarkable when compared with the average set, the slightest touch in the reaction condenser making an astonishing difference to the results. One thing which impressed me very favourably indeed was the fact that it was practically impossible to make the set re-radiate and become a general nuisance, and also that the four tuning controls require an almost identical setting, two features which make the "Elstree Six" an ideal receiver for the individual who understands little or nothing of the art of tuning in distant stations.

Whilst passing I would like to mention that my general impressions of the laboratories were distinctly good, the work benches being fitted with the latest and most up-to-date instruments and appliances necessary for the research work and testing carried on, and the staff there certainly know their job. I certainly think that when the proprietors of Radio Press instituted this section of their activity they made a big step forward in the right direction.—Yours truly,

G. W. FENNY.

Camden Road, N.7.



The transmitting aerial at W R A Q, San Juan, Porto Rico.

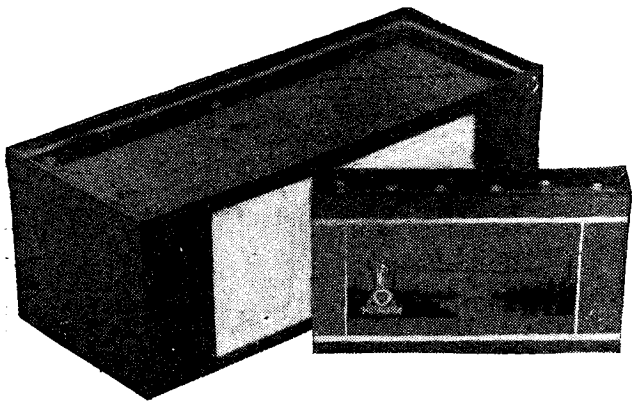
"Delighted"

SIR,—A few days ago I visited the Elstree Laboratories for the demonstration of the "Elstree Six." I came away delighted. Selectivity, ease of control, volume of sound are all that one could wish for. Have scrapped 5-valve and 7-valve Sup. Het. and have started to build the "Elstree Six." When finished should be pleased to demonstrate to anyone caring to call. Wishing your paper every success, and thanking you for a set that I have been looking for but never before found.—Yours truly,

Hoddesdon. J. C. HAWARD.

THE HIGH-TENSION PROBLEM

By the Staff of the Elstree Laboratories.



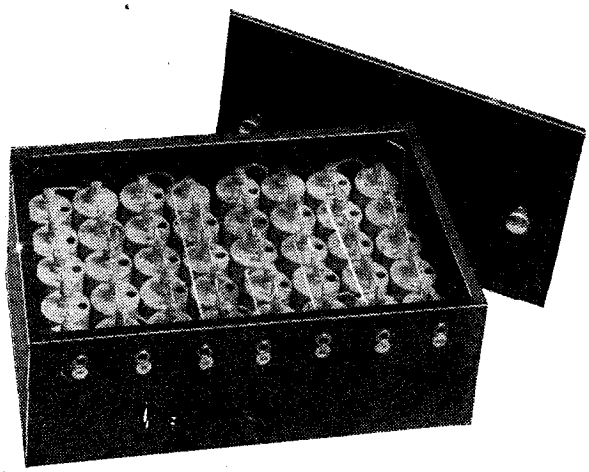
THE question of high-tension supply to valves has always been a difficult one right from the very beginning of wireless reception. Particularly in the early days of wireless the dry batteries used for supplying the necessary high potential on the anode of the valve used to run out very quickly and would often break down prematurely in actual use. So much was this trouble prevalent that the phrase "crackly H.T." has become part and parcel of wireless parlance.

This condition of affairs has certainly improved rapidly since the beginning of broadcasting, but at the same time the demand for high-tension current has also increased.

Current Demands

In fact the problem is again becoming quite a serious one. When we consider, for example, for the needs of a straight five-valve receiver employing two H.F. valves, detector and two low-frequency power valves, the H.T. current required becomes quite considerable. The first three valves would have a fairly high impedance and would require a mean anode current of the order of 1 milliamp. each, while the last two valves would each take a current of about 3 milliamps. Thus we have a total current consumption of 9 or 10 milliamps, which is a fairly considerable current to be supplied by dry batteries for any length of time.

The "Elstree Six" requires a current of the order of 15 milliamps. when a large valve is used in the last stage, and actually with this receiver the high-tension voltage is supplied by either accumulators or small sized Leclanché cells. Several readers have indeed experienced trouble with this receiver, which is directly attributable to the use of ordinary small dry batteries for the H.T. supply.



A battery composed of wet cells possesses the advantage of being rechargeable when run down.

Recuperation

Now, the mechanism of the dry battery was explained in an article which appeared in MODERN WIRELESS, Vol. 6, No. 1. It was stated there that there are several factors which contribute to the life of the battery. The proportions of the various chemicals in an ordinary dry battery are designed to give it a reasonable life, allowing for certain periods of recuperation.

This means to say that during the period when the battery is not being used certain chemical processes take place which tend to revive the battery, or in other words allow it to recuperate. The life of a battery which is kept under continuous discharge is very considerably shorter than that of the same battery if discharged and allowed to rest in alternate periods.

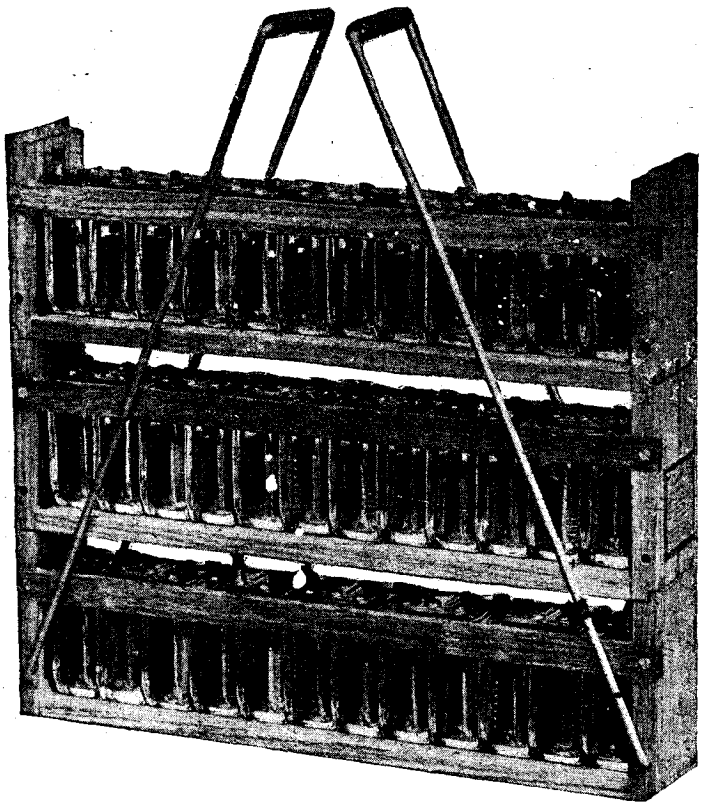
Rating

From this point of view only, the smaller the discharge taker from the battery, the longer will be the actual output from the battery in ampere-hours. An accumulator is usually rated in ampere-hours, which is the product of the current taken from it in amperes, and the time in hours for which this current is taken.

Very few people, however, dream of rating a dry battery in terms of its ampere-hour capacity, yet, nevertheless, it has such a property associated with it. Certainly this factor is somewhat more variable with a dry battery, since it depends very considerably upon the rate at which the current is taken from it, but nevertheless it is a useful property, since it gives some indication of the life a battery should give.

Actually the life of a battery tends to increase as the actual current or rated discharge decreases. There is, however, an opposing

THE HIGH-TENSION PROBLEM—*(Continued)*



High-tension accumulators may be arranged in a reasonably compact form as this photograph indicates.

factor to this which is that of the local action which it gives, and which ensues when the battery is left idle.

Local Action

It is well known that if a dry battery is kept unused for some considerable time, it deteriorates after a certain period and rapidly becomes useless. This is because all the time certain small local actions are taking place inside which ultimately cause an eating away of the zinc containers, when of course the battery becomes useless. Anyone who has examined an old battery will find that it is riddled with holes where the chemicals inside have eaten right through the zinc.

Since this local action is taking place the whole of the time, there is obviously a limit to the reduction of the discharge current from the battery. Even if the battery is not used at all it will wear out in time, and we have to find the point at which the battery is utilised to its fullest advantage before the local action has time to become of serious consequence.

Optimum Discharge Rate

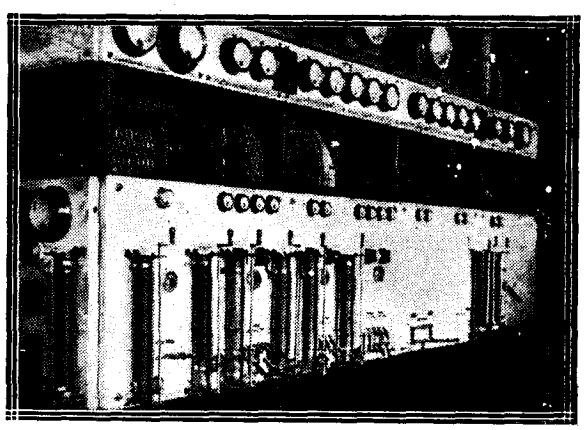
This leads to an optimum rate of discharge. If a series of similar batteries is taken and all discharged at different rates we shall find that the actual life of each battery, in ampere-hours, before its voltage drops below, say, 1 volt (instead of 1·4 when the battery is new), is different in the several cases. As the rate of discharge, *i.e.*, the current taken from the battery, increases so the life increases until a certain optimum current is reached. After this point the life begins to fall off again somewhat rapidly, and if too heavy a current is taken from the battery the life becomes exceedingly short.

There is a considerable scarcity of information concerning what is the best rate of discharge for various types of dry batteries. We have various types of high-tension batteries made up with cells of different sizes. We wonder how many people could say with any degree of reliability just what would be the best current to take from a battery of a given size.

Current Measurement

The truth is that the great majority of people do not trouble about the discharge current from their battery. They realise that a small battery cannot be expected to give quite the same rate of discharge as a larger one, but very few people measure their anode current, and if they do they are not much better off, because they do not know whether such a current is suitable for the battery or not.

Another reason for the lack of information concerning the best current to take from a given size of cell is the fact that this current varies considerably with the different uses to which the battery is put. One man will use his wireless set very much more than another, and it will be obvious that the rate of



The switchboard and controls at the well-known Eiffel Tower station.

THE HIGH-TENSION PROBLEM—*(Concluded)*

discharge depends on the amount of use.

A battery which is rarely used will stand a higher rate of discharge than one which is constantly in operation, owing to the greater time for recuperation.

Owing to this diversity of conditions the manufacturers have not made a general practice of stating the facts about their batteries, but although the reason for this can be appreciated, some information would be welcome.

Few people buy an accumulator without knowing its capacity, and the same state of affairs should obtain when dealing with dry batteries.

An Example

An exception to this rule is found in the case of the well-known Hellesen battery, which is handled in this country by Messrs. A. H. Hunt, Ltd., and there are indications that other manufacturers are also considering the matter. The information given by Messrs. Hunt, Ltd., however, has proved exceedingly useful, and in conjunction with matter gleaned from other sources the following information has been drawn up.

This information, it should be remembered, refers to a good class of battery, reasonably used, and in any case is simply intended as a guide. It is necessary to define the amount of use the battery receives. In the case of the Hellesen battery three ratings are taken, namely, 50, 100 and 150 hours' use per month. This corresponds to about 2, 4 and 6 hours' use per day, and we have termed the three classes Light, Medium and Heavy duty, respectively.

Sizes

There are three sizes of battery in general use, which may be classed as follow:—

Small size.—Each cell about $\frac{3}{4}$ in. diameter and about 3 in. high. A 60-volt unit of such cells would have a surface area (obtained by multiplying the length by the breadth) of about 30 sq. in.

Medium size.—Each cell about 1 in. diameter and 3 in. high. Surface area of 60-volt unit about 45 sq. in.

Large size.—Each cell about $1\frac{1}{4}$ in. diameter and 3 in. high. Surface area of 60-volt unit about 75 sq. in.

Ampere-Hour Capacity

With average use the capacity of the small size of cell is 1,000 milliampere-hours. The other two sizes give 2,000 and 3,000 milliampere-hours respectively. Thus at a given rate of discharge some idea of the life can be obtained.

Hilversum is a popular station with many British listeners. Here is seen a general view of the transmitter.

The life is defined as the time elapsing before the battery falls below about ·9 volt per cell.

As previously mentioned, however, the actual rate of discharge desirable depends on the amount of work which the cell has to do. The following table gives the rates of discharge necessary, under different conditions of duty (light, medium or heavy as just explained), in order to obtain the full rated capacity of the battery:—

Best Rates of Discharge

Small size (1,000 mA-Hr.).

Light duty ..	5 milliamps.
Medium duty	7 ,,
Heavy duty ..	10 ,,

Medium size (2,000 mA-Hr.).

Light duty ..	7 milliamps.
Medium duty	12 ,,
Heavy duty ..	15 ,,

Large size (3,000 mA-Hr.).

Light duty ..	10 milliamps.
Medium duty	15 ,,
Heavy duty ..	20 ,,

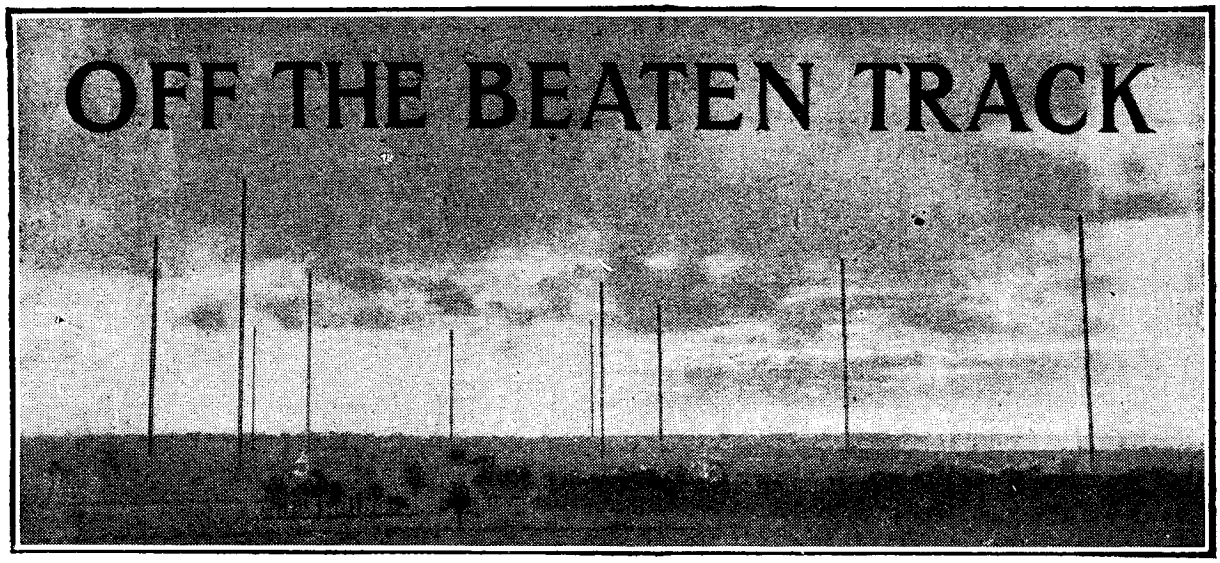
Probably the first point which is of interest is that the best rates of discharge are much lower than is often imagined, and that in order to handle a really large high-tension current such as is required with modern multi-valve receivers a really large type of battery is required.

Cost

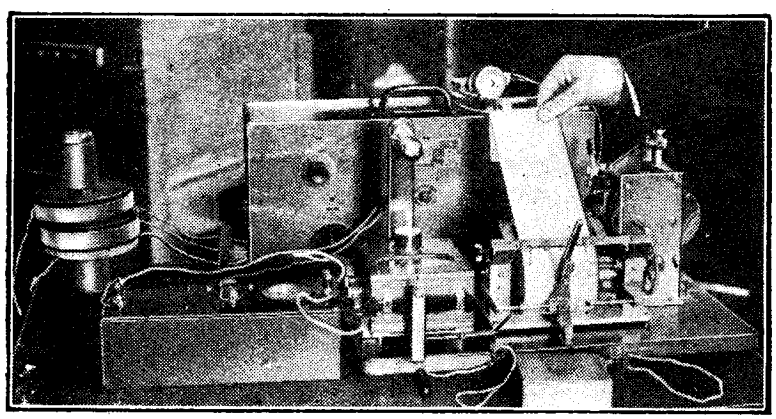
A point which will immediately be raised is why go to the extent of a large battery which lasts for a given number of months, when by buying one for half the price we can obtain equally good results for half the time, and then buy another battery? If this argument were sound, it would almost be unanswerable. As a matter of fact, a battery of twice the capacity does not cost anything like twice as much as the smaller size. The labour involved in making up a battery is very much the same whether the cells are small or large. The extra cost of a large battery is therefore principally due to the increased material which is employed in its manufacture. Consequently a battery which costs double the price of another will have nearly three times the material of the smaller battery, if not even more.

A Practical Case

We ourselves have had in use a large size dry battery for considerably over six months. This battery has been used for all types of experimental work, and roughly treated. In the intervals it has been providing high-tension current for a five-valve set throughout the whole period, yet when we measured its voltage the other day it was 85 per cent. of its rated voltage.



AFTER writing last month's notes under this heading, and mentioning the reception of time signals from Eiffel Tower, I have been thinking about a rather curious test that I carried out one Christmas night not very long after the war. I had had small bet with a friend to the effect that I could receive the spark signals of Moscow on 5,100 metres with one valve and an indoor aerial, and accordingly listened at 9.55 p.m. (which seemed quite late in those pre-broadcasting days) for MSK, who should have been transmitting sidereal (vernier) time signals similar to those transmitted by FL. Expecting some very weak signals, I settled down and strained my ears, and to my great joy heard an extremely faint spark station transmitting the well-known staccato "dots." To my distress, when the time for giving the call-sign arrived, it was not MSK, but *FL*! I had been receiving the "harmonic" of FL (2,600 metres) on 5,200 metres! A little lower down, however, I found MSK, considerably louder, and the next night I managed to receive them both at once, and noticed the lag of MSK's dots behind those of FL. Unfortunately the Moscow transmission now takes place at 8.55 p.m., and on a wavelength of 7,480 metres, C.W. being used, with the call-sign RAI! Nothing remains the same, and as FL and MSK (sorry, RAI!) now have a phase difference of about 59 minutes, the good old days have indeed gone for ever.



This photograph shows some of the apparatus used at the U.S. Bureau of Standards for the study and measurements of fading.

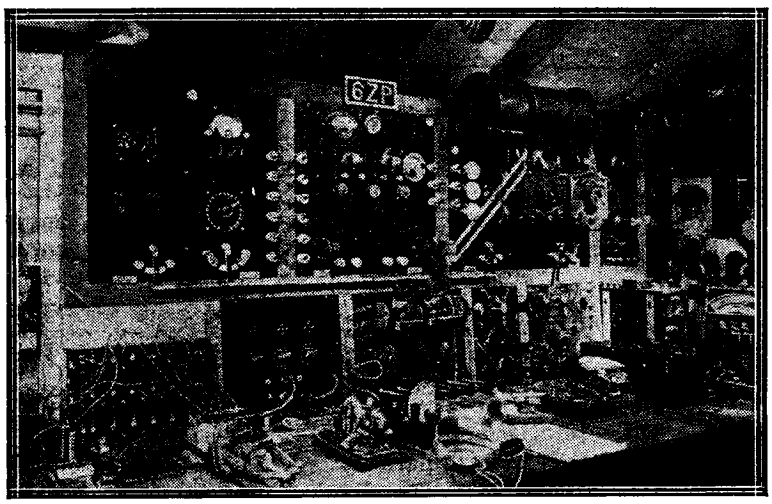
Fading on 200 Metres

ALTHOUGH during the past month I have been listening quite a lot on the longer waves most of the work I have been carrying out has been on the 150-200 metre band and the lower wave-lengths still. The peculiar slow fading that affects weak signals in the neighbourhood of 200 metres, though so familiar when this used to be the lowest wave-band used by the amateur transmitters, seemed quite strange after I had become used to the much more rapid fading that occurs on the 45-metre band. On this lower band, if an amateur station fades out, one rarely loses him for more than the space occupied by two letters (*i.e.*, about six dots or dashes), whereas on the higher band it is by no means uncommon to lose a whole sentence during a particularly bad swing.

OFF THE BEATEN TRACK —(Concluded)

Telephony

THE great majority of the amateur transmitters working on the 150-200 metre band are at present using telephony. It seems almost to have turned into an "unwritten law" that the 45-metre band is to be reserved for the knights of the key and the higher wave for the "lords of the microphone." It is just as well, really, that there should be fewer telephony stations using the lower band, for there is no doubt that they cause much more serious interference than C.W. stations. Nevertheless, the ease with which it is possible to cover great distances on the shorter waves is a great temptation to some of the higher-powered stations to use "fone," and they often do so, generally with disastrous results to any test that the real experimenters with low power are attempting to carry out at the time.



Mr. G. Pailin (6ZP) is carrying out experiments on the control of electrical switchgear by radio. The time and sequence relays used may be seen in the foreground of the photograph.

Those Commercials!

INCIDENTALLY, I have no doubt that the commercial stations of the future will use very much less power than they are doing even at present. Several of them have now been working experimentally on the shorter wavelengths for the best part of the year, and, from a chat I had recently with a Post Office engineer, it seems that the chief lesson that has been learnt is that the power input may generally be reduced by nearly one-half without any diminution of signal-strength being noticeable at the receiving end! One wonders how many times they would be able to halve the power before signals commenced to die out!

The Mysterious "ABC"

QUITE a large number of people have been asking me lately about the "ABC" station that all the commercials call up during the greater part of the twenty-four hours. They may all be heard at it after 11.15 p.m. or thereabouts any night. "ABC" is, of course, merely a general call signifying "test," and is *not* the call-sign of any particular station. The chief offender in the ABC line used to be FW, the short-wave station at Sainte Assise, near Paris. Apparently the engineers at that station have satisfied their curiosity, since FW has been silent now for some weeks. His absence from 42 metres is *not* regretted, but unfortunately his place has been very competently filled by AGC, one of the experimental stations at Nauen, Germany.

Atmospherics

I HAVE noticed just recently that when atmospherics are strongest on short waves, they are often not very noticeable up on the broadcast band. It has been common knowledge for some time, of course, that they are generally much weaker lower down than in the 300-500 metre band, but there seems to be a different kind of "stray" which is more pernicious on the shorter waves than elsewhere. One explanation that I have heard is simply that these atmospherics originate at a great distance, and are stronger on the short waves simply because *all* distant signals are stronger there. Readers' experiences would be very welcome.

A "Dead Spot"

THERE seems to be a distinctly dull spot in the band of wavelengths in the region of 240 metres. Descending from the broadcast band to the 150-200 metre amateur band there is usually nothing except Brussels to be heard between about 260 and 225 metres. This wavelength has just as good carrying properties as the waves normally used by the B.B.C., and I cannot understand why more use is not made of it. It would seem a convenient place into which to fit the Relay stations.

W. L. S.

RADIO PRESS TO TOUR THE PROVINCES

Lecturing Crusade by Elstree Engineers on our New Developments.

DEMONSTRATIONS OF THE "SOLODYNE" IN PRINCIPAL TOWNS OF GREAT BRITAIN.

READERS of MODERN WIRELESS will be interested, no doubt, to hear that Radio Press Limited, the Proprietors of this journal and also of the *Wireless Constructor* and *Wireless*, are proposing to arrange for a series of lectures up and down the country for the purpose of stimulating interest in the new developments which have originated in their Elstree Laboratories.

So strongly do they feel that entirely new fields are opened by this work that they propose to demonstrate how far advanced their new Star receivers are, compared to those produced by other designers and sets which a few months ago were regarded as satisfactory.

Revolutionary Developments

Every Radio Press designer appreciates how revolutionary some of the developments are. This is saying a great deal, because these same designers have enjoyed very extensive reputations in the past. There are one or two manufacturers who have specially catered for constructors who desired to build up receivers made from designs published in wireless periodicals. In the catalogues issued by the principal firms engaged in this work more than 90 per cent. of the designs are those published in Radio Press journals, while there are only one or two designs which have been published elsewhere. This is the most convincing proof that the Radio Press sets are the most popular, and that they are the ones that people build.

Now on top of these old and well-tried designs come the new developments from Elstree, and it is the intention of Radio Press Limited to do everything in their power to create a great revival of interest in radio by showing how very much superior these receivers are over the older types.

The "Solodyne."

It is the immediate intention of the proprietors of MODERN WIRELESS to demonstrate the truly fascinating set called the "Solodyne," described in this issue. You will only have to hear it and experience the thrill of adjusting a single dial to give loud-speaker results from numerous stations in order to become enthusiastic. It is, of course, impossible to arrange for every reader of MODERN WIRELESS to see and operate the "Solodyne," but by giving lectures in different parts of the country wireless enthusiasts will spread the news of the success of the instrument, and this will encourage the less enterprising to build what is undoubtedly the finest achievement of the Elstree Laboratories, taking into consideration simplicity and ingenuity, as well as signal strength, selectivity and range.

It will only be possible to visit the principal towns, and reports of the demonstrations will occasionally be published. Obviously no one who wants to build the set will wait until the receiver and the lecturer arrive near his home town, but we feel sure that our readers will be interested to hear a lecture, illustrated by lantern slides where a lantern can be provided, from the lips of Mr. John Scott-Taggart, Mr. J. H. Reyner, Mr. Percy W. Harris, or other Radio Press engineers. These lectures will cover broadly the field of work carried out by Elstree, and the "Solodyne" and possibly other sets will be demonstrated.

Details of Dates

If you wish to attend one of these lectures you obviously will want to know when and where they are being held. It is impossible to give details of dates, etc., in MODERN WIRELESS, which is only published monthly. You are therefore requested to send a postcard, addressed "Lecture Tour," Radio Press Limited, Bush House, Strand, London, W.C.2, stating your name and address, and the maximum distance you are prepared to go to hear the demonstration. If, for example, you enjoy life at Wigan, it is very unlikely that a public lecture would be given there, but, on the other hand, you might be prepared to go up to Manchester. Will you therefore mention on the card how far you are prepared to go to hear a lecture, *e.g.*, say 10 miles?

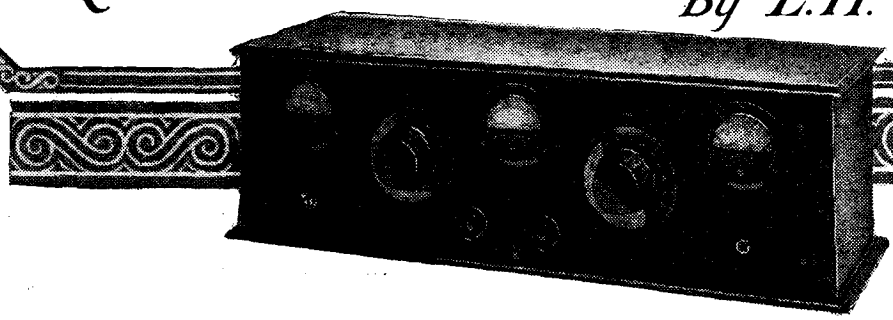
Accommodation Specially Reserved

We also propose to give details of these tours in our weekly paper, *Wireless*, although readers will find it safer to send us a card, in which case accommodation will be specially reserved. It may occasionally be necessary to give the same lecture several times over in a big town.

We should be pleased to hear from secretaries of Radio Societies in or near big towns who are prepared to assist in the organisation of the lecture and demonstration locally.

The "Colonial" Transmitter

By L. H. THOMAS, (6QB)



This transmitter has been designed to meet the needs of the numerous Colonial and other readers who have written to us for particulars of a reliable low-power telephony transmitter with a range of about 80 miles.

THE transmitter described in this article has been designed to operate in the wave-band between 150-200 metres, which is one of those allotted for amateur use both in the Colonies and in this country. All the components used are of standard well-known makes, so that no difficulty at all should be experienced in obtaining them, and the whole lay-out of the transmitter has been made as much like an ordinary receiver as possible. It is built into a cabinet, the vertical-panel-and-baseboard system having been considered the most suitable.

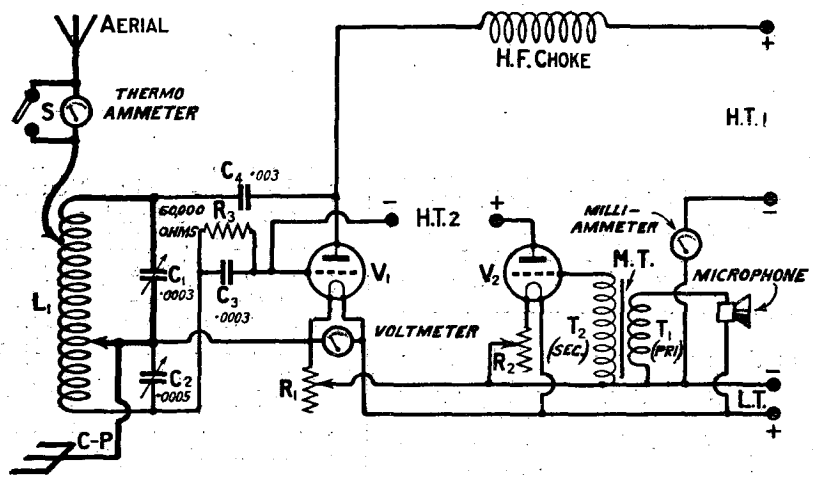


Fig. 1.—The voltage required for H.T.2 is between 6 and 9 volts, which may be supplied by a grid-bias battery.

Choosing a Lay-out

In designing a low-power transmitter all that is needed is a little experience in receiver design and construction, and a moderate amount of common-sense. Given these, the builder cannot go very far wrong. This is mentioned because the writer knows an astonishing number of people who seem to think that there is not the slightest relation between receivers and transmitters, and cannot persuade themselves to take up transmission because they are afraid that they would "have to start all over again." This is certainly not the case, and this misapprehension is the chief reason for the extremely conventional form in which this transmitter has been constructed.

The theoretical circuit diagram, Fig. 1, bears a striking likeness to the ordinary Reinartz type of receiver circuit, as far as the oscillator (V_1) is concerned. The modulator valve (V_2) is, of course, simply concerned with the telephony part of the apparatus, and need not be dealt with at first.

The Oscillator

Every telephony transmitter is, of course, divided into two parts: first, the oscillator, which generates a continuous wave, and, second, the modulator, whose function it is to impose the speech frequencies upon this emitted wave. The oscillator circuit used in this transmitter is of the "tuned-grid tuned-anode" type, and parallel feed is employed for the high-tension supply, which is therefore fed through an H.F. choke. The coil L_1 is connected to the grid-leak and condenser at one end, and to the anode of the oscillator valve (via the condenser C_4, which must be inserted to prevent a direct "short" of the H.T. supply) at the other. The aerial is tapped on the coil at a point near the anode, and the filament tap is generally somewhere in the neighbourhood of the centre of the coil, or, if anything, rather nearer to the grid end. As will be seen from the photographs, no special method of construction has been employed for this coil, which is wound with No. 18 D.C.C. wire on a standard low-loss former, 3½ in. in diameter. The grid condenser and the anode circuit condenser must both be of the highest quality, and, further, the latter

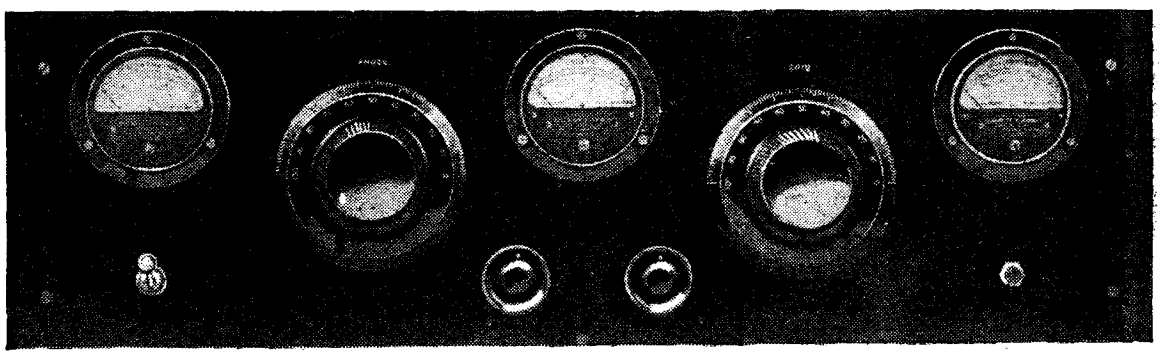
THE "COLONIAL" TRANSMITTER—*(Continued)*

must be capable of standing up to a voltage of 500 or 600. Those used in this set were made by the Dubilier Condenser Co., and are rated at 1,000 volts. The grid-leak has, of course, a considerably lower value than that used normally in a receiver, and almost any resistance with a value between 40,000 and 100,000 ohms serves satisfactorily. The writer has found 60,000 ohms the best value for all-round work, and has accordingly used one of this resistance.

COMPONENTS REQUIRED

One ebonite panel, 24 ins. by 7 ins. by 3-16 in. (Camco.)
Cabinet to take above, with loose baseboard 7 in. deep, and two panel brackets. (Carrington Manufacturing Co.)
One ·0005 and one ·0003 low-loss variable condenser. (Igranic Electric Co., Ltd.)
Two 6-ohm rheostats. (C.A.V.)
One 0-·5 ampere thermo-ammeter, one 0-10 moving coil voltmeter, and one 0-50 or 0-100 moving-coil milliammeter.
(Ernest Turner, High Wycombe.)
One ·003 and one ·0003 fixed condenser, Type 577. (Dubilier Condenser Co., Ltd.)
Two "Aermonic" baseboard-mounting valve-holders. (A. F. Bulgin & Co.)
One single-circuit filament jack, with plug. (Bowyer-Lowe Co.)
One special modulation transformer. (Radio Instruments, Ltd.)
One high-frequency choke.
One vacuum grid-leak, 60,000 ohms, with clips. (Ediswan.)
One seven-terminal strip (with one terminal removed.)
One two-terminal strip.
One on-off switch.
One low-loss coil former, 7 ins. by 3½ ins. (Collinson's Precision Screw Co.)
A microphone, to be referred to later.
Tinned copper wire, bolts, screws, etc., a packet of Radio Press panel transfers and two clips.

When the transmitter is working efficiently in conjunction with an aerial and counterpoise of the normal size, an aerial current of about ·5 ampere should be obtained with an input of five or six watts. Since this is the maximum reading given by the particular thermo-ammeter used, the instrument is shorted by the switch S if greater power than this is to be used. Ammeters reading from 0 to 1 ampere or from 0 to 1·5 amperes can be obtained, but for a low-power transmitter of this type it is always preferable to use one on which a fairly large deflec-



The symmetrical lay-out of the components gives the panel a pleasing appearance. The thermo-ammeter is on the left and the input milliammeter on the right.

Meters

Three meters are really necessary in a transmitter of this type. Those used are a thermo-ammeter, inserted directly in the aerial circuit, to serve as an indication of the current flowing into the radiating system; a voltmeter across the filament of the oscillator valve; and a moving-coil milliammeter to indicate the anode current. Working without meters is always a risky business, although a surprising number of beginners in transmission think that an aerial ammeter is all that is necessary. Any attempt at serious experiment, or even at reliable non-experimental work under these conditions, however, is very much like trying to read a book in the dark, and should not be attempted.

Constructional Details

The front and back-of-panel diagrams really make the construction of the transmitter sufficiently clear for it to present no difficulty at all. As there are probably some readers, however, who will wish to depart from the lay-out slightly, a few words of explanation on one or two points are desirable.

Looking at the front-of-panel photograph or diagram, the switch S on the extreme left is simply used to short-circuit the thermo-ammeter in the aerial circuit.

THE "COLONIAL" TRANSMITTER—(*Continued*)

tion is obtained, on account of the greater ease with which accurate tuning may then be carried out.

Condensers

The left-hand condenser tunes the anode section of the coil, and is of ·0003 capacity. That on the right tunes the grid section and has a value of ·0005. The reasons for the different sizes of condensers will be discussed later.

Separate rheostats have been provided for controlling the filaments of the oscillator and modulator valves, but the voltmeter is connected across the filament of the oscillator only, since the filament voltage of the modulator is by no means critical.

On the extreme right of the panel is a single-circuit filament-lighting jack, into which the microphone plug fits. It is so wired that when the microphone plug is removed the modulator filament circuit is broken, an economy in L.T. current thus being effected without any trouble when Morse is to be used instead of telephony.

Modulation Transformer

Referring to the back-of-panel photographs, the modulation transformer, the function of which will be mentioned later, is seen on the left of the baseboard. There are only three connections on the one actually used, which is an ex-Government transformer, the primary and secondary having a common connection at one end. This is made quite clear from the wiring diagram. Transformers with similar windings, which have four terminals instead of three, may be obtained from Radio Instruments, Ltd. In this case one primary and one secondary terminal must be connected together. The circuit diagram makes this quite plain, since the secondary winding is connected across the grid and filament of V_2, and the primary winding across the filament battery and the microphone. It is obvious, therefore, that the two windings must have one common point, and thus an "auto-transformer" with three terminals may be used.

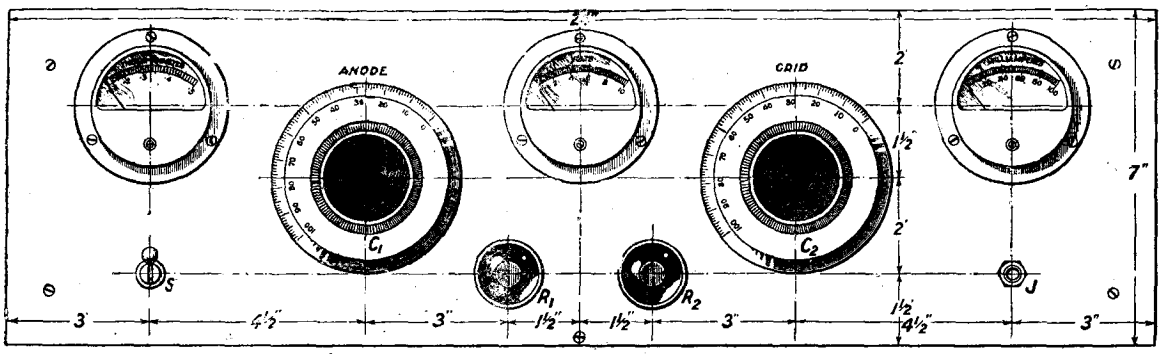
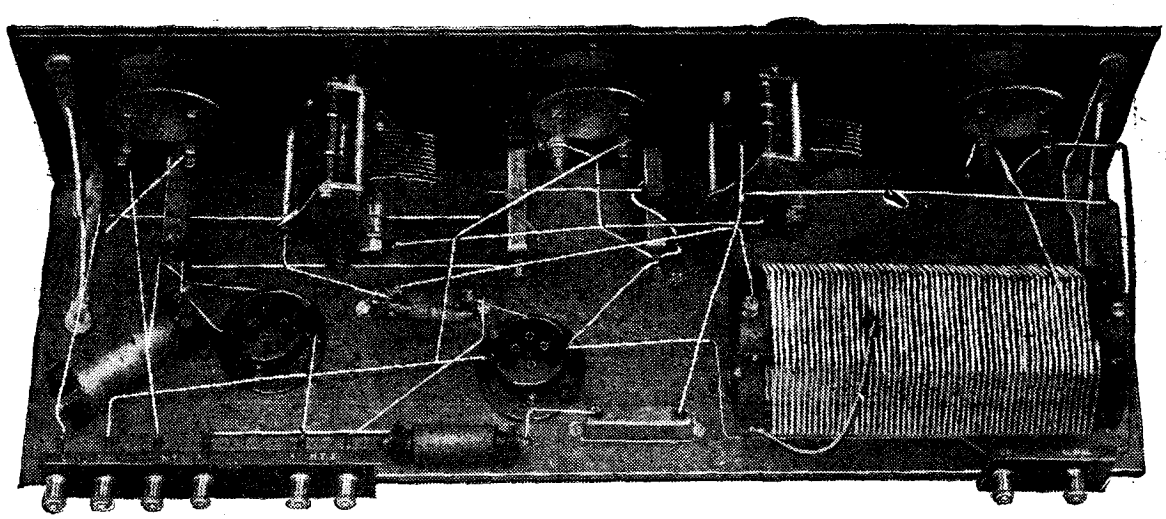


Fig. 2.—All drilling centres may be determined from this drawing provided that the same components are used. Blueprint No. 173a free.



All the wiring may be clearly followed from this photograph. Note the short anode and grid leads to the oscillator (right-hand) valve.

THE "COLONIAL" TRANSMITTER—*(Continued)*

Components

The actual components used are as listed. They have all been chosen with a view to their being readily obtainable in the Colonies, and are, of course, all of British manufacture. The valve-holders were chosen on account of the specially long leakage path between the four sockets. The self-capacity is also low, both of these features being very desirable when the components are used in a transmitter.

The Coil Dimensions

The coil former employed has a diameter of 3½ ins., and is wound for its whole length with No. 18 D.C.C. wire, double-spaced (*i.e.*, one slot is missed between turns). There are about fifty-four turns, and the positions for the filament tapping and also the aerial tap may be clearly seen from the diagram. One advantage of using a coil of this shape is that its field is kept small, making it possible to build the transmitter fairly compactly.

The Modulation System

The only other point requiring mention before the actual operation is dealt with is the action of the modulator valve. It is, of course, generally realised that the constant-current or "choke-control" method of modulation is the only system capable of giving absolutely pure, undistorted telephony. In fact, where high power of the order of that used by the B.B.C. stations is employed, it is the only system worth considering at all. It was not employed in this transmitter, however, on account of the fact that the modulator should be arranged to take almost the same power input as the oscillator when choke-control is used, and the Colonial reader will probably consider economy in H.T. consumption before anything else, and would welcome a set in which H.T. consumption is halved! The system employed, therefore, is a form of "grid absorption" control, which was used by the well-known station 2OM in the pre-broadcasting days, and works admirably with a "high-tension" voltage of 6 or 9 volts on the anode of the modulator valve. The speech frequencies generated by the microphone are passed through the primary of the modulation transformer (the six-volt L.T. battery being used to supply the necessary current), and are stepped-up by this transformer, the secondary winding of which is connected across the grid and filament of the valve. The anode of the modulator is connected to the grid of the oscillator through a small battery (actually a 9-volt tapped grid-bias battery was employed), the speech frequencies thus being amplified and superimposed upon the steady wave generated by the oscillator valve. With low powers really excellent telephony can be obtained with this arrangement. In fact, most of the stations with which the writer worked while testing out this transmitter asked him if he was using choke control.

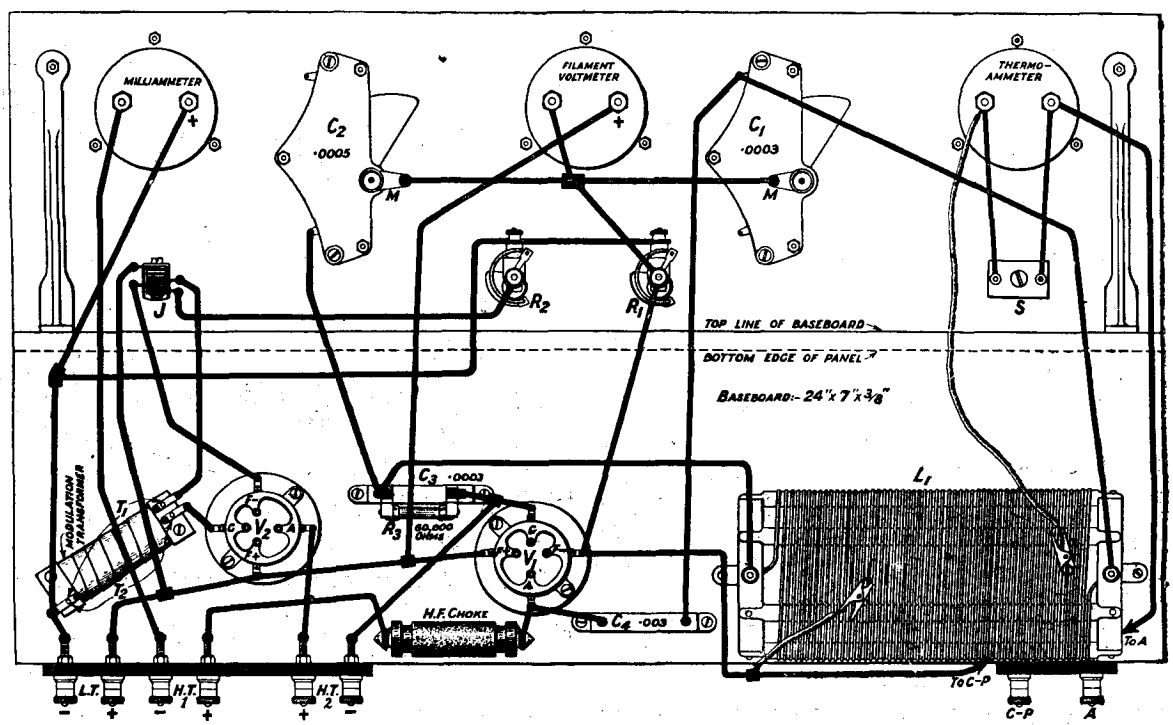


Fig. 3.—The connections to the modulation transformer and the positions of the taps on the coil are clearly shown in this diagram. Blueprint No. 173b free.

The Microphone

The microphone used, by the way, was a "G.P.O. solid-back," similar to those obtainable at many Government surplus stores. Should the reader not wish to use one of these, however, Messrs. Ericsson, Ltd.,

THE "COLONIAL" TRANSMITTER—(*Continued*)

manufacture one that is eminently suitable for the purpose.

Operation

Having assembled all the components, the wiring may be proceeded with, and as soon as this is finished the transmitter may be placed on test. Connect the aerial and counterpoise (or direct earth) to the appropriate terminals, and the clips on the coil in the positions in which they are shown in the diagram. A valve of the L.S.5 type should be inserted in the oscillator (V_1) socket, a six-volt accumulator across the L.T. terminals, and about 9 volts across the H.T.2 terminals. The main high-tension may be obtained either from dry cells, or from a small generator. The writer has used both a hand-generator made by Messrs. Evershed and Vignoles and an M-L Anode Converter supplied by S. Smith & Sons. It is best to use about 80 or 100 volts in dry cells for the first test, however.

First Trial

Remove the microphone plug, and, with about 100 volts high-tension connected, rotate the dial of C_2 slowly, leaving C_1 in the *minimum* position. At one point on the dial the thermo-ammeter should give a "kick," indicating that the set is radiating properly. Should it not do so, the receiver should be tuned to about 200 metres to see if the transmitter is oscillating. If it is, a heavy click should be heard when the H.T. supply to the transmitter is made and broken. (A key may be inserted in the negative high-tension lead for the purpose of signalling by telegraphy, and this may be used as a switch during these tests.) Once the transmitter has been found to be oscillating correctly an aerial current of about ·1 ampere or more should be obtained with 100 volts or so on the anode of the oscillator. The input milliammeter should not indicate an anode current greater than about 6 milliamps. with 100 volts on the anode of an L.S.5 type valve. The H.T. may now be increased, until with 300 volts or so a full-scale deflection of the aerial ammeter should be obtained.

The wavelength should now be about 160 metres, and may be raised by increasing the value of both grid and anode condensers simultaneously. The aerial current should not vary much during this process.

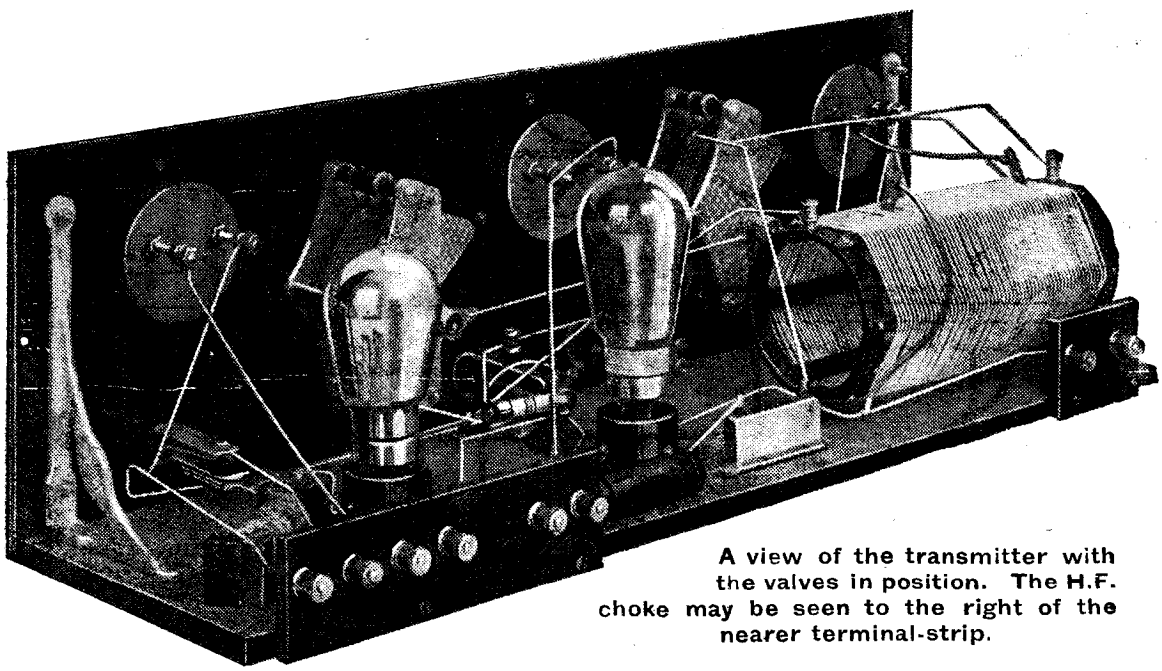
Telephony

Telephony may now be attempted. Screw down the key (or switch on the high-tension), insert a valve of the power type in the modulator socket, place the microphone plug in position, and speak. The milliammeter needle and the aerial ammeter needle should both "duck" slightly, and quite large deflections should be obtained if you whistle into the microphone. It is well to listen on the receiver to make certain that the speech quality is as it should be, although the writer experienced no difficulty at all in this direction. Really reliable reports should be obtained from distant stations before anything is taken for granted.

Values

It should now be noted that the input is at its lowest point when the filament tap is as near the *grid* end of the coil as possible. Thus, if the input is very low and the reader desires to increase it (thereby increasing the output as well), the filament tap may be moved higher up the coil. To compensate for this, *more* capacity across the anode section and *less* across the *grid* section must be arranged by the condensers C_1 and C_2. If a high voltage is being used on the anode of the oscillator (the writer's anode converter delivers 600 volts), the tappings may be adjusted so that the anode current is as low as 10 milliamperes, giving a power of six

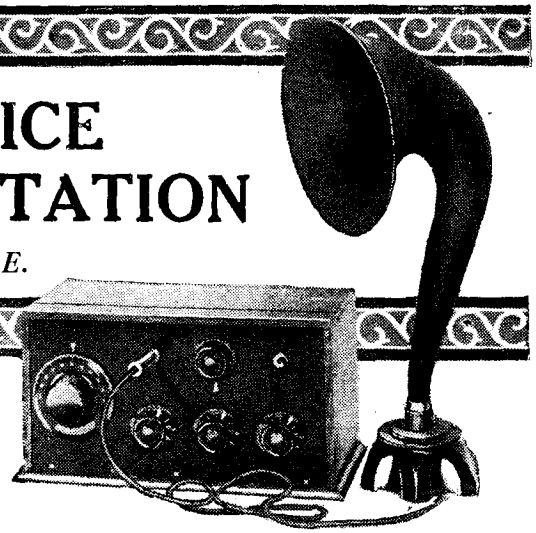
(*Concluded on page* 427.)



A view of the transmitter with the valves in position. The H.F. choke may be seen to the right of the nearer terminal-strip.

SOFTENING THE VOICE OF THE LOCAL STATION

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



In this interesting article the Chief of the Research Dept. of Marconi's Wireless Telegraph Co., Ltd., gives some helpful hints upon tuning and volume control.

A NUMBER of methods of controlling strength of signals can obviously be suggested, but as one or two of these are of considerable use during tuning operations, as well as for simple strength control, I propose to discuss some of them at length here.

I am not fond of sets designed to alter the number of valves for different conditions. Usually the switches are troublesome and one is apt to be tied up in the arrangement of valves. As an example of this the common habit of cutting in and out the second low-frequency valve limits one to using two valves of the power type, which again limits one to transformers.

Controlling Strength

A compromise L.F. circuit of which I am fond on account of its good quality and high sensitiveness is as in Fig. 1, where the rectifier and first note magnifier are DE5b type valves and the last a power valve. To cut down the number of valves in this arrangement necessitates jumping the second DE5b with rather too big a drop in magnification—or if putting valves in and out is permissible, of course the power-valve could be shifted back. This is bad practice, however, on account of the danger of broken filaments. I am strongly in favour of leaving severely alone and even putting one's telephones on through a high resistance to the last valve.

Mistuning

Everything tends to show that the control of strength should take place in the H.F. circuit, and all those sets only sensitive enough to take the local station, of course, have the immediate control of mistuning, which, in that case, is a perfectly legitimate control to use, but which will be troublesome when we have pairs of local stations. Sets with one or more tuned H.F. valves with their attendant condensers can of course be treated in the same way if the condenser moves separately, and here the condensers can not only be mistuned to the wave

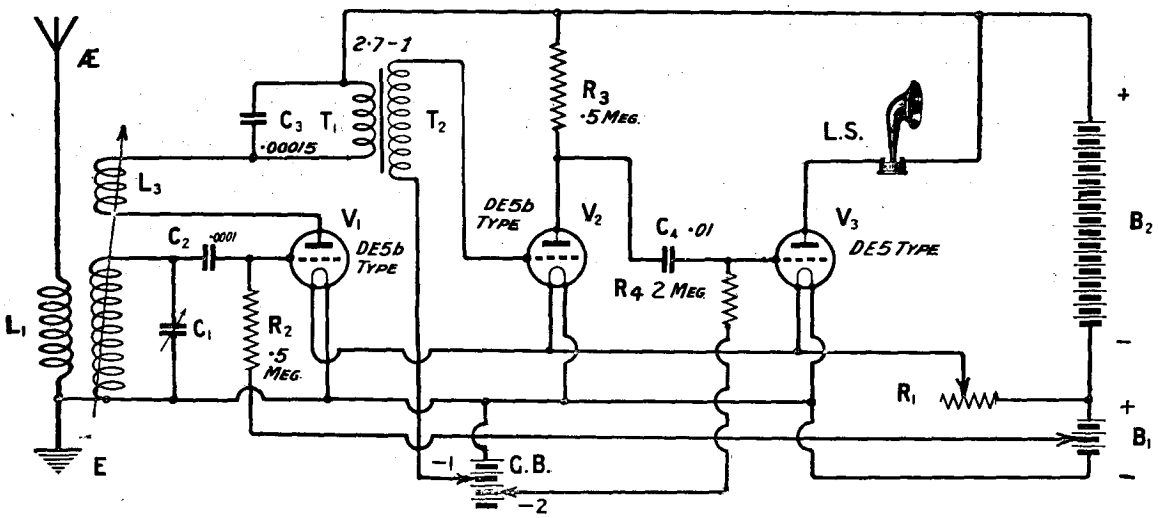


Fig. 1.—A sensitive three-valve circuit utilising two stages of L.F. amplification. Note that one side of the grid-leak is taken to a tapping on the L.T. battery.

SOFTENING THE VOICE OF THE LOCAL STATION—*(Contd.)*

but mistuned to one another. One curious case arose in a neutralised 2 H.F. valve receiver with three condensers linked together. Mistuning all the condensers at once merely gave me another station, and my object was to weaken London, so that I was forced to add another strength control. Three methods were tried, and all were successful, but they led me to consider more carefully the general actions of strength and tuning.

The First Method

The first method was to control the filament brilliancy of the H.F. valves below a certain fixed maximum, and the second was to control the high-tension voltage on the H.F. valves, and the third was to alter the grid bias. All methods seem to be good and produce no distortion of signals, if not carried too far.

With one H.F. alone the effect of any of these operations is not usually sufficiently marked, but with two high-frequency valves it is a very useful control, as we have the square of the effect with only one valve.

The control of the filament brilliancy was to my knowledge first used by C. E. Prince during war time to enable him to control at a distance his aeroplane amplifier, and in broadcast sets it might be used for the purpose now, enabling one

Where no volume control is included in the design quite a lot can be done by adjusting the filament brilliancy of the H.F. valves.

to lock one's set up in a cupboard near by and control its strength from any room in the house.

Strength control on the L.F. amplifier by either H.T. or filament seems to be quite wrong, and this in the majority of cases includes the rectifier.

A point I have particularly noted is that H.F. filament control gives one a very valuable aid to tuning, in a way almost identical with loose coupling.

A Valuable Aid

Suppose you have a set with one H.F., one detector and one L.F., and with this set the local station tends to come on over a longer wave range of the set than you want.

Of course, standard practice is to weaken the coupling between the aerial and the first coil by any of the well-known methods, bringing up the signals required by using reaction; but if your first valve is neutralised you can to some extent perform the same operation by dulling the H.F. filament and bringing up the signals required by reaction.

The weakening permissible on one valve is not very great, but with two valves or more in cascade, when they are all weakened together, the control possible is quite large.

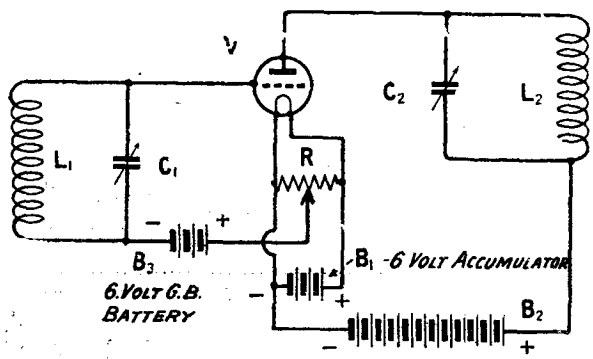


Fig. 2.—A method of controlling grid-bias without having to connect the potentiometer across the grid battery.

I have in front of me now a circuit with two tuned H.F. valves, reaction on to the last circuit from the rectifier and two L.F. stages. On this circuit with all filaments well up and reaction at zero, London is of course of overpowering strength when fully tuned in, but by dulling the first two valves simultaneously the signals are brought down to just a nice loud-speaker strength without any perceptible distortion—that is the first use of such a control.

Assisting Selectivity

Now, if I put the set at full brilliancy again, tuned up to 400 metres, I can still hear London. But suppose I want to get Newcastle the way I do it is this: I set to about 400 metres, dull my two H.F. filaments down till London is negligible, and then I bring up my reaction as near as possible with safety, and then search a little until I get Newcastle. Similarly I can get Bournemouth without any trace of London, and with a fourth circuit in Cardiff and Manchester are quite easy to handle, using in each case this method of working which in action is almost identical with loosening couplings and much easier to apply.

SOFTENING THE VOICE OF THE LOCAL STATION—*(Contd.)*

Adjusting Grid Bias

In some cases it may be easier to use the high-tension control, either by plain tappings on the H.T. battery, say, from 80 volts down to about 50, with a fixed grid bias setting, or the H.T. may be left alone and the grid bias altered by a potentiometer. A trick for making this operation continuous without running down the grid bias battery with a potentiometer is shown in Fig. 2.

Principles Involved

All these methods depend on an alteration of slope of the valve characteristic. Theoretically dulling a valve filament should not seriously alter its curve until saturation is arrived at, but a valve filament is cooled at its ends by the attached metal legs, and as we reduce the current, less and less of the filament gets into action, thus flattening out the curve.

Reducing the high-tension obviously takes us down the valve curve to a point with less slope, and finally increasing the grid bias takes us to a point of less slope.

Less slope means a higher impedance valve, and even if the magnification constant remains the same this in general reduces the magnification in a circuit such as Fig. 2, but it also reduces the damping applied to L_2 C_2, so that in this way, even in the circuits previous to the last one, where reaction is applied the tuning is being improved, although it cannot obviously be reduced below the natural damping of the coils.

If there is any tendency to oscillate due to accidental reaction, this will not usually be increased, because the overall magnification falls off as the tuning improves, but of course in the last circuit, where deliberate reaction is being employed, as the damping of the previous valve is removed a slight decrease of this reaction will be required if one is anywhere on the edge of oscillation.

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

Mr. J. H. REYNER.

A NEW APPOINTMENT.

Commencing with the current issue, Mr. J. H. Reyner will act as Editor of MODERN WIRELESS. In making this appointment I have taken into consideration the fact that a greater portion of my time is taken up in technical development work. No change of policy accompanies this appointment, and I shall continue to act as Editor-in-Chief.

The appointment of Mr. Reyner as Editor will relieve me of certain editorial work, and no one is more fitted than he to take over officially duties which he has in fact carried out for a considerable period during the last year.

Readers may rest assured that we all intend to make MODERN WIRELESS better and better. This issue, the first bearing Mr. Reyner's name as Editor, speaks, I think, for itself!

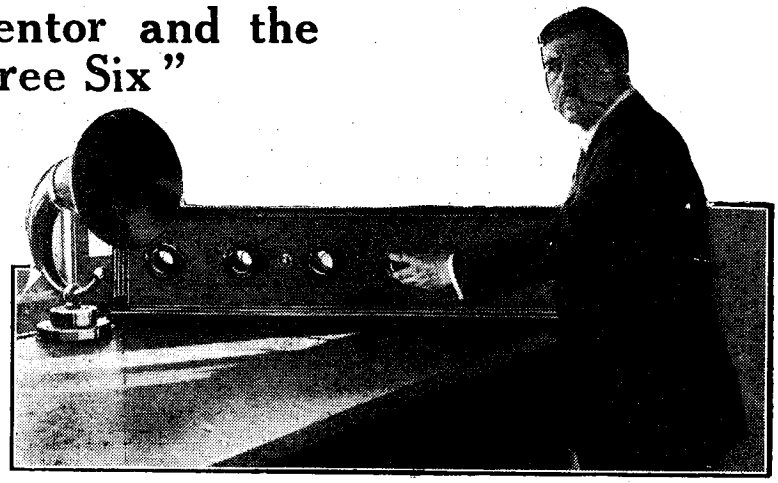
John Scott-Taggart

Chairman and Technical Director of Radio Press Limited, Publishers of "Modern Wireless."

PROFESSOR HAZELTINE AT ELSTREE

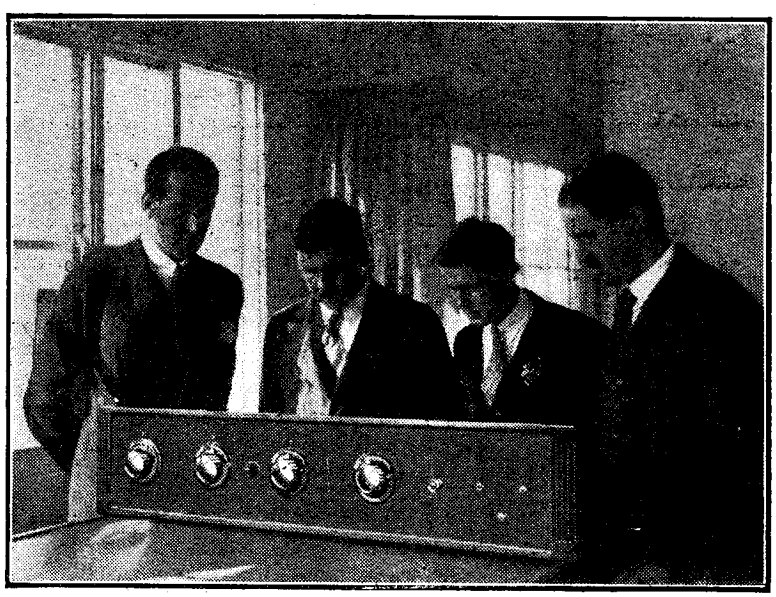
Great Inventor and the "Elstree Six"

"Equal to the Best I have heard in America."



Professor Hazeltine is here seen himself operating the "Elstree Six."

THE famous American inventor, Professor L. A. Hazeltine, who recently paid a visit to this country, quickly availed himself of the opportunity of visiting the Radio Press Laboratories at Elstree. He was received there by Mr. John Scott-Taggart, Mr. Percy W. Harris, and Mr. J. H. Reyner, and was first shown several of the latest "Radio Press" receiver designs, and afterwards the "Elstree Six."



The centre of attraction—Professor Hazeltine examining the "Elstree Six" with Mr. John Scott-Taggart, Mr. J. H. Reyner and Mr. Harris standing by.

Nothing but Praise

Professor Hazeltine himself tuned in a number of stations on this receiver, and immediately expressed his appreciation both of its sensitivity and its selectivity. He thought the latter was as great as it was possible to obtain without cutting off side bands from telephony and introducing undesirable distortion. He was, in short, very much impressed by the entire performance of the "Elstree Six," and remarked that the problem of separating London from Cardiff was greater than the average "separation" difficulty in New York. His opinion of the quality of reproduction was "Excellent." The actual words he used were: "This is certainly equal to the best I have heard in America."

In America

Professor Hazeltine said that the trend of development in America was in the direction of increased numbers of valves, chiefly on account of the number of sets in blocks of flats, where no outside aerial was practicable. Several six-valve sets were also on the market. Listeners in the States are rapidly becoming more critical about the quality obtainable from their sets, and were also demanding an improved high-tension battery eliminator.

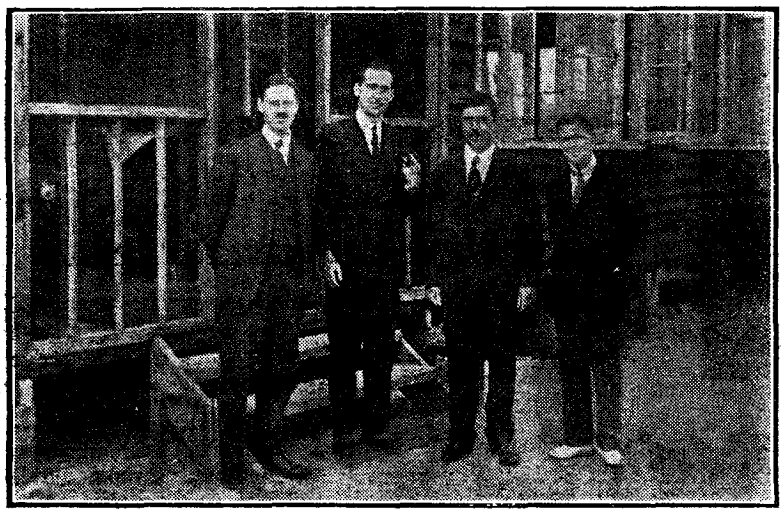
The Howler Problem

He expressed great surprise at the acuteness of the oscillation problem in this country, but congratulated Radio Press on the good work that is being carried out at Elstree, remarking that both the listeners and the Press should be grateful to them for the way in which they are "serving the art."

The "Wireless Dealer" Lunch

On July 15 Professor Hazeltine was the "guest of honour" at a luncheon given by the proprietors of the *Wireless Dealer* at the Savoy Hotel. Many other distinguished guests were present, including Mr. Willis H. Taylor, of the Hazeltine Corporation, Sir Edward Marshall-Hall, K.C., Capt. Ian Fraser, M.P., Capt. P. P. Eckersley, Capt. H. J. Round, Lieut.-Commander Kenworthy, Lieut.-Col. Eric Ball, and nearly a hundred others. Mr. Percy W. Harris was in the chair.

PROFESSOR HAZELTINE WORKS THE "ELSTREE SIX"



Outside the Elstree Laboratories. From left to right: Mr. Percy W. Harris, Mr. John Scott-Taggart, Professor Hazeltine, and Mr. J. H. Reyner.

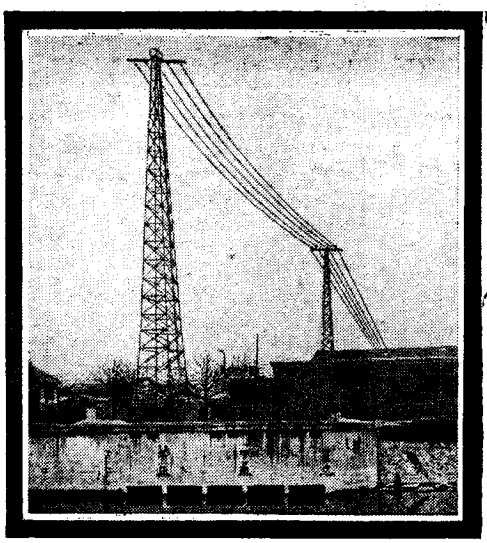
Review of Radio

Mr. Harris welcomed Professor Hazeltine, who replied in an important speech, reviewing the steps which have led wireless up to its present stage. After dealing with important developments, such as tuning, rectification, and the three-electrode valve, with due homage to the pioneers, Professor Hazeltine touched upon the effect on modern radio design of the practice of the neutralisation of capacity coupling in valve sets.

"The Scott-Taggart Neutrodyne"

He pointed out that for the last stage the honours were due both to America and Great Britain, for he himself in America and Mr. John Scott-Taggart developed a stable tuned high-frequency amplifier almost simultaneously. While in America it is called the Hazeltine neutrodyne, in Great Britain it should certainly be called the "Scott-Taggart neutrodyne."

At the U.S. Bureau of Standards investigations are being made into the cause of the fading of wireless signals. Some of the apparatus used is shown in the above photograph.



BRINGING THE CONTINENT TO YOUR DOOR

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

Who describes in a simple manner the essential points which should be borne in mind by those who wish to obtain the best results from a stage of H.F. amplification.

IN these days, when completely stable high-frequency circuits are available, the use of one or more stages of high-frequency amplification in a receiver is becoming more and more popular. Even the veriest novice finds that he can add an H.F. valve without making the set appreciably more difficult to handle, so that he is able clearly to hear foreign stations all over the Continent previously not received.

With the old circuits, especially the tuned anode, the use of even one stage of H.F. in an efficient receiver was liable to introduce uncontrollable oscillation, so that except in skilled hands little or nothing could be done with it. It is now a simple matter, however, to use a neutralised form of tuned anode coupling which is perfectly stable. In fact, neutralised forms of the old circuits can be used, thus enabling the maximum H.F. amplification per stage to be obtained.

Damping

The value of this is rapidly being realised, since it enables reception to be carried out over greater distances with far more ease and certainty. With a receiver that needs a great deal of damping introduced into one or more of the H.F. circuits, in order to hold it down, it is obvious that the H.F. stages will not be pulling their weight, and not only volume but selectivity also will suffer. In a set not using high-frequency amplification the critical use of reaction is required to bring in any other than the local station, and this is extremely likely to introduce distortion, while the fact that the set is just on the verge of oscillation and has to be kept there does not make for easy operation by those without much experience in wireless reception.

There are many, no doubt, who have considered the addition of, say, one stage of H.F. to an existing receiver, or who intend constructing a receiver with an H.F. stage or two, in order to enable continental transmissions to be heard, and some of them may be somewhat uncertain how to go about the job.

Estimating Space

The first thing to consider in the design of the H.F. side of a receiver is the amount of room available. In many cases limitations are imposed by factors beyond control, so that it is imperative that a certain space must not be exceeded. It is as well, therefore, to bear in mind just what is the minimum space that can be occupied by one stage of high-frequency. I generally reckon this stage as comprising the input and output circuits so that two tuning condensers and two or more inductances are involved, depending on the circuit employed.

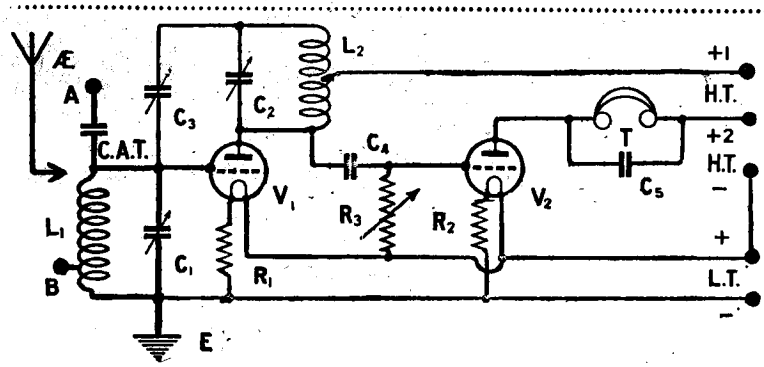


Fig. 1.—A useful form of neutralised circuit to use where space is limited.

A Suitable Circuit

Where space is limited the most suitable circuit to use is that shown in Fig. 1. As will be seen this can be arranged so that only two coils are used. The aerial circuit consists of a coil L_1 which may either be auto-coupled to the aerial by connecting this to a point B, as shown, or by the well-known device of constant aerial tuning (C.A.T.), in which case the aerial is connected to A, the value of the small series condenser being usually .0001.

The anode inductance is tapped at the centre, to which point the H.T.+ lead is connected. The end opposite to that connected to the anode of the H.F. valve is connected back on to the grid through a neutralising condenser C_3, the value of which should be variable between

BRINGING THE CONTINENT TO YOUR DOOR—(*Continued*)

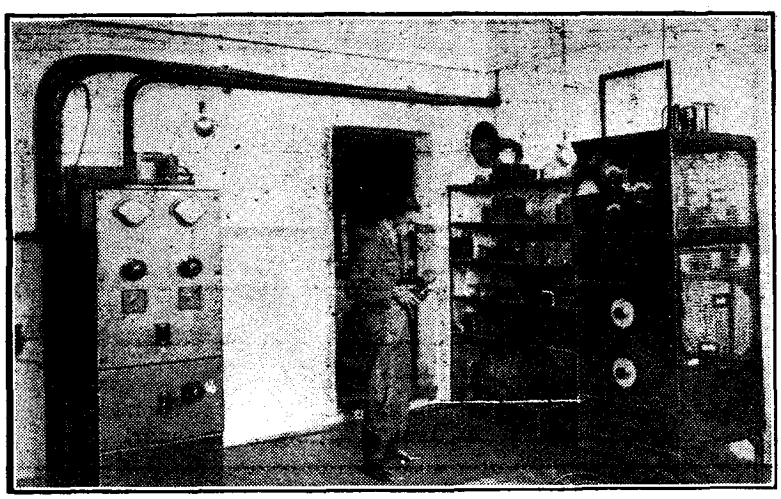
about 2 and 20 micro-microfarads. This condenser may conveniently be mounted on the panel and forms a simple method by means of which reaction can be controlled. It should be used with care and discretion, however, since the upsetting of the balance to obtain reaction will result in energy being radiated from your aerial if you allow the receiver to oscillate.

Fieldless Coils

If there are no objections to the employment of special means to prevent unwanted coupling between the grid and anode circuits there are two methods open to the experimenter, these being fieldless coils and screened coils. The choice will be largely decided by the question of cost since both methods are efficient.

The room taken up on the panel by the two tuning condensers will not be less than 7 in. or 8 in., and it is advisable for the average constructor to give the same amount of space to the rest of the circuit and not to try to compress it into a smaller space.

A practical point about the Fig. 1 circuit is that both sides of the anode condenser C_2 are at high H.F. potential, and that therefore this condenser will be somewhat liable to hand capacity effects unless special precautions are taken. The only things that can be done are either to mount the condenser well behind the panel and fit the spindle with an insulated extension handle or else to purchase a type of condenser in which this is already done in some way. In both cases a metal shield may be placed with advantage between the condenser and the operating dial, this shield being connected to L.T. negative. Care must be taken, of course, to see that the shield is insulated from the condenser itself or else the H.T. battery will be shorted.



The Assistant Engineer at the Johannesburg broadcasting station checking the wavelength of the transmitter.

Values

Suitable values for the 200 to 500 metre wavebands in the Fig. 1 circuit are :—L_1 and L_2 No. 50 coil

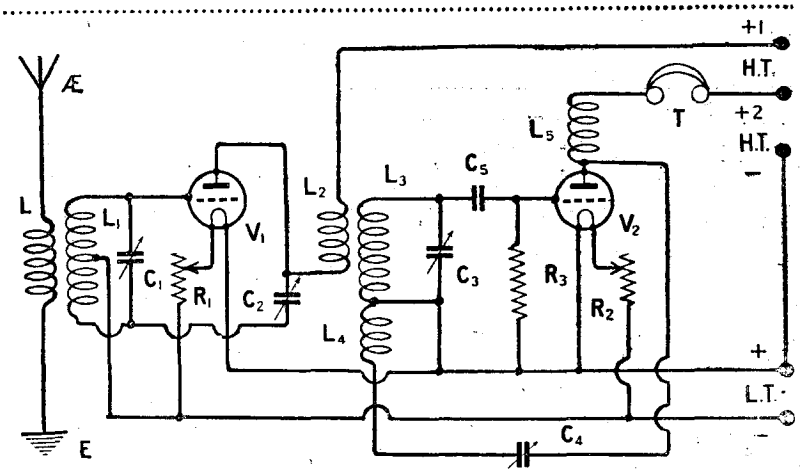


Fig. 2.—In this circuit C_2 is the neutralising condenser, while reaction is controlled by means of the condenser C_4.

(about 200 mics.), C_1 and C_2 .0005 each, and C_4 and R_3 the usual values for grid condenser and leak, though it may be an advantage to have the leak variable as indicated in the circuit.

Those who wish to make their own coils will find that 40 turns of gauge 34 d.c.c. copper wire wound on a 3 in. former will give them a value of about 200 mics, and this should tune in 2LO at about 90 degrees on a .0005 variable condenser with a 180 degree dial. Birmingham should be received at about 130 degrees and Newcastle at about 105 degrees, other wavelengths coming in at intermediate points.

A Popular Circuit

A form of neutralised circuit that is proving popular is shown in theoretical form in Fig. 2. In this case the grid coil L_1 has one end connected to the grid of the H.F. valve the other end being connected through a neutralising capacity C_2 of the plate to the valve. The centre point of L_1 is connected to L.T.—the whole coil being tuned by a variable condenser C_1. The output is transformer coupled to the detector valve, as shown, while "Reinartz" reaction is indicated in the diagram.

Stray Coupling

Since the two tuned circuits are

BRINGING THE CONTINENT TO YOUR DOOR—(Continued)

the grid circuits of the H.F. and detector valves the question of stray coupling is not quite so serious as in the preceding circuit from the point of view of stability, though, of course, its effect on the efficiency of the circuit must not be overlooked. Due care in spacing the coils should therefore be exercised, especially if inductances with a widely distributed field are used.

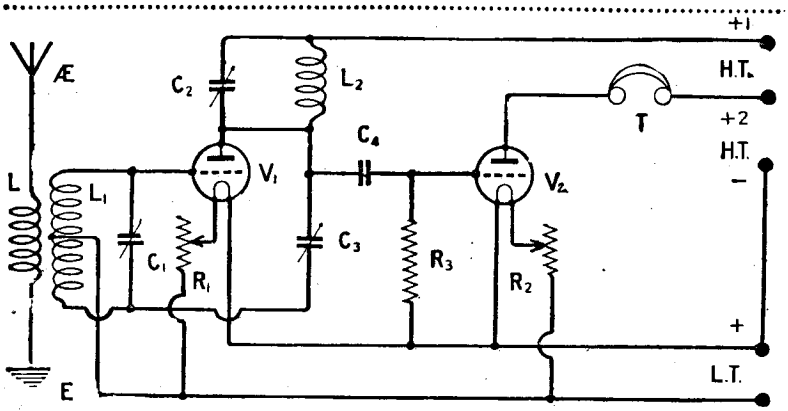


Fig. 3.—In his experiments the author was unable to obtain satisfactory neutralisation with this type of circuit.

It is interesting to note here that any attempt to combine the Fig. 1 and Fig. 2 circuits in some such manner as shown in Fig. 3 may be found to be unworkable. I recently made up an experimental set in which I tried to do this, and though I experimented with several variations of the circuit none of them could be got to stabilise properly. I also tried the scheme with transformer coupling, using the conventional plug-in H.F. transformer, either with tuned primary or secondary winding. Results were, however, by no means satisfactory in either case, and all the results obtained indicated that the centre-tap grid coil method of neutralisation was not suitable for use when the anode circuit of the H.F. valve was fully tuned.

In cases where it is desired to tune the anode circuit then the centre-tap anode coil method as shown in Fig. 1 was employed.

Shunt Feed

A variation of this circuit which is favoured by many employs a form of the tuned anode circuit that I first made use of about eighteen months ago, namely, the shunt-feed tuned anode. In this circuit the H.T. potential for the H.F. valve is applied through a high-frequency choke, the tuned circuit being connected between grid and filament of the detector valve, a small stopping condenser being connected between the anode of the H.F. valve and the grid of the detector valve so as to prevent the H.T. battery being short-circuited. This arrangement separates the D.C. and H.F. currents in the plate circuit of the valve.

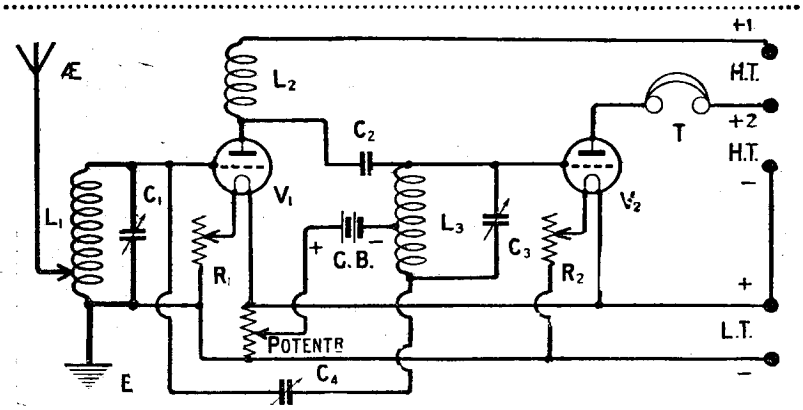


Fig. 4.—A shunt-feed circuit which the author found gave good results. C_2 is a stopping condenser.

Anode Rectification

It also enables anode-bend rectification to be used, or else a special circuit, such as the Prince Trigger circuit. Its application is shown in Fig. 4, and it will be seen to be practically the same as the Fig. 1 circuit except for the fact that shunt instead of series feed is used. The neutralising condenser is shown at C_4, while C_2, the coupling condenser, may suitably be about .0003 in capacity. This value, however, is not critical.

It is important in shunt-feed circuits that the H.F. choke in the plate lead of the H.F. valve not only has a low distributed capacity but also has low dielectric losses otherwise the efficiency of the circuit will be seriously impaired.

The Grid Coils

It is also important to place the choke (or chokes if more than one stage is used) so that it is well away from the fields of the grid coils. Particular attention must also be paid to the spacing of the grid coils and the coupling between them must be reduced to as low a value as possible if the maximum amplification is to be obtained.

It will readily be seen that excessive coupling between these circuits will result in part of the signal energy in the circuit L_1 C_1 being inductively transferred to the detector circuit L_3 C_3 without amplification at all, the loss of selectivity on distant transmissions being marked.

A Useful Hint

In order to reduce this unwanted coupling experiments should be carried out with the H.F. valve removed from its socket so as to see what arrangement of the coils in the receiver, together with the directions of their windings, gives the least transfer of energy into the detector valve circuit. Such experiments will most readily be carried out where the location of

BRINGING THE CONTINENT TO YOUR DOOR—*(Concluded)*

the receiver is close to a broadcasting station, though if too close it must not be forgotten that there will be a decided amount of direct pick-up on the coils themselves.

Transformer Coupling

Where transformer coupling is employed considerations that enter into the design are whether maximum amplification or selectivity is desired. Suppose the Fig. 2 circuit is to be used, then increased selectivity is obtained by loosening the coupling between aerial and grid coils (L and L_2) and between anode and grid coils (L_2 and L_3). This may be done in two ways (1) by reducing the number of turns in L or L_2; (2) by placing these coils further away from their respective grid coils. From considerations of space (1) is the course preferable, though from considerations of efficiency (2) is the better method.

For maximum amplification the coupling will of course be tighter, but this must not be carried too far in either case. Measurements which have been taken show that there is a certain number of turns in the aerial circuit which, if exceeded, results in a reduction in signal strength, while if the coupling between L_2 and L_3 is made too tight L_2 will approximate to a tuned circuit and the stability of the receiver will be affected.

Layout

In deciding on the layout of the receiver it is advisable that all high-frequency leads be made as short as possible and a couple of arrangements are shown sketched in Fig. 5. At the top is shown a layout which would be suitable for use with the Fig. 1 type of circuit and it will be seen how short anode and grid leads are provided for. The aerial coil should be placed so that its field is well clear of the variable condenser which tunes it, while the anode inductance is placed at right angles well away from the aerial coil. The effect of reversing the connections to one of these coils should be tried, since this will affect the coupling between them. A low-frequency stage is indicated, and it will be noticed that the L.F. transformer is placed well away from the field of the anode coil.

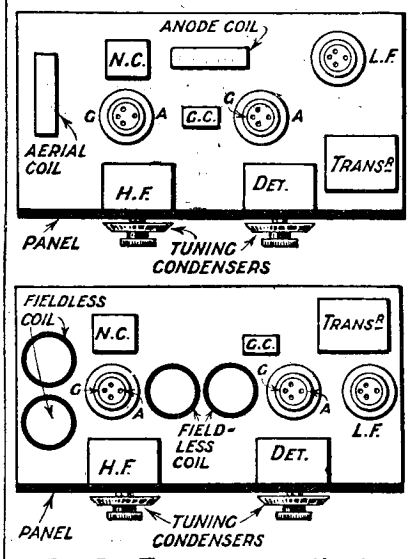
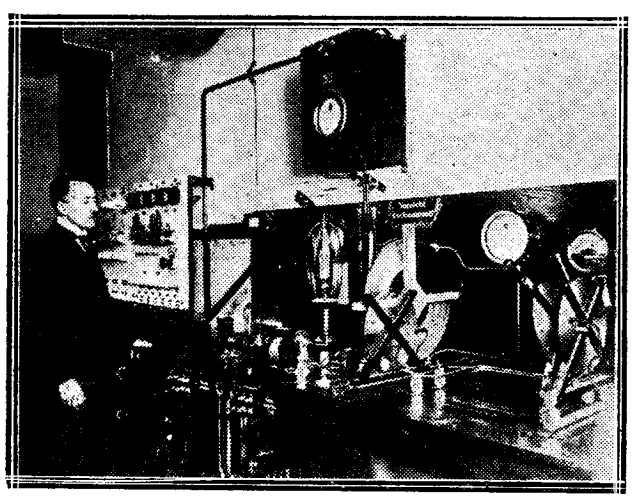


Fig. 5.—Two good methods of laying out a three valve set. In each case short leads are a feature.



The Hamburg station is one of the most easily received in this country. Some of the transmitting apparatus may be seen above.

I show above a suggestion for laying out a receiver using fieldless coils, and the arrangement shown is probably slightly preferable to that in which the two fieldless coils are similarly placed.

Short Leads

In both layouts the neutralising condenser is shown mounted right against the valve-holder so that the leads to it shall be as short as possible. If it is intended to use the neutralising condenser as a reaction control it may be mounted on the panel, but its position should be such as to avoid long leads being required.

H.F. Valves

A question that is frequently raised is with regard to the type of valve to use for high-frequency amplification, and it may be generally stated that a high-impedance valve will be found most satisfactory. In some cases a small power-valve of the 5-volt ¼ ampere type will give a greater signal strength, but the degree of selectivity obtained will certainly be not so good.

Suitable Impedances

A suitable impedance for a valve to use for H.F. work appears to be between 25,000 and 60,000 ohms, this depending on the type of circuit employed. It is, of course, difficult to lay down hard-and-fast rules, since the impedance of the valve should be suitably related to that of the external anode circuit. This will, of course, vary according to the value of the inductance used and its H.F. resistance, but in most cases the Fig. 1 circuit may work better with a higher impedance valve than that which would give the best results with the Fig. 2 type of circuit.

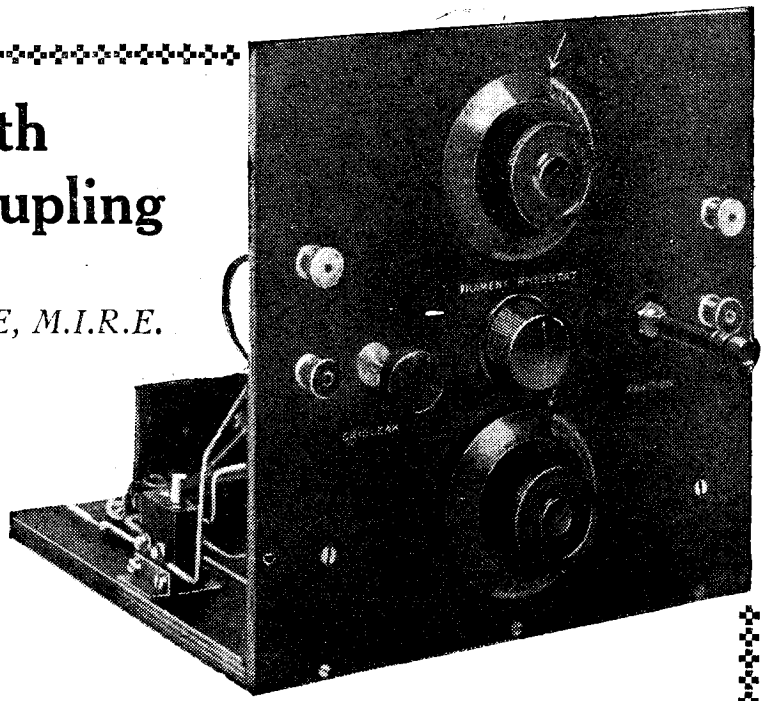
The "Screened Coil Three"

In our last issue a three-valve receiver was described by Mr. J. H. Reyner under the above title, and a list of stations heard was given. It was not specified in this list whether phones or loud-speaker was used, and it should be added that loud-speaker results were obtained in each case.

Selectivity with Capacity Coupling

by
STANLEY G. RATTEE, M.I.R.E.

This neat little one-valve set is capable of cutting out the local main station, and of receiving other British and Continental stations. At a distance of ten miles the author is able to eliminate 2LO and to receive Bournemouth at good strength.



IN so far as reception of any station other than the local is concerned, the success or otherwise is mainly dependent upon whether the receiver is selective.

Ruling out crystal sets, which, after all, cannot be seriously regarded as being capable of receiving more than the local and Daventry stations, where the broadcast listener is concerned, it is usually found that the most generally unselective set is a single-valve receiver. Even though certain two-valve sets may not be all that could be desired in this direction, so long as one of the valves is used for H.F. amplification, the degree of selectivity of such a set is more often than not above that of the ordinary single-valve set.

The reason for this is probably due to the fact that the majority of experiments are carried out upon circuits using more than one valve, for as soon as one departs from the more conventional type of circuit, the single-valve receiver behaves in a most encouraging manner, indicating that like its bigger brothers it is capable of doing really interesting things.

Coupled Circuits

Once we get away from the direct aerial coupled circuit and incorporate some form of inductive arrangement the improvement is felt, and experiment along these lines will be found to be most enlightening.

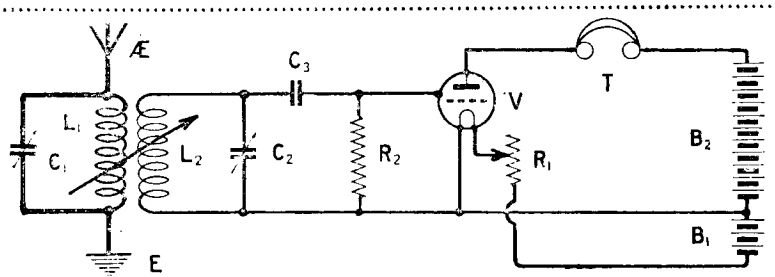


Fig. 1.—A loosely coupled circuit of this type suffers from the disadvantage that any alteration in the coupling between L_1 and L_2 has an appreciable effect upon the tuning.

Given a suitably smooth control of reaction and a really sharp tuning grid circuit, the elimination of the local station and the reception of the distant transmission becomes a feasible proposition, and as an instance of this fact the receiver to be described is capable, both at Elstree and in the Crystal Palace district, of cutting out London and receiving at moderate strength such distant stations as Bournemouth, in spite of the proximity of their wavelengths.

In the Present Case

Actually there is nothing revolutionary in the circuit, in fact there is not even anything new, but by a careful lay-out of the components and loosening the coupling as much as possible without any appreciable loss in signal strength, the desired effect has been brought about.

Readers will probably recall the circuit given in Fig. 1 as being that of a one-time popular arrangement employing loose-coupling, the degree of selectivity being obtained by varying the coupling between L_1 and L_2. Those readers who have tried this arrangement will remember how difficult the circuit is to handle on account of the fact that variation of the coupling upsets the settings of the tuning condensers, and if the desired station is at all weak the operation of tuning becomes not only tedious but decidedly irritating.

In the receiver illustrated a form of loose-coupling is also used, but the degree of coupling is fixed to such a value that the local station can be received at good strength, but can when desired be completely tuned out over a few degrees of either tuning condenser or both.

SELECTIVITY WITH CAPACITY COUPLING—*(Continued)*

The Circuit Used

The arrangement of the two tuned circuits in the receiver layout is such that there is practically no coupling between them; there is a little, it should be understood, but this is of so low an order that if used alone the loss in signal strength is quite considerable.

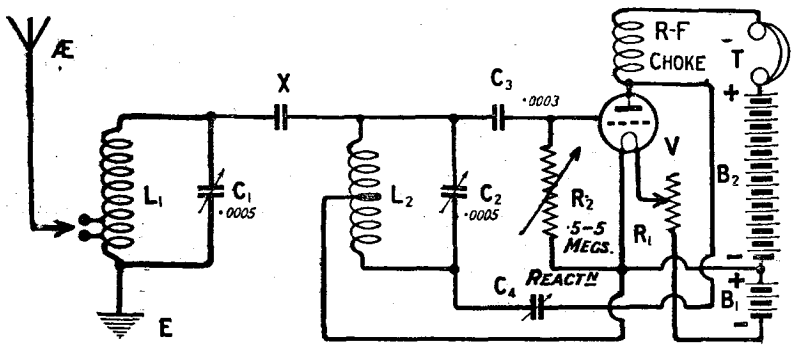


Fig. 2.—The theoretical circuit of the receiver. The small condenser marked X consists of two short parallel lengths of wire.

The two tuned circuits may be seen in Fig. 2, as L_1 and C_1, and L_2 and C_2. L_1 is an X coil, auto-coupling being used for the aerial connection, the whole coil being tuned by a ·0005 variable condenser. L_2 is a centre-tapped coil, tuned by another ·0005 variable condenser, while the centre tapping is taken to the positive of the low-tension battery.

The coupling between these two circuits is determined by the fixed condenser shown in the diagram at X, and this in practice, instead of being a fixed condenser of conventional type, is actually made by laying two pieces of insulated wire, one upon the other, and binding the two together by means of insulating tape.

It will be appreciated that this "condenser" is of very small value, the length of overlap determining the actual capacity; in the set as photographed this overlap is about one and a half inches.

The Reaction Control

In order that the reaction control may be easily adjusted and at the same time smooth in its control, without appreciably affecting the tuning adjustment of the condensers, capacity control is used as shown by the condenser C_4, which is in fact a "Neutrovernia" condenser.

Realising that with some types of valves the condenser may not in itself be sufficient to give a satisfactory reaction effect, the receiver is also fitted with a variable grid leak, variation of which in conjunction with a suitable adjustment of the filament current and H.T. voltage, will enable the reaction effect to be obtained over the whole tuning range of the condensers.

Components and Materials

Those readers who contemplate building a receiver to the specification given herein will first need to collect the listed components and materials, bearing in mind the necessity for strict observance in the matter of values where mentioned. Readers desirous of duplicating the receiver in every detail will find the names of the manufacturers, or their trade marks, following upon the component or material named, though it should be borne in mind that other suitable makes may be chosen without hesitation from the advertisement pages of this journal.

When mounting the valve-holder it is advisable before screwing this to the baseboard to first insert a coil in the L_1 socket and a large valve in the valve holder in order to ensure that sufficient clearance is being allowed, not forgetting that the coil may be a No. 250 with auto-coupling taps.

The Coupling Condenser

The two wires which form the coupling condenser X are taken, one from the fixed vanes of C_1 and the other from the fixed vanes of C_2. These two wires may be seen in the photographs bound together by means of two pieces of insulating tape.

The best procedure to adopt is to arrange these two wires with about 2½ inches overlap, when, upon testing the set for selectivity the overlap may be shortened

COMPONENTS REQUIRED

One Ebonite panel, measuring 9 in. by 9 in. by ¼ in. ("Trelleborg.")
One cabinet to take panel, and baseboard, 9 in. by 8½ in. by ⅜ in. ("Camco.")
One ebonite strip with four terminals. (Burne-Jones and Co., Ltd.)
Quantity No. 16 "Glazite" connecting wire.
Packet Radio Press panel transfers.
Two coil sockets for baseboard mounting.
Two variable condensers, each of ·0005 capacity. (Jackson Bros.)
One fixed condenser, ·0003 capacity. (Dubilier Condenser Co., Ltd.)
Two right-angle brackets.
One variable grid leak, ½ to 5 megohm. ("Bretwood.")
One "Neutrovernia" condenser. (Gambrell Bros., Ltd.)
One anti-microphonic valve holder. ("Lotus.")
One radio choke. (Lissen, Ltd.)
One 35-ohm filament rheostat. (A.F. Bulgin.)
Four terminals, marked "Aerial," "Earth," "Phones +," "Phones." (J. J. Eastick and Sons.)
Short length of rubber covered flexible wire.
Quantity of small wood screws.

SELECTIVITY WITH CAPACITY COUPLING—*(Continued)*

by cutting off short lengths until the desired amount of coupling is arrived at, that is to say, when the required selectivity is obtained.

Trying It Out

Testing the set upon the completion of the wiring should be preceded by a careful check to see that all the connections are as laid out in the practical wiring diagram. Having satisfied oneself upon this point, connect the aerial, earth, 'phones and batteries to their respective terminals and then insert a No. 60 X-coil in the L_1 socket, connecting the flexible lead from the aerial terminal to, say, the larger tapping; insert a No. 60 centre tapped coil in the L_2 socket and insert a suitable valve in the holder. Turn the reaction condenser in an anticlockwise direction as far as it will go, connect up, say, 45 volts H.T. and light the valve.

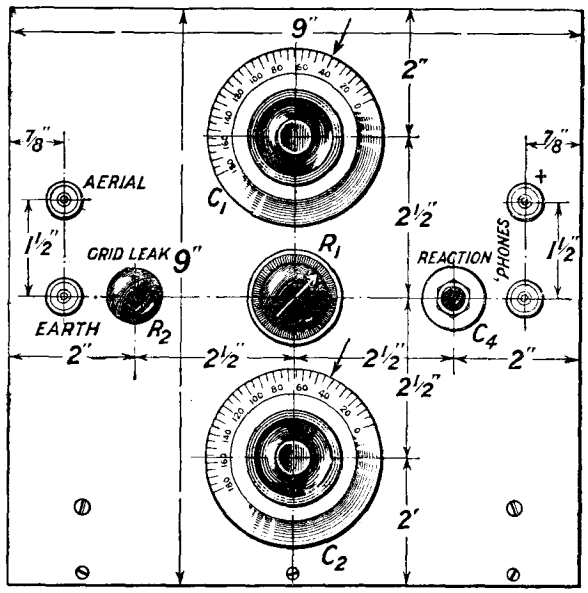


Fig. 3.—This drilling diagram may be obtained free of charge. Ask for Blueprint No. 175a.

By turning the two condensers C_1 and C_2 together from their zero readings, the local station, so long as it is working, will soon be found. Adjust C_1 separately so that the loudest signals are obtained, then do the same with the C_2 condenser. Now try tuning-in, say, Bournemouth, by slowly increasing each condenser one degree at a time, and if it is found that signals from the local station extend round the dial more than five degrees, reduce the size of the coupling condenser X by cutting off a little of the overlap; reducing this too much will, of course, mean an appreciable loss in signal strength. The operation, therefore, should be done with some care and patience, with a keen observance kept upon signal strength.

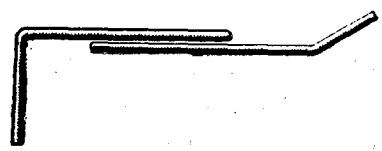


Fig. 4.—The condenser shown at X in Fig. 2 is adjusted by varying the overlap of the two lengths of insulated wire.

Wavelength near to the "Local"

In cases where the receiver is being used very near to the local station it may not be altogether possible to cut out local interference without loss of signal strength, but even in these circumstances the selectivity given by the present receiver will be found markedly superior to that given by the ordinary single-valve set, and will enable stations to be heard which previously were drowned out by the local transmission.

Operating the Set

It will be found that the dials of the two condensers are approximately the same in their readings, and for reception upon the broadcast band a No. 60 X-coil should be used for L_1 with a No. 60 centre tap for L_2. Where it is desired to receive 5XX or other long-wave stations, then L_1 should be a No. 250 X-coil with a No. 250 centre tap for L_2. Both tappings on the X-coil should be tried for the aerial connection, when it will generally be found that the smaller tapping gives greater selectivity, though possibly with some small loss in signal value.

Having tuned in, say, the local station by slowing turning the two tuning condensers together from their minimum reading, turning the reaction condenser in a clockwise direction will bring about a reaction effect. If it is found that reaction is "fierce," that is a loud "pop" is heard in the 'phones

WIRING INSTRUCTIONS

Join terminal A to spade tag (flex lead, L1 tap).

Join pin of L1 to terminal E and thence to moving plates of C1.

Join other side of L1 to other side of C1.

Join one side of L2 to fixed plates of C2 and to one side of C3. Between the latter point and fixed plates of C1 arrange the small condenser X.

Join remaining side of L2 to remaining side of C2 and to one side of C4.

Join other side of C4 to one side of R.F. choke and thence to A of valve-holder.

Join other side of R.F. choke to bottom telephone terminal.

Join top telephone terminal to H.T.+

Join remaining side of C3 to G of valve-holder and thence to one side of R2.

Join other side of R2 to F+ of valve-holder and thence to L.T.+ and H.T.—. From latter point take flex lead terminated by spade tag (L2 tap).

Join L.T.— to one side of R1.

Join other side of R1 to F— of valve-holder.

SELECTIVITY WITH CAPACITY COUPLING—*(Concluded)*

when the set is made to oscillate (a state of things which no reader should be guilty of), the value of the anode voltage should be reduced.

Testing the set for reaction control should be made outside broadcasting hours, when by reducing the value of the anode voltage step by step a value will soon be reached where the set slides into self-oscillation with a delightful smoothness. Should it be found, however, when this adjustment is made that the set will not oscillate over the full tuning range, then a slight adjustment in the value of the variable grid leak will have the desired effect.

Distance Work

When the reaction control has been satisfactorily adjusted it will be found that by careful handling the receiver may be maintained in a sensitive state throughout the whole tuning range, when a number of distant stations will be heard. It should be borne in mind, however, that before reducing the readings of either or both the variable condensers C_1 and C_2, the reaction condenser should be reduced slightly in value, otherwise self-oscillation will take place. The tuning of the C_2 condenser will be found extremely critical and careful operation is called for, otherwise the majority of possible stations will be missed; the handling of the C_1 condenser is not so critical, though careful tuning is still called for.

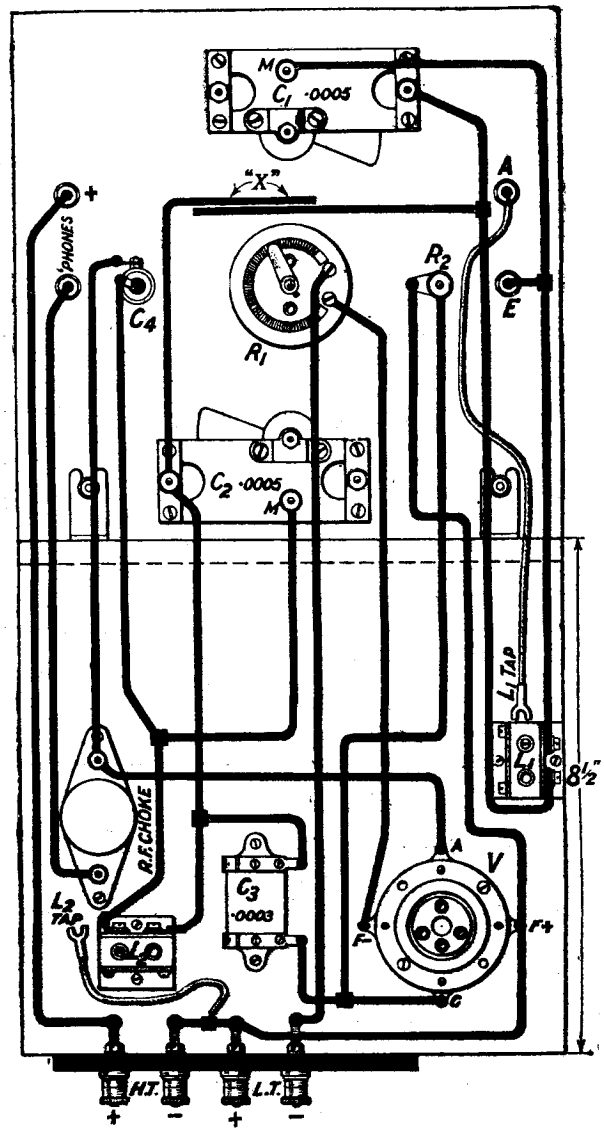
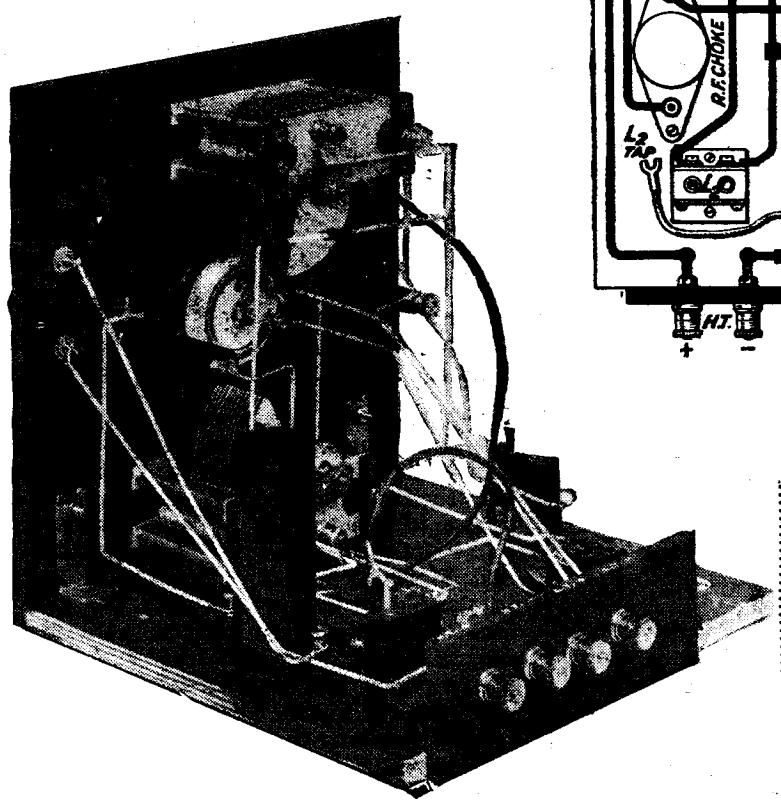


Fig. 5.—The pin of the L_1 coil socket should be joined to terminal E. Blue print No. 175b free.



Note that the two lengths of wire forming the condenser "X" are bound together with insulating tape.

The Author's Results

Using the receiver in South-East London at a distance of ten miles the London station can be tuned out with perfect comfort and Bournemouth received without interference. Similarly, a number of German stations whose wavelengths are near to that used by 2LO can also be received.

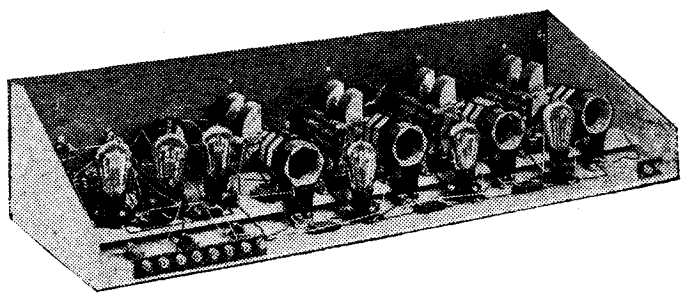
Other stations which have been heard and which have been identified are Birmingham, Hamburg, Madrid, Radio-Belgique, Daventry, Radio-Paris.

OUR NEW STAR SET POLICY

WE desire to announce to our readers that a new set design policy has been adopted. In past years readers of Radio Press journals have had a multitude of wireless receivers placed before them from which to pick out the ones they desired to build. We ourselves have never attempted to differentiate between the various sets, or to help the reader to choose. The result has been that he has often built the set designed by the most popular author, independently of whether or not it is the most effective design. Many readers consequently were cautious before building a set, and often waited until some more venturesome enthusiast had tried it out. The result was that it often took many months before a particular receiver achieved widespread popularity, and, for many, a wireless winter was spoiled by waiting to hear what someone else had done!

Rigid Tests

With our new laboratories at Elstree every single receiver published in our papers is put through rigid tests, and no one is more competent to judge the relative merits of different Radio Press designs than those in charge of the Laboratories. Although every set is required to come up to a certain standard there are bound to be certain small variations in what the sets will do. Readers must remember that cheapness, quality of components, appearance, convenience, selectivity, signal strength, quality of reproduction, simplicity of control, etc., etc., are all features about which people have different opinions. It is impossible to say that any particular set is the ideal for every reader.



The "Elstree Six" receiver which was described in the June issue of this journal.

Production

The production of wireless designs is very much like the production of motor-cars. Motor-car users do not refuse to buy merely because they cannot afford a Rolls-Royce. Moreover, there are dozens of motor-cars of a standard price which are chosen by motorists for entirely different reasons. One man may prefer a touring car, another a limousine. One motorist may prefer a car capable of doing 70 miles per hour, another prefers a roomy, comfortable automobile for family use. It is much the same in the case of wireless sets. Some people may wonder whether they should build the "Elstree Six" or the "Solodyne." The truth is that neither set is better than the other. 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." Moreover, the latter receiver has got screened coils, which places it ahead of other five-valve receivers having open coils. On the other hand, the "Elstree Six" possesses the advantage that when close in to a broadcasting station the selectivity may be enhanced by the use of smaller anode coils; when further out from a broadcasting centre these coils may be larger, and while the selectivity will fall off somewhat the signal strength will increase. In the case of the "Solodyne" the transformers are fixed at an average value giving selectivity as well as signal strength. The "Solodyne" is a very compact, small receiver, whereas the "Elstree Six" is of substantial size.

Price Considerations

It would be possible to take numerous examples and to compare one set with another, but you would find that in the case of the best sets a great deal has to be said for each. Some experimenters may find one or two of our new receivers too expensive. We shall consequently publish other receivers of cheaper construction, which may perhaps not be as simple to operate, or be as handsome-looking, or be quite as effective. The question of the cost of production of a receiver is a problem in itself. It is our intention to give really first class designs, as regards both the very cheapest sets and also the more expensive. We propose to use screened coils for many of our Star sets, but for the benefit of those who desire to use something cheaper we shall supply designs for receivers which will give the reader everything he may require at a less cost. He must be prepared, however, to sacrifice something in building a cheap set, but there is no reason why he should not

OUR NEW STAR SET POLICY—*(Concluded)*

enjoy the benefit of much of the research work done at Elstree. These cheap receivers will be vast improvements over older models of Radio Press sets, of however excellent design. We confidently expect, moreover, that they will stand metaphorically head and shoulders over others published elsewhere than in our own journals.

Star Sets

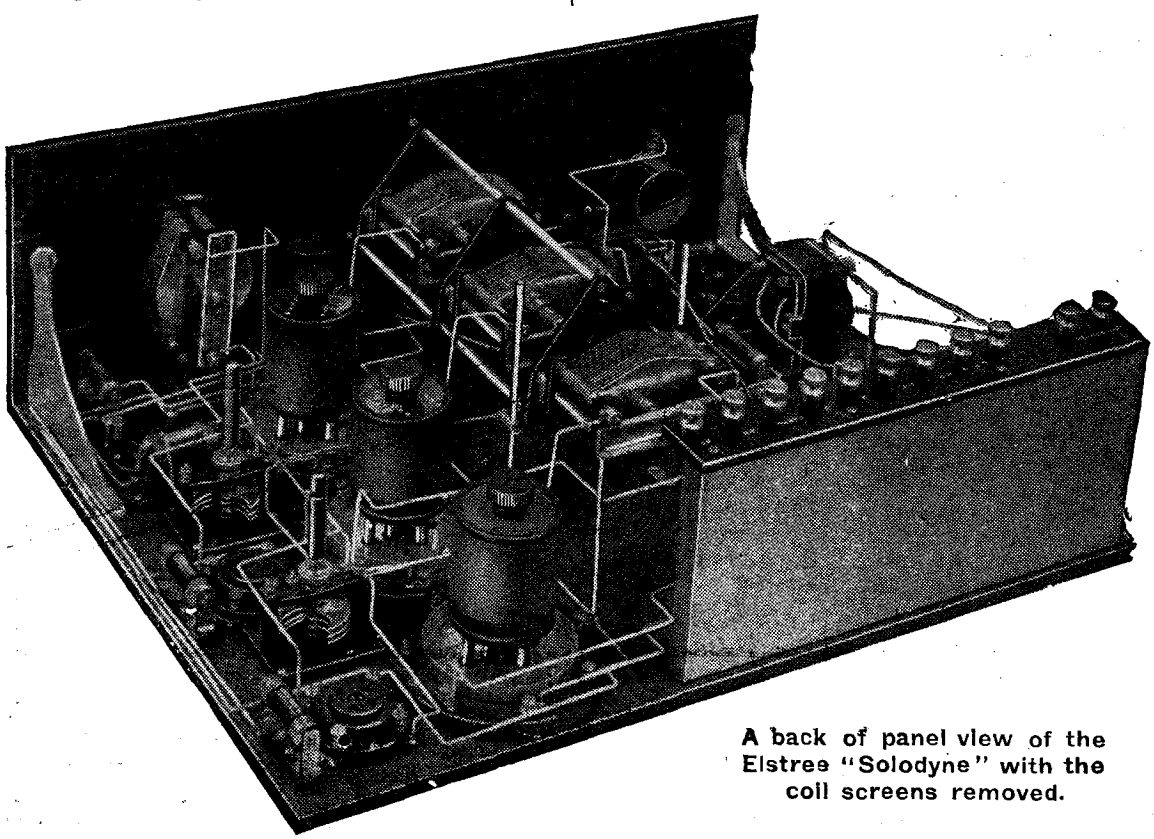
There will, however, be certain receivers which are of such very exceptional merit that the special attention of our readers will be drawn to these. These sets will be known as Star sets of the Radio Press. The "Elstree Six" is the first of the new Radio Press Star receivers. The "Solodyne" given in this issue is also a Star receiver, and so is the "Mewflex." The "Elstreflex 2" to be described in *Wireless* dated 18th September, 1926 (the issue which will contain a free booklet) will also be a Star set, although very cheap and economical.

Demonstration and Lectures

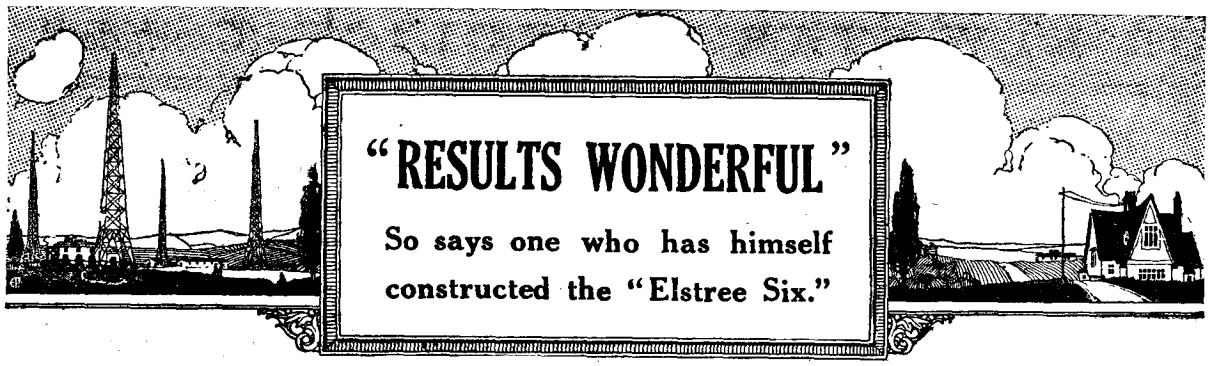
It is our special intention of demonstrating and lecturing on these receivers, and devoting a great deal of space in the papers in which they are described to matters of interest to the builders of these sets. A certain amount of lack of confidence has arisen in the past through certain receivers being subsequently slightly modified. For example, the original ST 100 was soon changed. There was the temptation on the part of some readers to "wait until they had finished fooling about with the design." This will not happen in the case of Star sets. They will remain standardised, because everything possible will have already been done with regard to the design of the receiver, and you can build it immediately without any fear that next month we are going to bring out something better, or alter the design, or do anything of that sort. This new policy will ensure stability and will also, by enabling mass production of components to be carried out, cheapen the cost to the builder. Obviously, however, receivers cannot be standardised for more than a year, because of new developments.

The Best of its Class.

We can, however, say that an entirely new technical position is now in existence, which enables such range and selectivity to be obtained, that there is no fear of readers being disappointed by building up a set and then reading about an obviously better set described a month later. If you find that one of our Star sets suits your pocket, your requirements regarding range, your desire for simplicity, or whatever particular features you like to have in a set, then build it at once. You will be absolutely safe in doing so, and while obviously a six-valve set will give more than a three-valve you will know that you are building the best set in a particular class.



A back of panel view of the Elstree "Solodyne" with the coil screens removed.



"RESULTS WONDERFUL"

So says one who has himself constructed the "Elstree Six."

"The Set of the Age"

SIR,—It was a great pleasure to me to be able to accept your very kind invitation to the Radio Laboratories to see the "Elstree Six" working. I would not have missed the opportunity for anything, as the set is indeed a marvel, and so wonderfully selective and so easily answers to any station required, both in the daylight and after dark; it certainly opens up a new era in receiving sets.

I may say I had the pleasure of being able to neutralise the set, and found no difficulty whatever, as everything seemed considerably simplified, and when once set it is no trouble to pick up any station and without the least oscillation at any one point, the set being perfectly stable.

I have been a regular reader of MODERN WIRELESS and the *Wireless Constructor* since the first issues, and also other Radio Press journals, and have found them most helpful to me.

The following are a few of the many sets I have built as described in your journals:—S.T.100, All-Concert Receiver, All-Wave Receiver, "General Purpose Three," "Three-Valve Dual," the "Midget One-Valve," and several crystal sets, and at the present time I have working the "Special Five" described in MODERN WIRELESS last November by Mr. Percy W. Harris; indeed, I must thank him for such a wonderfully selective set.

I have added to my log over 50 stations received on the loud-speaker and have tuned these in without a pair of telephones, which I consider is very good.

My advice *now* to every reader of MODERN WIRELESS is to start at once and build the "Elstree Six," as without a doubt it is the set of the age and the best set yet described in any journal; in fact, words cannot express sufficiently the wonders of the receiver.

In conclusion, may I thank you for the pleasant evenings I have had through the reading of your publications and also the many concerts I have enjoyed by the sets I have been able to build by the aid of your staff.—Yours truly,

H. W. LEE.

Reading.

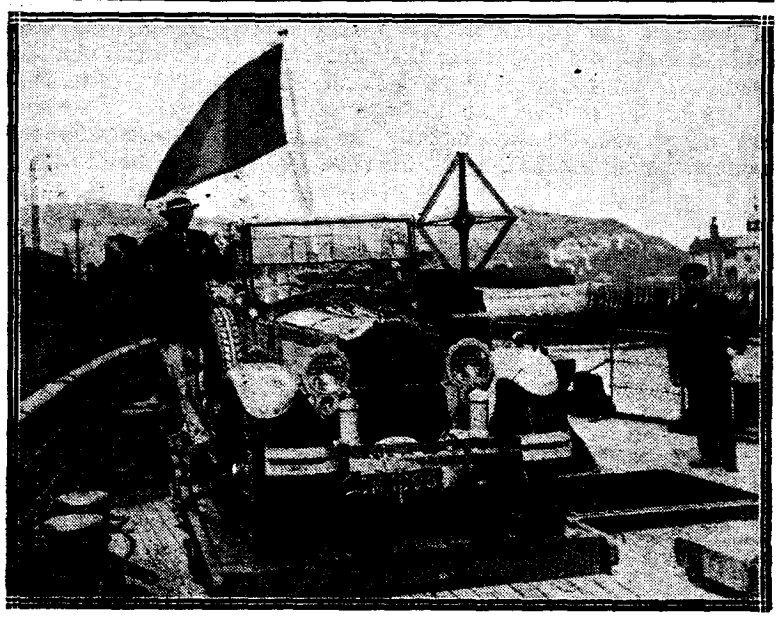
"Results Wonderful"

SIR,—It may interest you to know that the writer is manager of Messrs. Clipson Bros., wireless department, and has already constructed the "Elstree Six" for demonstration purposes. Despite the fact that all the tests have taken place during the recent hot weather, the results have been wonderful, and the set has created a considerable amount of interest with the home-constructors in the district. On one afternoon during brilliant sunshine the writer tuned in eight British stations on the loud-speaker in 2½ *minutes*. During another test in the early evening, 24 stations were tuned in on the speaker when using only the set of Dimic Coils 1A.—Yours truly,

Rushden. C. CLARK.

"Perfect Quality"

SIR,—It was a particular pleasure to me to be present at the demonstration of the "Elstree Six," and I can confidently say that its merits have not been over-estimated



Capt. L. F. Plugge is making a radio tour to Constantinople in a wireless-equipped car. He is here seen leaving Dover.

The synchronisation of dial readings greatly facilitates rapid tuning, and the ease with which stations occupying adjacent wavelengths can be separated, was ably demonstrated. Yet with al perfect quality and purity of tone were manifested throughout.

I shall never hesitate to recommend the "Elstree Six" to anyone seeking a "Super Set."—Yours truly,

S.E. CHAS. R. BEACON.

RADIO REVOLUTIONISED!

How Intense Research has given us distance and selectivity hitherto undreamed of and rendered tens of thousands of sets obsolete.

MR. JOHN SCOTT-TAGGART

By JOHN SCOTT-TAGGART,
F.Inst.P., A.M.I.E.E.
Author of "Thermionic Tubes in Radio Telegraphy and Telephony," "Elementary Text-Book on Wireless Vacuum Tubes," etc. Technical Director of the Elstree Radio Laboratories.

SENSATIONALISM as regards technical matters is something I abhor; besides it has been done to death. Consequently when the Editorial staff informed me that my article was to be entitled "Radio Revolutionised," I felt a certain reluctance to write under such a heading.

I consequently looked up in the dictionary the meaning of the word "revolution." I found, "space measured by a revolving body, a complete rotation through 360 degrees, change of circumstances, a radical change." The latter two meanings seem most appropriate. I then looked up "revolutionise" and found, "to cause a revolution or entire change of anything."

In this article, therefore, I am bound to prove that there has been an entire change in radio. It is because I am so utterly convinced that during the last few months the whole technical outlook of radio has been entirely changed that I am prepared to put up with the title to this article, and elaborate what I mean.

The Ideal Set

Many of you who are reading this—I should say most of you who are reading this—have wireless sets which give quite good results. **Have you, however, sat back in an armchair and tried to visualise the sort of set which you could manipulate with one hand, and bring in station after station on the loudspeaker without interference? Have you ever desired a change of programme, or wanted to receive some special item being transmitted some 500 miles away? Has your mouth ever watered when looking through the "Radio Times" and caused you to long for a set which would enable you to pick out any particular item on any particular day at any particular time, and receive it clear of interference on your loud-speaker?**

Whatever your replies to each of these questions may be my own have been "yes" every time. I have read with envy the letters from readers of MODERN WIRELESS in which they enumerate the various stations which they are capable of receiving, often with sets which I have designed myself, and still more often with circuits of my own invention. I have been puzzled and secretly annoyed by the results which so many readers seem to be able to obtain with their sets, which I never have been able to obtain myself. Having lived close into London for several years I have not been in such a favourable position as when lecturing occasionally in a more central position of England. The results I have hitherto obtained with sets have not come up to the standard I felt was necessary. What is good is very largely a matter of opinion. Some people are satisfied with signals which almost disappear if one moves about near the set, other people require about ten minutes to adjust a receiver to the utmost point of sensitivity. Other people require a week's notice before they will give a demonstration of a receiver for which they claim long range. Others are always blaming atmospherics, poor weather conditions, or some other factor which prevents their set from giving quite such satisfactory results as it did the other day.

Reception at Will

Perhaps I am too critical. Perhaps I do not know how to operate a receiver properly. It has always seemed to me essential for comfortable reception to an absolute stranger to wireless to be able to turn a dial to a certain point and pick up any station he desires. After all, the station is there and working, and there should be only one thing to prevent proper reception, and that is jamming by a spark or other station directly on the same wavelength. Some people seem to be able to squeeze dozens of stations out of a single-valve set, but, frankly, I have never tried myself. **The ideal receiver, to my mind, should be as certain of getting results as a gramophone is of playing a tune when a record is placed on it.**

The Neutrodyne

It was in this frame of mind that twelve months ago I conceived the idea of the Elstree Radio Laboratories situated twelve miles north

RADIO REVOLUTIONISED—*(Continued)*

of London, and I took up the post of Technical Director. Having collected together a very able staff of radio engineers and erected the necessary buildings, I decided that the first and foremost problem was that of obtaining a sensitive wireless receiver. **We consequently concentrated on high-frequency amplification, and the most promising field to work in was the Neutrodyne, which three years before I had invented.** The success of Professor Hazeltine in America was an added encouragement to develop this type of receiver beyond what had been at that time achieved. It was, however, not sufficient to concentrate only on range, because it was no use having a receiver capable of long-range reception if it was to be interfered with by other stations. The question of selectivity was consequently considered simultaneously with that of sensitivity.

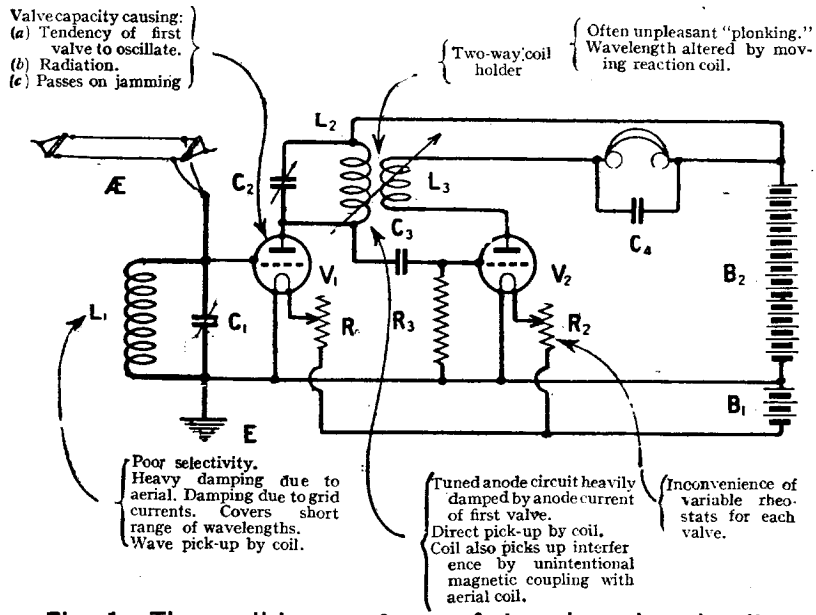


Fig. 1.—The well-known form of tuned-anode circuit employing a swinging reaction coil L_3

The "Elstree Six"

It is unnecessary to give details of the thousand and one schemes and experiments which have been tried out at Elstree during the last twelve months. **Many people were disappointed in the Elstree scheme. "Why is not Elstree turning out the new designs we were led to expect?" was a very common question. The reply was simple. Elstree had not produced any designs with which they were satisfied. We simply carried on, and to-day we are in a position to say that the whole technical aspect of radio reception has been changed.**

Have you yourself figured in the 500 experimenters invited from different parts of the country to witness the results obtainable with the "Elstree Six," which is the pioneer receiver in the new technique we have developed at Elstree? If you have not actually heard the receiver or enjoyed the extraordinary ease of tuning-in station after station on the loud-speaker, then at least you have read some of the letters of the hun-

NOTE TO NEW READERS

This article has been written primarily for those new readers who are not aware of the vast strides which have taken place, particularly during the last few months.

The author of this survey has been intimately associated with the development of the valve in radio for many years. His series of articles on the valve commencing in 1917 were virtually the first account the general public had of the wonderful potentialities of what was then a little-known device. Since then over 500,000 copies of his books on the valve have been sold.

Mr. John Scott-Taggart was the first British subject to take out a Patent for a reflex circuit (in 1919) and since then he has invented and perfected numerous reflex circuits with which work his name has been intimately associated.

The "tuned-anode with reaction" circuit (given in Fig. 1 of this article) was first disclosed and recommended in the first edition of the author's book "Thermionic Tubes in Radio Telegraphy and Telephony" and during the last five years has achieved almost universal popularity.

Mr. John Scott-Taggart's greatest invention, however, is undoubtedly the Neutrodyne circuit. His patent 217971 is acknowledged to be the master patent on the Neutrodyne in this country, and is earlier in date to the Hazeltine patents.

In view of its great importance the Hazeltine Corporation of America purchased this patent. Professor Hazeltine, who holds the master patent on the Neutrodyne in America, said at a public luncheon at the Savoy Hotel on July 15th: "We should in England call it the Scott-Taggart Neutrodyne." The Scott-Taggart Neutrodyne patent disclosed, incidentally, the true capacity bridge method of neutralising which has been embodied in the "Elstree Six."

New readers will no doubt be interested in the views of one who has been so intimately and personally associated with the three big classes of popular receivers—the "tuned anode with reaction," the reflex circuit (as typified by the ST 100 and other ST reflex circuits) and the Neutrodyne. In this article, the author brushes aside as obsolete many of the most popular receivers and circuits, including much of his own past work. He is of the opinion that recent circuit and design developments are of such a far-reaching character as to justify the scrapping or rebuilding of the majority of sets in use to-day, many of them as much as two years old.

RADIO REVOLUTIONISED—(Continued)

dreds who have actually heard the set.

We are staking our reputation on these new receivers. There is not a designer or writer to this journal who does not realise that a profound change of standards has taken place, that a new page has been turned in the history of wireless reception.

The Demonstrations

We are enthusiastic ourselves, and we have not the reputation of being enthusiastic about designs which are not meritorious. I cannot, in fact, recall any occasion when we were prepared to go to such lengths to show how efficiently these new sets worked. Has it ever occurred to those of you who have given demonstrations how dangerous and risky it would be to uphold the claims of the "Elstree Six" every Tuesday and Friday to parties of 25 highly critical radio enthusiasts? This is what has been happening at Elstree every week in absolute daylight in the middle of summer. Station after station was brought in at the request of the group of enthusiasts who stood round the "Elstree Six" and were astonished at the remarkable power and selectivity of what we, at Elstree, may regard as one concrete embodiment of our work.

A Great Success

The most gratifying thing to those who have spent night and day in perfecting the "Elstree Six" is that it has "caught on" from the very start. Quite apart from the demonstrations, the public interest and enthusiasm have been aroused. Thousands of these receivers are being made by home constructors. It would have been almost heartbreaking, knowing the merits of the receiver, if it had taken months before readers got really interested in the set. This is what has happened very frequently in the past, as, for example, in the case of the ST 100 set. If you wait to see what sort of results other people get with these new receivers you will be wasting months of pleasure and interest and you will gain nothing by it, I want you to take my word, and that of other Radio Press designers, that these special Star Sets represent such a great advance on what has hitherto been done that you will be fully justified in scrapping your existing receiver and building one of these new sets.

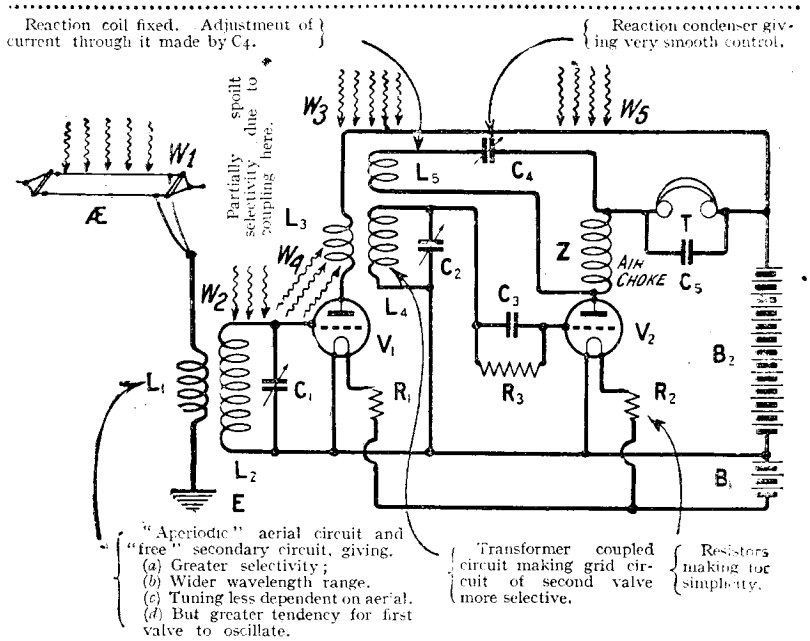


Fig. 3.—In modern circuits an "aperiodic" aerial coil is usually employed, the increase in selectivity being most marked.

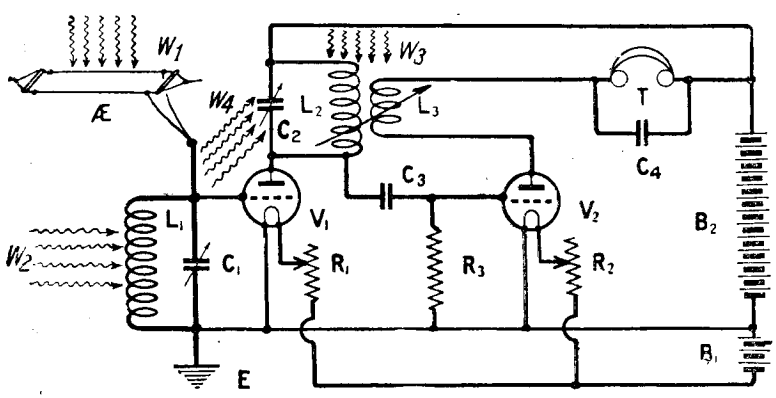


Fig. 2.—In this reproduction of the Fig. 1 circuit the wavy lines W_1 and W_2 represent the waves impinging on the aerial and inductance L_1.

Old Designs Obsolete

It is not everyone who is prepared to scrap or rebuild a set merely to get a small increase in efficiency, range, volume or selectivity. Our new designs, however, will be so distinctly superior that no one will want to keep an obsolete receiver.

Many of you, no doubt, are new readers of MODERN WIRELESS. How are you to tell whether your set is obsolete or not? What changes in design and what changes in circuit have taken place during the last six months? These are questions which I propose to answer now.

Envelopes Scrapped

First of all, we feel that any reader who does not possess a modern receiver with efficient high frequency amplification is losing much of the joy of radio.

RADIO REVOLUTIONISED—*(Continued)*

They may be contented at present but that is only because they have not any conception of what is now possible of achievement. Such highly popular sets as the "All Concert" the "ST 100," the "Family 4-valve Receiver," the "3-valve Dual," "Transatlantic 5," "Twin Valve," and "Anglo-American 6," are all now regarded as obsolete, in spite of their wonderful popularity in the past. Some thousands of these receivers are still being built by people who have heard their friends' sets. We want to stop this continual building of sets which the designers themselves know perfectly well are no longer comparable to the new standard receivers which we have developed. The Radio Press have gone so far as to stop the sale of those of their Envelopes, etc., which deal with sets which in their opinion have been superseded by recent work. This means a very big financial sacrifice. For example, the Radio Press have only just printed 10,000 copies of an Envelope dealing with my own 3-valve Dual receiver. Practically the whole edition is being withdrawn because it would be entirely inconsistent to go on selling instructions for building receivers which we know as a result of recent experience to be out of date, however efficient they may have been considered in their own time.

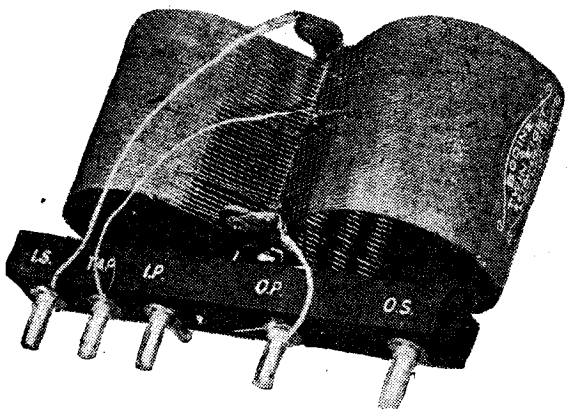


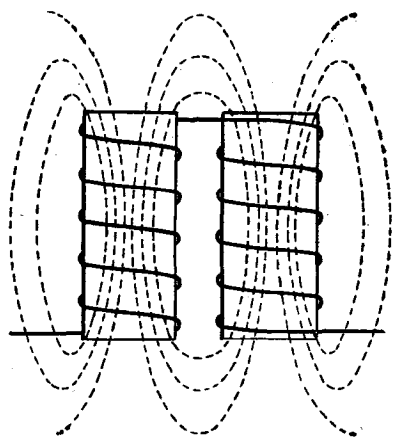
Fig. 4.—The use of binocular coils is of great value in avoiding direct pick-up.

Wide Appeal

We want you to start building these new receivers now. The "Elstree Six" will appeal to thousands. A 3-valve receiver will appeal to tens of thousands. The principles which we have proved at Elstree and the design work which we have done places us in a unique position to design a series of different receivers, each appealing to different classes of our readers. **Obviously everyone cannot afford to build an "Elstree Six." On the other hand, there are thousands who would like to build an extremely efficient 3-valve receiver, utilising the great fund of new knowledge and experience which has been accumulated by us during the last few months. They are really advance models for the next season.** There has hitherto been a tendency on our part to produce all sorts of 5-valve sets, all sorts of 3-valve sets, etc., etc., and to leave it to the reader to choose which one he will build. In many cases he builds a set designed by a well-known designer, although possibly a better set has been produced by a member of the staff who is comparatively unknown. It is now our intention to tell our readers which are our principal sets. These principal receivers are not usually the work throughout of any particular designer, but represent a joint effort. After all, every single set published in a Radio Press publication is tested at Elstree.

Impartial Judgment

No one is more competent to give an impartial judgment on the best receivers, and these sets are picked out as being Star Sets. These receivers represent almost an ideal design, and it is not our intention to produce say, a 5-valve set this month, and then give an improved model or an improvement on it next month. Readers can consequently feel satisfied that the "Elstree Six," for example, has come to stay for twelve months at least. **The design of the "Elstree Six" will remain entirely unmodified. We have attained a certain degree of perfection, and we do not contemplate any change in design for a considerable period.** We do propose, however, to publish different kinds of receivers in the Star class, for example, the "Solodyne" receiver in this issue is of such a unique design that the principles involved will be applied to a 3 or 4-valve set in the future, while recent reflex developments will enable those who prefer reflex circuits to build models which are altogether on a different plane than earlier types of reflex receivers. All this will encourage a reader to begin building a Star Radio Press set at once if the number of valves, the selectivity, the range and the cost please him. If a motor car manufacturer altered the design of his model every month no one would buy. Each prospective purchaser would say "I'll wait till next month and see what improvements have been made." **We are consequently definitely establishing the design of our Star receivers. We are not going to give you an excellent 6-valve set this month, a better one next, and a superb one in two months' time. We are concentrating on really first-rate designs, and propose to stand by them.** Every Star receiver has had months of thought and work



Binocular coils are wound so that the currents induced in them oppose one another.

RADIO REVOLUTIONISED—*(Continued)*

put into it, and all sorts of people have contributed to make each Star set a shining example of what a receiver should be like. This new policy will, we feel sure, be very welcome to our readers.

Screened Coils

Any up-to-date receiver therefore must incorporate modern methods of high-frequency amplification. In this connection I would like to extol the merits of screened coils. The brilliant work of Mr. J. H. Reyner in this field has resulted in a standard specification being prepared and a number of manufacturers have produced a standard screened transformer which conforms to this specification. Screening combined with neutrodyning and a scheme for eliminating short wave parasitic oscillation gives efficiency and selectivity. In some cases, notably the "Elstree Six," it has been found possible by careful design to achieve, with ordinary coils, results hitherto undreamt of. In the case, however, of sets using one or two stages of high-frequency amplification every possible method of getting greater selectivity should be employed, and so readers may expect a very extensive use of screened coils.

Can an obsolete set be recognised by looking at it without knowing the circuit? I would go so far almost as to say that obsolete receivers are recognisable by their obsolete design. The obsolescence of design, however, is not in itself such a serious matter as an obsolete circuit.

Reaction

Reaction, nowadays, has been very materially improved by the use of what is commonly called Reinartz or Hartley reaction. A variable condenser is used, and the method has the very great advantage that it does not modify the wavelength of the circuit into which reaction is introduced, whereas an ordinary two-way coil-holder having a moving reaction coil requires a readjustment of the tuning condenser whenever the reaction is adjusted. In the Reinartz reaction method a reaction coil is still used, but it is fixed in respect to the other inductance. We keep the coil fixed and adjust the current flowing through it, which is a much sounder method.

Series Parallel

Series parallel arrangements are little used nowadays. Sometimes a switch is provided, and sometimes three terminals, an ingenious arrangement introduced by Mr. Harris in the early days. Nowadays, however, we use

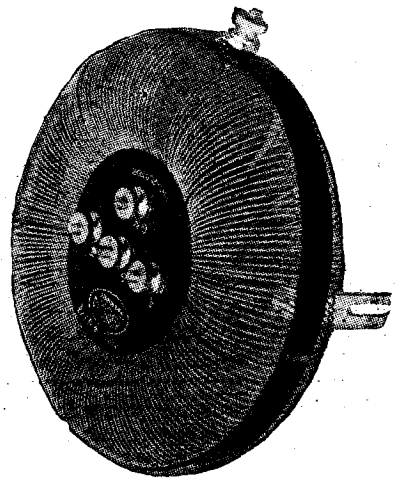


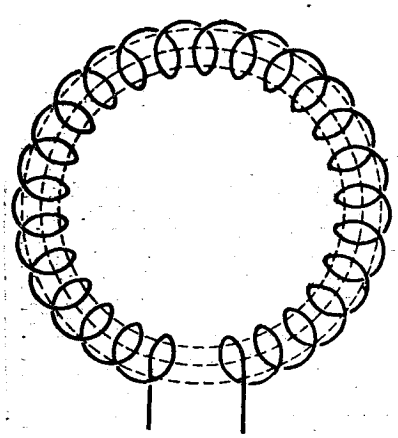
Fig. 5.—The toroidal coil needs careful construction to be mechanically robust.

"aperiodic" aerial coupling as it is sometimes called. This consists of an untuned coil coupled to another inductance which is tuned, and forms the grid circuit of the first valve. This method gives greater selectivity, and also it is possible to cover a wider range of wavelengths on the tuning condenser. An additional advantage is that in high-frequency amplifier receivers it is possible to make all the variable condensers read approximately the same, whereas if a series of parallel arrangements is used entirely different readings are frequently obtained, and considerable annoyance is experienced at having to change the coils.

Vertical Panels

Perhaps the most obvious and striking difference between modern receivers and the earlier ones is that nowadays we use a vertical panel instead of the old horizontal or sloping panel. The components are mounted on a horizontal baseboard, and the main panel contains only the principal controls, *e.g.*, condenser dials. The back of the vertical panel usually supports only variable condensers, switches etc.

The multi-knob set, which was formerly so popular, has died a natural death, and the whole tendency is towards simplicity. The great move towards simplifying the front of the panel and giving it a real professional appearance is the abolition of separate rheostats for each valve. The improvement in valve design and the consistency of different valves to a given standard enable us to use fixed resistances, or if rheostats are used they may be mounted behind the panel on the baseboard, and fixed once and for all for later valves. Devices for keeping filament current constant, such as barretters (*e.g.*, Amperites), are also used and prove very valuable. The idea that as the accumulator runs down the rheostats may be readjusted to obtain signals once again is not a sound one, because it means running the accumulator too low, and so causes injury. As a matter of fact, the discharge of an accumulator is very constant, and once it does begin to drop in voltage it drops rapidly, so very



A toroidal coil is similar to any ordinary solenoid, but the two ends are bent round so as to form a circle.

little is lost and the life of the accumulator is maintained.

Dry Cell Valves

The filament rheostat, however, is still useful in a variety of instances. Although the modern tendency is to make circuit

RADIO REVOLUTIONISED — *(Continued)*

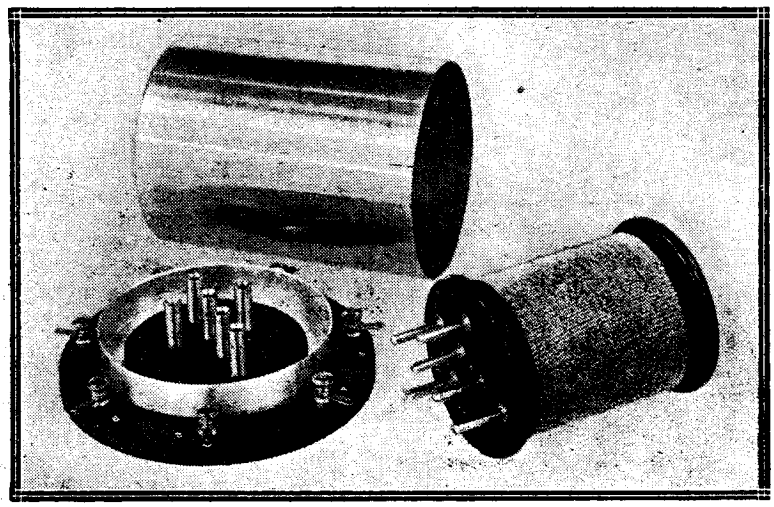


Fig. 6.—Screened coils can be used in a variety of circuits, since different types of coils can be employed with the same screening case.

independent of filament adjustment, there are and will occasionally be cases where some such control is desirable.

A particular case where fixed resistors are not satisfactory is that of valves working off dry cells. The discharge of an accumulator is obtained very nearly at a constant voltage, as was just stated, whereas the voltage of a dry cell falls almost continuously during its useful life.

A fixed resistor is thus useless in such a case, since its value would have to be quite different at the beginning and end of its life.

Another very marked change in design relates to the positions of the various terminals. This is largely wrapped up with the question of panels previously mentioned.

The old idea was to mount everything on the panel. Now only the controls are placed in this position, the valves and other components being placed on a baseboard behind the panel.

The connections are then made to terminal strips at the back of the set, or by means of "pigtails," or some similar scheme.

Loud-speaker or 'phone plugs and jacks are very largely used.

Coils and Transformers

Further design changes have been made in coils and transformers. Modern circuits and our experiments in high frequency amplification have enabled us to produce and appreciate designs of high frequency transformer which are definitely suited to the modern improved valves, and such transformers are steadily replacing less efficient types.

Valves

Valves have also improved greatly during the last year, and special types have been evolved. While much better results may be obtained with these newer valves the constructor and experimenter should get to know which valves are best used for certain purposes For example, a valve, while suitable for a certain stage of low-frequency amplification, might be quite unsuitable for selective high-frequency amplification.

Regarding accessories, probably the most important development has been the more extensive use of high-tension accumulators and this has greatly popularised a battery which is not much dearer than a dry battery, and which will last months on a multi-valve set, and may then be readily and cheaply recharged.

Non-Radiating Sets

We have heard a great deal about non-radiating receivers this summer. **The fact of the matter is that a well-designed modern circuit will give you the utmost high-frequency amplification without any risk of oscillation, even though reaction may be adjusted to such a point that the later stages will oscillate.** Of course, if the first valve of any receiver is made to oscillate, there will be a certain amount of radiation,

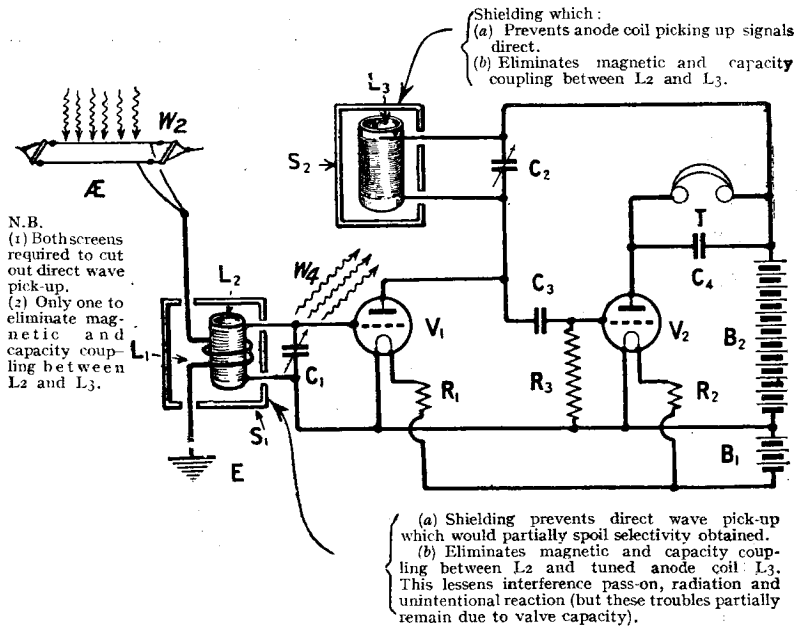


Fig. 7.—In this circuit the screens S_1 and S_2 prevent direct pick-up.

RADIO REVOLUTIONISED—(Continued)

but if the first valve, which will be acting as a high-frequency amplifier, is neutralised, then even though there may be oscillation in the intermediate circuit between the first and second valve, yet these oscillations cannot get to the grid circuit of the valve through the grid to anode capacity because this capacity is balanced up by the neutralising condenser. The older types of circuit would radiate because of this grid to anode capacity coupling, but now this has been neutralised we have incidentally solved the source of howling. **This incidentally is another reason why you should use a modern circuit. If everyone used such circuits there would not be any worrying oscillation.** In America it is practically unknown owing to the very wide use of Neutrodyne receivers.

Press Demonstration

A Press demonstration of non-radiating receivers was given at Elstree to a large body of representatives of the London newspapers, and it was shown how a neutralised circuit could completely cut out oscillation. This demonstration was not given with the idea of claiming any great new invention. It was really given with the intention of showing that, although the public did not seem to realise it, the modern type of receiver was actually a non-radiating receiver, although not designed for that particular purpose.

As regards developments in neutralised circuits themselves the Elstree Laboratories have traced a lot of previous trouble to the fact that a curious oscillation, corresponding to about 60 metres, takes place in many of the circuits. At first sight it would appear that the non-operation of the receiver was due to faulty neutralising and so causing oscillation, but further examination unearthed the parasitic oscillation few experimenters appear to have previously suspected, or notified to the general public. **Elstree not only traced this parasitic oscillation, but cured it, and the "Elstree Six" circuit cuts out all possibility of any kind of oscillation in the receiver.** It will operate from 150 to 5,000 metres, not oscillating on any point of the scale of the variable condensers, and without any readjustment of the Neutrodyne condenser. A remarkable achievement.

I have arranged two tables, one showing the design changes which have recently occurred, and the other the circuit changes, I would invite every reader to study carefully these changes, and then to think out whether his set is not so out of date as to justify it being rebuilt, or another set being made.

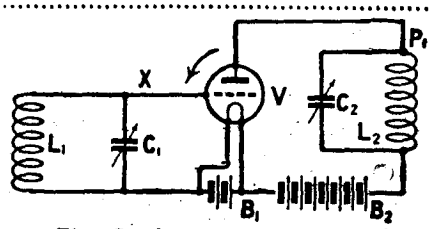


Fig. 8—In an arrangement of this nature if the circuits L_1 C_1 and L_2 C_2 are tuned to the same frequency oscillation will occur.

Recent Developments

In order to give some idea as to how we have developed from the state of affairs which has existed for several years, I can hardly do better than illustrate the popular tuned anode with reaction circuit given in Fig. 1, and to explain the disadvantages of this arrangement, and how the new receivers overcome this.

A Well-known Circuit

The arrangement in Fig. 1 is so well-known that it needs no explanation. An ordinary parallel tuned grid circuit is shown, and a tuned-anode circuit having a coil L_3 connected in the anode circuit of the second valve to introduce reaction into the tuned anode circuit L_2 C_2. The aerial circuit suffers from the disadvantage of poor selectivity. This is due largely to the fact that there is damping produced in the circuit L_1 C_1 by the aerial circuit, which in many cases has a very considerable resistance. Then again this grid circuit has the additional damping due to the grid current in the first valve. This grid current effect may need a little explaining because it is an important one. If a set using the Fig. 1 circuit were connected up and no aerial and earth were employed, then when the circuit L_1 C_1 was tuned to the same wavelength as L_2 C_2 the first valve would oscillate, even though the reaction coil L_3 were taken right away from L_2. This oscillation effect, to remove which the Neutrodyne system was invented, may be caused by:—

(*a*) The grid to anode capacity of the valve, the grid and plate acting as two sides of a small condenser which serve to transfer energy from the anode circuit to the grid circuit, and so set up oscillation just as effectively as if L_2 were coupled to L_1.

(*b*) The capacity coupling between the coils L_1 and L_2 through the earth, which may be greatly reduced by separating the coils a considerable distance, although there will always be a certain amount of coupling, because each coil has a capacity to earth and therefore a capacity effect on the other coil.

(*c*) There will always be some

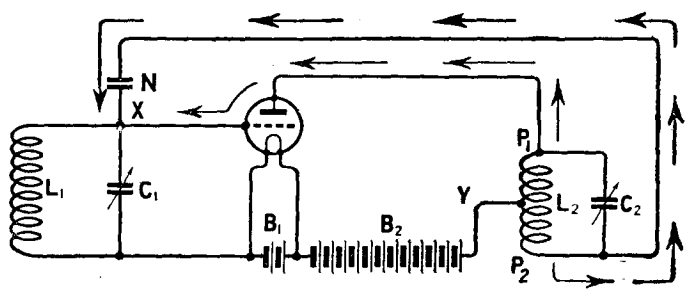


Fig. 9.—An elementary form of neutralised circuit in which the neutralising condenser N is joined to the point P_2 on L_2, the battery B_2 being connected to a centre tap on L_2.

RADIO REVOLUTIONISED — *(Continued)*

capacity effect between the leads and wires in the grid and anode circuits.

(*d*) A certain amount of magnetic, *i.e.*, inductive coupling, will exist between L_1 and L_2, but this may be eliminated by suitably placing the coils.

Series Tuning

The condenser C_1 used for tuning the aerial circuit is sometimes connected in series with the aerial, but while this tuning method gives good signal strength, yet it lessens the load of the aerial. The total capacity across the coil L_1 will now be less, and it may be shown mathematically that the lower these capacities across the inductances are the more readily will the valve oscillate. The same applies to the condenser in the anode circuit, and many experimenters will have noticed that tuned anode receivers tend to oscillate more readily on the lower readings of their condensers. The use of series aerial tuning is to make the valve tend to oscillate more readily than when paralle

DESIGN CHANGES

1. Horizontal panel gives way to vertical panel.
2. The vertical panel contains main controls (*e.g.*, condenser dials) which are reduced to a minimum,
3. The multi-knob set has died, and practically all components are mounted on a wooden base board. Vertical panel usually supports variable condensers.
4. Separate rheostats are being replaced by barretters, resistors or "fixed" rheostats on the baseboard.
5. Loud-speaker or 'phone plugs and jacks are largely used instead of terminals.
6. Terminals now appear at the back of the set or are replaced by "pigtails."
7. Coils and transformers have been made more efficient, *e.g.*, Dimic coils and screened transformers.
8. Much more efficient and specialised valves are on the market and their proper use is important.
9. A very definite and commendable tendency towards the use of high-tension accumulators.

Introducing Damping

If instead of leaving the circuit L_1 and C_1 free we connect an aerial and earth to it, we will find that in many cases, especially as the aerial is a big one, the first valve will immediately stop oscillating. This does not mean that interaction between the anode circuit and the grid circuit has ceased—it is still there, but we have counteracted the influence by introducing losses and damping into the grid circuit.

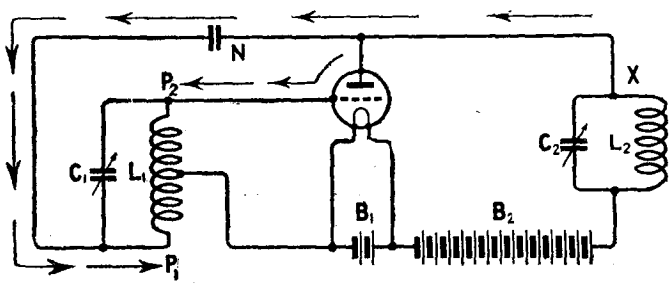


Fig. 10.—Another method of neutralising the energy feed back is as shown above.

We have, in fact, tended in the past to favour the use of the parallel aerial tuning arrangement, because it lessens the tendency of the high-frequency to oscillate, but we have not in the past realised that the very thing which reduces the tendency of the valve to oscillate also reduces the efficiency.

tuning is employed, but even the parallel tuning arrangement is by no means infallible. When only a small aerial is employed the first valve, Fig. 1, will oscillate readily, even though no reaction is employed to the tuned anode circuit.

Grid Damping

How did we get over this trouble so as to give a stable receiver? By introducing grid damping in the grid circuit of the first valve This is done by connecting the bottom of the grid circuit to the positive terminal of the filament battery B_1, or sometimes to a potentiometer connected across this battery. This makes the first grid positive and causes a small grid current to flow from the filament to the grid through the inductance L_1 and back to the filament. This passage of current is equivalent to a resistance connected across the circuit L_1 C_1 and so introduces damping. Moreover, when signals are being received the alternating positive and negative impulses on the grid of the valve will affect the damping of the circuit L_1 C_1. This is because the positive half-cycles of the oscillating current will make the grid more positive, which will attract more electrons from the filament to flow round the inductance L_1. This additional flow of current is also more or less equivalent to a resistance connected across the circuit L_1 C_1, and will introduce damping. This damping, of course, very definitely reduces the voltages across the circuit L_1 C_1, and so reduces signal strength.

Disadvantages

There are three additional disadvantages of the parallel aerial tuning arrangement. One is that the selectivity can never be as great as that of a loose-coupled arrangement. A second disadvantage is that since there is always the aerial capacity across the coil L_1 the tuning variation which can be accomplished by the condenser C_1 is limited in its

RADIO REVOLUTIONISED—*(Continued)*

range, whereas if no aerial and earth were connected to the circuit L_1 C_1 the condenser C_1 would tune the coil L_1 from between say 275 metres and 600 metres. It might only tune the coil between 310 and 550 when aerial and earth were connected. The disadvantage is not so much a technical one as a matter of inconvenience. If the variable condenser was only tuned over a short band of wavelengths constant changing of the aerial coil would be necessary. Moreover, the user of the set will never know what size coil to connect in the aerial circuit. One experimenter may use a No. 35, and another a No. 50, and another a No. 75, according to the size and capacity of the aerial used. Obviously with a large capacity aerial a small coil will be required, whereas with a small indoor aerial a larger aerial coil is necessary. We also get no relationship between the adjustment of the condenser C_1 and the adjustment of C_2. You may get a station coming in at good strength with the condenser C_1 at 15 degrees, and the condenser C_2 at 170 degrees. If now you want to pick up a station of slightly higher wavelength you are allright as far as the condenser C_1 is concerned, but you would have to change the coil L_2 to a higher value. All this is extremely inconvenient, and every reader will appreciate how very simple it would be if the two condensers C_1 and C_2 read alike, or very approximately alike.

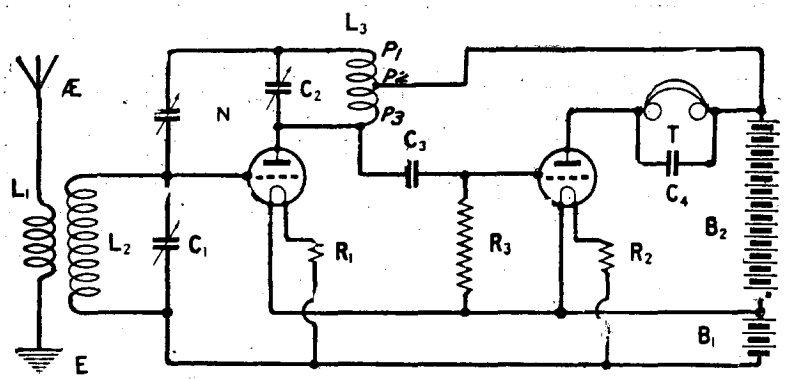


Fig. 11.—A practical neutrodyne circuit. The H.T. tapping is taken to approximately the centre point of L_3.

"Pick-up"

The third disadvantage of the straightforward parallel tuned aerial circuit as usually used is that the coil L_1 will pick up signals directly quite independently of the aerial and earth. Quite a lot of my readers must have at some time or another received a set which by careful adjustment would receive signals without aerial or earth being connected. Sometimes stations can be obtained on the loud-speaker under these conditions, and the operator is proud of his achievement. As a matter of fact he ought to be ashamed of it. This remark may seem strange at first sight, since the fact of being able to pick up a station without aerial or earth is a testimony to the sensitiveness of the set, but the achievement is also a proof of a lack of selectivity in nearly all cases. You must remember that any inductance coil in a wireless receiver will act as a miniature frame aerial, and if there are stages of a high-frequency amplification the very weakest signals will be amplified up to sufficient strength to be heard in the telephones or loud-speaker, even though no aerial may be connected. The direct pick-up effect of the inductance coil L_1 in Fig. 1 is shown diagramatically in Fig. 2; while W_1 represents the waves affecting the aerial and the receiver, and W_2 other waves impinging on the aerial inductance L_1. Since these are the same waves, both ultimately effecting the same circuit L_1 C_1, we do not worry about this direct pick-up effect of the aerial coil in this circuit, but direct pick-up effect elsewhere in the circuit or where a more selective aerial circuit is employed will assist jamming from the near-by station

A Better Method

Most modern circuits utilise the method of aerial coupling shown on the left of Fig. 3, and I will explain the great advantages of this arrangement. It will be seen that the aerial inductance L_1 is now not tuned, but is coupled to a grid inductance L_2, which latter coil is tuned by means of the condenser C_1. By using this method of aerial coupling we get just the same signal strength, and in many cases a little more. We get, however, very much greater selectivity, a wider wavelength range with the condenser C_1, tuning is substantially independent of the aerial used, so that whatever aerial you may employ you will always pick up a station on the same degree with a condenser C_1, and it is possible to get the condenser C_1 and other tuning con-

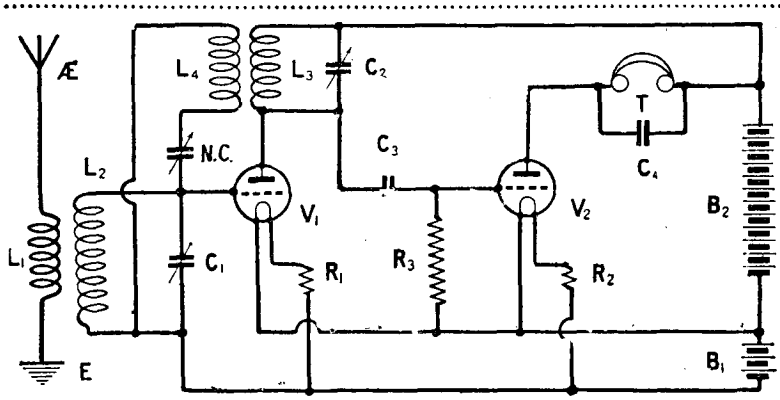


Fig. 12.—In this neutralised circuit two coils L_3 and L_4 are employed. L_4 is the same size as the coil L_3.

RADIO REVOLUTIONISED — *(Continued)*

densers in the receiver reading approximately the same to any given station. It is thus possible to calibrate a receiver without reference to the aerial employed. You will have noticed that in the "Solodyne," "Elstree Six" and other receivers, which we have designed, we give the number of degrees on the condenser which will bring in certain stations. You yourself, if you use the same apparatus, will be able to pick up these stations almost within a degree of those we specify, although some of the broadcasting stations change their wavelengths somewhat from time to time. This is

many designers use the antiquated series of parallel tuning arrangement. An alternative arrangement which amounts to the same thing consists in taking an aerial tapping on the grid coil L_2. This is the auto-coupled method of tuning, and is really the same thing as separate coupling.

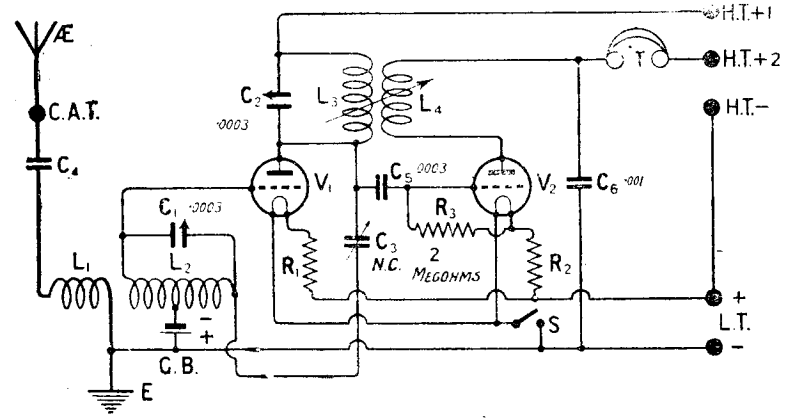


Fig. 13.—A popular neutralised circuit, the "Huntsman Two."

Loose Coupling

What about the direct pick-up effect of the aerial coupling arrangement of Fig. 3? While here again you get the aerial picking up the waves and also the secondary inductance coil L_2, I have shown the waves marked W_1 as affecting the aerial in the normal manner, while waves W_2 are influencing the coil L_2 quite independently. These separate waves affecting the circuit L_2 C_1 may be coming from the same station as those affecting the aerial, or they may come from a different station. Any broadcasting station which is close to your receiving set cannot be tuned in on the simple inductance condenser circuit without covering a considerable number of degrees of the condenser. When, say, your condenser is adjusted to the wavelength of Bournemouth and you are very close to London the chances are that you will hear London over perhaps 30 degrees of your condenser, and Bournemouth is completely drowned out, even though the receiver is capable of receiving Bournemouth when London is not working. By using a loose-coupled arrangement as shown in Fig. 3 we can confine London's influence to far fewer degrees on the condenser C_1. The trouble is, however, that we may adjust L_2C_1 to Bournemouth's wavelength and we will still get London coming in. Although the coupling scheme may be capable of cutting out London when Bournemouth is to be received, yet if the London waves are allowed to come and ignore this special arrangement and directly influence the circuit L_2 C_1, we lose a great deal of the selectivity we hoped to get.

Preventing "Pick-up"

This is known as the direct pick-up effect, and while it is not of importance in the Fig. 1 circuit

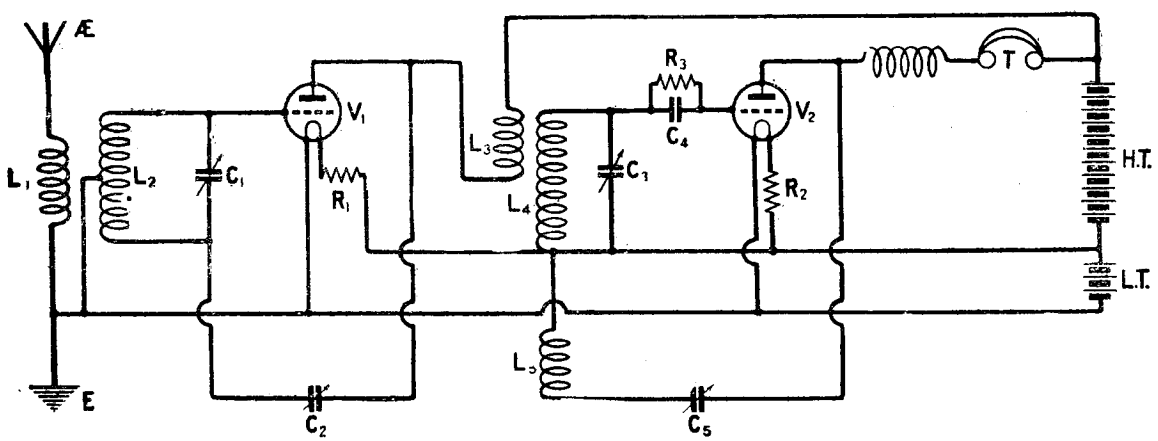


Fig. 14.—In this circuit capacity controlled reaction is obtained by means of the condenser C_5.

of great assistance, and the arguments in favour of this method of aerial coupling are so powerful that I cannot understand why so

because the aerial circuit is in any case not selective, yet when we go to the trouble to provide a selective aerial coupling method it is

RADIO REVOLUTIONISED — (Continued)

very annoying to find that our endeavours are made partially useless by the coil L_2 pleasing itself and picking up the waves of London of its own accord. If the coil L_2 could be persuaded to refuse to have anything to do with signals other than those supplied through the coupling between L_1 and L_2, then we would have solved one of the greatest, although one of the least known, causes of interference due to a neighbouring broadcasting station. This direct pick-up effect is particularly noticeable when very close in to a broadcasting station, but it can be noticed 10, 20 or 30 miles. The closer you are to a broadcasting station the more does the direct pick-up effect swamp the selectivity given by the "aperiodic" aerial coupling method. We therefore have to find some means of preventing direct pick-up.

Methods Adopted

The methods we adopt for this purpose are three-fold. We can use an ordinary coil, such as the ordinary plug-in kind, and place it in a horizontal position, or in a vertical position and pointing at right angles to the direction of the station. If, for example, you are north of London, you might make your coils point east and west, so as to avoid a direct pick-up effect. This sounds very simple, but, as a matter of fact, waves get distorted and it is very difficult to prevent an ordinary coil from picking up the waves direct.

Astatic Coils

We therefore have to resort to some other method, and we can either screen the coil, *i.e.*, put it in a metal box or other container which will prevent the waves affecting it, or we can split the coil into two and arrange the windings so that any currents induced in them directly have an opposing effect. For example, one half of the coil might pick up 2LO's wave, and so might the other half. By suitably arranging the connections the induced currents are made to oppose each other and are so washed out. This, however, does not prevent the coil acting as an ordinary coil as regards currents which we actually want to receive. This kind of coil is sometimes known as the binocular coil, or figure of eight coil, and an example is illustrated in Fig. 4.

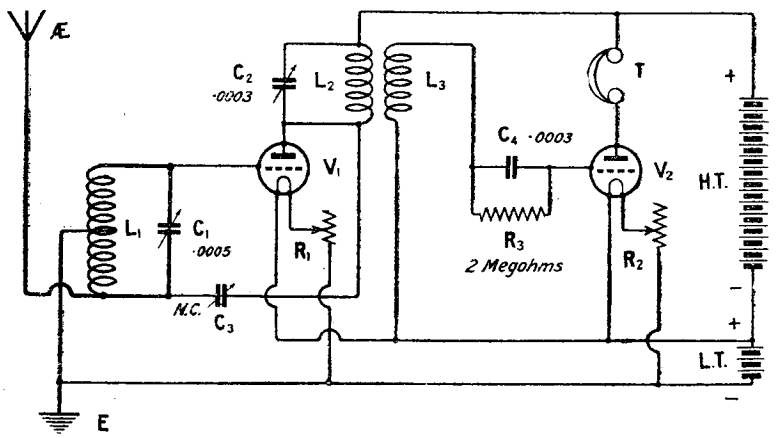


Fig. 15.—In order to obtain greater selectivity in some cases the aerial and earth are connected across only a portion of the grid coil.

The Toroidal Coil

Another form of coil which will not pick up waves direct is the toroidal coil. This coil is like an ordinary one, except that the ends are bent round so as to form a circle, or almost a circle. This sort of a coil will not be affected by waves because they are not able to get into the middle of the coil. This is a very rough-and-ready explanation, but will serve at the present stage. The first toroidal coils shown in a wireless circuit were described by myself in an article in MODERN WIRELESS.

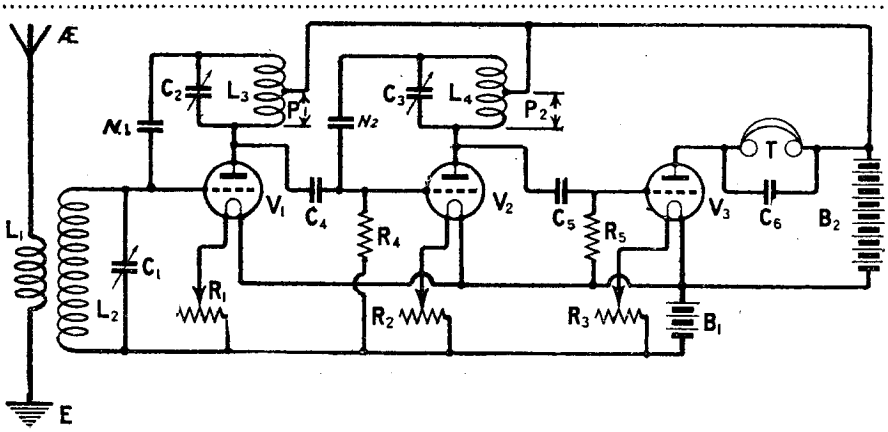


Fig. 16.—With a circuit of this type trouble may arise from parasitic oscillations having a wavelength of about 60 metres.

The Screened Coil

Here we have an ordinary coil or transformer which would pick

They have been used in America, but we on this side have preferred the use of the third method of avoiding directly coupled effects. This is the screened coil.

RADIO REVOLUTIONISED — *(Continued)*

up waves direct, but we prevent it doing so by putting it in an almost completely enclosed metal cage.

An example of Mr. Reyner's screened coil is shown in Fig. 6. The actual metal case is capable of being used with all sorts of transformers and coils, so that once you have bought the case you will always be able to use it in any screened coil set, and the coils used from the circuit. They are, of course, there, but they cannot get in the metal box.

The metal screen used with shielded coils should always be connected to earth, and the Fig. 3 and Fig. 7 circuits should have the negative terminal of the accumulator connected to earth. This connection for the sake of simplicity is not shown in the diagram.

CIRCUIT CHANGES

1. So-called Reinartz or Hartley reaction (both involving a variable condenser for varying the adjustment of reaction) is becoming general, and even receivers involving no high-frequency amplification (*e.g.*, single-valve sets) are improved by it.

2. The series-parallel arrangement for aerial tuning is practically obsolete. "Aperiodic" aerial coupling or the auto-coupled method are universally used in the best set designs. These methods give greater selectivity and a wider range of wavelengths on the tuning condenser. In multi-H.F. sets this method makes all the variable condensers read approximately the same.

3. Except for above two cases, single-valve receivers and those sets not involving high-frequency amplification have not been improved.

4. Receivers using one or more stages of high-frequency amplification have been improved beyond recognition by the use of neutralised circuits. Much greater range, selectivity, and volume are now obtainable and, moreover, such receivers will not radiate. The "Elstree Six" is an example of the vast strides in high-frequency amplification.

5. Practically every modern receiver using neutralised circuits is non-radiating. In circuits using one stage of high-frequency amplification, it is customary to introduce reaction into the intermediate circuit and not into the aerial circuit.

6. True neutralisation of inherent reaction has been achieved. Better neutralising methods have been developed and better coils and transformers have been designed for use in neutrodyne circuits. The "Elstree Six" receiver is stable on a wavelength range of 150 to 5,000 metres without readjustment of the neutrodyne condenser—a remarkable achievement.

7. The Elstree Laboratories of the Radio Press have carried out an extraordinary amount of research on the problem of range and selectivity. The causes of interference—which are much more complicated than appear on the surface—have been probed and solutions found. The screened coil and transformer is an Elstree development, and all those now marketed are made to the Radio Press specification. Screened and "non-pick-up" coils (*e.g.*, toroidal and figure-eight coils) have altered the whole technique of receiving methods, and in importance come second only to the introduction of the Neutrodyne type of circuit.

8. The laboratories at Elstree have solved the remaining problems in connection with reflex circuits. Special arrangements for neutralised reflex circuits have proved of extraordinary efficiency, and the disadvantages of the ordinary reflex arrangement have been eliminated. The reflex receiver in this issue is a remarkably effective one. Circuits such as the ST 100, three-valve Dual and Twin-valve are rendered completely obsolete by the new circuits.

9. Parasitic short-wave oscillations in multi-H.F. receivers were first discussed and "exposed" by the Radio Press. Before this recent discovery, no radio journal had even mentioned the existence of such oscillations. The exposure of this latent defect in multi-H.F. receivers was immediately followed by descriptions of various ingenious methods which the Elstree laboratories had evolved for the elimination of these oscillations. The very greatest importance attaches to the discovery and satisfactory cutting out of this hidden defect in long-range receivers.

10. The first receiver in this country to use a single-condenser control to tune three circuits simultaneously is described in this issue. The problems involved have been very difficult, but have been solved, and this receiver marks an epoch in the simplification of long-range receivers.

11. Purity of reproduction has not advanced materially, chiefly because excellent methods of low-frequency amplification have always existed. The wireless public, however, are far more critical regarding quality, and methods of amplification known to give good reproduction are being adopted even at the expense of some unnecessarily loud signal strength. The mania for maximum noise for a given number of valves is dying out. A receiver which does not provide for negative grid bias cannot be regarded as conforming to modern practice. The Prince circuit has achieved considerable and deserved popularity.

12. Volume control methods are becoming more popular and are independent of an adjustment in tuning and perfectly independent of reaction adjustment.

in conjunction with it are produced at a very reasonable price. Fig. 7 shows the "aperiodic" aerial coupling system used in conjunction with a shield which prevents the secondary coil from picking up waves direct. This arrangement is very selective and it will be noticed in Fig. 7 that the waves marked W_2 in Fig. 3 have vanished

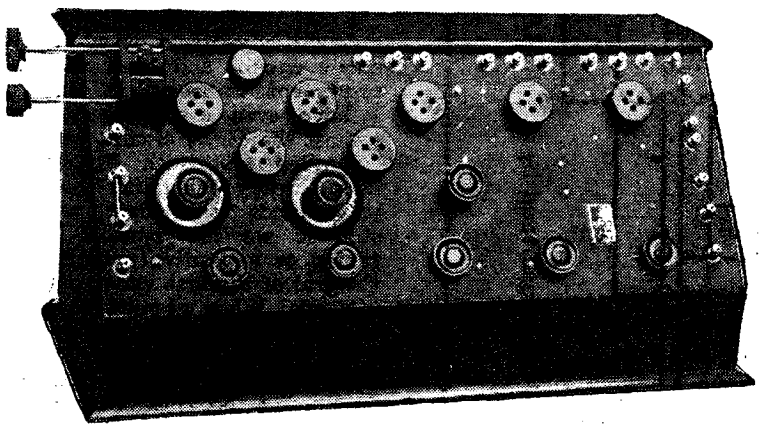
Other Criticisms

Having treated fairly fully the question of aerial coupling and the use of a screen to maintain the selectivity we have obtained by aperiodic aerial coupling, I propose to go back to Fig. 1, and show in what other respects we have made it obsolete. The tuned anode circuit $L_2 C_2$ in itself is not very selective as we understand selectivity to-day. It is heavily damped by the current which is flowing through the circuit. You can prove this damping for yourself by connecting up a Fig. 1 circuit and having adjusted the reaction coil L_3 so that a full reaction effect is obtained, turning out the filament of the first valve. It should be found that the second valve will immediately begin to oscillate. This is because the circuit $L_2 C_2$ is really now the grid circuit of the second valve, while L_3 is in the anode circuit. It is only the passage of the current through L_3 from the anode circuit to the first valve that has such a big damping effect that the second valve does not oscillate.

This damping effect must ap-

RADIO REVOLUTIONISED—(Continued.)

preciably influence the selectivity of the tuned anode circuit, and we can get over the difficulty by making the anode current go through only a portion of L_2, or by using an efficient transformer. I say an efficient transformer deliberately because old types of high-frequency transformers were not as good as the tuned anode coil.



Placing the valves on the front of the panel is no longer considered good practice. Receivers of this type with a multitude of small knobs are practically obsolete.

Screening Anode Coils

There is another disadvantage in the Fig. 1 arrangement, that is, that the circuit L_2 C_2 picks up waves direct, the coil L_2 acting like a miniature frame aerial. I have explained how we can obtain "greater" selectivity by using aperiodic aerial coupling as in Fig. 3, and then finally putting the aerial and secondary coils in a metal box shown in Fig. 7. But what is the use of taking all these precautions if we are going to allow the tuned-anode coil to pick up waves on its own account? We certainly gain some advantage by highly selective schemes at the beginning of the receiver, but if we are going to allow jamming waves to come in at intermediate stages we are going to have nearly all our old troubles back again. We must consequently make the anode coil incapable of picking up waves direct. This can be done as before by making it a toroidal, binocular or screened coil. In Fig. 7 I have shown the tuned-anode circuit put in a metal box.

Reaction

Doing this incidentally makes it very difficult to get ordinary reaction coupling with the coil, but in any case that was a point I was coming to. The ordinary reaction as obtained by moving one plug-in coil next to another is in itself not sound, and in any case cannot be done in a modern circuit. It is not sound because accurate adjustment of reaction is not too easy, and the old method resulted in making tuning very much more difficult because every adjustment of reaction required a readjustment of the tuning condensers. The modern method of obtaining reaction is by means of the variable condenser, and Fig. 3 shows how after replacing a tuned-anode circuit by a transformer L_3 L_4 we introduce reaction into the circuit L_4 C_2 by having a small reaction coil L_5 permanently coupled to L_4 in the fixed position. We connect the coil L_5 and the variable condenser C_4, across it an air core choke Z, in the anode circuit of the second valve. The circuit works as follows. The amount of reaction introduced into the circuit L_4 C_2 depends upon the amount of high-frequency current induced back into it from the coil L_5. Since the coupling between L_5 and L_4 is constant the only way to vary the amount of "feed-back" is to vary the amount of current flowing through L_5, and we do this by means of the condenser C_4. This latter condenser is really a by-pass condenser. The high-frequency currents in the anode circuit of the second valve do not like to go through the air core choke Z, and consequently travel through L_5 and C_4. High-frequency currents, however, equally dislike going through very small condensers, so that by varying the capacity of C_4 it is possible to vary the amount of current passing through C_4, therefore through L_5. Sometimes the coil L_5 is actually part of L_4, and sometimes the right-hand side of C_4 is connected to the filament instead of the top end of Z. All these schemes, however, boil down to the same thing in the end.

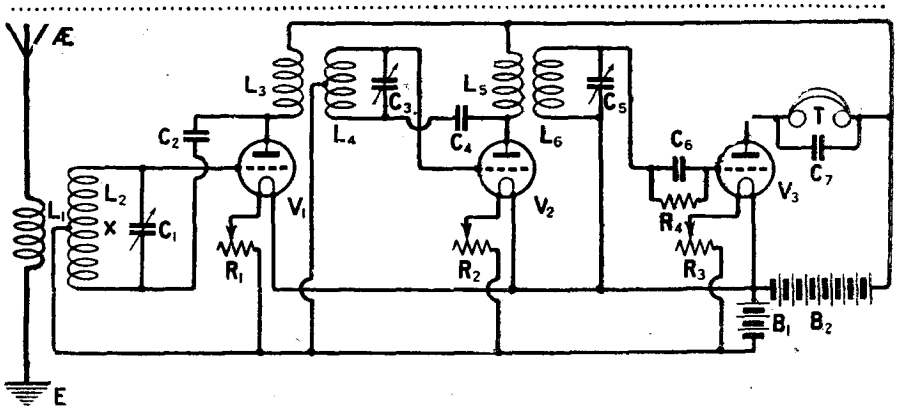


Fig. 17.—In this circuit the grid coils L_2 and L_4 are tapped. It suffers from the disadvantage that parasitic oscillation can occur, as in Fig. 16.

RADIO REVOLUTIONISED — (*Continued*)

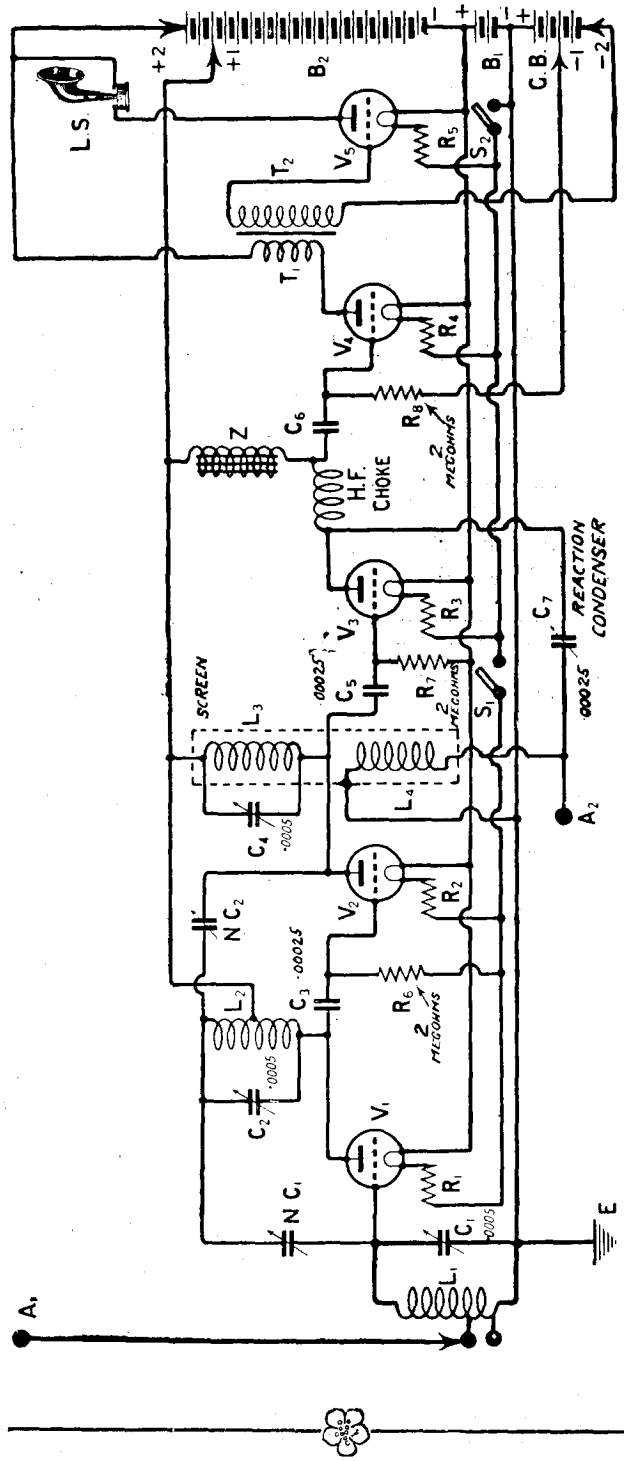


Fig. 18.—The theoretical circuit of the "Five Fifteen" receiver which was described by Mr. J. H. Reyner in the "Wireless Constructor."

Another criticism of the Fig. 1 circuit is that separate rheostats were used for each valve. The whole tendency nowadays is to avoid a multitude of rheostats, and the case against them has been made out previously in this article.

Interaction Effects

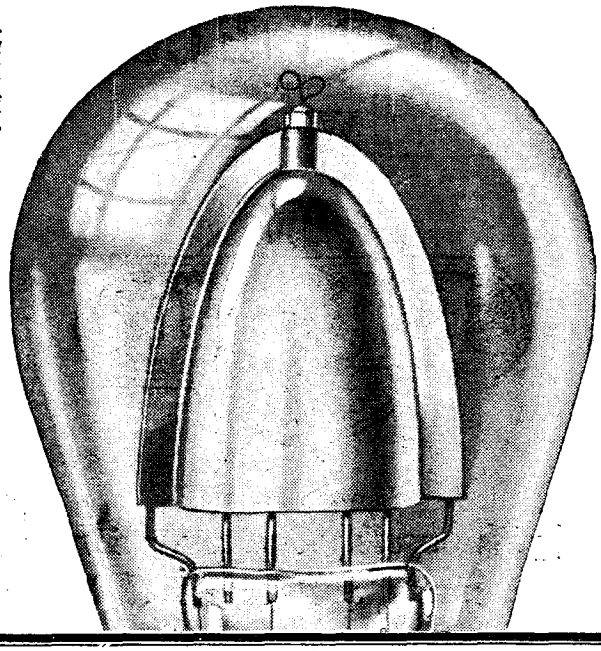
I now want to discuss two very serious disadvantages of the tuned-anode circuit, and even the improvement embodied in Fig. 3. I have even something to say against the Fig. 7 circuit.

Dealing first with Fig. 1, I have already said that the first valve tends to oscillate, and to stop it we use parallel aerial tuning or a positive potential on the grid of the first valve, or both methods. When we start using the Fig. 3 circuit, in which "aperiodic" aerial coupling is employed, the tendency for self-oscillation of the first valve becomes very much worse, because the damping on the circuit L_2 C_1 is very small. I am not at all sure that it was not the aperiodic aerial method of coupling which forced many of us to adopt the neutrodyne method. The neutrodyne is not so essential in the Fig. 1 circuit because we can adopt other simple methods of preventing the first valve from oscillating. It is, however, almost impossible to prevent the trouble when aperiodic aerial coupling is employed. Putting the coils L_1 and L_2 in metal boxes as in Fig. 7 will certainly prevent any capacity coupling between the coils L_2 and L_3 of Fig. 7. It will also stop the magnetic coupling between these two coils which sometimes helps to increase the tendency towards self-oscillation. The use of screens, however, does not in any way affect the grid to anode capacity which is the primary cause of self-oscillation. It was due to the use of the neutrodyne principle which affected this tendency towards self-oscillation, and the next big stage in this article is to consider the neutrodyne and its problems in greater detail.

Coupling Effects

Before passing on, however, I would like to mention another very important cause of lack of selectivity in the ordinary circuit. Fig. 2 will help to explain this phenomenon. I have drawn several

According to Homer, Stentor was the name of a Greek herald in the Trojan War whose voice was as loud as that of 50 other men combined. As the name for a new Cossor Power Valve it is, therefore, peculiarly appropriate.



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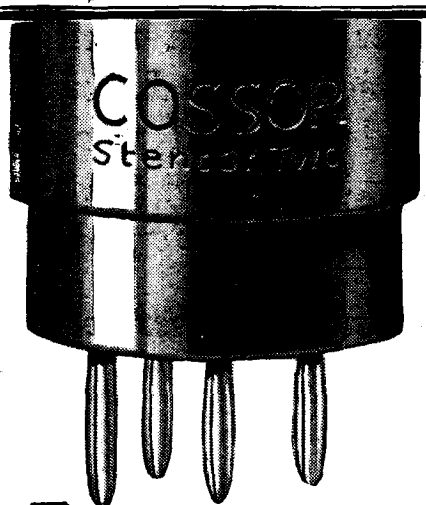

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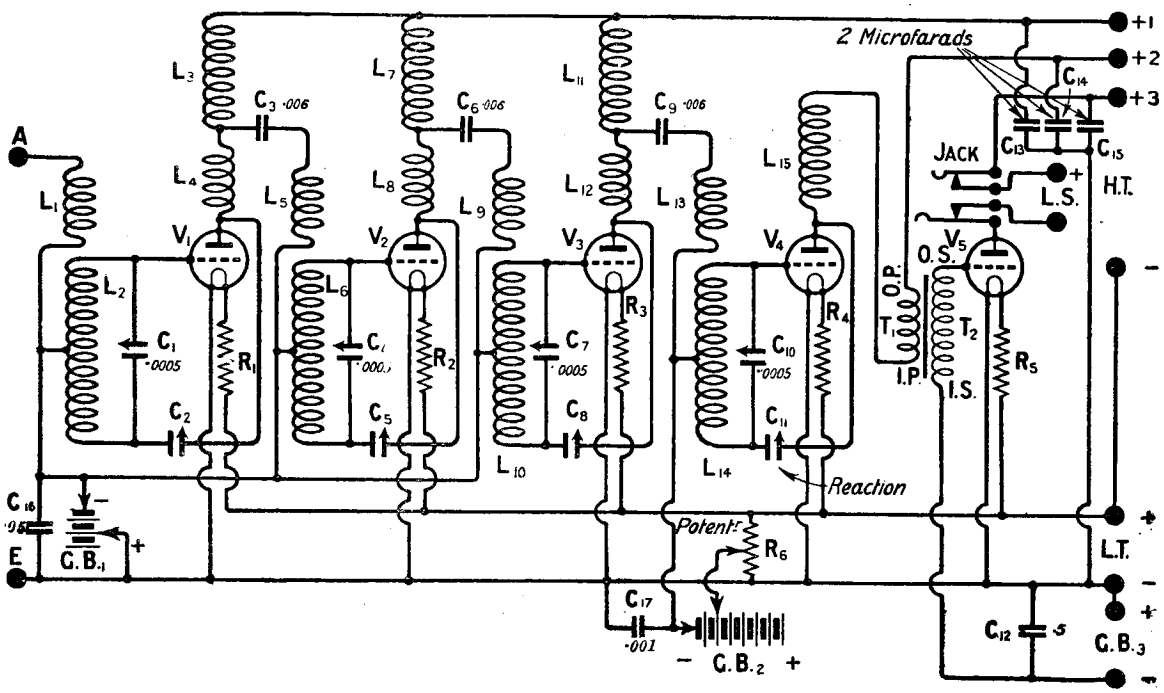


Fig. 19.—One of the earlier forms of circuit which overcame the trouble produced by parasitic oscillation made use of small radio chokes in series with the anode coils.

wriggly lines marked W_4 to represent the transference of high-frequency current from the circuit L_1 C_1 to the circuit L_2 C_2. This transference of energy is different from the pick-up via the coils

fying action of the valve. You have probably noticed that on the Fig. 1 or Fig. 2 circuits if you turn out the filament of the first valve you can still often get excellent signals, and this is due

capacity coupling due to the grid to anode capacity of the valve.

Magnetic Transference

Now what we really should aim at is to get the circuit L_2 C_2

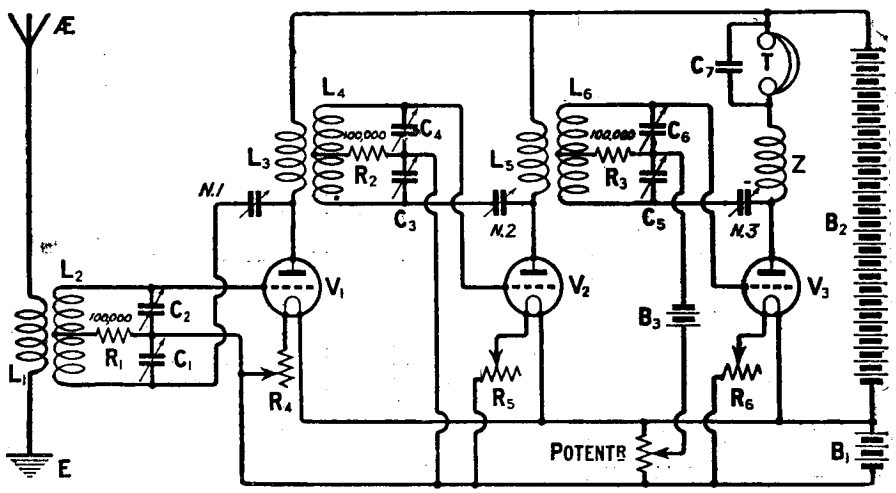


Fig. 20.—In the "Elstree Six" type of circuit short-wave parasitic oscillation is avoided by using dual condensers, the centre points of which are joined to the middle of the grid coils through high resistances.

L_1 and L_2. The current in L_1 C_1 is due partly to the current picked up by L_1. However the currents may be produced in L_1 C_1, the fact remains that they are passed on to the circuit L_2 C_2, quite independently of the ampli-

to the transference of the current in L_1 C_1 to the circuit L_2 C_2 which is in the grid circuit of the second valve. This pass-on of the current is due partly to the magnetic coupling between the inductance L_1 and L_2, and partly to the

thoroughly independent of L_1 C_1, so that it is simply energised by the amplifying action of the valve, there being no direct coupling between the circuits L_1 C_1 and L_2 C_2. The mere fact of using tuned circuits in a high-frequency

RADIO REVOLUTIONISED—*(Continued)*

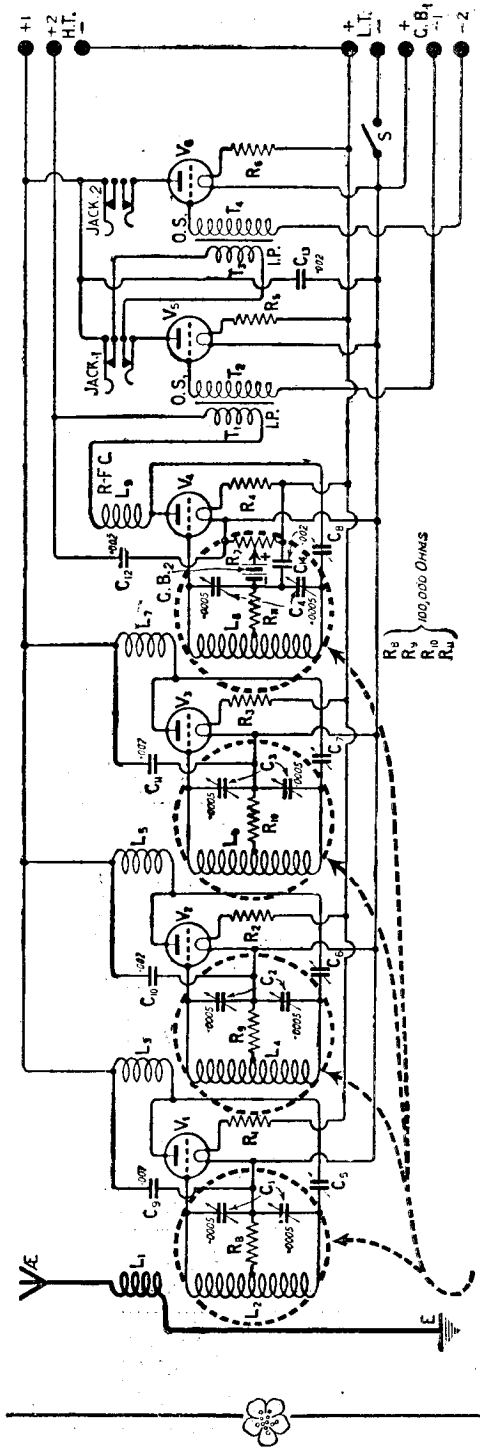


Fig. 21.—The theoretical circuit of the well-known "Elstree Six" receiver described in the June issue of this journal.

amplifier gives a high degree of selectivity which is increased by every additional stage of high-frequency amplification. This desirable state of affairs may, however, be largely nullified by high-frequency currents in L_1 C_1 ignoring the valve and going straight across to the circuit L_2 C_2 without amplification. You may get a lot of jamming signals in the circuit L_1 C_1 which would be sifted out if you could ensure that the first valve acted simply as an amplifier, and that there was no pass-on effect between the grid and anode circuits independent of this amplification effect. The effect is very noticeable where there are several high-frequency stages. Here, all the interference in the aerial circuit may be transferred by loose-coupling effects independent of the intermediate valves to the last tuned circuit. In other words, the oscillations, instead of going through our delightfully arranged intermediate high-frequency amplifiers, which would have a very selective effect, simply push their way through without bothering about the selective obstacle we have placed in the way. The phenomenon is specially noticeable when a frame aerial is used. The currents in the frame aerial circuit are often induced without amplification directly into the last tuned circuit of the receiver. In this last circuit we consequently get two kinds of current. We get those which have been greatly amplified by the high-frequency valve which has cut out interference signals, and we also get the original signals plus interference induced directly into the circuit. This obviously, while not affecting the desired signals in the normal way, brings in a lot of interference which we thought we had cut out.

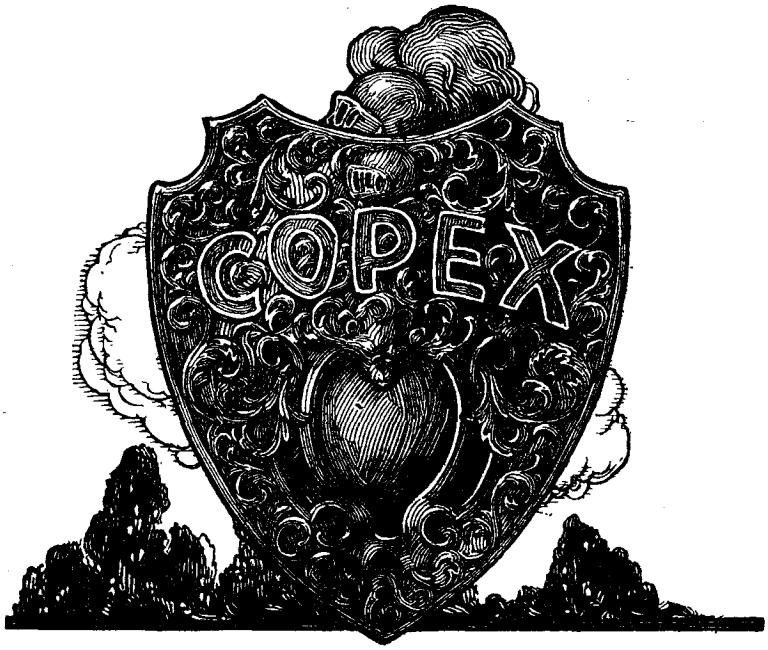
An Example

In a receiver such as the T.A.T., which was a stable arrangement not using a neutrodyne connection, this trouble was very prevalent, and the first grid circuit was really connected to the last grid circuit by the capacities of all the valves, and this allowed a leakage of jamming from beginning to end.

While the use of screens as in Fig. 7 will prevent transference of jamming through magnetic coupling and the different coils, yet the wriggly lines W_1 still exist in Fig. 7 because of the capacity coupling inside the valve itself between grid and anode. This transference of jamming can be overcome by the use of the neutrodyne circuit. This neutrodyne method makes each grid and anode circuit a separate entity, coupled merely by the amplifying action of the valve.

The ultimate solution, however, also includes screened coils or other non-pick-up coils, because the partially mixed up signals in the first grid circuit or in a frame aerial, if the latter is used, is always likely to be handed on to one of the later tuned circuits, and so influence the telephone or loudspeaker.

The above remarks will, I think, have made out a complete case for the great precautions which we take nowadays to ensure real selectivity. The work we have done at Elstree during the last twelve months has placed the whole question of selectivity on a different footing, and no doubt



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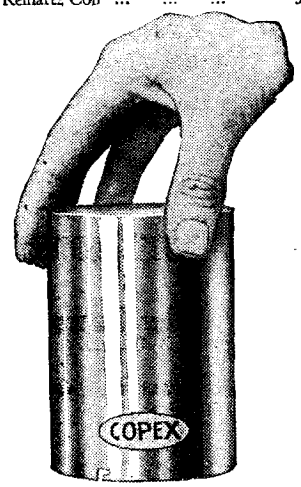
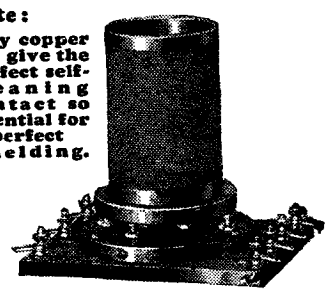
Reinartz Coil		5	0



Note:

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



Gilbert Ad. 5655

RADIO REVOLUTIONISED — *(Continued)*

in twelve months' time the wireless public generally will have forgotten who has done the pioneer work in this field. We will in twelve months' time treat these matters as obvious.

Meanwhile, I invite you to compare our new receiver designs with those of any others published twelve months, or even a few months, ago!

The Neutrodyne Principle

The neutrodyne consists, broadly speaking, in the balancing out of unwanted capacities, particularly the grid to anode capacity of the valve, by means of a condenser or condensers.

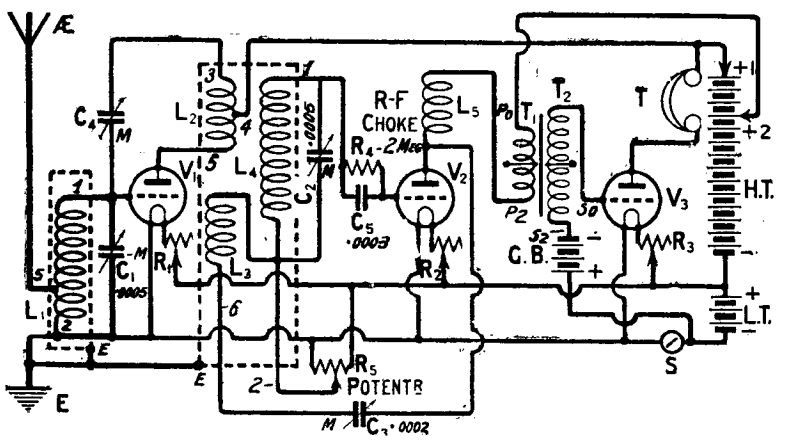


Fig. 22.—In the "Screened-Coil Three" all the coils were completely shielded,

My British Patent 217971, which is the Master Patent of the neutrodyne in this country, covers every type of modern receiver, and the first claim of this Patent will give some idea of its scope.

It reads as follows:—

"A radio-frequency amplifier in which the currents are amplified by pluralitive stages of amplification involving a plurality of tuned circuits, a condenser or condensers being connected so as to produce a reverse reaction effect to counteract the tendency of the amplifier to generate oscillations."

It will thus be seen that neutrodyning involves the overcoming of inherent reaction effects by means of some capacity arrangement.

Self-oscillation

Fig 8 shows a simple valve circuit containing a tuned grid and a tuned anode. If the two circuits are tuned to the same wavelength oscillation will immediately be set up, the energy transference from the anode circuit to the grid being accomplished by means of the small condenser formed by the grid and anode. The energy transference in Fig. 8 is shown by the curved arrow head. This form of circuit is used in the Fig. 1 arrangement, which is the ordinary tuned-anode receiver. There are a large number of methods of stopping the basic circuit of Fig. 8 from oscillating. Fig. 9 shows that by taking a tapping from the anode coil and by connecting the free end P_2 of the inductance L_2 to a small condenser and to the grid of the valve the energy transferred from anode to grid is wiped out by an opposing flow of current from P_2 to the neutralising condenser N. The point P will always be at opposite potential to the point P_2 with respect to the filament, and consequently with respect to the grid, whilst in Fig. 9, whereas there is a natural tendency due to the capacity of the valve for the latter to oscillate yet by the introduction of an artificial condenser supplying opposite potentials we can counteract this effect.

Tapping the Grid Coil

Fig. 10 shows how we can do the same thing by taking a tapping off the grid coil to the filament. The high-frequency currents in the anode circuit of the valve are now transferred to the grid circuit L_1 C_1 through the anode to grid capacity, and in the reverse direction through the neutralising condenser N.

Let us now see how these basic circuits may be neutralised in an actual tuned-anode receiver. Fig. 11 shows a single high-frequency valve followed by a detector valve. The usual tuned-anode circuit L_2 C_2 is employed, but instead of taking the connections from the top end of L_2 the connection to the positive terminal of the high tension battery is made from approximately the middle point, while the small condenser N, which is the neutralising condenser, is connected between the grid of the valve and the top end P_1 of the inductance L_2. A reversal effect is obtained by this middle tapping method, but another scheme is that illustrated in Fig. 12 where no separate tappings are employed, and the neutrodyning elements are added to the circuit without really altering the latter. We now use an inductance L_4 of the same size preferably as L_3, and a small condenser N.C. is used as before. An adjustment of N.C. will stop all tendency for the first valve to oscillate. It is, of course, important to see that the connections to the coil L_4 are the right way round.

Upsetting Neutralisation

There are, however, innumerable other methods of neutralising and in all the cases after the circuits have been properly neutralised reaction may be introduced. The fact that introduction of reaction is greatly to be preferred to any scheme whereby neutralising balance is upset, we use both neutralised tuned-anode circuits and also neutralised high-frequency transformers in which either the primary or secondary is tuned. All three methods are used and possess their merits, and sometimes in a single receiver both tuned-anode and high-frequency transformers are employed.

The "Huntsman" Two

An example of a neutrodyne receiver employing reaction is illustrated in Fig. 13. This is the circuit of Mr. Percy W. Harris's

RADIO REVOLUTIONISED — *(Continued)*

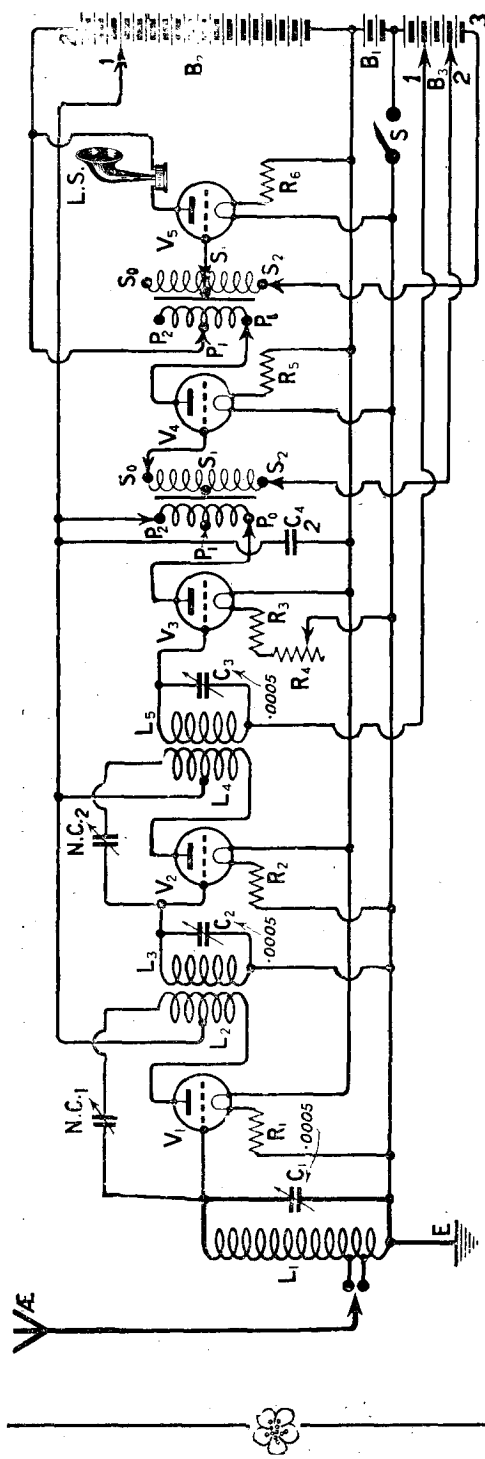


Fig. 23.—The "Magic Five" receiver employed split-primary screened coils and was described in "Wireless," Vol. IV. No. 1.

well-known "Huntsman Two" receiver described in the *Wireless Constructor*. The middle tapping is this time taken from the grid circuit and an ordinary tuned anode is employed, a neutrodyne condenser C_3 serving to maintain absolute stability. A small grid bias battery is connected in the grid circuit of the first valve. Since the receiver is perfectly neutralised and cannot oscillate there is no need to add any grid damping, and consequently a greater development of signal strength is obtainable. Anyone who has tried connecting the secondary of a low-frequency transformer to the positive terminal of their filament battery will realise how much weaker signals can become due to grid damping, quite apart from the question of distortion.

Movable Reaction Coils

In the Fig. 13 circuit reaction is shown as being obtained by a movable reaction coil coupled to the tuned anode inductance. The whole tendency now is to avoid this method of obtaining reaction, and consequently Fig. 14 will have an added interest in that it shows how an intervalve high-frequency transformer arrangement may be neutralised, and also how capacity controlled reaction may be introduced. In this Fig. 14 a middle tapping is taken from the grid coil of the first valve, while C_2 is connected from the end of the grid inductance remote from the grid, and also to the anode of the valve. The inductance L_3 is the primary of the transformer L_3 L_4, the secondary of which is tuned by a condenser. Reinartz reaction is obtained by coupling an inductance L_5 to L_4, a variable condenser C_5 serving to obtain the reaction effect. Where reaction has to be introduced into a transformer coupled neutrodyne receiver it is desirable to have the grid circuit of the second valve tuned. Where no reaction is required it is quite in order to tune the primary of the high-frequency transformer and leave the secondary untuned. An example of such a circuit is given in Fig. 15. In this circuit it will be noticed that the aerial and earth are connected across a portion of the inductance L_1 to obtain greater selectivity.

Parasitic Oscillation

A mysterious trouble arose in certain multi-stage neutrodyned receivers which was at first very obscure. It was ultimately traced to the fact that one or more of the valves was oscillating on a wavelength of about 60 metres. Although correctly neutralised for the main wavelength for which the receiver was tuned there was no neutralisation of the short wave oscillation which arose due to an accidental existence of a tuned grid and tuned-anode circuit adjusted to about 60 metres. Fig. 16 shows a neutralised receiver in which there are two stages of high-frequency amplification each operating on the tuned-anode system, a middle tapping being taken from the anode inductance. In the case of the first valve a neutrodyne condenser N_1 is employed, while a similar condenser N_2 keeps the second valve stable. By the use of centre tappings we introduce, however, a subsidiary tuned circuit which consists of the portion P of the inductance L_3 shunted by the

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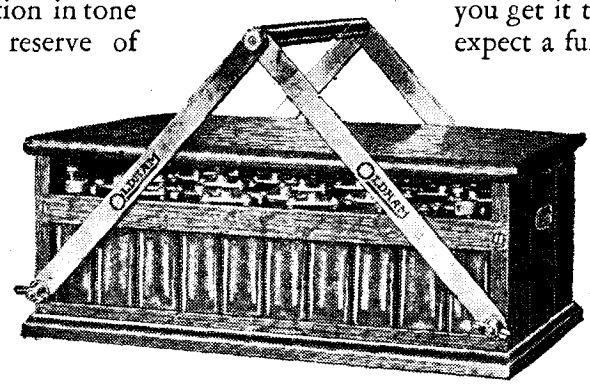

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Special Activation Process OLDHAM Accumulators

Gilbert Ad. 5650

RADIO REVOLUTIONISED—(Continued)

self capacity of this coil and the capacity of the first valve. These capacities are very small, but, nevertheless, there is a small oscillatory circuit tuned to about 60 metres in the anode circuit of the first valve. This portion is also in the grid circuit of the second valve. Exactly the same thing applies to the portion of P_2 of the inductance L_1 in the anode circuit of the second valve. The second valve is therefore very liable to oscillate on about 60 metres, since we have the circuit P and the circuit P_2 in the grid and anode circuits of this valve respectively.

Fig. 17 is another neutrodyne circuit, n which the grid circuits are tapped, the same troublesome parasitic oscillation, however, was found also in this circuit.

Elimination

Obviously there is something required to be done to stop this troublesome effect in neutralised receivers, and two or three methods were ultimately adopted. One of the most fascinating of these methods involved the use of a centre-tapped tuned-anode circuit in the case of the first valve, and an ordinary tuned-anode circuit in the case of the second valve. The arrangement was used in the *Wireless Constructor* receiver called "The Five Fifteen," an economical set giving very excellent results and designed by Mr. Reyner. It will be seen in Fig. 18 that a special aerial tapping is taken to give selectivity, and that the already explained method of neutrodyning is employed in the case of the first valve. The anode circuit of the second valve, however, contains an ordinary tuned-anode circuit, the coil, however, being screened, partly to get selectivity, but chiefly to avoid magnetic interaction with L_1 or L_2. To the anode coil L_3 is coupled a Reinartz reaction inductance L_4, while a reaction condenser C_7 is employed for the same purpose. Since there is no centre tapping on to the second anode coil there is no tendency for the second valve to oscillate, because there is only one circuit tuned to about 60 metres, and that is only in the grid circuit of the second valve. It will be noticed that a neutrodyne condenser $N.C_2$ is connected in a special position, which gives eminently satisfactory results. The terminal A_2 in this figure is an alternative aerial terminal, and when employed enables the last three valves to be used for the reception of the local station, the first two valves being turned off.

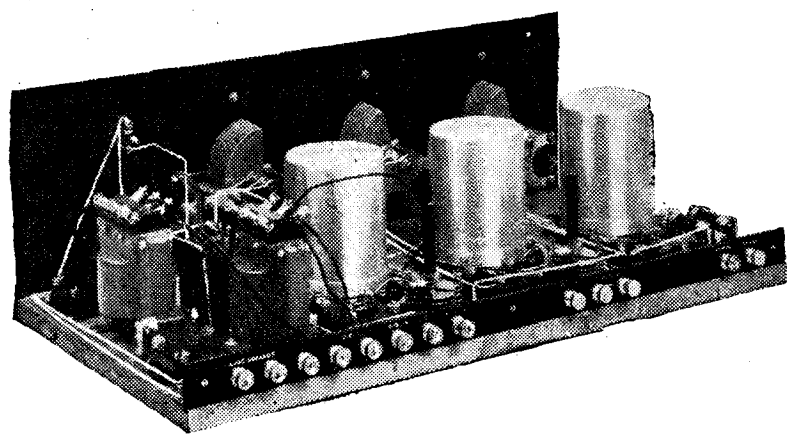


Fig. 24.—With screened coils a very compact lay-out can be employed without loss of efficiency.

An Early Method

A rather earlier method of overcoming the parasitic oscillation is that illustrated in Fig. 19. This circuit looks rather complicated, but is really only a modified transformer-coupled receiver in which a middle tapping is taken from each grid circuit. There are three stages of high-frequency amplification, and the parasitic oscillation which becomes more and more troublesome as more valves are used is prevented by small choke coils L_4, L_8 and L_{12} connected in the positions shown.

The trouble about this receiver circuit was that it did not lend itself to different range of wavelengths. Various readjustments became necessary and the circuit tended to be unstable on the lowest ranges of the main variable condensers.

"Elstree Six" Arrangement

A very much more fascinating circuit ultimately replaced the last one, and was used in the "Elstree Six" with extraordinary success. The "Elstree Six" circuit as applied to a two-stage high-frequency amplifier followed by a detector is shown in Fig. 20. Here it will be seen that instead of taking an actual middle tapping from the grid coils a middle tapping is taken between two condensers C_2 and C_1, which operate on a single knob. These dual condensers are of .0005 capacity, and the junction point between them is taken to the filament. Neutrodyne condensers N_1 and N_2 are provided where shown. The 100,000 ohm resistances R_1 and R_2 act as grid leaks and maintain symmetry, without introducing damping.

In this figure also is the last valve acting as a detector, not on the leaky grid condenser principle, but by giving the grid a variable negative potential and working on the lower band of the anode current characteristic curve. The centre tapping arrangement on the grid circuit of the last valve is not for any neutralising purpose, but to enable Hartley reaction to be employed, the condenser N_3 acting as a reaction condenser, the coil Z being the usual air core high-frequency choke.

This article would not be historically complete unless I also gave the "Elstree Six" circuit itself which contains three stages of high-frequency amplification, a detector and two stages of low-frequency amplification. This circuit is reproduced in Fig. 21.

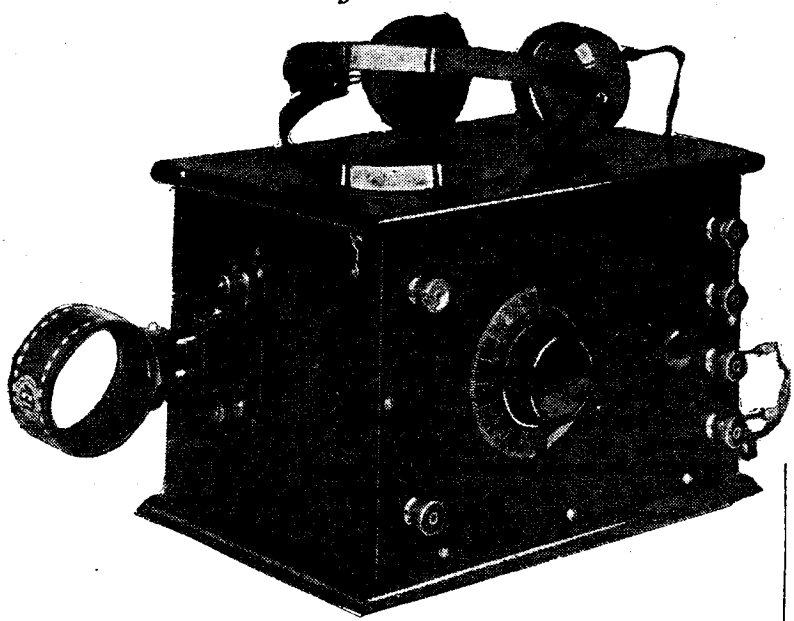
Screened Coil Receivers

The work carried out on screened coils has persuaded us that receivers will employ these very extensively in the coming years. Up to now two receivers have been completely screened, namely the "Screened Coil Three" described

(*Concluded on page* 413).

A CRYSTAL SET FOR THE NEW CONDITIONS

By GEORGE T. KELSEY



To receive a programme on a crystal set from one of two local stations, as in the recent tests from Oxford Street and Marconi House, calls for something a little more selective than the average crystal set. With this receiver, which uses ordinary plug-in coils, it is possible to obtain in effect a centre tapping for the crystal.

THE popularity of split coil circuits in valve receivers is already too well known to need further comment, yet comparatively little attention has been paid to their use in crystal sets. This is understandable since there must be many readers who already possess a set of ordinary plug-in coils and who, although perhaps interested in such circuits, feel disinclined to purchase further special coils in order to give them a trial on a special set.

Dual Condensers

In such cases it is quite a practical proposition to obtain in effect a centre-tapped coil by using a suitable dual condenser in conjunction with ordinary coils. Under these conditions the crystal detector is connected to the centre point on the dual condenser, and at whatever setting this condenser may be placed, the crystal will, in effect, be tapped across only half of the coil. Now by tapping the crystal in this fashion, damping will be reduced and in consequence the tuning of the circuit L_1 C_1 will be noticeably sharper. This selectivity may at the moment seem rather superfluous as the instrument is only a crystal receiver, but if in the near future the B.B.C. carry through the double programme scheme which has already been tried it will be very useful.

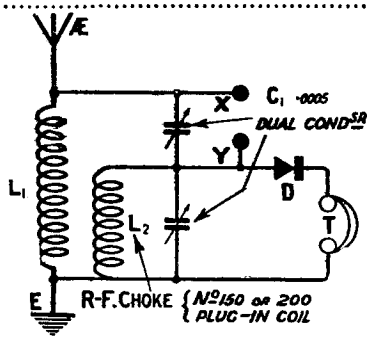


Fig. 1.—It is recommended that the shorting link between X and Y be always used when receiving 5XX.

A Practical Design

Such a circuit is shown in Fig. 1, and around this the crystal receiver which may be seen in the photographs has been designed. It will be seen from the circuit arrangement that the present instrument differs from the conventional crystal receiver in two respects. First, a dual condenser is employed to tune to the desired wavelength, and second, a radio-frequency choke is employed.

Daventry and the Choke

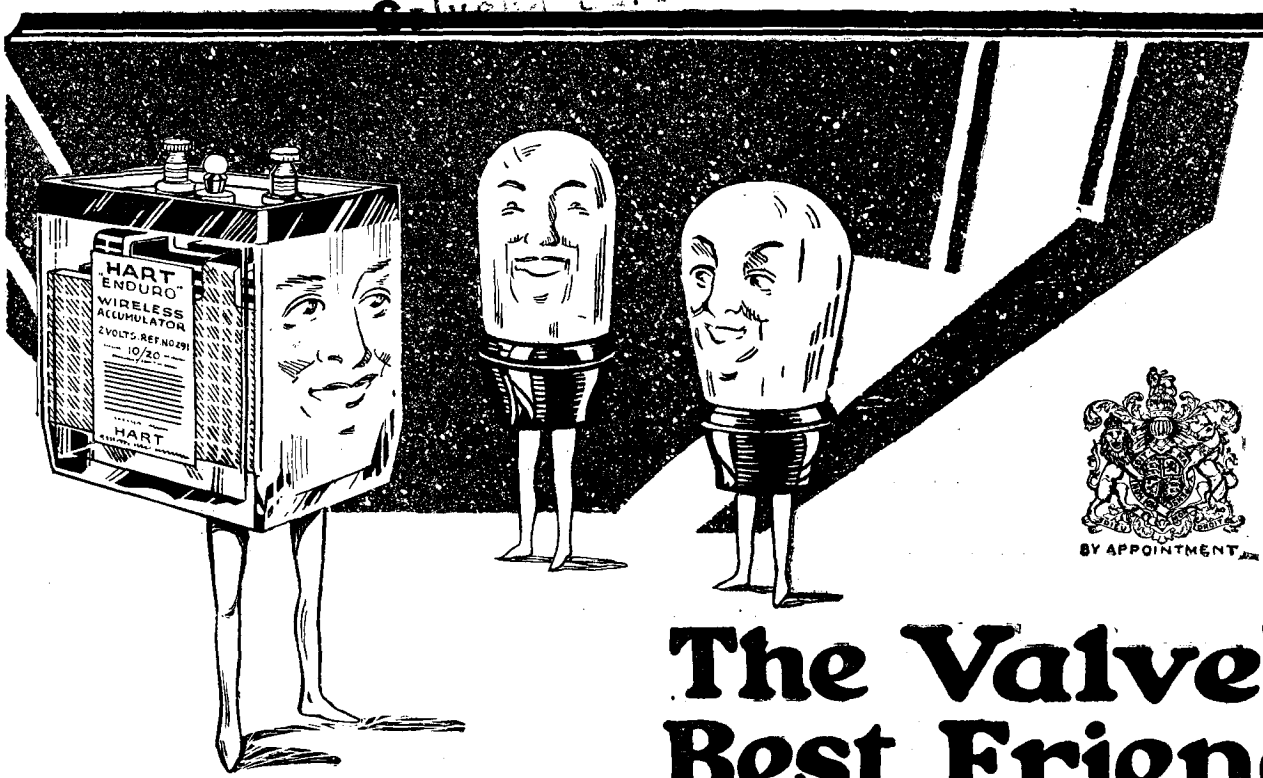
To obtain the best results from the circuit which is incorporated in the receiver the choke coil is necessary, but since the receiver can be used for receiving Daventry, the 5XX coil can function as the choke when receiving stations on the 200-550 metre band.

Circuit Arrangements

It will be noticed on examination of Fig. 1 that provision has been made whereby one half of the dual condenser can be shorted. This enables comparisons to be made in

COMPONENTS REQUIRED

One cabinet, and panel 8⅞ in. by 5¾ in. by 3-16 in. (Peto-Scott Co., Ltd.)
One dual variable condenser ·0005. (K. Raymond.)
One "P.M." fixed crystal detector. (Radio Instruments, Ltd.)
Six "Eelex" terminals, four marked "Aerial," "Earth," two "Telephones," and two unmarked. (J.J. Eastick & Sons.)
Two single-coil sockets, baseboard mounting type. (Beard & Fitch, Ltd.)
"Glazite" and flex for wiring.



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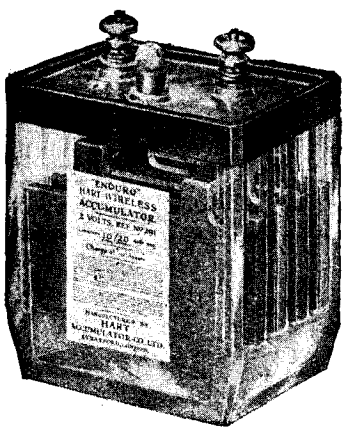

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A CRYSTAL SET FOR THE NEW CONDITIONS—(*Continued*)

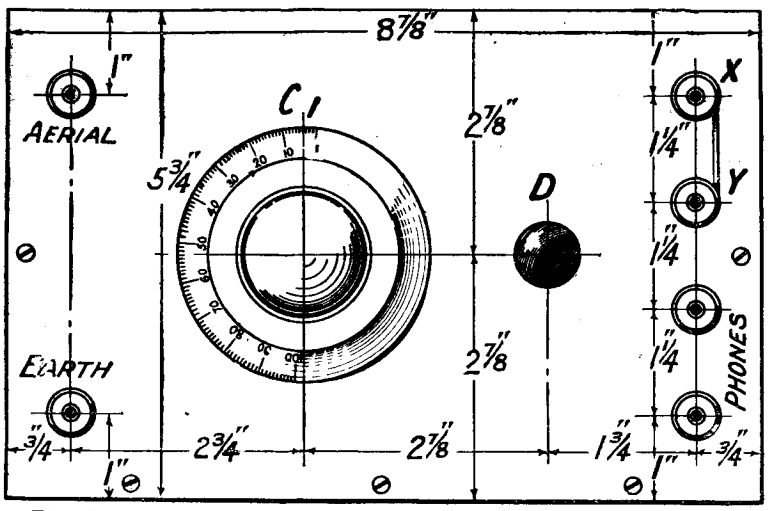


Fig. 2.—All dimensions are clearly marked in this layout of the front of the receiver. Free Blueprint No. 174a.

various ways between the conventional and the present circuit arrangements. It is recommended that the shorting link be always used when receiving the long-wave station, as otherwise an appreciable drop in signal strength may result.

About Components

Having devoted a short space to the uses of a dual condenser in crystal receiving apparatus, it is proposed in the following paragraphs to describe the construction of the receiver illustrated.

In mentioning the names of components used in the original receiver it should not be assumed that these are the only suitable makes, and reference to the advertisers' announcements in this journal will reveal many alternative makes. Care should be taken if deviations from the original are made to see that the component substituted is of good quality and will adapt itself to the original layout. The components used are as given in the list.

Regarding Design

With the American type cabinet, where coils are mounted on the baseboard, it is often impossible to pull out the coil by its base owing to wiring and neighbouring components. The extraction of a coil by its windings should on no account be practised, and so in the receiver described the socket for the aerial coil, which coil may require considerable changing, is mounted on the side of the cabinet. With the socket in this position coils can be withdrawn with ease and without fear of damage to their windings.

Drilling the Panel

Simple as is the panel drilling a diagram is given showing the layout of the original receiver, and to this the reader is recommended to adhere.

Absence of Soldering

If the uninitiated home-builder has felt doubts as to his competence to construct the receiver, the wiring should be a deciding factor, since only two soldered connections are needed throughout, and if desired it is even possible to dispense with soldering at these two points. Flex wire constitutes the connections to the aerial coil-holder, and these pass through two holes in the side of the cabinet, one above and one immediately below the ebonite base of the coil-holder.

WIRING INSTRUCTIONS

Join aerial terminal to one set of fixed plates on C_1 and also to terminal X.

Join earth terminal to one side of L_2 coil socket, to remaining set of fixed plates on C_1 and also to one phone terminal.

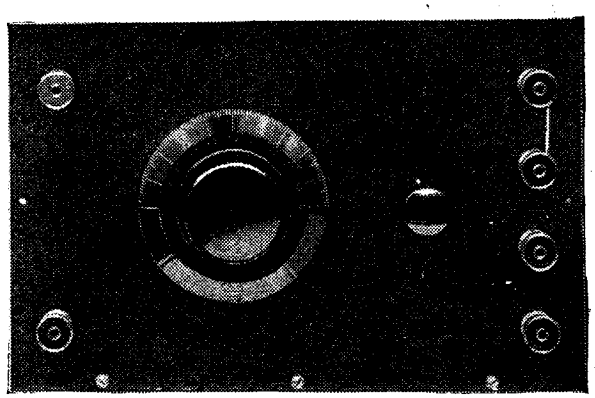
Join remaining phone terminal to one side of crystal detector.

Join the remaining side of crystal detector to terminal Y, to moving plates of C_1 and to remaining side of L_2 coil socket.

Do the above connections first, and when completed join two pieces of flex wire, one to the aerial and one to the earth terminal. Place panel and baseboard in cabinet and pass the loose ends of the flex wires through holes in the cabinet and secure one to each side of L_2 coil socket.

Preliminary Tests

In the early tests of this receiver it may be desirable to use the shorting link when receiving the local station, in which case the choke coil should be removed from its socket, and a number 35 or 40, or,



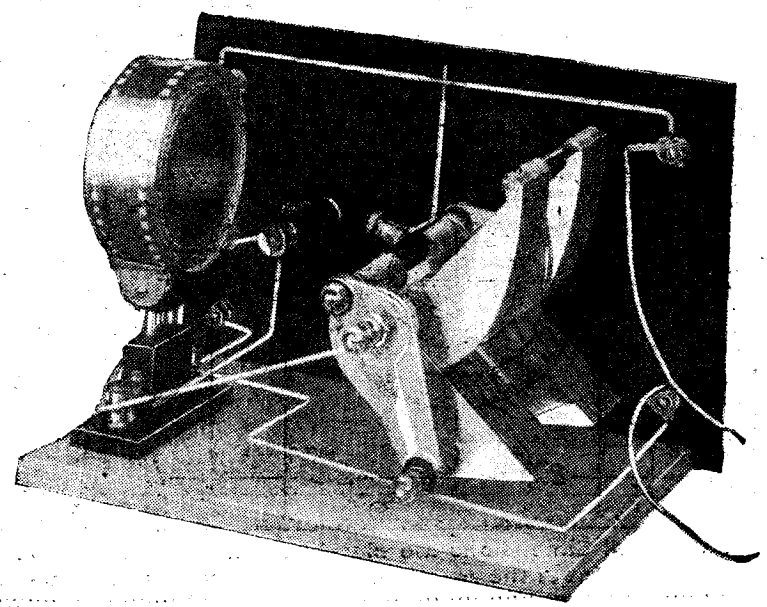
The telephones are attached to the two lower terminals on the right.

A CRYSTAL SET FOR THE NEW CONDITIONS—(*Concluded*)

if your aerial is small, a number 50 coil should be placed in the socket on the side of the cabinet. Connect up aerial, earth and telephones, and rotate the condenser dial until signals are heard at maximum strength.

The Centre-tapped Circuit

To try the centre-tapped arrangement, remove the shorting link and insert the radio-choke (the plug-in coil which is used in the aerial circuit for Daventry). Now rotate once again the condenser dial and notice how rapidly the local station appears and disappears. To receive 5XX remove the aerial coil and in its place put the choke, which should be a number 150 or in some cases perhaps a number 200 coil, and once more readjust the condenser, when at one setting signals from



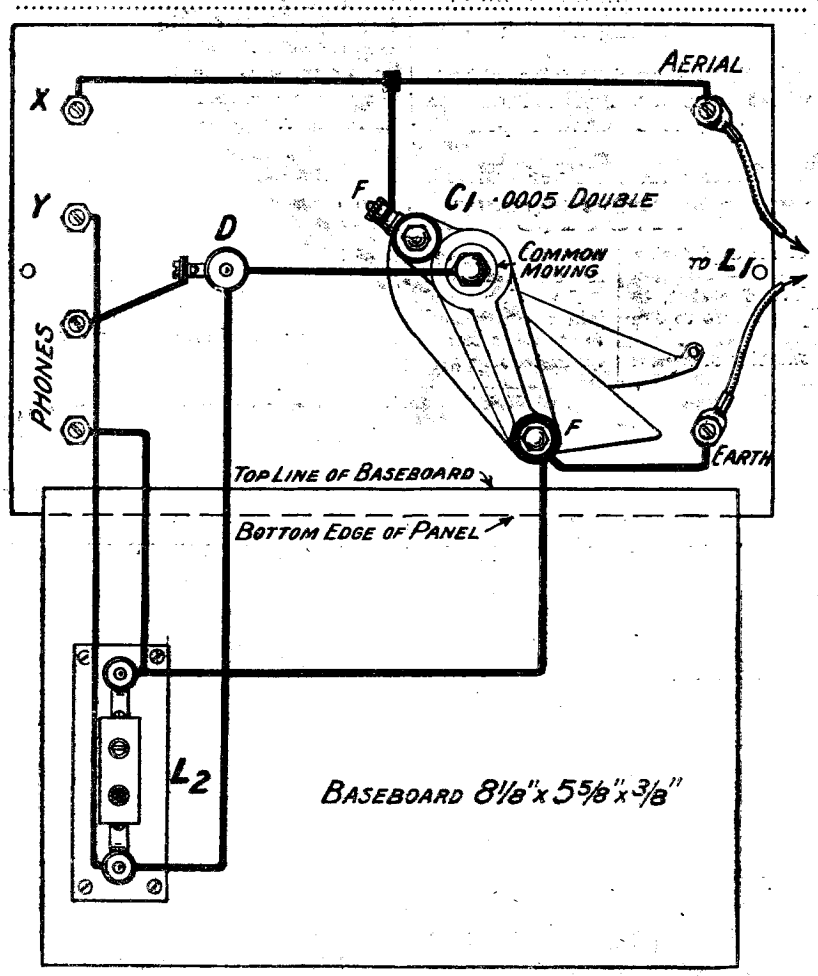


Fig. 3.—The two flex leads pass through one side of the cabinet, and are connected to the L_1 coil socket. This is Free Blueprint No. 174b.

When wiring up the receiver only two soldered connections are required, and even these can be avoided if desired.

Daventry should be heard. (This latter is of course assuming that you are situated within crystal range of this station.)

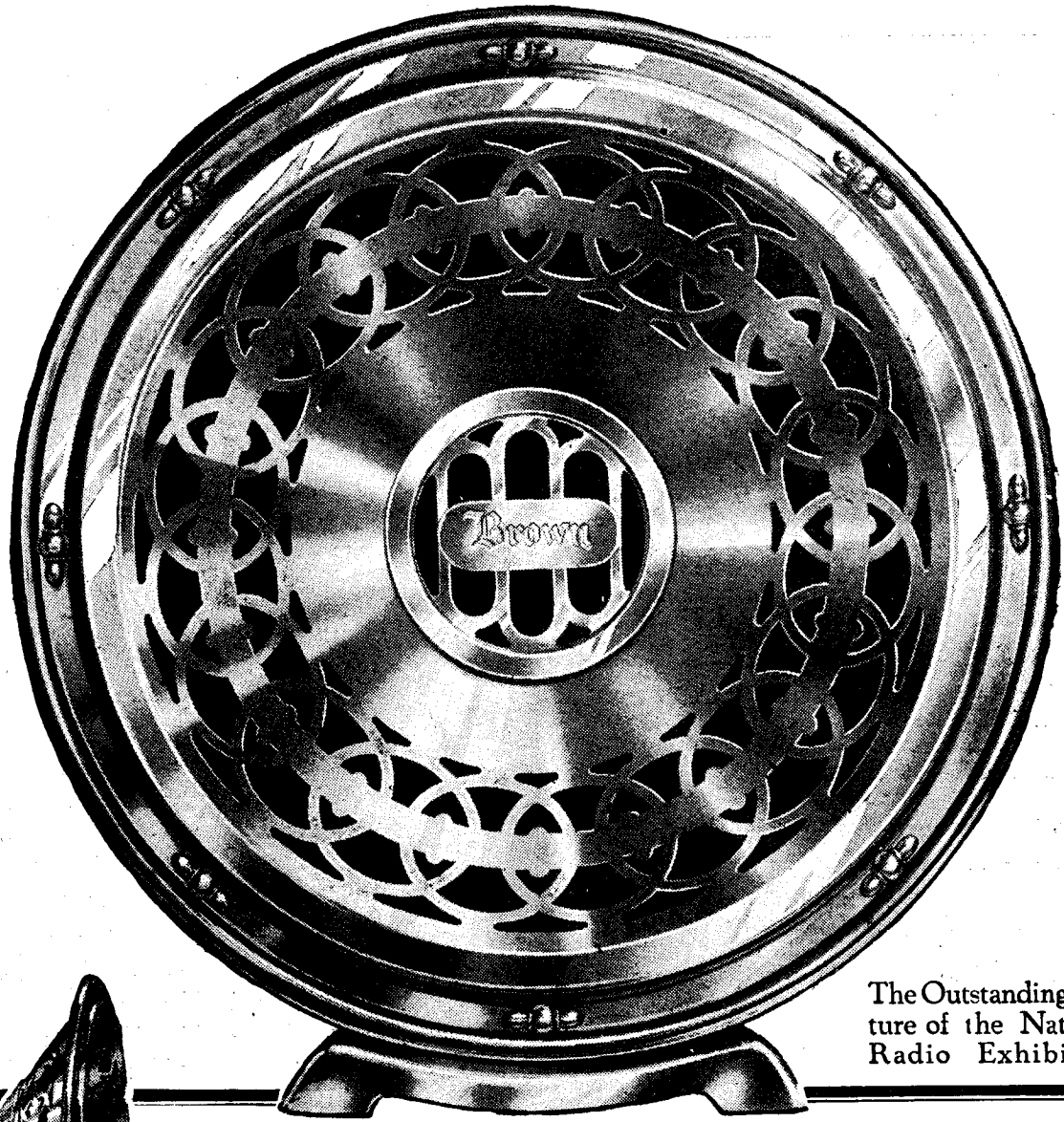
Author's Results

The receiver was first used for the reception of 2LO at a distance of 10 miles. The shorting link was employed and the choke coil was omitted, thus the early tests were carried out using a straightforward circuit arrangement. Signals from London were easily found and were of good strength.

Selective Arrangement

The choke was now placed in position after the shorting strip was removed upon readjustment of the condenser, signals from the local station were once again heard. With this arrangement the selectivity of the receiver was considerably improved, it being noticed how rapidly signals appeared and disappeared on rotation of the condenser dial.

Tried on Daventry, a number 150 coil was used, with, as previously recommended, the link in position. Signals seemed about the normal strength from this station in the locality in which the tests were carried out.



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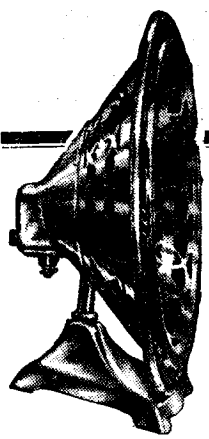

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British Experimental Transmitting Stations

Revised to August 20th, 1926

Owing to the fact that we are informed by the Post Office that the three-letter call signs are only allotted to artificial aerial systems, these have been purposely omitted. Every endeavour has been made to bring this list up to date, and those experimenters whose call signs are of more recent issue are invited to send particulars to the Editor for inclusion in subsequent lists.

2 A

2 AA	The Radio Communication Co., Ltd.	Slough, Bucks.
2 AB	J. O. Walker	16, Ash Road, Headingley, Leeds.
2 AC	Metropolitan - Vickers Electrical Co., Ltd. ..	Research Dept., Trafford Park, Manchester.
2 AD	Siemens Bros. & Co., Ltd. ..	Woolwich, S.E.
2 AF	.. .. ..	
2 AG	T. Moor	Castlemaine, Lethbridge Road, Southport, Lancs.
2 AH		
2 AI		
2 AJ	The Radio Communication Co., Ltd. (Works)	67, High Street, Barnes.
2 AK	C. H. Young, Jr.	52, Maidstone Road, Handsworth, Birmingham.
2 AL	W. Halstead	"Briar Royd," Briar Lane, Thornton-le-Fylde.
2 AM	A. Perl	Victoria House, York Road, Hove, Sussex.
2 AN	A. W. Sharman	1, Morella Road, Wandsworth Common, S.W.
2 AO		
2 AP	F. J. W. Adams	4, Blackheath Vale, Blackheath, S.E.3.
2 AQ	Davis	Thornton Heath.
2 AR	Edgar Gaze	3, Archibald Street, Gloucester.
2 AS	Capt. W. Harwood Moon ..	69, Coleridge Avenue, Penarth, nr. Cardiff.
2 AT	Beresford	Birmingham.
2 AU	Alfred C. Bull	25, Fairland Road, West Ham, E.
2 AV	D. H. W. Swiney	18, Southchurch Road, Southend-on-Sea.
2 AW	H. H. T. Bureury	Crigglestone, Wakefield.
2 AX		
2 AY	D. F. Owen .. .. .. (Portable)	Limehurst, Sale, Cheshire.
2 AZ	William le Queux	93, Marina, St. Leonards-on-Sea.

2 B

2 BA	W. H. Eccles	Finsbury Technical College, Leonard Street, E.C.2.
2 BB	J. Simpson	"Hatfield," Bonnybridge, Stirling.
2 BC	D. F. Owen	Limehurst, Sale, Cheshire.
2 BF		
2 BG		
2 BH	G. W. Wigglesworth ..	90, Blenheim Road, Barnsley.
2 BI	Lt.-Col. W. S. Palmer ..	Elm Field, Calne, Wilts.
2 BJ		
2 BK		
2 BL		
2 BM	H. L. Garfath	166, Birchanger Road, S. Norwood, S.E.25.
2 BN		
2 BO	Marconi's Wireless Telegraph Co., Ltd.	Writtle, Essex.
2 BP	Daimler Motor Co. ..	Glasgow.
2 BQ	L.N.W.R.	Euston Station.
2 BR		
2 BS	Marconi Station	Chelmsford.
2 BT		
2 BU		
2 BV		
2 BW		
2 BX	Municipal College of Technology	Belfast.
2 BY	F. A. Bevan	"Vine House," London Road, Kingston.
2 BZ	Basil Davis	23, Ferncroft Avenue, Heath Drive, N.W.3.

2 C

2 CA1	C. E. Palmer-Jones.. ..	20, Princes Road, Wimbledon, S.W.
2 CA2	C. E. Palmer-Jones.. ..	Willesden, N.W.10.
2 CA3	C. E. Palmer-Jones (Portable)	
2 CB	C. E. Davies	159, Boyson Road, Walworth, S.E.17.
2 CC	H. S. Nicholls	"The Whins," Stocksfield-on-Tyne.
2 CD	Burton-on-Trent Wireless Society	High Street, Burton-on-Trent.
2 CF		
2 CG		
2 CH	Science Society	Oundle School, Oundle, Northants.
2 CI	R. Brooks-King	West Hill, Ottery-St.-Mary, Devon.
2 CJ		
2 CK	City & Guilds Engineering College	Exhibition Road, London, S.W.7.
2 CL	C. Woods	Woolwich.
2 CM	N. D. B. Hyde	92, Littledale Road, Egremont, Wallasey, Cheshire.
2 CN		
2 CO	G. E. Pohu	10, Colville Road, W.11.
2 CP	Wolverhampton & District Radio Transmitter's Society	Wellington Place, Penn Fields, Wolverhampton.
2 CQ		
2 CR		
2 CS	N. Guy	Elm Park Road, Pinner, Middx
2 CT		
2 CU		
2 CV		
2 CW	Commdr. B. Hippisley ..	"Ston," Easton Park, near Bath.
2 CX	A. L. Rockham	114, Beauchamp Road, Upper Norwood, S.E.19.
2 CY	J. G. Lucas..	6, Spencer Avenue, Palmer's Green, N.13.
2 CZ	C. T. Atkinson	17, Beaumont Road, Leicester.

2 D

2 DA		
2 DB	F. Graham Turner	88, Chesterton Road, Cambridge.
2 DC	M. Child	60, Ashworth Mansions, Maida Vale, W.9.
2 DD	A. C. Davis	105, Brynland Avenue, Bristol.
2 DF	R. E. Miller	77, King's Avenue, New Malden, Surrey.
2 DG, 2 DH, 2 DI	W. Burnet	16, Bannerdale Road, Sheffield.
2 DJ	A. T. Lee	Alvaston, Derby.
2 DK		
2 DL	R. S. Clay	Northern Polytechnic Institute, Holloway, N.7.
2 DM		
2 DN	M. N. Durnford	Kingswear House, Kingswear, S. Devon.
2 DO, 2 DP	1st Troop, Ormskirk Boy Scouts	15, Wigan Road, Ormskirk.
2 DQ	N. V. Webber	Vale Road, Oatlands Park, Weybridge.
2 DR	S. R. Wright	14, Bankfield Drive, Nab Wood, Shipley, Yorks.
2 DS	E. Redpath	61, Iron Mill Lane, Crayford, Kent.
2 DT	Barrow & District Wireless Association	Market Tower, Barrow-in-Furness.
2 DU	W. D. Norbury	51, Chilwell Road, Beeston, Notts.
2 DV	Capt. R. Gambier-Parry ..	The Old Toll House, Broxbourne, Herts.
2 DW		
2 DX	W. K. Alford	"Rosedene," Camberley, Surrey.
2 DY, 2 DZ	F. H. Haynes	38, Sittingbourne Avenue, Enfield Middlesex.

2 F

2 FA	F. G. H. Bennett	16, Tivoli Road, Crouch End, N.8
2 FB	W. Ison	"Avonview," Harnham, Salisbury
2 FC	F. Cholerton..	52, Bridge Street, St. Helens Lancs.
2 FD		
2 FF		

LIST OF EXPERIMENTAL CALL SIGNS—(Continued)

2 FG	I. McMichael	"Everest," Princes Park Avenue, Golders Green, N.W.3.
2 FH	T. I. Rogers	2, Park Hill, Moseley, Birmingham.
2 FI		
2 FJ	W. J. Fry	22, Thirsk Road, Lavender Hill, S.W.11.
2 FK	F. C. Grover	20, Rutland Road, Ilford, Essex.
2 FL	L. C. Willcox	21, George Street, Warminster, Wilts.
2 FM	F. C. McMurray / R. E. L. Beere	38, Galpins Road, Thornton Heath.
2 FN	L. M. Baker	Ruddington, Notts.
2 FO		Harrow.
2 FP	F. Foulger	74, Jerningham Road, New Cross, S.E.14.
2 FQ	W. W. Burnham	"Wildcroft," Elmstead Wood, Chislehurst.
2 FR	S. Rudeforth	54, Worthing Street, Hull, Yorks.
2 FS	C. S. Frowd	"Ranamere," Knebworth Road, Bexhill-on-Sea.
2 FT	J. E. Wells	186, Noel Street, Nottingham.
2 FU	E. T. Manley, Junr.	49A, Arthur Road, Wimbledon Park, S.W.19.
2 FV	W. Scott Hay	"Ivycraig," Newton Mearns, Renfrewshire.
2 FW	Rev. D. Thomas	St. Paul's B.P. Scouts, Bournemouth.
2 FX	H. C. Binden	32, Oxford Road, Bournemouth.
2 FY		
2 FZ	Radio Experimental Society of Manchester	102, Glenville Street, Stockport.

2 G

2 GA	Rev. J. A. Gibson	18, Daniel Street, Bath.
2 GB		
2 GC		
2 GD	J. C. Elmer	"Aethelmar," Seabrook Road, Hythe, Kent.
2 GF	J. V. Newson	139, Ormside Street, S.E.15.
2 GG	R. H. Kidd	Marlborough House, Newbury, Bucks.
2 GH		
2 GI		
2 GJ / 2 GK	L. Johnson	"Park View," Hinde House Lane, Pitsmoor, Sheffield.
2 GL	W. J. Henderson	2, Hollywood Avenue, South Kensington.
2 GM		
2 GN	L. Manning	36, School Green Lane, Fulwood, Sheffield.
2 GO	L. Bland-Flagg	61, Burlington Road, Bayswater, W.2.
2 GP	W. Gartland	14, Baalbec Road, Highbury, N.5.
2 GQ	1st Taunton (Wilton) Scouts	11, Park Street, Taunton.
2 GR / 2 GS	Thomas Forsyth (Portable)	"Wenslea," Ashington, Northumberland.
2 GT	G. Irvine	11, Park Street, Liverpool.
2 GU	Halifax Wireless Club	Clare Hall, Halifax.
2 GV	Rev. W. P. Rigby	St. Lawrence Vicarage, Bristol.
2 GW	G. S. White	"Fiveways," Chippenham, Wilts.
2 GX		
2 GY	F. C. Hardwell	91A, Temple Street, Bristol.
2 GZ	A. L. Megson	"Highwayside," Bow Green, Bowdon, Cheshire.

2 H

2 HA	A. L. Megson	"Highwayside," Bow Green, Bowdon, Cheshire.
2 HB	L. H. Lomas	"Highfield," Summerseat, near Manchester.
2 HC	F. M. J. White	Bucklebury Manor, near Reading.
2 HD	Prestwich & District Radio Society	Spring Bank, Church End, Prestwich, near Manchester.
2 HF	W. G. Gold	"Koyama," Lichfield Road, Sutton Coldfield, near Birmingham.
2 HG	T. Boutland	25, First Row, Ashington, Northumberland.
2 HH	T. Boutland, Junr.	57, Seventh Row, Ashington, Northumberland.
2 HI		
2 HJ		
2 HK	J. Mellanby and J. Somerset Murray	Emmanuel College, Cambridge.
2 HL	A. A. Campbell Swinton	40, Chester Square, S.W.1.
2 HM	C. W. Goyder	44, Hale Lane, Mill Hill, N.W.7.
2 HN		
2 HO		
2 HP	C. R. Waterer	123, Upper Brockley Road, S.E.4.
2 HQ	A. W. Fawcett	11, Leigh Road, Clifton, Bristol.
2 HR	H. Harte	40, Fields Road, Newport, Monmouth.
2 HS	G. W. Hale	36, Dagnall Park, South Norwood, S.E.25.
2 HT	R. H. Klein	11, Crediton Hill, W. Hampstead, N.W.6.
2 HU		
2 HV	H. Beresford	"Drayton," Wylde Green, Birmingham.
2 HW	H. Beresford	2, 3 and 4, Bull Street, Birmingham.
2 HX	F. A. Love	"Ivy Dene," Guildford Park Road, Guildford.
2 HY		
2 HZ	P. Northey	12, Pelham Crescent, S.W.7.

2 I

2 IA		
2 IB	Igranic Electric Co., Ltd.	Bedford.
2 IC	Capt. O. S. Stiles	Herons Ghyll, South Harrow, Middlesex.
2 ID	E. S. Firth	"Rosemead," The Lee, Great Missenden, Bucks.
2 IF	S. W. Bligh	1 and 2, North Lane, Canterbury.
2 IG		
2 IH	H. Hiley	"Rivercrest," Riddlesden, Keighley, Yorks.
2 II	A. M. Ralli	14, Torrington Road, Wallasey, Cheshire.
2 IJ		
2 IK	County High School for Boys	Altrincham.
2 IL	H. R. Goodhall	"Fernlea," Winchester Road, Bassett, Southampton.
2 IM / 2 IN	J. F. Fish	"Thornleigh," Station Road, Thornton-le-Fylde, Blackpool.
2 IO		
2 IP		
2 IQ / 2 IR	W. A. Ward (Portable)	26, Marlborough Road, Sheffield.
2 IS		
2 IT	B. Walsh	Clovelly, Victoria Street, Armagh, N. Ireland.
2 IU	G. A. E. Roberts	Twyford, near Winchester.
2 IV	L. F. White	10, Priory Road, Knowle, Bristol.
2 IW	G. R. Marsh	Mallards' Close, Twyford, near Winchester.
2 IX	S. G. Taylor	Fressingfield, Littleover, Derby.
2 IY	Hampstead & St. Pancras Radio Society	Crogsland Road, Chalk Farm, N.W.
2 IZ	A. H. Maidment	"Sheldrake," Siddons Road, Forest Hill, S.E.23.

2 J

2 JA	A. S. Atkins	"St. Malo," Beauchamp Road, U. Norwood, S.E.19.
2 JB	J. C. Bird	1, Stapleford Road, Wembley.
2 JC	G. Sykes	13, Longford Street, Gorton, Manchester.
2 JD	J. L. Summerfield	218, Thorold Road, Ilford, Essex.
2 JF	C. G. Williams	"Moranedd," 86, Rullerton Road, Wallasey, Cheshire.
2 JG	W. A. Seed	Crigglestone, Wakefield, Yorks.
2 JH	C. Barrand	158, Wellington Street, Slough, Bucks.
2 JI		
2 JJ	W. A. Skinner	370, Old Kent Road, S.E.1.
2 JK	P. R. Coursey	Stamford House, Marchmont Road Richmond, Surrey.
2 JL	G. G. Bailey	"The Beaches," Cowley, Middlesex.
2 JM	G. G. Blake	10, Hounslow Road, Richmond, Surrey.
2 JN	H. B. Burdekin	85, Tachbrook Road, Leamington, Spa.
2 JO	J. W. Whiteside	30, Castle Street, Clitheroe, Lancs.
2 JP / 2 JQ	M. C. Ellison (Portable)	Brooklands, Follifoot, nr. Harrogate.
2 JR / 2 JS	Leicestershire Mines Radio Investigation Committee	Operated at Desford Colliery, Desford, nr. Leicester.
2 JT		
2 JU	E. J. Pearcey	19, Mendora Road, Fulham, S.W.6.
2 JV	A. G. Robbins	Birch House, Station Road, Epping.
2 JW	J. R. Barrett	Westgate Court, Canterbury.
2 JX	L. Vizard	46, Brandville Gardens, Barkinside.
2 JY		
2 JZ	R. D. Spence	Craighead House, Huntley, Aberdeenshire.

2 K

2 KA	B. Hodson	31, Broomfield Avenue, Palmer's Green.
2 KB	W. E. Earp	675, Moore Road, Mapperley, Nottingham.
2 KC	H. T. Longuehaye	96, Barnmead Road, Beckenham.
2 KD	Denison Bros.	Wireless Engineers, Halifax.
2 KF	J. A. Partridge	22, Park Road, Colliers Wood, Merton, S.W.19.
2 KG	Major G. K. Field	19, Edith Villas, Kensington, W.14
2 KH	W. A. Brooke	Ashley's W/T Co., 69, Renshaw St., Liverpool.
2 KI		
2 KJ		
2 KK	R. H. Parker	Radio House, Wilson Road, Smethwick.
2 KL	F. Pinkerton	50, Peak Hill, Sydenham, S.E.26.
2 KM	C. Stainton	155, Estcourt Street, Hull.
2 KN	A. B. Day	"Branksome," 64, Holdenhurst Avenue, Finchley, N.12.

LIST OF EXPERIMENTAL CALL SIGNS—(*Continued*)

2 KO	C. S. BAYNTON	.. .. ..	48, Russell Road, Moseley, Birmingham.
2 KP	F. A. BIRD	.. .. ..	13, Henrietta Road, Bath.
2 KQ	H. TAYLOR	.. .. ..	The Lodge, Tettenhall Wood, nr. Wolverhampton.
2 KR	E. EDMONDS, Junr.	.. ..	2, Yew Tree Road, Edgbaston, Birmingham.
2 KS	C. C. BREAKELL	.. ..	"Mill Bank," Church Street, Preston.
2 KT	J. E. NICKLESS	.. .. ..	83, Wellington Road, Snaresbrook, E. 11.
2 KU	A. J. SELBY	.. .. ..	66, Edward Street, Burton-on-Trent.
2 KV	W. J. CRAMPTON	.. ..	Huntington House, South Cliff, Bexhill.
2 KW	W. R. BURNE	.. ..	"Springfield," Thorold Grove, Sale, Cheshire.
2 KX	W. STANWORTH	.. ..	"Sherwood," Gorse Road, Blackburn.
2 KY	L. POLLARD	.. .. ..	209, Cunliffe Road, Blackpool.
2 KZ	B. CLAPP	.. .. ..	"Holmville," Warwick Road, Coulsdon, Surrey.

2 L

2 LA	H. F. YARDLEY	.. ..	The Castle, Egremont Drive, Sheriff Hill, Gateshead.
2 LB	ABDUL HAMID GHANI	..	7, Mount Ararat Road, Richmond, Surrey.
2 LC			
2 LD	R. J. COTTIS	.. .. ..	4, Crondace Road, Parsons Green, S.W. 6.
2 LF	P. HARRIS	.. .. ..	Chilvester Lodge, Calne, Wilts.
2 LG	H. H. WHITFIELD	.. ..	"The Glen," Primrose Ln., Hall Green, Birmingham.
2 LH	L. H. CROWTHER	.. ..	18, Linden Avenue, Woodseats, Sheffield.
2 LI	C. H. WILKINSON	.. ..	14, Kingswood Avenue, Queen's Park, N.W. 6.
2 LJ, 2 LK	23rd L. ARMOURED CAR CO.		90, Henry Street, St. John's Wood, N.W. 8.
2 LL			
2 LM, 2 LN	Dr. N. S. WELLS (Portable)	.. ..	Platt Lane, Hindley, near Wigan, Lancs.
2 LP	A. W. KNIGHT	.. ..	26, Stanbury Road, Peckham, S.E. 15.
2 LQ	J. A. HENDERSON	.. ..	18, Elm Hall Drive, Mossley Hill, Liverpool.
2 LR	J. SCOTT-TAGGART	.. ..	
2 LT	A. F. BARTLE	.. .. ..	5, Coleraine Road, Blackheath, S.E. 3.
2 LU	W. A. APPLETON	.. ..	Wembley Hill Road, Wembley.
2 LV, 2 LW	Capt. R. TINGEY	.. ..	223, Leinster Gardens, Hyde Park, W. 2.
2 LX	T. S. SKEET	.. .. ..	98, Stenson Road, Derby.
2 LY	H. H. THOMPSON	.. ..	24, Golders Way, Golders Green, N.W. 11.
2 LZ	F. A. MAYER	.. .. ..	"Stilemans," Wickford, Essex.

2 M

2 MA	P. L. SAVAGE	.. .. ..	14, Norwich Road, Lowestoft.
2 MB	E. H. JEYNES	.. .. ..	67, St. Paul's Road, Gloucester.
2 MC	H. B. DENT	.. .. ..	39 Fleetwood Avenue, Westcliff-on-Sea.
2 MD	C. CHIPPERFIELD	.. ..	9, Nacton Road, Ipswich.
2 MF	MARCONI SCIENTIFIC INSTRUMENT CO.		70, Dudden Hill Lane, Willesden.
2 MG	C. CREED MILLER	.. ..	"Arndene," Bearsden, Dumbartonshire.
2 MH	T. A. D. LAWTON	.. ..	Brownedge Vicarage, Stoke-on-Trent.
2 MI	A. O. MILNE	.. .. ..	41, Victoria Avenue, Northdown, Margate.
2 MJ			
2 MK	A. W. HAMBLING	.. ..	80, Brondesbury Road, Brondesbury, N.W. 6.
2 ML	R. C. CLINKER	.. .. ..	"Tryfn," Bilton, Rugby.
2 MM	C. HINES	.. .. ..	"Watley," Twyford, nr. Winchester.
2 MN			
2 MO	F. O. READ	.. .. ..	26, Flanders Road, Bedford Park, W. 4.
2 MP			
2 MQ	PERCY W. HARRIS	.. ..	29, South Ridgway Place, Wimbledon, S.W. 19.
2 MR	R. H. REECE	.. .. ..	62, Addison Gardens, W. 14.
2 MS	R. H. REECE	.. .. ..	62, Addison Gardens, W. 14.
2 MT	MARCONI'S W/T. CO.	.. ..	Writtle, Essex.
2 MU	.. ..		
2 MV	R. WALLIS	.. .. ..	"Denh de Lion," Westgate-on-Sea.
2 MW			
2 MX	N. V. WEBBER	.. .. ..	Vale Road, Oatlands Park, Weybridge.
2 MY	H. M. HODGSON	.. ..	Clifton House, Hartford, Cheshire.
2 MZ	J. MAYALL	.. .. ..	"Burfield," St. Paul's Road, Gloucester.

2 N

2 NA	H. FROST	.. .. ..	"Longwood," Barr Common, Walsall.
2 NB	Capt. N. G. BAGULEY	..	33, Castlegate, Newark, Notts.
2 NC	J. GOODWIN	.. .. ..	Crown Street, Duffield, Derby.
2 ND	E. H. PICKFORD	.. ..	Doncaster Road, Rotherham.
2 NF	G. S. WHALE	.. .. ..	Whales' Wireless Works and College, East Parade, Colwyn Bay.
2 NG			
2 NH	E. A. DEDMAN	.. ..	"Rossmoyne," 65, Kingston Road, New Malden.
2 NI	R. H. LYNE	.. .. ..	56, Watling Street, Bexley Heath, Kent.
2 NJ	N. JOHNSON-FERGUSON	..	Luckington Court, Chippenham.
2 NK	P. PRIEST	.. .. ..	152, Woodside Road, Lockwood, Huddersfield.
2 NL	F. J. HUGHES	.. .. ..	"Ashdene," 129, Wells Road Bath
2 NM	GERALD MARCUSE	.. ..	"Coombe Dingle," Queen's Park Caterham, Surrey.
2 NN	H. PALMER	.. .. ..	"Ashleigh," Offington Lane, Worthing.
2 NO	H. R. ADAMS	.. .. ..	"Linkley," Wellington Road, Walsall.
2 NP	H. G. TREADWELL	.. ..	Middleton Cheney, Banbury.
2 NQ	J. W. PALLISTER	.. ..	33, Westbourne Terrace, Stockton-on-Tees.
2 NR	G. T. UNGOOD	.. ..	The County School, Acton, W. 3.
2 NS	M. BURCHILL	.. .. ..	30, Leighton Road, Southville, Bristol.
2 NT	A. C. C. WILLWAY	.. ..	Knowle Hill, Mayfield, Sussex.
2 NU			
2 NV, 2 NW	H. LITTLEY	.. .. ..	Lodge Road, West Bromwich.
2 NX			
2 NY, 2 NZ	J. N. C. BRADSHAW	.. ..	"Wyngarth," Bilsborough, near Preston.

2 O

2 OA	Capt. E. A. ANSON	.. ..	Morton Cottage, Port Seton, E. Lothian, Scotland.
2 OB			
2 OC	Capt. D. SINCLAIR	.. ..	"Morven" Shepperton-on-Thames
2 OD	E. J. SIMMONDS	.. ..	"Meadowlea" Gerrards Cross, Bucks.
2 OF	H. C. TRENT	.. .. ..	"Fernside," Yarmouth Road, Lowestoft.
2 OG	W. L. WILLIAMSON	.. ..	Rawdon House, Grimsby Road, Cleethorpes.
2 OH	Lieut. C. S. GOODE	.. ..	Abbotsford, Hinckley, Leicester.
2 OI	C. BAIN	.. .. ..	140, Northumberland Street, Newcastle-on-Tyne.
2 OJ	E. A. HOUGHTON	.. ..	52, First Avenue, Hove, Sussex.
2 OK	C. A. VANDERVILL & CO., LTD.		Warple Way, Acton, W. 3.
2 OL	H. D. BUTLER	.. .. ..	"Trebaruth," South Nutfield, Surrey.
2 OM	H. S. WALKER	.. ..	Park Lodge, 9, The Butts, Brentford, Middlesex.
2 ON	Major H. C. PARKER	.. ..	56, Shernhall Street, Walthamthamstow, E. 17.
2 OO	Capt. P. P. ECKERSLEY	..	Derby House, Hendon.
2 OP	Capt. G. C. PRICE	.. ..	2, St. Anne's Villas, Hewlett Road, Cheltenham.
2 OQ	D. P. BAKER	.. .. ..	Crescent Ho., Newbridge Crescent, Wolverhamption.
2 OR	G. P. KENDALL	.. ..	1, Devas Road, Raynes Park.
2 OS			
2 OT, 2 OU	ILFORD RADIO SOCIETY	..	Ilford, Essex.
2 OV			
2 OW	F. W. WOODWARD	.. ..	5, Portland Gardens, Harringay, N.4.
2 OX	Dr. J. R. RATCLIFFE	..	22, Wake Green Road, Moseley, Birmingham.
2 OY	C. A. HARNWELL	.. ..	Denby Dale, near Huddersfield.
2 OZ	J. W. NORTON	.. .. ..	20, Perryn Road, Acton, W. 3.

2 P

2 PA			
2 PB	D. E. O. NICHOLSON	.. ..	383, Kennington Road, Lambeth, S.E. 11.
2 PC	A. G. DAVIES	.. .. ..	"Redcot," Park Road, Timberley, Cheshire.
2 PD	Dr. W. H. MARSTON	.. ..	477, Coventry Road, Birmingham.
2 PF	R. B. JEFFERIES	.. ..	Lynn Dene Mount Hill, Kingswood, Bristol.
2 PG	B. HESKETH	.. .. ..	Wrexham Road, Slough, Bucks.
2 PH	L. J. DORE	.. .. ..	139 Lightswood Road Bearwood, Smethwick, Staffs.
2 PI, 2 PJ	LOUGHBOROUGH COLLEGE	..	Loughborough, Leicester.
2 PK			
2 PL	Major L. N. STEPHENS	..	Haddon House, Bridport Harbour, Dorset.
2 PM			
2 PN	C. J. PRATT	.. .. ..	332 Upper Richmond Road, Putney, S.W. 15.
2 PO	N. C. HARDMAN	.. ..	"Mayfield," Cloughfold, near Manchester.
2 PP	J. S. KNIGHT	.. .. ..	Clark's Hill, Nursery, Prestwich.

LIST OF EXPERIMENTAL CALL SIGNS—(*Continued*)

2 PQ	G. E. Mortley Sprague & Co. Ltd.	Nelson Road, Tunbridge Wells.
2 PR	A. E. Whitehead	"Hollingwood," King's Ride, Camberley, Surrey.
2 PS	J. H. Gill	"18 Fourth Avenue Sherwood Rise, Notts.
2 PT	J. Jardine	"Syntony," Hall Road, West, Blundellsands, near Liverpool.
2 PU	C. R. W. Chapman	"Nirvana," 44, Chaplin Road, Wembley.
2 PV	G. Smith-Clarke	"Shenandoah," Gibbet Hill, Kenilworth.
2 PW	J. Matthewson	35, Chapel Road, Forest Gate, E. 7.
2 PX	H. H. Lassman	429, Barking Road, East Ham, E. 7.
2 PY	H. Carter-Bowles	51, Gunterstone Road, Barons Court, W.
2 PZ	A. E. J. Symonds	12, Addison Avenue, Holland Park, W. 11.

2 Q

2 QA	Dr. H. W. Taylor	Cambridge.
2 QB	R. W. Bailey	Broadeaves, Fairfield Road, Widnes, Lancs.
2 QC	F. V. Smith	Station Approach, High Street, Rochester, and "Rowsley," Beacon Road, Herne Bay.
2 QD	J. Ayres	18, Seaforth Avenue, West Barnes Lane, New Malden, Surrey.
2 QF	R. F. Gordon	5, Landowne Square, Weymouth.
2 QG		
2 QH	G. Hewens	42 St. Augustine Avenue, Grimsby.
2 QI	Hurst & Lucas	3, Mayford Road, Balham, S.W.12.
2 QJ	J. F. Warren	"Pollards," Gerrards Cross, Bucks.
2 QK	J. Bever	85, Emm Lane, Bradford.
2 QL	R. J. Hibberd	St. Paul's School, Dorking.
2 QM	L. Hotine	c/o B.B.C., Daventry.
2 QN	A. Hobday	Flint House, Northdown Road, Margate.
2 QO	P. Pritchard	Blenheim House, Broad Street, Hereford.
2 QP	L. C. Grant	Wandsworth House, Heaton, Newcastle-on-Tyne.
2 QQ	F. Phillips	17, Eliot Vale, Blackheath, S.E. 3.
2 QR	E. T. Bateman	Grimston, Wood Mill Lane, Bitterne, Southampton.
2 QS	S. Ward	28, Pendle Road, Streatham, S.W. 16.
2 QT	C. C. Barnett	Orchard Bungalow, Churchdown, near Gloucester.
2 QU	Hurst & Lucas	196, Landsdowne Road, Blackheath.
2 QV	J. R. Forshaw	Westville, St. Helen's Road, Ormskirk.
2 QW		
2 QX		
2 QY	A. Hinderleigh	15, Lyndcroft Gardens, N.W. 6.
2 QZ	B. H. Colquhoun	3, Eastbrook Road, Blackheath, S.E. 3.

2 R

2 RA	F. F. Warner	"Northdene," High Lane, near Stockport.
2 RB	H. B. Grylls	"Leightondene," Willingdon Rd., Eastbourne.
2 RC	A. C. Reid	74, Reads Avenue, Blackpool.
2 RD	G. W. Fairall	27, Newbridge Street, Wolverhampton.
2 RF	Technical College	Bradford.
2 RG	E. W. Scammell	20, Primrose Lane, Hall Green, Birmingham.
2 RH	H. A. Pound	4, St. Anne's Promenade, Albion Street, Cheltenham.
2 RI	R. R. Pecorini	Fern Villa, Mortlake, S.W. 14.
2 RJ		
2 RK	C. A. V. Roper	7, Yale Court, Honeybourne Road, N.W. 6.
2 RL		
2 RM	S. Cross	3, Norman Road, Heaton Moor, Stockport.
2 RO	P. N. Langham	102, Wilberforce Road, Leicester.
2 RP	F. W. Emerson	178, Heaton Moor Road, Heaton Moor, Stockport.
2 RQ	E. Strong	119, Church Lane, Handsworth, Birmingham.
2 RR	M. Richardson	39, Bell Street, Wolverhampton.
2 RS	T. Hesketh	42, Castle Hill Avenue, Folkestone.
2 RT	North Eastern Instrument Co.	Durham Road, Low Fell, Gateshead.
2 RU	North Eastern Instrument Co.	Rowlands Gill, Co. Durham.
2 RV	A. L. Rawlings	162, Burnt Ash Hill, Lee, S.E.
2 RW	T. Belshaw / D. M. Burn	16, Manor Gardens, Merton Park, S.W. 20.
2 RX	R. W. Nixon	3, Sumpters Pathway, Hoole, Cheshire.
2 RY	D. A. Hanley	"Forbury," Kintbury, Berkshire.
2 RZ	D. T. Woods	Denley Villa, Parker Road, Bournemouth.

2 S

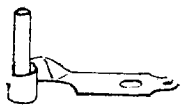
2 SA	Sir Hanbury Brown	"Newlands," Crawley Down, Sussex.
2 SB	R. Heather	Avenue Works, Avenue Road, Harlesden, N.W. 20.
2 SC		
2 SD	J. Mayall	"Burfield," St. Paul's Road, Gloucester.
2 SF	C. Midworth	"Sumia," Ridgeway Road, Osterley, Middlesex.
2 SG		
2 SH	F. L. Hogg	37, Bishop's Road, Highgate, N.6.
2 SI	L. C. Holton	112, Conway Road, Southgate, N.14
2 SI	W. J. Bryce	Walpole Street, Preston, Lancs.
2 SK	K. Graham Styles	19, Southampton Buildings, W.C.2
2 SL	K. Graham Styles	"Kitscot," Maidstone, Kent.
2 SM	R. J. Bates	34, Abbeygate Street, Bury-St-Edmunds.
2 SN	Sunderland and District Wireless and Scientific Association.	
2 SO	T. Geeson	Gainsborough House, Congleton Road, Macclesfield.
2 SP	L. Mansfield	27, Rutland Road, Southport.
2 SQ	A. J. Spears	"Woodlands," Monmouth Road, Warley Woods, Birmingham.
2 SR		
2 SS	Dr. J. S. Sewell	Winter Hey House, Horwich, near Bolton.
2 ST	L. Lambert	46, Clarendon Road, Holland Park, W. 11.
2 SU	M. Esksdale	330, Manchester Road, Bradford.
2 SV	L. V. Bridge	New Hall, Hockley, Essex.
2 SW	A. H. Fielding	32, Stanley Avenue, Birkdale, Lancs.
2 SX	F. B. Baggs	24, Westhorpe Street, Putney, S.W.
2 SY	H. Stevens	35, Oaklands Road, Wolverhampton.
2 SZ	W. H. Brown	Mill Hill School, N.W. 7.

2 T

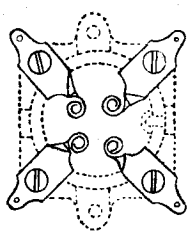
2 TA	H. Andrews	8, North Grove, Highgate, N. 6.
2 TB	H. W. Sellers	"Gledholt," Weetwood Lane, Headingley, Leeds.
2 TC	(Portable)	
2 TD		
2 TF	W. Winkler	13, Lockharton Crescent, Edinburgh.
2 TG / 2 TH	Dr. T. F. Wall (Portable)	The University, St. George's Sq., Sheffield.
2 TI	H. Bevan Swift	49, Kingsmead Road, Tulse Hill, S.W. 2.
2 TJ		
2 TK	K. H. Thow	35, Footscray Road, Eltham, S.E.9.
2 TL	E. V. R. Martin	128, Dairy House Road, Derby.
2 TM	L. H. Mansell	"Woodfield," Madresfield Road, Malvern.
2 TN	C. E. Stuart	Lyndon Lodge, Poiesworth, Tamworth.
2 TO	F. T. G. Townsend	46, Grove Lane, Ipswich.
2 TP	C. W. Andrews	26, Melody Road, Wandsworth Common, S.W. 18.
2 TQ	T. C. Macnamara	55, Winterbrook Road, Herne Hill, S.E. 24.
2 TR	F. O. Sparrow	8, North Drive, Swinton, Manchester.
2 TS		
2 TT	P. Hamilton	The Villa, Glenfield, Paisley.
2 TU	W. T. Tucker	"Parkside," Loughborough, Leicester.
2 TV / 2 TW	E. W. Wood (Portable)	69, Kettering Road, Northampton.
2 TX	A. R. C. Johnston	87, Twyford Avenue, Acton, W. 2.
2 TY	S. Scott	Inglemount, Kingsgate, Bridlington.
2 TZ	E. Jones	"Newholme," 540, Hempshaw Lane, Offerton, Stockport.

2 U

2 UA	E. Woods	190, Liverpool Road, Irlam, nr. Manchester.
2 UB	A. Kenrick & Co.	Westbury, Wilts.
2 UC	E. J. Nock-Winstone	53A, Gunterstone Road, West Kensington, W. 14.
2 UD	A. Acland	"Kenwell," Boxley Road, Chatham.
2 UF	H. Bailey	51, Manchester Road, Denton, Manchester.
2 UG	W. Humphreys Burton	103, Portland Road, Nottingham.
2 UH	W. H. Cross	107, Machon Bank, Nether Edge, Sheffield.
2 UI	A. R. Ogston	41, Broomfield Avenue, Palmer's Green, N. 13.
2 UJ	L. R. Rowlands	23, Cholmeley Park, Highgate, N.6.
2 UK	A. E. Vick	Bournville Day Continuation School, The Green, Bournville, Birmingham.
2 UL	C. W. Cottam	15, The Strait, Lincoln.
2 UM	H. Lloyd	3, Ventnor Place, Sharrow, Sheffield.
2 UN	W. Bensley, Junr.	13, Kelfield Gardens, W. 10.
2 UO	Lockhead-Sayer Radio Co.	Birmingham.
2 UP	Armstrong College	Newcastle-on-Tyne.
2 UQ	H. F. A. Saunderson	23, Palace Road, Llandaff, Cardiff.

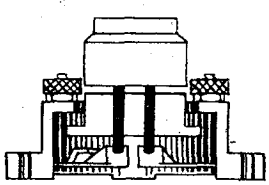


Valve sockets and springs are stamped in one piece. Thus there are no rivetted, soldered or clamped joints to work loose and cause microphonic noises.

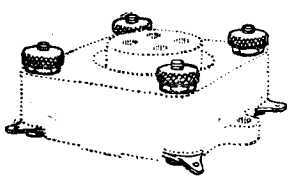


The four one-piece springs allow the valve to move in every direction, and absorb both lateral and vertical vibration.

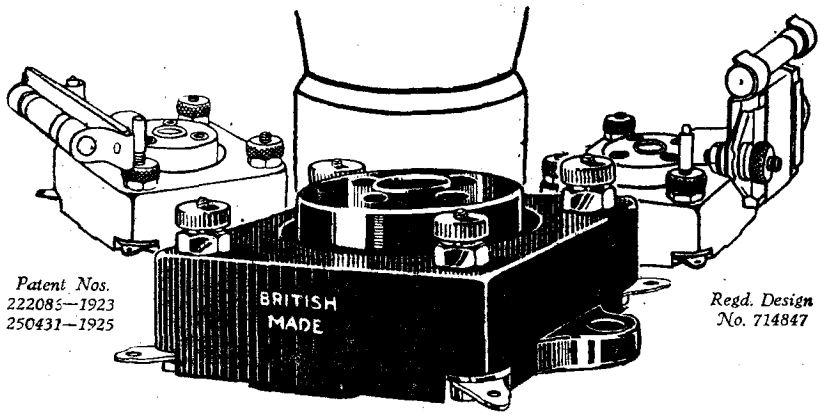
Suitable stops control spring movement, making it easy to insert valves and without risk of damaging either the springs or the valves.



Valve legs, however far pushed home, cannot possibly foul baseboard and thus destroy the springing.



Both terminal and soldering tags are provided for temporary or permanent connections.



Patent Nos. 222085—1923 250431—1925

Regd. Design No. 714847

Certified Sales.

44, Gresham Street,
19-7-1926. E.C.2.

"We have examined the records of the Company and certify that during the ten months from 1st September, 1925, to 30th June, 1926, the Benjamin Electric Limited have manufactured and sold 351,455 Benjamin Clearer Tone Valve Holders."

(*Signed*) G. N. Read, Son, Cooke & Watson,
Chartered Accountants.

The explanation of this amazing popularity as compared with other valve holders lies in the five vital constructional features outlined on the left.

Benjamin Valve Holders are now offered either alone or with the following attachments. Constructors will instantly appreciate what an enormous saving of space and wiring these ingenious attachments mean.

Benjamin Clearer Tone Valve Holder - - -	complete	2/9
Equipped with Dubilier Dumetohm Grid Leak - -	complete	5/3
With same Grid Leak and also Dubilier Grid Condenser (.0003) (series or parallel) - - - - - - - -	complete	7/-

From your Dealer or direct from the Manufacturers:

BENJAMIN

CLEARER TONE, ANTI-MICROPHONIC

VALVE HOLDER

THE BENJAMIN ELECTRIC LIMITED

Brantwood Works, Tottenham, London, N.17

STAND No. 105 AT THE NATIONAL RADIO EXHIBITION

LIST OF EXPERIMENTAL CALL SIGNS—*(Continued)*

2 UR	G. H. H. Richards	The Warren, Hastings Road, Thornton-le-Fylde, Lancs.
2 US	J. F. Stanley	49, Cholmeley Park, Highgate, N.6.
2 UT		
2 UU		
2 UV	W. E. F. Corsham	104, Harlesden Gardens, Harlesden, N.W. 10.
2 UW		
2 UX	A. T. Headley	104, Grosvenor Road, Harborne, Birmingham.
2 UY	W Penn	Holly Cottage, Polesworth, Tamworth.
2 UZ	C. V. Stead	22, Roundhay Mount Harehills Lane, Leeds.

2 V

2 VA	R. J. Sawbridge	The Broadfield Radio Co., Ltd., Tenby.
2 VB	F. E. Hammond	Shooter's Hill, S.E. 18.
2 VC	A. S. Gosling	63, North Road, West Bridgeford, Nottingham.
2 VD	E. L. Crowe	Juniper Rough, Hades, Canterbury.
2 VH	H. A. Blackwell	Whyte House, Bispham, Blackpool.
2 VG	F. E. Wenger	The Brampton, Newcastle-under-Lyne.
2 VH	S. E. Payne	11, St. Mark's Road, Bush Hill Park, Enfield.
2 VI	H. Curtis	26, Upper Hall Lane, Walsall.
2 VJ	B. J. Axten	78, Ealing Road, Wembley.
2 VK	Burndept Wireless Co., Ltd.	Aerial Works, Blackheath, S.E.3.
2 VL	G. A. Vandervell	87, Holland Park, W. 11.
2 VM	J. Lipowsky	614, Old Ford Road, E. 3.
2 VN	H. Drury-Lavin	Old House, Sonning, Berks.
2 VN	A. C. Holmes	60, Aire View, Cononley, Keighley, Yorks.
2 VP	P. G. A. H. Voigt	121, Honor Oak Park, S.E. 23.
2 VQ	H. B. Old	"Park View," St. Jude's Avenue, Mapperley, Notts.
2 VR	F. W. Wilson	115, Richmond Road, Montpelier, Bristol.
2 VS	J. D. R. Hammett	88, Fairlop Road, Leytonstone, E. 11.
2 VT	W. K. Hill	79, Beulah Hill, Norwood, S.E.19.
2 VU	J. W. Hobley	The Drive, Wellingborough.
2 VV	Installations, Ltd.	Southampton.
2 VW	E. H. Robinson	125c, Adelaide Road, N.W. 3.
2 VX	W. R. Clark	3, Caroline Place, Aberdeen.
2 VY	R. E. V. Ely	"Highlands," Sutton, Surrey.
2 VZ	Rev. J. Brown	39, West Hill, S.E. 26.

2 W

2 WA	F. W. J. Pigot	Manor Farm, Wolvercote, Oxford
2 WB / 2 WC	W. Bannister	62, Knoll Street, Rochdale, Lancs.
2 WD	C. W. Clarabut	Beverley Crescent, Bedford.
2 WE	Prof. A. M. Low	"The Yews," Woodstock Road, W. 4.
2 WG	Gambrell Bros., Ltd.	Merton Road, Southfields, S.W. 18.
2 WH	A. P. M. Fleming	"Highclere," Hale Road, Hal, Cheshire.
2 WI	C. J. Mundy	37, Leat Street, Tiverton.
2 WJ	R. L. Royle	"Southwold," Alderman's Hill, Palmer's Green, N. 13.
2 WK	W. A. Hayes	"Moyallon," Portadown, Ulster.
2 WL	F. J. Cripwell	Lonkhill, Thorpe, Tamworth.
2 WM	J. W. Pallett	111, Rugby Street, Leicester.
2 WN	A. H. Wilson	8, Stanley Street, Hanley.
2 WO	J. H. Brown	"Redbrook," Baguley, Cheshire.
2 WP	Standard Telephone and Cables, Ltd.	Connaught House, Aldwych, W.C.2
2 WQ	C. H. Gardner	Amblecote House, Brierley Hill, Staffs.
2 WR	L. W. Burcham	"Valence," Grosvenor Road, Church End, N. 3.
2 WS	H. Squelch, Junr.	35, Crown Lane, Bromley.
2 WT	H. Chadwick	9, Raimond Street, Bolton.
2 WU	C. H. Bailey	Charlacre, Chepstow.
2 WV	C. E. Lilley	"The Cedars," Robin Hood Lane, Hall Green, Birmingham.
2 WW		
2 WX		
2 WY	H. J. Swift	77, Upper Tulse Hill, S.W. 2.
2 WZ	E. A. Hare-Hobson	32, Wilbury Road, Hove, Sussex.

2 X

2 XA		
2 XB	A. T. Croucher	35, Douglas Road, Canonbury, N.1.
2 XC	H. Johnson	"Avondale," Chestnut Walk, Worcester.
2 XD	H. R. Gladwell	London Road, Abridge, Essex.
2 XF	E. I. Chapman	Studland Bay House, Studland, near Swanage.
2 XG / 2 XH	A. E. Turville (Portable)	108, Abingdon Street, Northampton.
2 XI	R. H. Wagner	6, Maresfield Gardens, N.W.3.
2 XJ / 2 XK	Sheffield and District Wireless Society	Sheffield.
2 XL	Capt. E. S. Davis	12, Hyde Park Place, W.1.
2 XM / 2 XN	Downside Wireless Society (Portable)	Downside School, Stratton-on-the-Fosse, Bath.
2 XO	A. Turner	13, Elgin Avenue, W. 9.
2 XP	J. F. Payne	22, Shakespeare Crescent, Manor Park, E. 12.
2 XQ	C. F. Elwell, Ltd.	138, Gordon Road, Peckham, S.E.15
2 XR	J. F. Haines	36, Zetland Street, E.14.
2 XS		
2 XT	W E. Philpott	Onward House, Appledore, Kent.
2 XU	A. H. A. Killbourn	Bath Street, Abingdon.
2 XV	G. A. Jeapes	"Chandos," Gt. Shelford, Cambs.
2 XW	H. A. Woodyer	51, Caldy Road, West Kirby Cheshire.
2 XX	D. F. Young	23, Holcombe Road, Ilford.
2 XY	H. T. Littlewood	"Esholt," Wedgewood Drive, Roundhay, Leeds.
2 XZ	L. T. Dixon	"Strathspey," 4, Heythorp Street, Southfields, S.W. 18.

2 Y

2 YA	R. A. Miles	4, Cambridge Green, New Eltham, S.E. 9.
2 YB		
2 YC	A. Kendrick	49, Tasker Street, Walsall.
2 YD		
2 YF	J. R. Clay	Upper Longbottom, Luddendon Foot, S.O., York.
2 YG	W. H. Andrews	Trainer, Totnes Road, Paignton.
2 YH	G. E. Dueen	Broadway, Limpsfield, Surrey.
2 YI	W. J. Hewett	83, Reddings Road, Moseley, Birmingham.
2 YJ		
2 YK	H. T. Winter	23, Willoughby Park Road, Tottenham, N. 17.
2 YL	W. H. Allan	80, Newington Causeway, S.E. 1.
2 YM	R. W. Piper	62, Chiltern View Road, Uxbridge,
2 YN	A. W. Thompson	32, St. Nicholas Street, Scarborough.
2 YO	A. L. M. Douglas	Hanwell.
2 YP	F. Harrison	190, Almond Street, Derby.
2 YQ	W. P. Wilson	c/o Standard Tel., Ltd., H.M. Radio Station, Rugby.
2 YR	A. R. Pike	17, Avonwick Road, Heston, Hounslow.
2 YS	A. S. Harvey	"Fernleigh," Bisley Road, Stroud.
2 YT	Marconi Test Station	Poldhu, Cornwall.
2 YU	M. H. Wilkinson	"Southerlea," Park Avenue, Rawdon, Leeds.
2 YV	G. M. Whitehouse	All Port House, Cannock, Staffs.
2 YW	J. H. F. Town	4, Eversley Mount, Halifax.
2 YX	F. E. B. Jones	"Hill Crest," Birmingham Road, Wylde Green, Birmingham.
2 YY	O. H. Patterson	26, Allerton Road, Stoke Newington, N. 16.
2 YZ	Standard Telephones and Cables, Ltd.	North Woolwich.

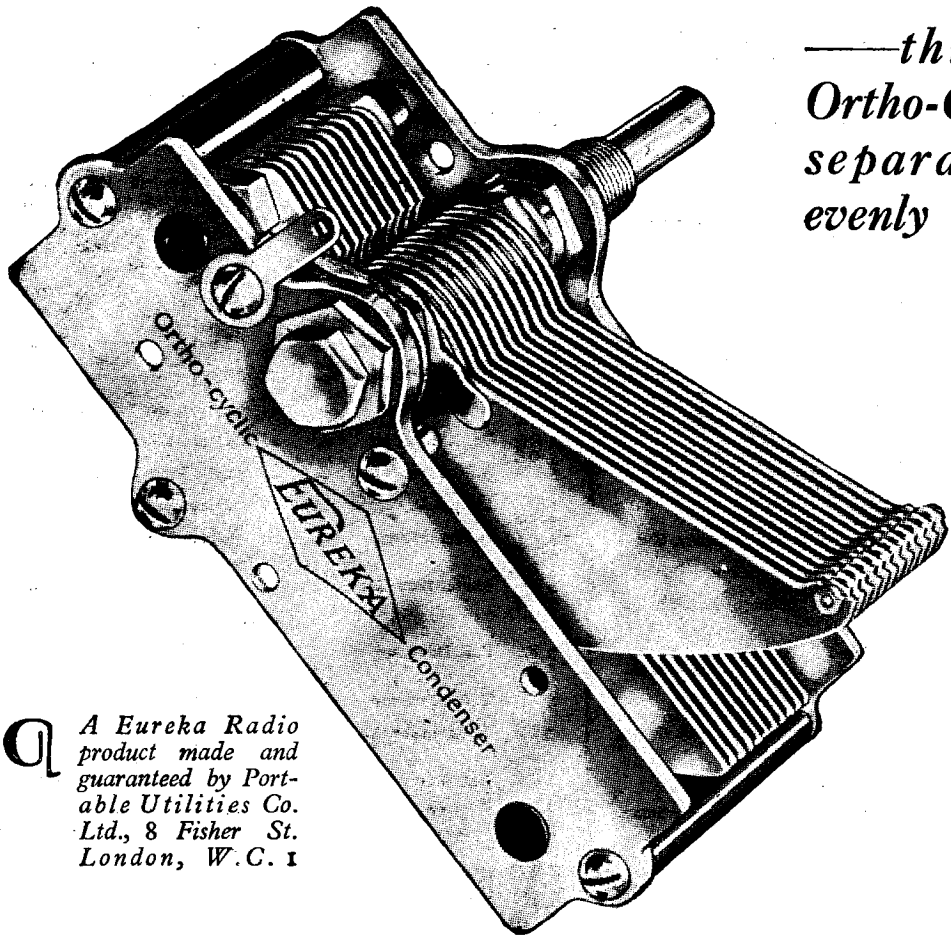
2 Z

2 ZA		
2 ZB	L. F. Aldous	48, Harpenden Road, W. Norwood, S.E. 27.
2 ZC	A. M. Houston-Fergus	"La Cotte," La Moye, Jersey, C.I.
2 ZD	A. Woodcock	1, Montague Road, Handsworth, Birmingham.
2 ZF		
2 ZG	W. J. Badman	St. Albans, Southside, Weston-Super-Mare.
2 ZH / 2 ZI	B.T.H. Co., Ltd.	Rugby.
2 ZJ	W. J. Brown	"Eversley," Devonport Park, Stockport.
2 ZK	W. L. Turner	"Purley," Caldy, West Kirby, Cheshire.
2 KL	H. W. Haydon	158, Bristol Road, Gloucester.
2 ZM	T. H. Isted	Terling, Essex.
2 ZN		
2 ZO	L. H. Soundy	8, Chester Gardens, Argyle Road, Ealing.
2 ZP	G. F. Forward	West Chart, Limpsfield, Surrey.
2 ZQ	H. W. Nunn	49, Leigh Road, Highbury, N. 5.
2 ZR	S. G. Brown, Ltd.	19, Mortimer Street, W. 1.
2 ZS	L. C. Patterson	18, Lancaster Court, Newman Street, W. 1.
2 ZT	C. M. Benham	"Benhilton," Westbury Road, New Malden, Surrey.
2 ZU	F. H. H. Smith / T. Heckles	Sefton House, Birscough Junction, Lathom, Lancs.
2 ZV	F. T. Smith	Ivy Hall, Panfield, Braintree, Essex.
2 ZW	S. C. Parish	"The Uplands," Lordswood Road, Harborne, Birmingham.
2 ZX		
2 ZZ	Fellows Magneto Co., Ltd.	Cumberland Avenue, Park Royal, N.W. 10.

5 A

5 AA	"Leicester Mercury"	25-29, Albion Street, Leicester.
5 AB	L. W. C. Martin	4, Beer Street, Yeovil.
5 AC	W. G. Kimber	39, Bargery Road, Catford, S.E.6.
5 AD		
5 AF	J. A. H. Devey	232, Gt. Brickkiln Street, Wolverhampton.

Don't get lost in the Maze!



——*this new Eureka Ortho-Cyclic Condenser separates Stations as evenly as the steps of a ladder*

A Eureka Radio product made and guaranteed by Portable Utilities Co. Ltd., 8 Fisher St. London, W.C. 1

Eleven points of superiority

1. Moving plates clamped together at their tips to ensure absolute rigidity.
2. Fixed plates insulated from main frame.
3. Impossible for plates to short circuit.
4. Ball bearings ensure velvety smooth movement.
5. Positive connection between rotor plates and frame doubly ensured by pig-tail lead and cone bearing.
6. Sound scientific design cuts electrical losses to a minimum.
7. Generous soldering tags.
8. One hole—or four hole—mounting.
9. Positive Contact Stops at both ends of scale.
10. Exceptionally compact design permits total panel depth of less than 2 inches.
11. Superb finish—you'll be proud to know it has been made by expert British instrument makers.

FOR three years wireless enthusiasts have been struggling to obtain selectivity. Sets have been made more and more sensitive—long distance reception is simplicity itself. But the trouble has always been to receive stations *one at a time* without interference.

With Jazz Bands inextricably intermingled with Italian Opera, it is little wonder that long-distance Broadcasting has—to the average man—lost much of its earlier fascination.

But now, at last, there comes the dawn of a new era—the promise of razor sharp tuning. The new Eureka Ortho-cyclic sets a higher standard in Condenser design—by its aid a measure of selectivity is obtained which but a year ago would have been unbelievable.

Compare these two simple tests. An ordinary Variable Condenser fitted with a normal 100 degree dial crowds within its first fifteen degrees no fewer than 51 possible wavelengths, each of 10 kilocycles separation.

The same 15 degrees on a Eureka Ortho-cyclic Condenser shows only fifteen possible wavelengths of the same separation. And all the way up the dial you will find the same amazing regularity—each degree covers exactly 10 kilocycles. Just like the steps of a ladder. Think of it—the 51 possible wavelengths (each of 10 kilocycles separation) previously jumbled within the first 15 degrees on an ordinary condenser are now spread out evenly over 51 degrees of the dial on a Eureka Ortho-cyclic. At last we are freed from the serfdom of complicated expensive and irritating verniers. With a Eureka Ortho-cyclic, tuning becomes a pleasure—the station you want can always be picked out.

Look at the impressive list of features given here and decide to install Eureka Ortho-cyclics on your set now.

In two sizes
·0003 mfds 14/6
·0005 mfds 15/6

EUREKA ORTHO-CYCLIC

Other Eureka Products
Eureka L.F. Transformers
Eureka H.F. Transformers
Eureka Low Loss Coils
Eurekastats
Eureka Potentiometers
Eureka Rotary Detectors

LIST OF EXPERIMENTAL CALL SIGNS—(Continued)

5 AG	A. E. Gregory	77, Khedive Road, Forest Gate, E.7
5 AH		
5 AI	A. H. Sheffield	"Gleneagles," Whitehall Road, Chingford, Essex.
5 AJ	W. C. Barraclough	9, Rutland Avenue, Withington, Manchester.
5 AK	H. G. Mansell	Cleeve View, Harvington, near Evesham.
5 AL		
5 AM		
5 AN	E. W. V. Butcher	16, Manor Gardens, Purley.
5 AO	J. McLaren	"Dalrieda," Worthing, Sussex.
5 AP	A. J. Hill	4, Parkhurst Road, Bexhill-on-Sea.
5 AQ	D. Douet	10, Ruvigny Gardens, Putney, S.W. 15.
5 AR	E. D. Ostermeyer	59, Gordon Road, E. 18.
5 AS	F. A. Bourne	10, Linley Road, Tottenham, N.17.
5 AT	Dubilier Condenser Co., Ltd.	Ducon Works, Victoria Road, N. Acton, W. 3.
5 AU	W. H. Goodman	94, Addison Road, Holland Park, W. 14.
5 AV	R. W. Harvey	25, Shakespeare Avenue, Portswood, Southampton.
5 AW	Frank Hough (Southport), Ltd.	60, Sussex Road, Southport, Lancs.
5 AX	F. Walker	Crowmarsh, Wallingford, Berks.
5 AY	T. F. Crowther	25, North Drive, St. Annes-on-Sea, Lancs.
5 AZ	F. Charnley	43, Reads Avenue, Blackpool.

5 B

5 BA	Berwick Journal Office ..	Berwick-on-Tweed.
5 BB	Vickers, Ltd.	Vickers House, Broadway, Westminster.
5 BC	Sir Trevor Dawson, Bt. ..	Edgewarebury House, Elstree, Herts.
5 BD	C. E. Bradford	Empire Buildings, Mablethorpe, Lincs.
5 BF		
5 BG	J. B. Kaye	Close Hill, Huddersfield.
5 BH	A. V. Simpson	28, West Gate, Burnley, Lancs.
5 BI	G. E. Beale	Bournemouth.
5 BJ	Autovevors, Ltd.	84, Victoria Street, S.W. 1.
5 BK	W. G. H. Brown	82, Winstonian Road, Cheltenham.
5 BL	A. E. Vick	19, Cresham Road, Hall Green, Birmingham.
5 BM		
5 BN		
5 BO		
5 BP	R. A. Wells	59, Compton Road, Winchmore Hill, N. 21.
5 BQ		
5 BR	J. J. Smithies, Ltd.	20, Oldham Road, Rochdale.
5 BS		
5 BT	L. V. Clark	4, Compton Crescent, Chiswick, W4
5 BU	J. B. Kaye	London (vide 5 BG).
5 BV	H. N. Ryan	88, Holm Park Road, Wimbledon Park Road, S.W. 19.
5 BW	Castle Radio Co.	161, Westminster Bridge Road, S.E. 1.
5 BX		
5 BY	H. L. O'Heffernan	69, Lower Addiscombe Road, Croydon.
5 BZ		

5 C

5 CA	N. L. Yates-Fish	"Clevelands," 19, Mansfield Road, Reading.
5 CB	Capt. K. Hartridge	14, Westbourne Crescent, W. 2.
5 CC	A. W. Young	Foxcombe Road, Bath.
5 CD	G. N. Booth	"Eastlands," Queen's Road, Wisbech.
5 CF	F. G. S. Wise	12, Crouch End Hill, Crouch End, N. 8.
5 CG	D. Shannon	Wyvern Grange, Sutton Coldfield, near Birmingham.
5 CH		
5 CI		
5 CJ	O. Carpenter	35, Sunnyside Road, Weston-super-Mare.
5 CK	L. H. Pearson	Premier House, Thorncliffe Road, Nottingham.
5 CL		
5 CM		
5 CN		
5 CO		
5 CP	D. V. L. Fellows	"View Point," 20, North Common Road, Ealing, W.
5 CQ		
5 CR	J. S. McLeod	327, Blackburn Road, Bolton.
5 CS	G. R. M. Garratt	35, Abbey Road, St. John's Wood, N.W. 8.
5 CT	W. T. Turberville-Crewe ..	111, Prince's Park Avenue, Golder's Green, N.W.
5 CU	J. A. Walshaw	Garnet Villa, Otley, Yorks.
5 CV	R. J. Harrison	c/o *Morning Post*, London, W.C.2.
5 CW	C. W. Ashton	Kensington House, James Street, Stoke-on-Trent.
5 CX	C. R. Pill	17, Brudenell Grove, Hyde Park, Leeds.
5 CY	L. Gordon	133, Old Street, Ashton-under-Lyne.
5 CZ		

5 D

5 DA	G. Gore	24, Brucegate, Berwick-on-Tweed.
5 DB	C. H. P. Nutter	39, Warminster Road, S. Norwood Park, S.E. 25.
5 DC	W. T. Aked	"Ashdell," Victoria Road, Thornton-le-Flyde.
5 DD	Capt. M. H. Barnes	"Akabo," Ainsdale, Southport.
5 DF		
5 DG	C. H. Stephenson	32, Tettenhall Road, Wolverhampton.
5 DH	G.P.O. Station	Dollis Hill, N.W. 2.
5 DI	C. J. Matthews	"Broxhill," Romford, Essex.
5 DJ	R. Eaves	56, Furzehill Road, Muthill, Plymouth.
5 DK	.. .. ..	Finchley.
5 DL		
5 DM	A. N. Jackson-Ley	Grove House, Albert Grove, Nottingham.
5 DN	Capt. L. A. K. Halcomb ..	"Southdene," 106, Millhouses Lane, Sheffield.
5 DO	E. J. Watts	Selbourne House, Devizes Road, Salisbury.
5 DP	M. H. Coaffee	67, Leander Road, Thornton Heath.
5 DQ	Dr. L. S. Palmer	College of Technology, Manchester.
5 DR		
5 DS	A. W. Fithian	51, St. James Road, Wandsworth, S.W. 17.
5 DT	Lieut. S. C. Tucker, R.N. ..	"Eardemont," Crayford, Kent.
5 DU		
5 DV	D. Whittaker	56, Park Road, St. Annes-on-Sea.
5 DW		
5 DX		
5 DY	Chelmsford Radio Eng. Co.	76, Duke Street, Chelmsford.
5 DZ		

5 F

5 FA	F. L. Deveaux	86, Bingham Road, Addiscombe.
5 FB		
5 FC		
5 FD	T. A. Hewitson	"Northdene," Grosvenor Road, Birkdale, Lancs.
5 FF	R. Ferguson	23, Cavendish Avenue, Finchley, N. 3.
5 FG		
5 FH	L. H. Lee	155, Rosefield Road, Smethwick, Staffs.
5 FI	H. D. Webb	59, Bradford Street, Walsall.
5 FJ	F. J. Jackson	Sunnyside Mansions Hotel, Southport.
5 FK		
5 FL	S. Pevensey	146, High Road, Lee, S.E.
5 FM	C. A. Carpenter	5, Lenton Boulevard, Nottingham.
5 FN		
5 FO		
5 FP		
5 FQ	E. H. Capel	32, College Road, Harrow, Middlesex.
5 FR	J. L. Jeffree	191, St. James' Road, Croydon.
5 FS	W. A. Andrewes	1, Balmoral Mansions, St. Andrew's Park, Bristol.
5 FT	H. E. Taylor	Felsted School, Essex.
5 FU	University College	Nottingham.
5 FV	N. H. Gwynn-Jones	Burford House, Malvern, Worcester.
5 FW	S. I. Holt	"Aylesbury," 21, Bromley Road, St. Annes-on-Sea.
5 FX	Gent & Co., Ltd	Faraday Works, Leicester.
5 FY	.. .. ..	
5 FZ	Lincoln Wireless Society	Municipal Technical School, Lincoln.

5 G

5 GA		
5 GB	B.B.C. Experimental Stn. ..	Chelmsford.
5 GC		
5 GD	E. C. Burdett	3, Stockfield Road, Streatham, S.W.
5 GF	H. Stopher	"The Holt," Hare Hatch, Twyford, Berks.
5 GG	Capt. L. G. Young	Petit Cottage, Havant.
5 GH	J. Gillespie	16, Knockdene Park South, Belfast.
5 GI	R. Horrocks	65, Leander Road, Thornton Heath, Surrey.
5 GJ	J. Bevis	4, Somerset Road, Linford Estate, near Stanford-le-Hope, Essex.
5 GK		
5 GL		
5 GM	A. Greenslade	Jelf Road, Brixton, S.W. 2.
5 GN	Greenslade & Brown ..	Lansdowne Road, Clapham, S.W.8
5 GO	H. Jordan	84, Northolt Road, South Harrow.
5 GP	J. E. Simpson	"Baskerville," Epsom Road, Guildford.
5 GQ	B. G. Wardman	5, Pollards Hill South, Norbury, S.W. 16.
5 GR		

LIST OF EXPERIMENTAL CALL SIGNS—(*Continued*)

5 GS	W. Grieve	Winter Wood, Waltham, near Grimsby.
5 GT	E. S. Dobson	Lorne House, Richmond Place, Ilkley, Yorks.
5 GU	J. O. J. Hudson	70, Huxley Road, Upper Edmonton, N. 8.
5 GV	L. B. Flagg & A. H. Arnoll	40, Springwell Avenue, Harlesden, N.W. 10.
5 GW	D. Grove-White	"Le Chalet," La Chasse, St. Helier, Jersey.
5 GX	P. D. Tyers	30, Mildred Avenue Watford.
5 GY	G. F. Horwood	"St. Helier," 56, Cranston Road, Forest Hill, S.E. 23.
5 GZ	J. Geary	Landore, Swansea.

5 H

5 HA	R. Watson	"The Beeches," Streetley, Bucks
5 HB	H. Brooks	Milton Works, Chester.
5 HC	J. A. Beveridge	8, Cluny Drive, Edinburgh.
5 HD	G. Hawkyard	Wootton Bridge, I.O.W.
5 HF		
5 HG	F. Illidge	Main Street, Frodsham, near Warrington.
5 HH	A.T.M. Co., Ltd.	Liverpool.
5 HI	L. W. Birch	30, Limesford Road, Waverley Park, S.E. 15.
5 HJ	N. A. Richardson	68, Finchley Lane, Hendon, N.W.4
5 HK	H. S. Beckett	70, Kendal Road, Hillsbrough, Sheffield.
5 HL	G. E. Vowles	St. Leonards, Hooley Street, Sherwood, Notts.
5 HM	J. Fitton	27, Milnrow Road, Rochdale, Lancs.
5 HN	D. R. Etchells	"Great Bents," Codsall, near Wolverhampton.
5 HO		
5 HP	Cunningham, Ltd.	169-171, Edgware Road, W. 2.
5 HQ	E. A. Pollard	"Spring Bank," Limefield, Blackburn.
5 HR		
5 HS	M. Samuel	16, Blenheim Road, N.W. 8.
5 HT		
5 HU	A. V. D. Hort	8, Aquila Street, St. John's Wood, N.W. 8.
5 HV		
5 HW	National Physical Laboratory.	Teddington, Middlesex.
5 HX	L. J. Heaton-Armstrong ..	111, Kenilworth Avenue, Wimbledon Park, S.W. 19.
5 HY	H. Baynham	Cromwell Hall, East Finchley, N.2.
5 HZ	C. A. Carpenter	5, Lenton Boulevard, Nottingham.

5 I

5 IA	G. M. Whiteley	"The Hollins," Sowerby Bridge, Yorks.
5 IB	L. H. & L. W. Carder ..	5, Deeside Parade, West Kirby, Birkenhead.
5 IC	F. E. Harvey	"Fairmead," Woodford Green, Essex.
5 ID	P. D. Coates	55, Ennismore Street, Burnley, Lancs.
5 IE		
5 IF	H. Featherstone	3, Cumberland Gardens, Tunbridge Wells.
5 IG	J. E. Sheldrick	Third Avenue, Denville, Havant, Hants.
5 IH		
5 II		
5 IJ		
5 IK	B. L. Stephenson	12, Sheringham Road, Withington, Manchester.
5 IL	E. Pepperell	337, Cowbridge Road, Cardiff.
5 IM		
5 IN	A. H. Cooper	58, Greyswood Street, S.W. 16.
5 IO	R. H. Brown	10, Coverdale Road, W. 12.
5 IP	R. H. Knox	25, Bridge Street, Berwick-on-Tweed.
5 IQ		
5 IR	H. Field	62, Chertsey Road, Woking.
5 IS	P. Johnson	49, Carson Road, Dulwich, S.E. 21.
5 IU		
5 IV		
5 IW	Marconi (Chelmsford) Wireless Society.	Marconi Works, Chelmsford.
5 IX		
5 IY	J. Wynn	Solihull, Warwickshire.
5 IZ		

5 J

5 JA		
5 JB	D. Price-Jones	Manoravon, Llandilo, South Wales
5 JC	Ivor I. Morris	Cemaes Bay, Anglesey.
5 JD	J. L. Wood	Stanhurst, Burntisland, Fife.
5 JF		
5 JG	R. F Longley	19, Totton Road, Thornton Heath, -Surrey.
5 JH	L. Waddington	171, Great Horton Road, Bradford.
5 JI	J. J. Smallwood	66 Shireland Road, Smethwick, Birmingham.
5 JJ	L. D. G. Morrison	"Woodville," Arkley, Herts.
5 JK	L. R. Harper	Seafield House, Aberdeen.
5 JL		
5 JM	W. Woods	8, Brighton Street, Barrow-in-Furness.
5 JN	S. Wilkinson	118, Liverpool Road, Newcastle, Staffs.
5 JO	L. Jones	50, King Street, Cambridge.
5 JP	M. C. Ellison	17, Princes Street, Harrogate.
5 JQ	W. B. Sydenham	Torquay Sec. School, Barton Road, Torquay.
5 JR	W. C. P. Hepworth	"Moorings," Dovercourt, Essex.
5 JS	H. B. Burdekin	9, Marine Avenue, Westcliff-on-Sea.
5 JT		
5 JU		
5 JV		
5 JW	P. Cox	101, Birchfields Road, Longsight, Manchester.
5 JX	M. G. Scroggie	19, St. Mildred's Road, Lee, S.E.
5 JY	R. L. Aspden	6, Southport Road, Chorley, Lancs.
5 JZ	H. J. Chenly	179, Highfield Road, Washwood Heath, Birmingham.

5 K

5 KA		
5 KB	F. W. Coomber	Radio House, Fything, Worcester,
5 KC	T. Dootson	12, Gilnow Road, Bolton, Lancs.
5 KD		
5 KF	W. Bird	"Llangrove," Hednesford Street, Cannock, Staffs.
5 KG	L. Hammond	"Whitegate," Lightwoods Hill, Birmingham.
5 KH		
5 KI	C. D. Kidd	33, Berkeley Road, Bishopston, Bristol.
5 KJ		
5 KK		
5 KL		
5 KM	L. W. J. Silcocks	77, St. Albans Road, Redlands, Bristol.
5 KN	E. J. Earnshaw	"Llantwitt," Furze Lane, Purley, Surrey.
5 KO	T. W. Higgs	107, High Park Road, Newcastle-on-Tyne.
5 KP	A. T. Wallace	"Brettenham," Hedge Lane, Palmers Green, N. 13.
5 KQ		
5 KR	C. M. Thorpe	The Crossways, Rhuddlan, North Wales.
5 KS	H. R. Harbottle	438, Durnsford Road, Wimbledon Park, S.W. 19.
5 KT		
5 KU	R. Pollock	4, Glenhurst Avenue, N.W. 5.
5 KV		
5 KW, 5 KX	Rene Hodges .. .. .. (Portable)	Park Road, Daybrook, Nottingham.
5 KY	E. G. Allsopp	Radio House, Church Street, Tamworth.
5 KZ	R. Mitchell	"Woodstock," High Spring Gds., Keighley, Yorks.

5 L

5 LA	L. H. Soundy	60, Bellevue Road, Ealing.
5 LB	H. C. Foster	Hornby Castle, Lancaster.
5 LC		
5 LD	G.P.O.	Denman Street, London Bridge.
5 LF	Kenyon Secretan	105, Castlenau, Barnes, S.W. 13.
5 LG		
5 LH	F. Thompson	18, Stratford Grove, Heaton, Newcastle.
5 LI		
5 LJ	E. Jackson	37, Manley Road, Whalley Range, Manchester.
5 LK	J. V. Rushton	"Craig-y-don," Penn, Wolverhampton.
5 LL	Manchester Radio Co. ..	155, Oxford Road, Manchester.
5 LM	F. H. McCrea	"Charnwood," 14, Malefin Avenue, West Didsbury.
5 LN		
5 LO	J. W. Clough	"Holly Hurst," 142, Revidge Road, Blackburn.
5 LP	L. P. Pullman	213, Golders Green Road, N.W.11.
5 LQ		
5 LR		
5 LS	A. J. Stevens, Ltd. (R. W. H. Bloxam).	56, Humber Road, Blackheath, S.E. 3.
5 LT		
5 LU	D. T. Blunden ... ... C. F. Scruby	8, Penrith Road, Basingstoke.
5 LV	N. Willson	"Claremont," Tenbury Road, King's Heath, Birmingham.
5 LW	J. Drury	7, Salisbury Avenue, Goole.
5 LX		
5 LY	B. C. Calver	321, Vauxhall Bridge Road, S.W.1.
5 LZ	A. G. S. Gwinn	61, Carnarvon Road, Stratford E. 15.

5 M

5 MA	R. Munday	17, Malden Road, New Malden, Surrey.
5 MB	W. H. Lamb	208, Stockport Road, Longsight, Manchester.

LIST OF EXPERIMENTAL CALL SIGNS—*(Continued)*

5 MC	W. Woodhams	24, Marlborough Place, Brighton.
5 MD	R. W. Hardisty	First House, High Pine Close, Weybridge.
5 MF	F. A. King	35, Oakmead Road, Balham, S.W. 12.
5 MG	J. W. Green	Staveleigh, Knott End, near Fleetwood, Lancs.
5 MH		
5 MI		
5 MJ	C. F. Howes	Enfield.
5 MK	N. Bates	"The Towers," Sowerby Bridge, Yorks.
5 ML	L. D. Healey	11, Glebe Road, Wallasey, Cheshire.
5 MM		
5 MN		
5 MO	W. G. Dixon	"Dipwood," Rowlands Gill, Newcastle-on-Tyne.
5 MP	Colin Bain	140, Northumberland Street, Newcastle-on-Tyne.
5 MQ	E. Menzies	School House, Fazakerley, Liverpool.
5 MR	N. P. Stoate	15, Winterstone Gardens, Mill Hill, N.W. 7.
5 MS	H. M. Swan	9, Seafield Road, Lytham, Lancs.
5 MT		
5 MU	C. W. Titherington	"West Lodge," Moigre Coomb near Dorchester.
5 MV	J. P. McVeigh	84, Edward Street, Lurgan, near Belfast.
5 MW	Burndept Wireless Ltd.	Eastnor Works, Blackheath, S.E.3
5 MX		
5 MY	J. E. Montgomery	Felsted School, Felsted, Essex.
5 MZ		

5 N

5 NA		
5 NB		
5 NC		
5 ND	J. H. Taylor	Macaulay Street, Huddersfield.
5 NF	R. W. Galpin	"Chardstock," Mickleburgh Hill, Herne Bay.
5 NH	A. C. Holme	39, Poplar Avenue, Edgbaston, Birmingham.
5 NI		
5 NJ	F. R. Neill	"Chesterfield," Whitehead, Co, Antrim, Ireland.
5 NK		
5 NL	H. C. Turner	45, Manley Road, Whalley Range, Manchester.
5 NM		
5 NN	J. H. D. Ridley	"Studley," 105, Woodside Green, S. Norwood, S.E. 25.
5 NP		
5 NQ		
5 NR		
5 NS		
5 NT	C. H. Friskney	106, Yarboro' Road, Lincoln.
5 NU	H. L. Thomson	109, Old Fallow Road, Cannock, Staffs.
5 NV		
5 NW	E. J. Allan	"Red Oak," 8, Westfield Place, Dundee.
5 NX		
5 NY	Hart Collins, Ltd.	38A, Bessboro' Street, S.W. 1.
5 NZ		

5 O

5 OA		
5 OB	Park Motor Co., Ltd.	Wells Street, Jermyn Street, S.W.1
5 OC	Col. E. C. Jennings	"Gelli Deg," Kidwelly, Carmarthen.
5 OC	R. Bates	"Holmeside," St. Catharine's, Lincoln.
5 OF	W. G. Gold	"Koyama," Lichfield Road, Sutton Coldfield, near Birmingham.
5 OG		
5 OH		
5 OI	J. Warburton	Moorfield Terrace, Clayton Road, Bradfield.
5 OJ		
5 OK		
5 OL	J. F. Cullen	68, Queen's Drive, West Derby, Liverpool.
5 OM	D. E. Osman	44, Cambridge Park, Wanstead, E. 11.
5 ON		
5 OO		
5 OP		
5 OQ		
5 OR		
5 OS	W. H. J. Coombs (Portable)	29, Alexandra Road, West Park, Chesterfield.
5 OT	F. J. Woods	"Belmont," Upper Colwyn Bay, North Wales.
5 OU		
5 OV	C. H. F. Hubbard (Portable)	196, Putney Bridge Road, S.W.15.
5 OW	E. C. Chidwick	46, Alcombury Road, Clapton, E 5.
5 OX	C. H. F. Hubbard	196, Putney Bridge Road, S.W.15.
5 OY	Belvedere and District Radio Society.	85, Hengist Road, Erith.
5 OZ		

5 P

5 PA		
5 PB	F. C. Hirst	Broom Field, Longwood, Huddersfield.
5 PC		
5 PD	F. A. Durrant	366, Forest Road, Walthamstow, E. 17.
5 PF		
5 PG		
5 PH		
5 PI	The British Radio Corporation.	Weybridge.
5 PJ	A. Shaw	8, Hall Road, Trawden, near Colne, Lancs.
5 PK		
5 PL		
5 PM	Royal Military College	Sandhurst.
5 PN	V. H. Penfold	199, Melrose Avenue, Cricklewood, N.W. 2.
5 PO	H. J. Pollard	10, Woodhey Park, Rock Ferry, Cheshire.
5 PP	W. S. Plymouth-Perkins	"Levuka," Cumberland Road, Harrow.
5 PQ	R. C. Williamson	20, Scott Road, Pitsmoor, Sheffield.
5 PR	C. Ratcliffe	68A, Dewsbury Road, Leeds, Yorks.
5 PS	J. E. Catt	"Melrose," Alexandra Road, Farnborough.
5 PT		
5 PU	T. Allison	33, Wilton Grove, Wimbledon, S.W. 19.
5 PV		
5 PW	S./W. Exp. Station	Leafield.
5 PX	D. Shannon	Wyvern Grange, Sutton Coldfield, Birmingham.
5 PZ	G. F. Gregory	3, Castle View Gardens, Ilford.

5 Q

5 QA		
5 QB	A. C. Bainton	"The Hollies," Palace Road, S.W.2.
5 QC	H. C. Bateman	2, Gideon Road, S.W.11.
5 QD	G. H. Wray	19b, Church Gate, Loughborough, Leicestershire.
5 QF		
5 QG		
5 QH		
5 QI	South Shields & District Radio Society.	
5 QJ	J. P. Pragnell	"Dalegarth," Methuen Road, Bexley Heath.
5 QK	Southend & District Radio Society	Hon. Sec., F. Waller, Eastwood House, Rochford, Essex.
5 QL		
5 QM	V. R. Mills	122, Hughenden Road, Hastings.
5 QN		
5 QO		
5 QP		
5 QQ	H. C. Gooding	20 Ipswich Street, Stowmarket.
5 QR	D. G. Bird	8, Osborne Terrace, South Shields
5 QS		
5 QT	A. Davidson	21, Queen Street, Worksop, Notts.
5 QU	L. J. Dolphin	229, Hole Lane, Northfield, Birmingham.
5 QV	F. L. Stollery	"Fairmead," Vista Road, Clacton-on-Sea.
5 QW		
5 QX	J. W. Holt	6, Raby Road, New Malden, Surrey.
5 QY		
5 QZ	F. Crawford	34, Leasowe Road, Wallasey, Cheshire.

5 R

5 RA	H. King	2, Henslowe Road, East Dulwich, S.E.22.
5 RB	A. Garrett	"Bonair," Camberley, Surrey.
5 RC	W. Brierley	59, Gaynet Park, Filton, Bristol.
5 RD		
5 RF	L. F. Hunter	18, Tannsfield Road, Sydenham, S.E.26.
5 RG		
5 RH	A. Smith	55, Colne Road, Burnley, Lancs.
5 RI	A. J. Stevens, Ltd.	Wireless Branch, Wolverhampton
5 RJ		
5 RK	G. A. Litchfield	Nottingham.
5 RL		
5 RM	Peto-Scott Co., Ltd.	77, City Road, E.C.1.
5 RN	G. E. Prance	1, Holyrood Terrace, The Hoe, Plymouth.
5 RO		
5 RP	Capt. H. J. Hughes	Hughes & Watts, Ltd., Engineers, Birkenhead.
5 RQ	G. W. Tonkin	164, Coldharbour Road, Westbury Park, Bristol.
5 RR		
5 RS	Radio Press Laboratories	Elstree, Herts.
5 RT	C. Hamilton	4, Arnold Crescent, Arnold Street, Hull, Yorks.
5 RU		

LIST OF EXPERIMENTAL CALL SIGNS—(*Continued*)

5 RV		
5 RW	L. W. ELLIOTT	69, Castleton Road, Goodmayes, Essex.
5 RX	S. NEWELL	9, Western Road, Stacksteads, Bacup.
5 RY		

5 S

5 RZ	A. G. WOOD	93, Upper Tulse Hill, S.W.2.
5 SA	MERCIAN RADIO CO.	Radio Works, Hinckley.
5 SB		
5 SD	J. D. TURNER	Barwitte, nr. Dunstable, Beds.
5 SF	J. K. WILKIE	Avondale, Knowsley Road, Cressington Park, Liverpool.
5 SG		
5 SH		
5 SI	C. L. NAYLOR	43, Hill Crescent, Longden Road, Shrewsbury.
5 SJ		
5 SK	W. H. MAYCOCK	61, Kirby Road, Earlsdon, Coventry.
5 SL	J. S. YEOMANS	11, Hill View Terrace, Chapel Allerton, Leeds.
5 SM	W. L. SMITH	Birds Park, Kendal, Westmorland.
5 SN	N. W. SKINNER	296, London Road, Westcliff.
5 SO	A. M. C. CHRISTIAN	270, New Chester Road, Port Sunlight.
5 SP	E. WARNER	"Dilnot," Horeham Road, Sussex.
5 SQ	A. P. MACGRORY	58, Kirk Street, Campbelltown, N.B.
5 SR		
5 SS	STRETFORD AND DISTRICT RADIO SOCIETY	The Cottage, Derby Farm, Derbyshire Lane, Stretford, M/C.
5 ST	R. R. MORRISON	Spring Grove, Kilbarchan, Renfrewshire.
5 SU	Capt. IAN FRASER	St. John's Lodge, Inner Circle, Regent's Park, N.W.
5 SV	S. D. MASON	86, Chester Road, Forest Gate, E.7.
5 SW	C. BEDFORD	Turton Hall, Gildersome, nr. Leeds.
5 SY		
5 SZ	J. W. RIDDIOUGH	"White Croft, Bare Lane, Morecambe, Lancs.

5 T

5 TA	V. I. N. WILLIAMS	"Merok," Lees Road, Bramhall, Cheshire.
5 TB		
5 TC		
5 TD	T. A. STUDLEY	6, Rutland Road, Harrow.
5 TF	P. A. GOODING	16, Cambridge Road, Hammersmith, W.
5 TG	W. J. TARRING	70, Cranmer Road, Forest Gate, E.
5 TH	S. H. SUTHERS	1, Stamford Brook Gardens, W.6.
5 TI	J. BONNETT	159A, Turner's Hill, Cheshunt, Herts.
5 TJ	C. G. JACKSON	29, Birchwood Avenue, Sidcup.
5 TK		
5 TL	E. D'ERESBY MOSS	4, St. George's Terrace, Regent's Park, N.W.
5 TM		
5 TN	Capt. C. E. STEWART	Mount Pleasant, Weymouth.
5 TO		
5 TP		
5 TQ	H. RAYNER	32, Grange Road, Cleckheaton, Yorks.
5 TR	J. A. J. COOPER	1, Montreal Road, Ilford.
5 TS	W. DEAN	"Bankleigh," Ramsgreave, nr. Blackburn.
5 TT		
5 TU	J. L. RODGER	"Woodside," Western Terrace, Falmouth.
5 TV	Lt. U. H. LLOYD, M.C.	27, Copthall Gardens, Twickenham.
5 TW / 5 TX	Capt. R. S. BAUGH (Portable)	"Longfield," Wake Green, Moseley, Birmingham.
5 TY		
5 TZ	W. G. SHERRATT	11, Bath Road, Cowes, I.O.W.

5 U

5 UA	A. BARBER	15, Hartingdon Terrace, Lidget Green, Bradford.
5 UB		
5 UC		
5 UD		
5 UF		
5 UG	L. E. BOXWELL	115, Trowbridge Road, Bradford-on-Avon, Wilts.
5 UH	C. ROBINSON	357A, Bury New Road, nr. Broughton, Manchester.
5 UI		
5 UJ		
5 UK		
5 UL	J. W. COVENEY	"Bonita," 30, Arundal Gardens, Goodmayes.
5 UM	H. ALLCHIN	78, Chester Road, Forest Gate, E.7.
5 UN	BIRMINGHAM UNIVERSITY RADIO SOCIETY	Edgbaston, Birmingham.
5 UO	R. C. SIMMONDS	61, Brightfield Road, Lee, S.E.12.
5 UP	F. J. DEVENISH	13, Marlborough Road, Bowes Park, N.22.
5 UQ	J. C. LLOYD EDWARDS	Trevor Hall, Trevor, Wrexham.
5 UR		
5 US	J. CROYSDALE	40A, The Grove, Ilkley, Yorks.
5 UT		
5 UU		
5 UV	L. A. JEFFREY	90, Harringay Road, Green Lanes, N.15.
5 UW	F. J. SINGLETON	Wellington Place, Penn Fields, Wolverhampton.
5 UX	H. STEPHENSON	"The Bottoms," Gildersome, Leeds.
5 UY	D. B. FRY	"The Laurels," Mayfield, Sussex.
5 UZ	J. LLEWELLYN	"Elmfield," Baldrock Road, Letchworth.

5 V

5 VA		
5 VB	G. C. CURTIS	33, Swindon Road, Edgbaston, Birmingham.
5 VC	H. LONGSTAFF	Commercial Bank Buildings, Bradford, Yorks.
5 VD	P. J. WAKEFIELD	31, Station Road, Church End, Finchley, N.3.
5 VF		
5 VG	F. L. HOGG	37, Bishops Road, Highgate, N.6.
5 VH		
5 VI		
5 VJ		
5 VK	B. CALDWELL	Ivy House, Whitley, nr. Northwich, Cheshire.
5 VL	R. W. LEADER	"Porth," St. Colomb Minor, Cornwall.
5 VM		
5 VN		
5 VO		
5 VP	G. F. KITCHEN	10, Beech Road, Epsom.
5 VQ		
5 VR	EDISON SWAN ELECTRIC CO., LTD.	123/5, Queen Victoria Street, E.C.4.
5 VS		
5 VT	G. C. WEBB	10, Osborne Road, Stroud Green, N.4.
5 VU	S. W. BUTTERS	51, Clarendon Road, West Croydon, Surrey.
5 VV	S. A. RICHARDS	103, Isledon Road, Finsbury Park, N.7.
5 VW	W. V. HARRINGTON	72, Bedford Road, Forset Road, Walthamstow, E.17.
5 VX	J. H. IVES	49, Acre Road, Watford, Herts.
5 VY		
5 VZ		

5 W

5 WB		
5 WC	W. CLOUGH	36, Victoria Street, Lower Broughton, Manchester.
5 WD	K. ULLYETT	"Zennor," Whipps Cross, Leytonstone, Essex.
5 WF	D. G. BOWER	10, Ventnor Villas, Hove, Sussex.
5 WG	G. M. JONES	49, Baron Road, Chadwell Heath, Essex.
5 WH	A. J. GOODWIN	57, Hale Lane, Mill Hill, N.W.7.
5 WI	R. E. L. BLANCHARD	"Mayville," Culliford Road, Dorchester.
5 WJ		
5 WK		
5 WL		
5 WM	J. B. RENSHAW	17, Walter Street, Audley, Blackburn.
5 WN	A. T. K. MOSS	Weardale Road, Lee.
5 WO		
5 WP	W. E. RUSSELL	5, Walton Road, Woking, Surrey.
5 WQ	J. R. WITTY	44, Cambridge Road, Gt. Crosby, Liverpool.
5 WR		
5 WS	WOOLWICH RADIO SOCIETY	A. G. BEESON, 12, Court Yard, Eltham, S.E.9.
5 WT	A. S. WOOD	37, St. James's Road, Forfar, Scotland.
5 WU	R. B. CROSS	9, Ormsby Avenue, Gorton Mount Estate, Gorton.
5 WV	D. WOODS	Station House, Braintree, Essex.
5 WW		
5 WX		
5 WY	F. J. WOOLFENDER	68, New Road, Dearnley, Littleboro', Lancs.
5 WZ	E. W. HETTICH	1, King Street, St. Helier, Jersey, C.I.

5 X

5 XA		
5 XB		
5 XC	I. H. LOTT	Bushey, Herts.
5 XD	B. C. CHRISTIAN	7, Hutchinson Square, Douglas, I.O.M.
5 XF		
5 XG		
5 XH		
5 XI		
5 XJ		

LIST OF EXPERIMENTAL CALL SIGNS—*(Continued)*

5 XK		
5 XL		
5 XM	F. EUSTANCE	92, Briardare Road, Mossley Hill, Liverpool.
5 XN	H. W. EVERETT	30, Gourock Road, Eltham, S.E. 9.
5 XO	Capt. L. A. BRAIT	Ravensdene, Holden Avenue, Woodside Park, N. 12.
5 XP	G. H. STANCER...	9, Mark Street, Rochdale.
5 XQ		
5 XR	F. A. TUCK	87, Mayo Road, Willesden, N.W.10
5 XS	F. B. THOMAS	76, Vicarage Lane, Stratford, E.15.
5 XT	P. B. THOMPSON	17, Fyfield Road, Enfield, Middlesex.
5 XU	T. N. LORD	6, Trafalgar Terrace, West Park Street, Dewsbury, York.
5 XV		
5 XW	C. BRYANT	5, Creffield Road, Colchester.
5 XY	J. C. HARRISON	"Highcroft," Park Lane, Burnley, Lancs.
5 XZ	A. F. C. BOYES	48, Lavender Gardens, Clapham Common, S.W.4.

5 Y

5 YA		
5 YB	G. THOMPSON	East Rigton, East Keswick, near Leeds.
5 YC		
5 YD	E. R. BRIDGWATER	75, Upper Normacot Road, Longton, Staffs.
5 YF		
5 YG	J. WYLLIE	105, Mossgiel Road, Newlands, Glasgow.
5 YH		
5 YI	A. L. GOODLIFFE	17, Malvern Road, Nottingham.
5 YJ	Major W. H. OATES	21, Wolverton Gardens, Hammersmith, W. 6.
5 YK	G. W. THOMAS...	169, Hills Road, Cambridge.
5 YL	B. HESKETH	Windy Corner, Kingston, near Littlehampton.
5 YM	Capt. E. H. ROBINSON ...	"Langmead," Pirbright, Surrey.
5 YN		
5 YO	J. E. NOBLE	108, James Street, Golcar, near Huddersfield.
5 YP		
5 YQ	J. GALLSCHER	4, Havelock Terrace, Paisley.
5 YR	F. H. WEBBER...	14, Bridge Street, Tiverton, Devon.
5 YS	C. H. DYER	Balsall Common, near Coventry.
5 YT		
5 YU		
5 YV		
5 YW	R. S. WHITWELL	12, Sidney Street, Penn Road, Wolverhampton.
5 YX		
5 YY		
5 YZ	G. H. HOUGHTON	110, Heathwood Gardens, Charlton, S.E. 7.

5 Z

5 ZA	R. T. WRIGHT	2, Grove Park Terrace, Chiswick, W. 4.
5 ZB		
5 ZC		
5 ZD		
5 ZF	BURNDEPT WIRELESS, LTD. ...	12, Basinghall Street, Leeds.
5 ZG	R. P. HAWKEY...	"Tregenna," Grange Avenue, Woodford Green, Essex.
5 ZH	T. ALLISON	80, Oxford Avenue, S.W. 20.
5 ZI		
5 ZJ		
5 ZK	C. A. C. RADIO, LTD. (G. E. WARD).	13, Queens Road, London, N.W.8.
5 ZL		
5 ZM		
5 ZN	J. F. PERRIN	Weybridge.
5 ZO	W. F. MILLS	11, Stoney Hey Road, Wallasey, Cheshire.
5 ZP		
5 ZQ	H. JESSOP	5, Crest Place, Halifax Road, Brighouse, Yorks.
5 ZR	F. H. AUSTIN	52, Church Street, St. Peter's, Broadstairs.
5 ZS	F. CLARKE	Church Mead, Pirbright, Surrey.
5 ZT	E. S. T. EDWARDS	18, Ripon Street, Moss Side, Manchester.
5 ZU	H. B. GARDNER	129, Salisbury Road, Barnet.
5 ZV	W. HERRING	221, Newark Road, Lincoln.
5 ZW		
5 ZX	T. L. RAWSON	Bell Rock, Belfield Road, Didsbury, Manchester.
5 ZY	L. HEADLAM	Stakesbury Road, Whitby, Yorks.
5 ZZ	H. C. WHITBY	"The Ness," Winsford, Cheshire.

6 A

6 AA, 6 AB, 6 AC	THE DURHAM AND NORTHUMBERLAND COLLIERIES FIRE AND RESCUE BRIGADE (Portable)	854, Scotswood Road, Newcastle-on-Tyne.
6 AD	S. MURGATROYD AND R. WOODLAND	2, Glenwyllin Road, Waterloo, Liverpool.
6 AE	R. H. RICE	70, Seaside, Eastbourne.
6 AG	W. H. FORTINGTON ...	237, Dudley Road, Rotton Park, Birmingham.
6 AH	R. H. P. COLLINS	4, Dean Place, Liskeard, Cornwall.
6 AI	H. ANDREWS	Wireless Depot, Ystradgynlais, Swansea.
6 AJ	BARNSLEY AND DISTRICT WIRELESS ASSOCIATION.	22, Market Street, Barnsley.
6 AK		
6 AL	J. P. MORTER	49, Westow Hill, Upper Norwood, S.E. 19.
6 AM		
6 AN		
6 AO	A. V. RUDDLESDEN	24, Wakefield Road, Dewsbury, Yorks.
6 AP	J. A. HOBSON	Hill Close, Berkswell, nr. Coventry.
6 AQ	A. H. BIRD	35, Bellwood Road, Waverley Park, S.E. 15.
6 AR		
6 AS		
6 AT	F. AUGHTIE	28, Terry Street, Dudley, Worcester.
6 AU	G. ALGER BLYDE	"East Cliffe," Sheffield.
6 AV	F. A. ELLIFF	10, Stumperlowe Park Road, Fulwood, Sheffield.
6 AW	E. J. JARVIS	24, St. James Road, Ilkley, Yorks.
6 AX		
6 AY	G. T. KELLAWAY	"Saxenhurst," Cheam, Surrey.
6 AZ		

6 B

6 BA		
6 BB	J. BOLT...	"Croudley," Lymm, Cheshire.
6 BC	W. D. CLAGUE	"White House," High Heworth, Gateshead.
6 BD	F. M. G. HUTTON	"Tullagee," Willingdon Road, Eastbourne, and Wellington College, Berkshire.
6 BF	S. R. DONALDSON	62, Woodville Road, Golder's Green, N.W. 11.
6 BG		
6 BH	F. T. SCRAGG	"Mayville," Meaford Road, Barlaston, Stoke-on-Trent.
6 BI		
6 BJ	F. HALDEN	5, Frinton Road, Stamford Hill, N. 15.
6 BK		
6 BL		
6 BN	G. E. MINVALLA	25, Weighton Road, Anerley, S.E.
6 BO	L. C. HAGGAR	35, Cunningham Park, Harrow.
6 BP	A. E. HAYWARD	"Devonia," Higham Road, Tottenham, N. 15.
6 BQ	J. L. CANNON..	65, Belsize Avenue, London, N.13.
6 BR	G. H. RAMSDEN	Overdale, Ilkley, Yorks.
6 BS		
6 BT	C. A. JAMPLIN	82, York Road, Bury St. Edmunds.
6 BU		
6 BV	V. F. M. OLIVER	Whitemore Lodge, Sunninghill Berks.
6 BW	J. C. MASON	3, Barnwell Avenue, Wallasey, Cheshire.
6 BX		
6 BY		
6 BZ		

6 C

6 CA		
6 CB		
6 CC	B. A. MATTHEWS	"Westgate," Frederick Road, Wylde Green, Birmingham.
6 CD		
6 CF		
6 CG	A. W. EAGLE	126, Rosebery Avenue, Tottenham N. 7.
6 CH	R. J. LEEVES	Denmark Villa, Denmark Road, Bromley, Kent.
6 CI	B. W. WARREN	19, Melville Road, Coventry.
6 CJ	F. J. H. CHARMAN	76, Salisbury Street, Bedford.
6 CK		
6 CL	J. CLARRICOATS	107, Friern Barnet Road, N. 11.
6 CM		
6 CN		
6 CO		
6 CP	C. L. CHAMPION	Alvescot, Crestway, Roehampton, S.W. 1.
6 CQ		
6 CR		
6 CS		
6 CT	G. S. AITCHISON	58, Mildred Avenue, Watford.
6 CU	J. E. BRAZENDALE	60, Waterloo Street, Hull.
6 CV	P. H DORTE	"Lynwood," Oatlands Park, Weybridge, Surrey.
6 CW	D. BURNE-JONES	"Gwalior," Rustic Avenue, Streatham, S.W. 16.
6 CX		
6 CY	F. W. G. TOWERS	12, Mayfield Road, Handsworth, Birmingham.
6 CZ		

LIST OF EXPERIMENTAL CALL SIGNS—(Continued)

6 D

6 DA	S. A. Davy	80, Essendine Mansions, Maida Vale, W. 9.
6 DB		
6 DC	G. Young	37, Barnard Road, Gorton, Manchester.
6 DD	John W. Barber	205, Brockley Road, Brockley, S.E. 4.
6 DF	F. G. Phinnimore	Andrew Lane Farm, High Lane, Stockport.
6 DG	H. H. T. Burbury	Crigglestone, Wakefield.
6 DH		
6 DI	T. Dickinson	Bolt Head Ferry, Salcombe.
6 DJ	A. C. Copsey	27, Sutherland Road, Tottenham, N. 17.
6 DK	F. A. Boyce	"Penguin," Garson Lane, Wraysbury, Bucks.
6 DL		
6 DM	Capt. C. Knight-Coutts ...	16, Vine Street, Evesham.
6 DN	C. M. Denny	19, Grange Avenue, Cheadle Hulme, Cheshire.
6 DO	P. H. Porte	"Lynwood," Oaklands Park, Weybridge, Surrey.
6 DP	N. Crowther	219, Roundhay Road, Leeds.
6 DQ	H. Drury	New Housing Estate, West Ardsley, Wakefield, Notts.
6 DR		
6 DS		
6 DT		
6 DU	E. J. Newton	1, Jerningham Road, New Cross, S.E. 14.
6 DV		
6 DW	D. H. Johnson	"Coombe Pines," Warren Cutting, Kingston Hill, Surrey.
6 DX		
6 DY	C. K. Murray...	Paulton's Estate, Ower, Romsey, Hants.
6 DZ	Capt. L. A. K. Halcomb ...	"South Dene," 106, Millhouses Lane, Sheffield.

6 F

6 FA	G. E. Wardle	"Kingsdown," College Road, North Blundellsands, Liverpool.
6 FB	W. Grocott	Church Road, Oxley, near Wolverhampton.
6 FC	L. S. Taylor	49, Frederick Street, Crosland Moor, Huddersfield.
6 FD	F. T. Carter	Flat A., Gleneagle Mansions, Streatham, S.W. 16.
6 FF		
6 FG	N. Hendry	30, Sanderson Road, Newcastle-on-Tyne.
6 FH	G. W. Livesley	3, Spring Bank, Market Drayton.
6 FI		
6 FJ	C. V. Jarvis	"Southleigh," 21, Baltic Road, Tonbridge, Kent.
6 FK	F. A. Clarke	48, Wilbury Road, Hove, Sussex.
6 FM		
6 FN		
6 FO		
6 FP		
6 FQ	A. B. Richardson	9, Quarry Road, Hastings.
6 FR	A. S. Freeman...	2, Carpenters Road, Lozells, Birmingham.
6 FS	— Sykes	Litchurch Street, Derby.
6 FT	R. T. Frost	19, Highfield Road, Felixstowe.
6 FU		
6 FV	W. H. Taylor	106, Bridge Street, Warrington.
6 FW		
6 FX		
6 FY	J. T. Thornton	Green Hill, Birkby Lodge Road, Road, Huddersfield.
6 FZ	H. E. F. Taylor	Abbot's Trace, Abbotswood, Guildford.

6 G

6 GA		
6 GB		
6 GC	H. H. T. Burbury	Crigglestone, near Wakefield.
6 GD		
6 GF	F. H. Tyler	"Rycroft," Kirby Muxloe, near Leicester.
6 GG		
6 GH	G. E. Hitchcock	"Elton," Manor Way, Beckenham, Kent.
6 GI		
6 GJ		
6 GK		
6 GL	F. L. Giles	201, Higham Hill Road, Walthamstow, E. 17.
6 GM	E. A. Wilson	42, Heber Road, N.W. 2.
6 GN	Tynemouth Volunteer Life Brigade	Brigade House, Tynemouth.
6 GO	L. A. Sayce	5, Toward Terrace, Sunderland.
6 GP		
6 GQ	J. S. Souter	Greyfriars Ironworks, Elgin Moray shire.
6 GR	J. S. Scotston...	93, Entwistle Road, Rochdale.
6 GS		
6 GT	G. Turton	3, Lydford Road, Maida Vale, W.9.
6 GU		
6 GV		
6 GW	P. Brian	79, Lakey Lane, Hall Green, Birmingham.
6 GX	G. Reynolds	71, Siddall Street, Oldham.
6 GY	T. MacL. Galloway	"Wyntersted," Dollar, Clackmannanshire.
6 GZ	R. C. Neale	Farnborough Road, Farnborough, Hants.

6 H

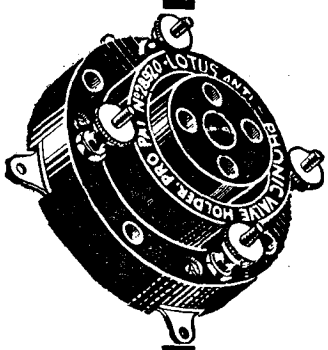
6 HA		
6 HB		
6 HC	H. Cooper	"Morning Dawn," Burnt Ash Lane, Bromley, Kent.
6 HD	National Wireless and Electric Co.	Church Road, Acton, W. 3.
6 HF	M. H. Wynter-Blyth ...	Tankersley, near Barnsley, Yorks.
6 HG	A. Franks, Ltd.	95/97, Deansgate, Manchester.
6 HH	A. R. E. Jennings	Glevern Radio Society, Caxton House, Gloucester.
6 HI		
6 HJ		
6 HK	J. W. F. Cardell	"Tretherras," Newquay, Cornwall
6 HL	H. H. Speke	12-14, Bilston Street, Wolverhampton.
6 HM	H. E. Daft	31, Eastfield Road, Peterborough.
6 HN		
6 HO		
6 HP		
6 HQ		
6 HR	W. D. Keiller	51, Highworth Road, New Southgate, N. 11.
6 HS	H. Saville	1, Delamere Avenue, Stretford, Manchester.
6 HT	A. E. Marlow	Penn Road, Penn, Wolverhampton
6 HU	G. Rutherford	103, Burbage Road, Herne Hill, S.E. 24.
6 HV	W J Butler	15, Algernon Road, Edgbaston, Birmingham.
6 HW	... ...	
6 HX	C. H. Nokes	"Misidia," High Street, Ripley, Surrey.
6 HY	F. Dyer	59, Antill Road, Tottenham, N. 17.
6 HZ	L. Kane	5, Burrard Street, Jersey.

6 I

6 IA	T. H. Colebourn	"Ardchalligan," Selbourne Drive, Douglas, I.O.M.
6 IB	R. Berriman	"The Woodlands," Fence Houses, Co. Durham.
6 IC	A. Jowett	310, Hopwood Lane, West End, Halifax.
6 ID	F. Wheatley, Junr.	24, Radnor Road, Handsworth, Birmingham.
6 IF	R. Sharpihouse	9, South Terrace, Thirsk.
6 IG	E. Brady	24, The Square, Ripon.
6 IH		
6 II		
6 IJ		
6 IK		
6 IL	J. H. Roscoe	183, Chester Street, Birkenhead.
6 IM	L. G. Kamm	88, Hornsey Lane, Highgate, N.6.
6 IN		
6 IO	T. Woodhouse	31, Tresco Road, Peckham Rye, S.E. 15.
6 IP		
6 IQ	H. Forshaw	45, High Street, Standish, near Wigan.
6 IR	G. Hornsby	14, Baring Street, South Shields.
6 IS	H. Higson	Beechwood, Lower Darwen, Lancs.
6 IT		
6 IU	Sparks Radio Dept. ..	47, Fitzwilliam Street, Sheffield.
6 IV	P. B. Snoaden..	68, Hide Road, Harrow.
6 IW	Leeds Y.M.C.A. Wireless Society.	P. Whiteley, Albion Place, Leeds.
6 IX	W. G. Fudger	"Brora," Priorswood Road, near Godalming.
6 IY	A. Pacy	28, Church Road, Epsom.
6 IZ	E. G. Ingram	18, Victoria Street, Aberdeen.

6 J

6 JA		
6 JB	Wimeledon Radio Society	57, Church Road, Wimbledon, S.W. 19.
6 JC		
6 JD		
6 JF		
6 JG	J. G. Young	Somerset Boys' Home, Lr. Bristol Road, Bath.
6 JH	J. Hartley	21, Plymouth Grove, Manchester.
6 JI		
6 JJ	Dr. J. O. P. Smith	"The Croft," Dingwall, N.B.
6 JK		
6 JL	P. N. Goulston	"Edgeleigh," Warwick Avenue, Coventry.
6 JM		
6 JN		
6 JO	J. Rodgers	13, Arwenack Street, Falmouth, Cornwall.



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2/3 Without terminals

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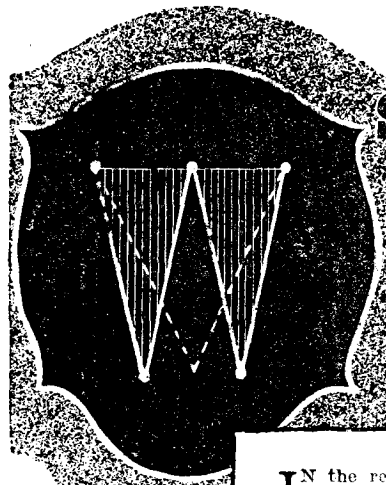
GARNETT, WHITELEY & CO., LTD.
Lotus Works, Broadgreen Road, LIVERPOOL.

Duo-triangular-filament suspension



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IN the record of the development of scientific valve design, DUO-TRIANGULAR FILAMENT SUSPENSION will always be hailed as "The Achievement of 1926."

The phenomenal advantages arising out of this unique, yet simple construction are amazing. To begin with, it is obvious that the length of filament employed in our new Point One Valves is almost double that in the usual type—represented by broken lines—with the result that a much greater electron emission is ensured, and further, none of this valuable electron stream is wasted since the entire filament is wholly enclosed within the grid and anode. And, remember, the Special Six-Sixty filament itself is wonderfully economical. Its current consumption is barely .1 amps., and when operating at the rated voltage there is absolutely no sign of "glow."

Then, too, the stability and perfect alignment resulting from the additional supports render it unnecessary to assemble the filament in tension, and ensure a constancy of perfect reception. Engineers for years past have realised the stability of the Warren Girder, but it was left to Six-Sixty to apply this to the design of the radio valve.

The story of success cannot always be told in a few words. Our subsequent advertisements will reveal the structure of the perfect Valve, built on the foundation of Duo-Triangular Filament Suspension.

S.S.1	Bright Emitter, General Purpose Valve,	8/-
S.S.2 H.F.	D.E., H.F. and Detector,	14/-.
S.S.3 H.F. & L.F.	D.E., .06 amps, H.F., L.F. and Detector,	14/-.
S.S.4	D.E. Power Amplifier,	18/6.
S.S.5	D.E. Power Amplifier,	18/6.
S.S.6	D.E. Resistance Amplifier,	18/6.
S.S.7	D.E. .1 amps. Power Amplifier,	18/6.
S.S.2A H.F. & L.F.	D.E. .1 amps. H.F., L.F. and Detector,	14/-.
S.S.8	D.E. .1 amps. General Purpose,	14/-.
S.S.9	D.E. .1 amps. Power Amplifier,	18/6.
S.S.10	D.E. 2 volts, .15 amps. Power Amplifier,	18/6.
S.S.11	D.E. Power Amplifier,	18/6.

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Better by Six Times Sixty

THE ELECTRON Co., Ltd., Triumph House, 189, Regent St., London, W.1

LIST OF EXPERIMENTAL CALL SIGNS—*(Continued)*

6 JP		
6 JQ		
6 JR	S. A. STUART	137, Inverness Place, Roath Park, Cardiff.
6 JS	P. R. SOLDER	76, Albert Road, Alexandra Park, N. 22.
6 JT		
6 JU	J. T. L. MALLARD & Co. ..	47, Sandy Lane, Stockport.
6 JV	Capt. H. J. B. HAMPSON ..	477, Earlham Rise, Norwich.
6 JW	V. PLASCOTT	12, Handel Terrace, The Polygon, Southampton.
6 JX	R. J. W. LANKESTER	"Wanderings Farm," Kingston Road, Kingston-on-Thames, Surrey.
6 JY		
6 JZ	V. A. G. BROWN	Fawley Lodge, Coley Avenue, Reading.

6 K

6 KA	K. HARDIE	58, Ulverston Road, Upper Walthamstow.
6 KB	[illegible] WILDING	306, Gidlow Lane, Wigan, Lancs.
6 KC	[illegible] FARMERY	136, Shear Brow, Blackburn.
6 KD	[illegible] EVAN	Technical College, Cardiff.
6 KE		
6 KG	[illegible] CENBRIDGE	32, Castle Street, Reading.
6 KH		
6 KI	C. D. KIDD	33, Berkeley Road, Bishopston, Bristol.
6 KJ	W. KROHN	18, Highcroft Gardens, Golders Green, N.W. 11.
6 KK	J. COOKSON	66, Albert Road, Blackpool.
6 KL	W. H. J. COOMBS	29, Alexandra Road, West Park, Chesterfield.
6 KM		
6 KN	W. BRIDGE	Henfold, Tyldesley, Lancs.
6 KO	J. B. STURROCK	Kirkbuddo, Forfarshire, Scotland.
6 KP		
6 KQ	R. J. RICHARDSON	18, Fairhaven Avenue, Chorlton-cum-Hardy.
6 KR	G. A. HUTCHINS	Birmingham.
6 KS		
6 KT	K. E. WILLSON	"Hedgerows," Main Road, Dovercourt Bay, Essex.
6 KU	H. G. CLACY	114, Bradshaw Road, Watford.
6 KV		
6 KW	PAYNE & HORNSBY, LTD. ..	Newcastle.
6 KX		
6 KY		
6 KZ		

6 L

6 LA	H. R. MOORE	Moorlands, South Road, Bishop's Stortford.
6 LB	L. J. FULLER	13, Seagry Road, Wanstead, Essex.
6 LC	S. INCE	72, Newton Road, Lowton, St. Mary's, Newton-le-Willows Lancs.
6 LD	H. HORROCKS	23, Mount Avenue, Littleborough, Manchester.
6 LF	G. W. HALL	7, Acton's Walk, Chapel Lane, Wigan.
6 LG		
6 LH		
6 LI		
6 LJ	S. K. LEWER	32, Gascony Avenue, West Hampstead, N.W. 6.
6 LK		
6 LL	J. W. MATHEWS	178, Evering Road, Clapton, E.5.
6 LM		
6 LN		
6 LO		
6 LP		
6 LQ		
6 LR		
6 LS		
6 LT		
6 LU	A. WOODMANSEY	8, Church Avenue, Harrogate.
6 LW	R. C. DAVIES	Sunnyside, Grainger's Lane, Cradley Heath, Staffs.
6 LX		
6 LY	H. W. SELLARS	47, Queen's Road, Chorley, Lancs.
6 LZ	C. S. ISAACS	Mercer's Road, Tufnell Park, N.19.

6 M

6 MA		
6 MB	A. J. BUTTRESS	7, Limekilns Fields, Hill Top, Bolsover, near Chesterfield.
6 MC	J. A. BADHAM	114, Fitzwilliam Street, Huddersfield.
6 MD	R. J. BROWN	"Greba," Gledhow Road, Roundhay, Leeds.
6 MF	S. HILL	Langford House, Langford, near Bristol.
6 MG	B. W. D. LACEY	197, Alcester Road, South King's Heath, Birmingham.
6 MH		
6 MI	R. MAYNARD	Tynwald Street, Douglas, Isle of Man.
6 MJ	H. A. FREER	110, Humberstone Drive, Leicester.
6 MK	R. WILBY	93, Brudenell Road, Hyde Park, Leeds.
6 ML		
6 MM	J. W. STEVENS	114, Devonshire Road, Forest Hill, S.E. 23.
6 MN		
6 MO		
6 MP	O. W. NICHOLSON	Fasing Park, near Alton, Hants.
6 MQ	G. C. PATCHING	84, Allcroft Road, Kentish Town, N.W. 5.
6 MR		
6 MS		
6 MT	W. H. LILES	21-22, Edwards Terrace, Cardiff.
6 MU	E. MEGAW	3, Fortwilliam Drive, Belfast.
6 MV		
6 MW	Lt.-Col. C. W. THOMAS ..	Clifton House, Old Swinton, Stourbridge.
6 MX	Y. W. P. EVANS	2, Parkside Road, Alexandra Park, Manchester.
6 MY		
6 MZ	H. H. MOULD (Portable)	"Ashleigh," Avenue Road, Wolverhampton.

6 N

6 NA		
6 NB		
6 NC		
6 ND		
6 NF	A. D. GAY	49, Thornlaw Road, West Norwood, S.E. 27.
6 NG	J. W. CROPPER	10, Manor Street, Audenshaw, Manchester.
6 NH	J. W. DAVIES	Coopersale Hall, Epping.
6 NI	Capt. W. S. CLEMMEY ..	Merton Road, Bootle, Liverpool.
6 NJ	C. W. WATSON	33, Rainhall Road, Barnoldswick.
6 NK	R. J. DENNY	1, Hillside, Waverley Road, Weybridge.
6 NL	BRITISH RADIO MFG. Co. ..	9, South Castle Street, Liverpool.
6 NM	.. .. ..	
6 NN	O. S. FRANCIS	Capitol Super-Cinema, Cardiff.
6 NO	H. E. NORRIS	48, Cold Overton Road, Oakham, Rutland.
6 NP	W. GILL	7, Church View, Heckmondwkye, Yorks.
6 NQ	L. B. PARKES	102, Lichfield Street, Walsall, Staffs.
6 NR	R. S. ROBERTS	92, Arlington Road, Camden Town, N.W. 1.
6 NS	J. FRATER	Felling-on-Tyne.
6 NT	H. PLUMER	20A, Tradescant Road, S. Lambeth Road, S.W. 8.
6 NU		
6 NW		
6 NX	J. T. McDADE	8, Monteith Row, Glasgow, S.E.
6 NY	.. .. ..	
6 NZ	L. E. NEWNHAM	14, Silchester Road, Copnor, Portsmouth.

6 O

6 OA		
6 OB		
6 OC		
6 OD	G. E. HEBDEN	124, Scotforth Road, Lancaster.
6 OF	.. .. ..	
6 OG	R. A. WEBBER	8, Theresa Avenue, Bishopston, Bristol.
6 OH	G. S. SAMWAYS	"Tregothnan," London Road, Lichfield.
6 OI	J. TIMBRELL	Rydal, Wall Heath, Kingswinford.
6 OJ		
6 OK	W. JONES	"Tegwell," Penybryn, Upper Colwyn Bay, N. Wales.
6 OL		
6 OM	IAN AUCHTERLONIE	"The Gables," Heswell, Cheshire
6 ON	C. H. WARRINGTON	47, Third Avenue, Queen's Park, W. 10.
6 OO	T. WOODCOCK	8, George Street, Bridlington.
6 OP	D. W. PUGH	97, Gordon Road, West Ealing, W.13.
6 OQ		
6 OR		
6 OS		
6 OT	H. A. CLARK	71, Station Road, Bedford.
6 OU	E. WILLIS	9, Winchester Street, Basingstoke.
6 OV	H. W. WEBB	37, Markhouse Avenue, Walthamstow, E. 17.
6 OW	J. P. BROWN	18, May Street, Hamilton, Lanarkshire.
6 OX	B. QUENTIN	L'Islet Lodge, St. Sampsons, Guernsey.
6 OY	P. L. F. JONES	181, Hampstead Way, Golder's Green, N.W. 11.
6 OZ	H. THOMPSON	7, Rye Street, Chorlton-on-Medlock, Manchester.

6 P

6 PA		
6 PB		
6 PC		
6 PD	A. J. DIXON	White House, 74, Hertford Road, Enfield Wash.

LIST OF EXPERIMENTAL CALL SIGNS—(*Continued*)

6 PF	F. M. Cooper	22, Guest Road, Endcliffe, Sheffield.
6 PG	C. H. Targett	21, High Street, Dartford, Kent.
6 PH		
6 PI		
6 PJ	F. Ison	47, Orford Road, Walthamstow, E.17.
6 PK	Universal Radio Co. ..	120, New Bridge Street, Newcastle-on-Tyne.
6 PL	J. F. Brockbank	51, Palatine Road, Withington, Manchester.
6 PM		
6 PN		
6 PO	—, McDonald	"Lynwood," Castle Road, Weybridge.
6 PP		
6 PQ	F. W. Edwards	"Fair Haven," Castle Gresley, near Burton-on-Trent.
6 PR	J. P. Price	"Coombehurst," Combe Hill Road, E. Grinstead.
6 PS		
6 PT	Leonard Lott	"Gants Muir," Berrow Road, Burnham-on-Sea.
6 PU	E. J. W. Ahier	"Elettra," Greve d'Azette, Jersey, C.I.
6 PV		
6 PW	W. B. G. Collis	The Rocklands, Church Avenue, Clent, Stourbridge.
6 PX	J. M. Shaw	"Glenbourne," Dore Road, Dore, nr. Sheffield.
6 PY	L. W. Parry	13, Huddersfield Road, Barnsley.
6 PZ		

6 Q

6 QA	A. H. Arnoll	40, Springwell Avenue, Harlesden, N.W.10.
6 QB	L. H. Thomas	33, Harpenden Road, West Norwood, S.E.27.
6 QC	H. J. Stamper	The Grammar School, Loughborough.
6 QD	J. C. Pollock	1, Notting Hill, Belfast.
6 QE		
6 QG	C. G. Carlton	"Horn Park House," Lee, S.E.12.
6 QH	A. J. Baker	67, First Avenue, Bush Hill Park, Enfield.
6 QI		
6 QJ		
6 QK	P. J. Calvert	56, Eton Avenue, Hampstead, N.W.3.
6 QL		
6 QM		
6 QN		
6 QO	C. J. Deal	"The Limes," Kelvedon, Essex.
6 QP		
6 QQ		
6 QR		
6 QS	H. Bishop	56, Upper Valley Road, Sheffield.
6 QT	J. R. Brown	93, Railway Street, Hebburn-on-Tyne.
6 QU	A. Eaton	21, Dashwood Road, Prestwich, Manchester.
6 QV	A. I. Rich	13, New Road, Ponder's End, Middlesex.
6 QW	G. V. Priestley	Bankfield, Taylor Hill, Huddersfield.
6 QX		
6 QY	J. A. Godfrey	160, Bethune Road, London, N.16.
6 QZ	W. R. Emery	39, Kilmorey Gardens, Twickenham.

6 R

6 RA		
6 RB		
6 RC		
6 RD	J. E. Hooper	26, Hale Street, Poplar, E.14.
6 RE		
6 RG		
6 RH		
6 RI		
6 RJ	A. H. Howe	51, Rosslyn Avenue, Barnes, S.W.13.
6 RK	R. Gregson	3, Bank Road, Blackpool, Lancs.
6 RL	K. Gregson	2, Laurel Avenue, Blackpool.
6 RM	A. E. MacFarlane	30, Vincent Road, Addiscombe, Croydon.
6 RN		
6 RO	A. Taylor	136, King's Road, Cardiff.
6 RP	C. A. Potter	Newfield Hall, Sheffield.
6 RQ	B. C. Thomas	93, Brynccaerau Terrace, Llanelly.
6 RR		
6 RS	F. C. Smart	"The Retreat," Fields Park Road, Newport, Mon.
6 RT		
6 RU		
6 RV		
6 RW	E. T. Salmon	15, Delmain Road, West Derby, Liverpool.
6 RX		
6 RY	H. L. Bowen	13, Daniel Street, Bath.
6 RZ		

6 S

6 SA	Prof. A. M. Low	"The Yews," Woodstock Road, Bedford Park, W.4.
6 SB	R. Heather	102, Lyndhurst Road, Peckham, S.E.15.
6 SC		
6 SD		
6 SF		
6 SG	L. W. Mant	35, Jessil Road, Southsea.
6 SH	S. Heald	2, Market Street, Chorley, Lancs.
6 SI		
6 SJ		
6 SK	A. E. Vollmer	57, Lyttleton Road, Leyton, E.10.
6 SL		
6 SM		
6 SN		
6 SO	E. L. Gardiner	36, Long Lane, Finchley, N.3.
6 SP		
6 SQ	G. A. Heaney	8, Dunedin, Antrim Road, Belfast.
6 SR	R. T. Hatton-Evans ..	6, Court-y-vil Road, Penarth.
6 SS	F. C. Holliday	"Forest Hill," Park Villas, Roundhay, Leeds.
6 SU	E. A. Parsons	111, Chester Terrace, Brighton.
6 SV	E. S. Stanley	Marlborough House, Parkside Road, Reading.
6 SW	T. Ball	Cambridge House, Mill Street, Cannock.
6 SX		
6 SY		
6 SZ	K. Riley	13, Park Avenue, Burnley, Lancs.

6 T

6 TA	C. D. Abbott	120, Cavendish Road, Balham, S.W.12.
6 TB	L. A. Sang	22, Strannillis Gardens, Belfast.
6 TC		
6 TD	K. L. Palmer	Gobowen, Salop.
6 TF		
6 TG	R. Harris	The Rectory, Long Crichel, Wimborne, Dorset.
6 TH	C. W. Liles	"Morningside," Fields Road, Newport, Mon.
6 TI	T. Baldwin	244, Dudley Hill Road, Undercliffe, Bradford.
6 TJ		
6 TK		
6 TL	J. H. Smith	8, Duke Street, Dartmouth, S. Devon.
6 TM	W. A. S. Butement ..	127, West End Lane, N.W.6.
6 TN	E. H. Wright	13, Roices Street, Brighton.
6 TO		
6 TP		
6 TQ		
6 TR		
6 TS		
6 TT		
6 TU	J. K. Byers	33, Richmond Avenue, Margate.
6 TV		
6 TW	J. Noden	"Fern Villa," Coppice Road, Willaston, nr. Nantwich.
6 TX	J. E. Fynn	"Maxwell," 12, Monkhams Avenue, Woodford Green, Essex.
6 TY	K. D. F. Townend	3, Winthorpe Street, Grove Lane, Headingley, Leeds.
6 TZ		

6 U

6 UA		
6 UB		
6 UC	A. C. Chatwin	162, Hagley Road, Edgbaston, Birmingham.
6 UD	W. J. Randall	Nottingham.
6 UF	F. J. Finn	"Ardnalia," Wath-on-Dearne, Rotherham.
6 UG	H. D. Poulton	[illegible] Street, Cheltenham.
6 UH		
6 UI		
6 UJ		
6 UK		
6 UL	C. S. Dodd & Sons ..	Elgar House, 8, Parl Street, Lytham, St. Annes, Lancs.
6 UM	Leeds Radio Society ..	Leeds.
6 UN	A. J. Howell	Pedmore, Stourbridge, Worcester.
6 UO		
6 UP	A. G. Halson	"Midhill," Wembdon, Bridgwater.
6 UQ		
6 UR	H. H. Mould	"Ashleigh," Avenue Road, Wolverhampton.
6 US	N. E. Read	"Ty-Rhos," Llandrinio, Llanymynech, Montgomery.
6 UT	T. A. St. Johnston	28, Douglas Road, Chingford, Essex.
6 UU	A. E. Edwards	60-62, Wellhead Lane, Parry Barr, Pirmingham.
6 UV	G. L. Morrow	"Penolver," Berkhamsted, Herts.
6 UW	P. Wood	Central Fire Station, Blackpool,
6 UX		Lancs.
6 UY	H. N. Gray	78, High Street, Barry, S. Wales.
6 UZ	W. M. Bakewell	Yeovil House, Regent Street, Stoke-on-Trent.

LIST OF EXPERIMENTAL CALL SIGNS—*(Concluded)*

6 V

6 VA			
6 VB			
6 VC			
6 VD			
6 VF			
6 VG			
6 VH			
6 VI	H. BRENCHLEY	.. ..	68, Springfield Road, Moseley, Birmingham.
6 VJ	W. J. FEATHERSTONE	..	[illegible], Ella Street, Hull.
6 VK	J. H. BEAN ..	.. ..	"Moorview," Toller Lane, Bradford.
6 VL	R. W. LEADER	.. ..	"Porth," St. Columb Minor, Cornwall.
6 VM			
6 VN	F. W. WELLBELOVE ..	..	37, St. John's Road, Erith, Kent.
6 VO	D. SIMPSON ..	.. ..	28, Bank Street, Terryhill, Aberdeen.
6 VP	A. SMITH ..	.. ..	98, High Street, Yiewsley, Middlesex.
6 VQ			
6 VR	A. E. DUFFIELD	.. ..	3, Stormont Road, Battersea, S.W.
6 VS			
6 VT			
6 VU			
6 VV			
6 VW	A. C. TAYLOR	.. ..	30, Gordon Road, West Bridgford, Nottingham.
6 VX	T. ST. G. LEIGH CLARKE	..	13, Lynmouth Road, N.16.
6 VY			
6 VZ	A. E. STEPHENS	.. ..	West View, Chewton Road, Keynsham, Bristol.

6 W

6 WA			
6 WB			
6 WC			
6 WD			
6 WF	T. B. WHITEHOUSE ..	..	52, Bourne Street, Dudley, Worcester.
6 WG	R. CARLISLE ..	.. ..	40, Walton Street, Shawlands, Glasgow, S.1.
6 WH	E. W. & H. J. KIRK	..	2, Riddings Street, Derby.
6 WI			
6 WJ			
6 WK			
6 WL	J. T. DICKINSON	.. ..	1, St. Austell Road, Lewisham, S.E.13.
6 WM			
6 WN			
6 WO			
6 WP			
6 WQ	A. C. WEBB ..	.. ..	"Carlton," Eastwood Lane, Westcliff-on-Sea.
6 WR			
6 WS	L. L. NEAVERSON	.. ..	40, Cowgate, Peterborough.
6 WT			
6 WU			
6 WV	V. W. CROOK ..	.. ..	26, Kenwyn Road, West Wimbledon, S.W.
6 WW			
6 WX	A. I. MORGAN	.. ..	Wraysbury, Bucks.
6 WY			
6 WZ			

6 X

6 XA	W. HARDINGHAM	.. ..	21, Burleigh Street, Gorse Hill, Stretford, Manchester.
6 XB			
6 XC			
6 XD	RADIO HOUSE LTD. ..	..	17, Union Street, Plymouth.
6 XF	C. POWELL ..	.. ..	34, Bridge Street, Toll End, Tipton.
6 XG	D. B. KNOCK ..	.. ..	34, Claremont Road, Birkdale, Lancs.
6 XH			
6 XI			
6 XJ			
6 XK			
6 XL			
6 XM			
6 XN			
6 XO			
6 XP			
6 XQ	H. FIELD ..	.. ..	Baggrave Hall, Leicestershire.
6 XR	T. MITCHELL ..	.. ..	Bentfield, Newhey, nr. Rochdale.
6 XS			
6 XT			
6 XU	L. J. GOULDEN	.. ..	31, Nunnery Fields, S. Canterbury.
6 XV	— PITCHER ..	.. ..	25, Eltham Road, Lee Green, S.E.12.
6 XW			
6 XX	RADIO SOCIETY OF GREAT BRITAIN		53, Victoria Street, S.W.1.
6 XY	F. CROPPER ..	.. ..	43, Acres Lane, Stalybridge, Cheshire.
6 XZ	M. MARSHALL ..	.. ..	Beach View, Island Road, Newquay.

6 Y

6 YA			
6 YB			
6 YC	J. ROBERTS ..	.. ..	Fern Bank, Endcliffe Rise Road, Sheffield.
6 YD	C. H. GREEN ..	.. ..	Holbmoor Road, Small Heath, Birmingham.
6 YF	C. P. ALLINSON	.. ..	1, Compayne Gardens, Hampstead, N.W.6.
6 YG	F. GOFF ..	.. ..	162, Woodside Road, Bowes Park, N.22.
6 YH	R. J. T. MORTON	.. ..	11, Woodside Road, Kingston-on-Thames.
6 YI			
6 YJ	J. F. METCALFE	.. ..	The Hirsel, Broadstone, Dorset.
6 YK	G. A. EXETER ..	.. ..	142, Campden Hill Road, Kensington, W.8.
6 YL			
6 YM	BELFAST Y.M.C.A. RADIO CLUB		Belfast.
6 YN	BRISTOL RADIO SOCIETY	..	32, Park Row, Bristol.
6 YO	(Portable)		
6 YP	F. HARRISON ..	.. ..	906, Almond Street, Derby.
6 YQ	G. A. MASSEY	.. ..	"Holmleigh," Hillside, Prestatyn, N. Wales.
6 YR	W. HARTLEY ..	.. ..	Spring Bank, Follifoot, nr. Harrogate.
6 YS	C. PROSSER ..	.. ..	Pleasant Harbour, East Aberthaw, nr. Cardiff.
6 YT	H. R. BOYLE ..	.. ..	Rosebank, Mansewood, Glasgow.
6 YU	J. HANSON ..	.. ..	56, Falstaff Gardens, Radford, Coventry.
6 YV	S. F. EVANS ..	.. ..	5, Clarence Crescent, Whitley Bay, Northumberland.
6 YW	T. P. ALLEN ..	.. ..	10, Ardgreenan Drive, Strandtown, Belfast.
6 YX			
6 YY	E. S. ROWLAND	.. ..	"Grasmere," Pinegrove Road, Sholing, Southampton.
6 YZ	F. G. BETTLES	.. ..	Brownsea Island, Poole, Dorset.

6 Z

6 ZA	H. C. & L. A. LAFONE	..	Hill Rise, Cobham, Surrey.
6 ZB			
6 ZC	CHELMSFORD WIRELESS SOCIETY		Marconi Works, Chelmsford.
6 ZD	THE LONGSTONE PHARMACY		Seahouses, Northumberland.
6 ZF	H. RAMSDEN ..	.. ..	18, Albert Avenue, Urmston, Manchester.
6 ZG	J. E. HOWARD SMITH	..	110, Whitaker Road, Derby.
6 ZH			
6 ZI			
6 ZJ	C. R. HUNT ..	.. ..	Kensington House, Church Street, Sheringham.
6 ZK			
6 ZL			
6 ZM			
6 ZN			
6 ZO			
6 ZP	G. PARLIN ..	.. ..	1472, Ashton Old Road, nr. Openshaw, Manchester.
6 ZQ			
6 ZR			
6 ZS			
6 ZT			
6 ZU			
6 ZV			
6 ZW			
6 ZX	H. FIELD ..	.. ..	Baggrave Hall, Leicestershire.
6 ZY	L. GORDON ..	.. ..	133, Old Street, Ashton-under-Lyne, Lancs.
6 ZZ			

G W (Irish Free State)

11 B	Col. M. J. C. DENNIS	..	"Fortgranite," Baltinglass, Co. Wicklow.
14 B	J. P. CAMPBELL	.. ..	Martello Terrace, Sutton, Co. Dublin.
15 B	W. R. BURNE	.. ..	"Irish Radio Journal," 34, Dame Street, Dublin.
16 B	H. J. DUNCAN	.. ..	49, South Anne Street, Dublin.
17 B	W. F. WARREN	.. ..	130, Tritanville, Sandy Mount, Dublin.
18 B	D. M. & D. F. O'DWYER	..	9, Upper Leeson Street, Dublin.
19 B	H. GOLDSBOROUGH	.. ..	Fethard, Tipperary, I.F.S.

Will readers please note that each constructional article in this issue is complete in itself. There is no reason why constructors should not commence to build any chosen receiver immediately, since in all cases every necessary detail is given. Blueprints for all the sets may be obtained free on application.

Gifts for EVERY READER

IN becoming a regular reader of WIRELESS there are many pleasures in store for you.

With the issue on sale Tuesday, September 14th, you are presented free with a magnificent 20-page Sixpenny Booklet—The WIRELESS "Rapid Tuning and Operating Guide." This is the only complete gift book of reference ever produced on this fascinating subject.

To be certain of obtaining **the first of the series of valuable gifts to be given free with WIRELESS—the leading popular weekly**—you are advised to place an order with your newsagent to-day. It will save you trouble if you ask him to deliver you your copy regularly every week.

In addition to the article by Mr. John Scott-Taggart the contents include :—

Secrets of Modern Radio Efficiency. The first of a series of articles. By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

How We have Beaten America. By PERCY W. HARRIS, M.I.R.E.

Stereoscopic Broadcasting. By CAPT. H. J. ROUND. M.I.E.E.

Do you Dance by Radio? By JACK HYLTON.

How the New Wavelengths will Affect You. By G. P. KENDALL, B.Sc.

New Inventions at the Exhibition.

Mr. John Scott-Taggart, F.Inst.P., A.M.I.E.E., Technical Director, in this issue describes THE ELSTREFLEX RECEIVER — the first two-valve reflex receiver to give selectivity and range—a wonderful set giving alternative programmes on the loudspeaker.

WIRELESS INCORPORATING WIRELESS WEEKLY 2D WEEKLY

Obtainable from all Newsagents, Bookstalls and Booksellers, or direct from the Publishers, Radio Press, Ltd., Bush House, Strand, London, W.C.2. Subscription Rates, 13/- per annum throughout the world.

From the nearest newsagent

THE ELSTREE "SOLODYNE"

(*Concluded from page 299*).

Terminals

It will be observed that the terminals have not been mounted in the usual manner, but are carried on a strip mounted on a wooden support. This brings all the terminals towards the top of the cabinet, and it is possible to connect a "pigtail" on to these terminals and to take all the leads through a single hole in the back of the cabinet. This method renders all the terminals readily accessible; and, moreover, keeps them out of sight.

Valves to Use

The valves in use should be of the high-impedance type for the first three valves, and of the low-impedance type for the last two. The voltages employed are 30 to 50 on the detector, 60 to 90 on the high-frequency valves, and 120 on the low-frequency valve.

NOTE.— This article is complete in itself, full information being given to enable the construction of the receiver to be carried out. Further details will be given in the October issue of this journal concerning the adjustment of the triple condenser, particulars of neutralising and other valuable operating notes. The price of the October issue, which will be another special number, will be one shilling as usual.

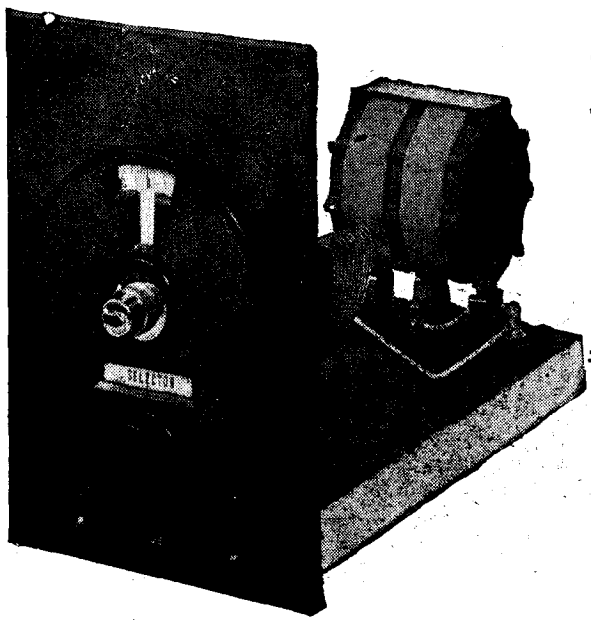
News in Advertisements

Messrs. Ferranti, Ltd., will be pleased to forward their Leaflet W 401, giving particulars of their well-known transformers, and invite readers to send a diagram of their set, together with their advertisement, whereupon improvements will be suggested.

The Sifam Electrical Instrument Co. invite applications for their "Sifam" free book.

Cleartron Radio, Ltd., invite readers to apply for the new season's catalogue, with full technical data on valves.

Messrs. Garnett, Whiteley and Co., Ltd., are advertising three new "Lotus" components—a jack, a plug, and a jack-type switch.



PICKING THEM OUT

A Chat about Slow-Motion Dials

by

G. P. KENDALL, B.Sc.

Have you ever envied the easy manner in which experienced operators can pick out the distant stations? Mr. Kendall, in this interesting article, outlines how you can effect a short cut to similar powers of accurate adjustment.

I EXPECT most of us must, at some time or other, have envied the superior skill of some more experienced operator of wireless sets. It can certainly be rather humbling to one's pride to watch such a one picking out station after station with sure delicate motions of the dials, making so easily those almost invisible adjustments which make all the difference to the signals.

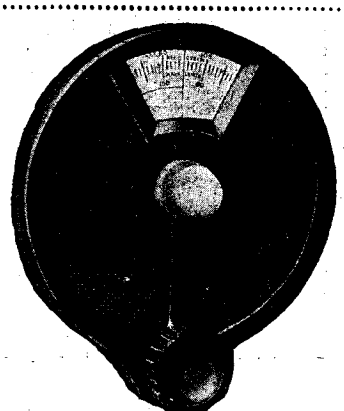
Wanted—a Short Cut

Of course, it is not every receiver which requires such exceedingly delicate manipulation, but the majority of those possessing a good degree of selectivity and sensitivity, that is to say, those capable of giving really good long-distance results, require a fair amount of accurate adjustment; and the beginner is rather apt to ask himself how long it will be before he can achieve a like degree of skill to that possessed by his more experienced friends, and to wonder whether there is no short cut which he can take in order to obtain the same results.

Where It Lies

As a matter of fact, a short cut does exist which will enable the comparative novice to make delicate adjustments with the same degree of certainty as his more experienced friends, although it will not perhaps confer upon him the same skill in searching with the certainty of picking up every transmission which may be within the powers of his receiver. The short cut to which I refer is the one commonly known as a vernier or slow-motion dial, since with a good specimen of this appliance anyone can make the finest and most accurate adjustments of tuning which may be required.

Since a suitable type of vernier dial can do so much to assist the operator, even the skilled one, to whom it renders the use of his set easier and pleasanter, it would seem that a little time spent in considering the desirable features in such dials, the particular types suitable for a given purpose, and so on, will not be wasted. This latter point of suitability for a given purpose is an important one, for few things are more annoying than trying to operate a set which is fitted with dials of a type quite unsuited for it.



With a good specimen of vernier or slow-motion dial anyone can make the finest and most accurate adjustments.

The Ratio

First and foremost, it is to be understood that the virtue of a slow-motion dial lies in the fact that it enables one to operate a knob which can be turned quite rapidly, and which will yet only turn the actual vanes of the condenser very gradually, so that fine and delicate adjustment is no longer needed upon the part of the operator. It is therefore evident that a very important question to be settled is that of the actual ratio of the gearing or other mechanism employed to produce the desired slow-motion effect. For example, if one found that turning the operating knob through 20 revolutions had the effect of increasing the condenser from its minimum setting to its maximum, one would say that the reduction gearing had a ratio of 40 to 1, since 20 revolutions of the operating knob have produced half a revolution of the condenser spindle.

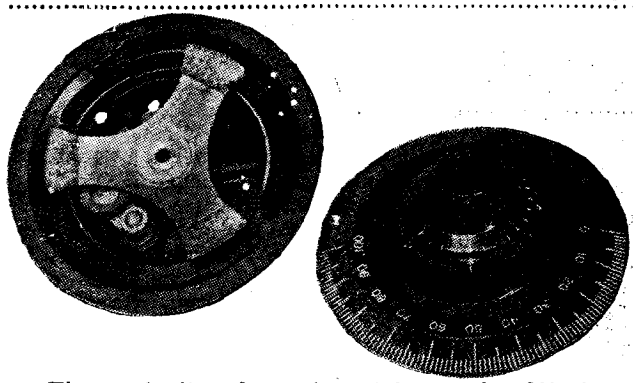
The Choice

The actual value of this reduction ratio has a very considerable bearing upon the suitability of the dial for a given purpose, and it is worthy of a little consideration when choosing dials for any particular receiver. It should be noticed in this connection that a

PICKING THEM OUT — *(Continued)*

good deal depends upon whether there is or is not a simple direct drive incorporated in the slow-motion device, for if such a direct drive is available, so that rough adjustment of the condenser can be made by its aid, a fairly high reduction ratio is always permissible. On the other hand, if there is no direct drive and all tuning must be done by means of the slow-motion drive, a very high ratio of 50 or 100 to 1 may prove extremely tedious to work with upon the ordinary broadcast wavelengths.

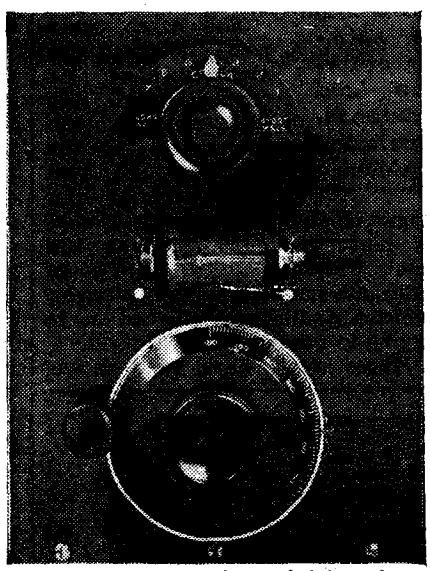
On the shorter waves —for example, of 100 metres and below—a high ratio is always useful and is to be recommended for everyone except the fairly skilled operator on account of the extreme accuracy of adjustment needed in those regions.



The majority of vernier dials can be fitted to an existing condenser without any skill.

The Ideal

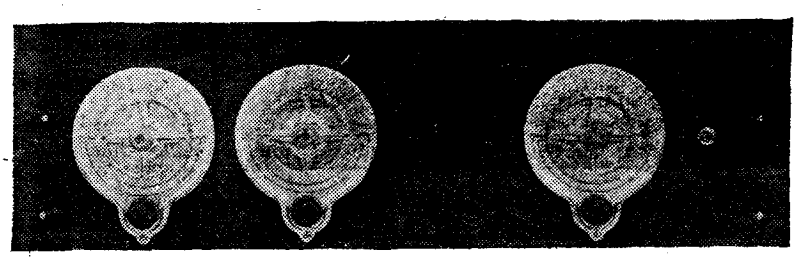
Upon the ordinary broadcast wavelengths between 200 and 600 metres it is my experience that where there is no direct drive available, a ratio of perhaps 5 to 1 or 10 to 1, or of that general order, is preferable, since a quite adequate degree of delicacy of tuning can be obtained upon the ordinary set with such a ratio, and operation is not made unduly tedious. Certainly an extremely high ratio of reduction and no direct drive is not to be recommended for any except the ultra-critical type of set.



Some slow-motion dials make use of a small knob at the side of the main dial to control the vernier adjustment.

The Decision

In general, a direct drive in addition to a slow-motion drive is only to be found upon special variable condensers upon which the vernier mechanism is an integral part of the design, and since we are now considering the special dials which can be added to a finished receiver, we may take it that in choosing our dials we shall select a ratio of quite a high order of, say, 50 to 1 for a short-wave set or one requiring exceedingly exact and delicate adjustment, such as some types of superheterodynes, while for general broadcast reception with normal sets we shall require a ratio of between 5 and 20 to 1.



Where three controls are incorporated in a receiver and tuning is sharp, precision in adjustment becomes an essential feature.

Scales

Having decided upon a ratio, the next question which comes up for settlement concerns the type of scale and indicator to which preference should be given. This is, no doubt, to some extent a question of personal preference, but probably everyone will agree that the first requirement is a really clear and open scale, since if our slow-motion device is to approach the ideal it must be possible to record accurately the dial readings of the various stations which we pick up.

For this purpose I have found that something more is needed than the simple engraved scale upon the ebonite edge of the dial, with a line or other pointer arrangement upon the panel, and for this purpose I prefer one of the newer types of scales consisting of clear and open divisions over which a pointer travels, or which itself moves beneath something in the nature of a hair-line or other indicator.

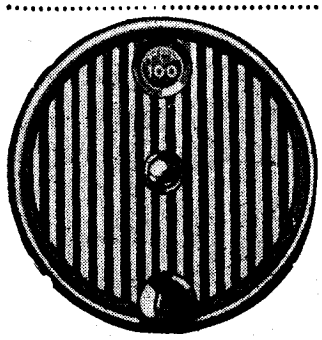
Mechanical Features

We come now to questions of the actual mechanical construction of the slow-motion drive, and here there are several quite well-defined desirable features that should be present in the design chosen, if it is to give satisfactory service. There is, of course, the obvious question of what is called "backlash" or "lost motion," which simply means that defect which prevents an immediate response on the part of the condenser to a motion of the control knob. For example, in some badly designed

PICKING THEM OUT—*(Concluded)*

and constructed devices one may turn the control knob perhaps half a revolution either way before the vanes of the condenser start to move, and tuning-in becomes exceedingly tiresome and erratic.

Such an amount of back-lash as this should be a ground for the immediate rejection of that particular dial, and it is a point worth noting that back-lash is particularly objectionable when it appears not merely in the lost motion of the control knob, but also as a possible error in the dial readings. With some types of dial, for example, it will be found that the actual pointer moves a little way in either direction as the back-lash is taken up and before the condenser starts to turn, so that quite a perceptible error is readily made in taking the reading of a given station. This is a particularly bad fault, and my own preference always goes to a dial in which the indicating device is rigidly locked to the condenser spindle, so that no errors of reading are possible, even should a little back-lash develop in the mechanism at a later date. Such back-lash as may then exist will be simply in the control mechanism itself, and will not affect the accuracy of dial readings.



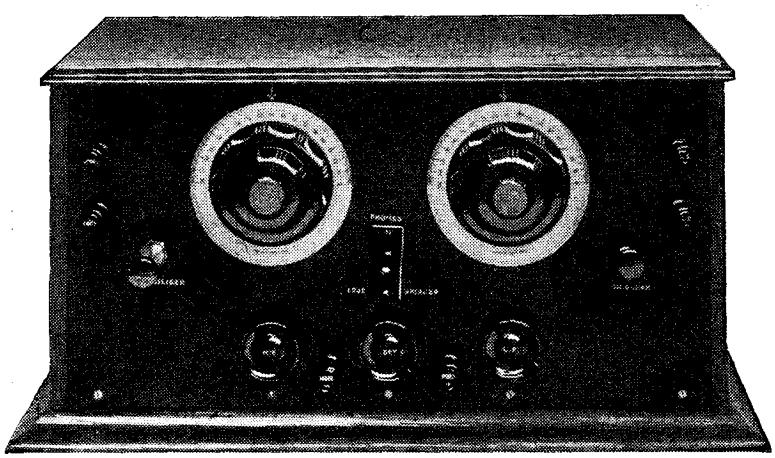
One of the main points affecting the satisfactoriness or otherwise of the dial concerns the smoothness of the operation of the mechanism.

Useful Types

Back-lash is most usually found in the cheaper dials employing actual teethed wheels to constitute the gearing, better class dials on this principle being fairly free from it. Dials also of the type which use friction drive or which drive through a small belt running over two pulleys are usually quite free from back-lash, nor does it develop in the course of service.

The other main point affecting the satisfactoriness or otherwise of the dial concerns the smoothness of the operation of the mechanism. In some of the cheaper kinds of dial it may be found that as the control knob is turned there come alternate smooth and stiff passages, which are embarrassing when one is trying to tune in a weak station.

These notes have been intentionally rather elementary, but I trust they will have served to indicate to the reader that the matter is one deserving a little more consideration than it usually receives, when its effect upon results is remembered.



The majority of slow-motion dials present quite a handsome appearance when mounted on the panel.

IN PASSING

(*Concluded from page* 301)

won. I mean a two-tailed shilling is quite useful to a gentleman when he is erecting ariels. But Poddleby stood up for me when the others became unrefined about it. Because he said that if I were to do any work the club house would probably fall down.

Foremen Work Hard

So then I told them how to start and sat in a deck chair in the shade and drank gingerbeer, which is very good for a person erecting ariels. So I closed my eyes to think out plans for getting the mast up. Because I always think that a gentleman can really think best with his eyes shut. I mean when he is like that he does not become distracted by looking at things. So in about a minute though the other gentleman said it was ½ an hour they dug me in the ribs with a crowbar and said the hole was finished. So I stopped thinking and told them how to deal with the mast. I mean it was forty feet long. So I put the General at the butt and the others at intervals and Professor Goop at the thin end. So then they lifted it up and carried it towards the hole. So the General had to walk backwards. And he had to walk quite quickly because Professor Goop, who was very anxious to get it up, was pushing the thin end forwards quite quickly. So it was quite a coinstance that the General did not see the hole, because he has no eyes at the back of his head. I mean just then the Admiral said "heave" and they all heaved and the mast went up, and when it was up we found that its butt was resting on the General's lower chest, and the General was being very unrefined at the bottom of the hole.

Gentlemen Prefer Strikes

So they had to let it down again. And then the General went on strike. So then the others said they would be on strike too unless they had a new foreman. So then I said we had all better be on strike, because it was really too hot to argue, because the others had picked up all the spades and crowbars. So we decided to call it a day, though the General was still calling it something else. So the Professor's ariel is still waiting to be improved.

THE LISTENER-IN.

RADIO REVOLUTIONISED *(Concluded)*

Concluded from page 375.

in the August MODERN WIRELESS, and the "Magic Five," a very successful receiver described in *Wireless*. The circuit of the "Screened Coil Three" is reproduced as showing the very latest modern practice in Fig. 22. This set, although using only one stage of high-frequency amplification, is very efficient and highly selective.

The "Magic Five."

The "Magic Five" circuit is given in Fig. 23, while Fig. 24 shows the very compact arrangement of the screened coils. The "Magic Five" circuit uses middle tappings on the untuned side of high-frequency transformers. This method does not give rise to parasitic oscillations, and perhaps the word middle tapping ought not to be employed in connection with this type of circuit. It is true that it looks from the circuit as though an ordinary inductance coil has been tapped in the middle, but although it was at first thought that this arrangement would suffice, yet further research showed that the neutralisation obtained by taking a middle tapping on an untuned coil was not satisfactory. In the "Magic Five" and other receivers, therefore, using this so-called middle tapping we wind the top half of the coil directly over the other half. If an ordinary inductance of, say, the single-layer type is tapped in the middle the coupling between the two halves is not adequate.

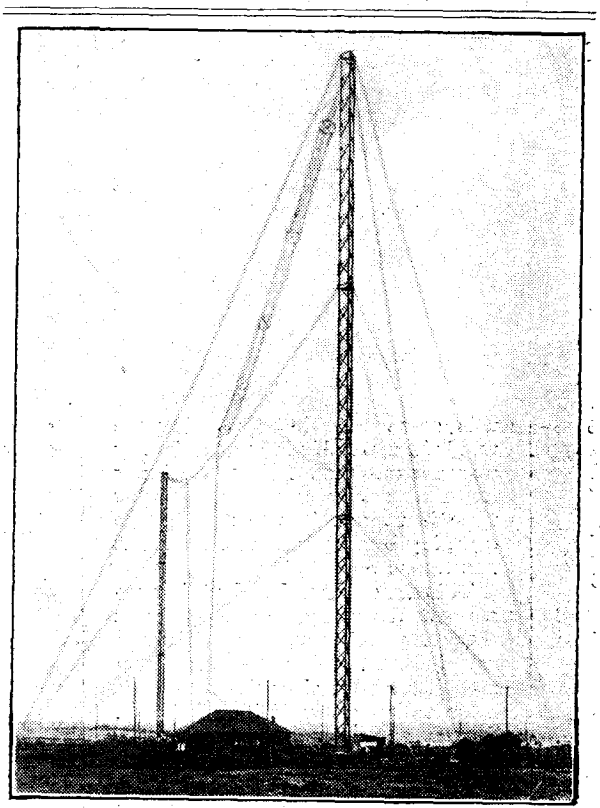
This article has already taken up a great deal of space and I do not propose on this occasion to elaborate my remarks. I hope I have given sufficient proof that radio designs have taken great strides forward. I want you to build our new style receivers with the utmost confidence that you are going to get new results which will outclass anything you and your friends have hitherto contemplated.

RANDOM NOTES

By A. V. D. HORT, B.A.

BATTERIES, the necessary attendants of a valve receiver, are a source of much annoyance to many listeners. They must have a certain amount of attention if they are to be kept in good order, and the conscientious enthusiast finds that a considerable amount of time needs to be devoted to charging, checking voltages and so on. Those who are lucky enough to live where there are electric supply mains are well placed, since they have at least the possibility of deriving their low- and high-tension from the mains.

Battery eliminators are available now in a variety of forms, suitable for both A.C. and D.C. mains. The unfortunate manufacturer is faced with the difficulty, however, that there is no standardisation of the supply system scattered about the country. Any battery eliminator produced has to be made in several types, for use on different voltages, and, when the mains are A.C., for different periodicities of the supply. When the electricity scheme to embrace the whole country, which has been so much discussed, is put into practice, there is a hope that the situation will become a great deal easier for all who now would like to be rid of their batteries.



The masts and aerial equipment at 3LO, Melbourne.

EXPERIMENTERS and constructors who take a pride in turning out apparatus which is really efficient and also neat in appearance would do well to consider the use of a special type of insulated wire when next they are winding a tuning or choke coil. The wire which I have in mind is not a new production, and it is probably known already to many enthusiasts. The virtue lies not in the wire itself, but in the insulation, which consists of enamel overlaid with a double cotton covering.

One of the disadvantages of the ordinary d.c.c. wire is that the insulating covering tends to absorb moisture from the atmosphere. An enamel covering alone is easily damaged, and in addition the spacing between turns provided by this insulation alone is not adequate for efficiency. The combination of the two coverings is an excellent solution of these difficulties. The double cotton provides the necessary spacing between the turns, while the enamel may be relied upon to keep out damp in the atmosphere.

❖ ❖ ❖ ❖

WIRELESS as a means of saving lives at sea has by now become almost a commonplace in our lives, though the thrill of reading about such rescues must always survive. On land, too, in the still sparsely populated parts of the world, wireless can work its miracles, as

RANDOM NOTES—*(Concluded)*

would be acknowledged by a party of men who were stranded and starving north of Hudson Bay. One of their number struggled through to the trading post at Southampton Island, and a message was sent on from there to the Canadian Government stations. Then the broadcasting station at Springfield, Mass., took up the tale and sent out an SOS message every night. A party of trappers picked up this message, and they were able to reach the stranded men in time to save them from starvation.

❖ ❖ ❖ ❖ ❖ ❖ ❖

SOME interesting facts about the transmissions from the Rugby station were brought to light recently in answer to a question in Parliament. Sir W. Mitchell-Thomson, the Postmaster-General, informed the House that the eastern part of the Pacific Ocean, between Honolulu and Valparaiso, had turned to be a more or less "blind spot" for the reception of Rugby. The power used at Rugby was consequently increased to meet the needs of these localities. This refers, of course, to the telegraphic transmissions from Rugby, and has no connection with the telephony tests which were carried out with the United States.

FOR the sake of those listeners who appreciate this feature of the programmes, I am glad to hear that the B.B.C. are proposing to include in their programmes for the coming winter season, operas performed in the studio or elsewhere under their immediate control. Although the system of broadcasting only one or two acts of an opera at a time may whet the appetite of some listeners and make them go to the opera house to hear more, it never appears to me to be quite fair to the composer to give an extract from his work in this way. If we are to be given merely a "selection" from an opera, well and good. Otherwise, if we are to hear one act, I think that we should have the opportunity of listening to the whole performance.

❖ ❖ ❖ ❖ ❖ ❖ ❖

THOSE fortunate ones who still have their holidays before them when they read these lines may be wondering what is the best thing to do with their accumulators when they go away. If you are going away for only a week or so, all that will be necessary is to see that the accumulator is fully charged and left in a cool place. If your holiday is to be longer than this, the best thing is to lend it to a friend.

FREE

with the OCTOBER NUMBER

MAKE a point to-day of placing an order with your newsagent for the next issue of THE WIRELESS CONSTRUCTOR on sale Wednesday, Sept. 15. **With every copy will be presented a Free Gift Booklet —"How to build Your Own Wireless Set"—containing 20 pages of absorbing interest to every home constructor.**

Beside containing a comprehensive review of the Radio Exhibition at Olympia, Mr. Percy W. Harris gives full constructional details of "The Night Hawk," his latest design. This selective, sensitive and compact receiver **can be built with the simplest tool kit; and the very low sum of £20 will purchase all the apparatus complete with loud-speaker, batteries and valves.** The Elstree Laboratories describe "The **Distaflex Two,**" a really astonishing reflex instrument, giving remarkable volume on the local and distant stations with two valves and a permanent crystal detector.

PERCY W. HARRIS, M.I.R.E.

The Wireless Constructor

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From the nearest Newsagent —

"MORE THAN I HOPED FOR"

This is the enthusiastic comment of a satisfied builder of an "Elstree Six."

"Most Remarkable"

SIR,—Upon receiving your kind invitation I went to your laboratories at Elstree to hear the "Elstree Six" working, and must say it is the finest *all-round* set I have ever heard. The purity and strength of the home stations on the loud-speaker had to be heard to believe such was possible; also the ease with which many of the Continental stations were picked up, almost at once on the loud-speaker, was most remarkable. With some of these a certain amount of interference was present, which of course at times is unavoidable, but the power and strength to get the station was there, and in broad daylight, too.

After your courteous representative had been the round, he invited members of the company to try the set themselves, and several tuned in stations very quickly. I did not try myself (you had a large company there that night), but as far as I could see, when one has got the hang of the circuit and the stabilising condensers properly set, it is only a matter of practice to pick up anything going.—Yours truly,

H. WHITE.

Windlesham.

A Delighted Constructor

SIR,—Having completed the "Elstree Six," I thought I should let you know some results. The first evening on test the set brought in countless stations on the loud-speaker with perfect ease. In fact, every degree from zero to 180° on the condensers accounted for a station. All tuning was done on the loud-speaker. The set is indeed everything claimed for it in report. I may add that atmospherics were very bad when testing, and on going over to an indoor aerial of some eight to ten feet, two Spanish, Hamburg, 6BM, 2LO, Newcastle, Manchester, etc. of B.B.C. stations came in at once on the loud-speaker. After this lightning showed frequently and the set was switched off. One can say that this set indeed eclipses all other sets for range, selectivity and volume (latter being extra loud and pure). These results when taken between 5 o'clock and 7 o'clock in the evening with atmospheric conditions bad and also the first try out of the set speaks volumes for the "Elstree Six."

The set is exactly as stated by Mr. John Scott-Taggart in the June MODERN WIRELESS. No one contemplating building this set need hesitate to do so any longer. I was rather dubious myself as to reports, but now having built the set I am even more than satisfied, and the set is more than I ever hoped for.—Yours truly, T. RICE.

Kilworth, Co. Cork.

A view of the transmitting apparatus at the Melbourne broadcasting station 3LO. The panels from left to right are the oscillator, modulator, amplifier and rectifier panels.

"Incomparable"

SIR,—I have to thank you for a very pleasant and instructive evening spent at your Elstree laboratories listening to the remarkable performance of the "Elstree Six."

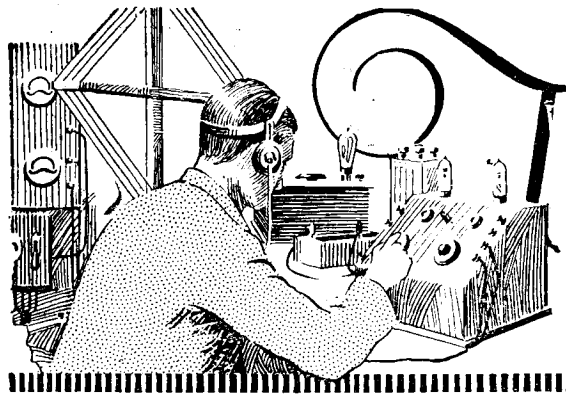
I can truthfully say that this receiver is well in advance of anything I have previously heard or handled. I still possess the first set I made (a coherer) over 25 years ago, and from that time to the present I have constructed many, I do not know how many, including the very latest in "Neutrodynes" and "Superhets," but none can accomplish what this "incomparable" can achieve.

I was also very impressed by the ease with which the many different stations could be found; although I had never before seen the instrument, I was able in a few seconds to pick up Bournemouth and Manchester, whilst London was working only a few miles away; others present were just as successful.

Quite a number of Continental stations were heard, and Birmingham was brought in, with only a short length of wire slung across the room, at good loud-speaker strength, in fact, with every station the volume was ample.—Yours truly,

GEO. W. ASBERY.

Bushey Heath.



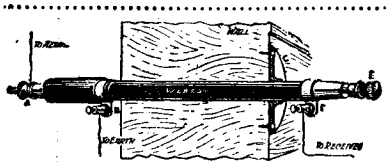
Tested by Ourselves

Combined Earthing Switch and Lead-in Tube

WE have received a combined earthing switch and lead-in tube which is manufactured by Messrs. J. Webb, of 35, Claremont Grove, Didsbury, Manchester.

The switch is operated from inside the house, a diagram showing the necessary connections being printed on the carton containing the combined instrument. The accessory is fairly simple to fix, it being, of course, necessary to make a hole in the window frame to lead into the house.

The component submitted consists of a length of brass rod covered by insulating material. About a quarter of the way down the tube is a round flange of metal, by means of which this tube is screwed into position. One end carries a slate covering as a means of insulation, and under this the arrangement for earthing the aerial is provided for, so that when the knob is pulled outwards the outside aerial is connected direct to earth outside the house. This is done by means of a brass collar fitting into a brass socket, thus making a direct connection to earth, at the same time cutting the brasswork carrying the aerial terminal to the set out of circuit.



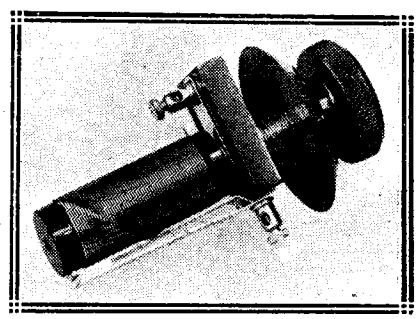
The combined earthing switch and lead-in tube submitted by Messrs. J. Webb.

The component is well manufactured and can be strongly recommended.

"Smoothac" Helical Contact Rheostat

A NEW type of rheostat has recently been placed on the market by Messrs. A. W. Stapleton, of Lorrimore Street, London, S.E.17.

This component consists of a piece of polished ebonite rod, cylindrical in shape, and wound round this rod is the resistance wire. A rather ingenious method of varying the resistance is incorporated in the component. A strip of No. 16 gauge wire is wound round the rod first, making one complete rotation in the whole length of the rod. The actual resistance wire is wound over this so that a small portion of every turn projects above the remainder. A springy piece of metal is provided for making contact as the bobbin is rotated, and thus the necessary variation in the resistance can be obtained. Two terminals are provided for making connection, and it is fitted with a well-manufactured knob and dial which are pleasing in appearance.



The "Smoothac" rheostat.

When tested at Elstree, at full resistance it was found to measure 34 ohms, and we can recommend this component to our readers.

Anti-capacity Coil Mount

A NEW anti-capacity coil mount has been marketed by Messrs. J. J. Eastick & Sons, of Bunhill Row, E.C.

This accessory consists of a strip of fibre material folded to the shape of the usual type of plug-in coil. At the bottom of the strip a plug and socket are inserted, and kept in position by means of the fibre which is folded somewhat after the manner of a cardboard box lid.

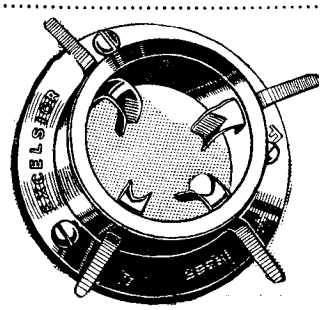
Connections are made to the coil by means of screws or soldering tags, and when the coil is in position the fibre strip and cardboard side-pieces (which can be cut to suit the size of the coil constructed) keep the coil rigid.

These coil mounts, we understand, can be purchased at the cost of 1s. 3d.; they certainly assist in making a neat job of a coil.

"Excelsior" Valve Holder

MESSRS. THE EXCELSIOR MOTOR CO. have sent us for test and report one of their excelsior valve holders.

This instrument consists of an insulating shell having a flange by means of which the component may be mounted. The valve sockets are composed of bent strips of metal, which press tightly against the outside of the valve legs. The construction of the holder eliminates the presence of any solid dielectric between the valve legs, so that the capacity of the valve holder is reduced to an absolute minimum.



The "Excelsior" valve holder is designed to have a low capacity.

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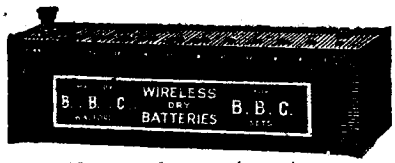

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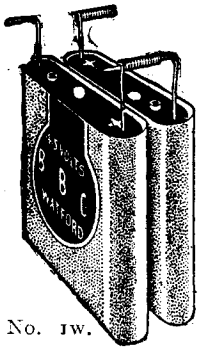

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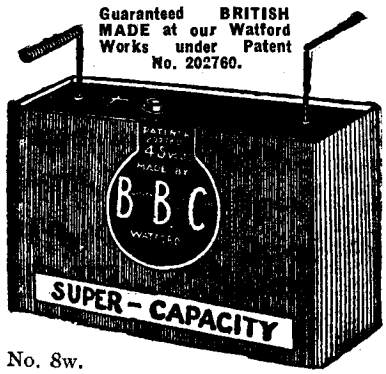

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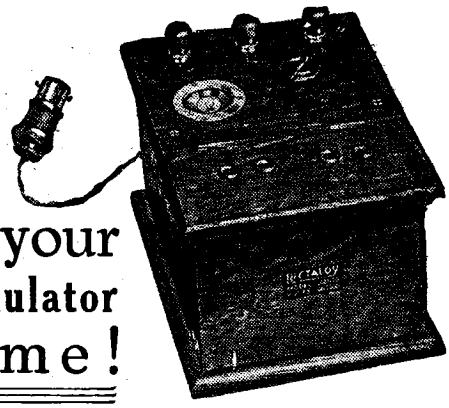

WITH the Rectalloy Charger shown above you can keep your high tension accumulator fully charged at practically no cost from your a.c. mains. It will charge any high tension accumulator up to 90 volts. in the normal series arrangement. It takes very little current, wasteful resistance being entirely obviated. At last the big difficulty of charging high tension accumulators is solved by an entirely new and patented method. No need to carry heavy accumulators to the charging station and wait while they are charged (and perhaps ruined). Instal a Rectalloy and leave it to do its work satisfactorily and well.

The charging rate is automatically governed so that a 20 or 90 volt H. T. Accumulator receives practically the same charge. An extremely neat charge-indicator and excess-current fuse is incorporated, making the apparatus foolproof and trustworthy.

47/6
For a.c. only, 200-250 volts, 40-60 cycles.

A separate charger is also available for filament lighting accumulators with a.c. current **65/-**

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P.S. 5687

YOU WOULD NOT TRY TO CARRY WATER IN A SIEVE

THEN WHY MOUNT YOUR COMPONENTS ON A LEAKY PANEL? THE EFFECT IS THE SAME.

PARAGON

PANELS ARE GUARANTEED LEAK PROOF

Insulation Resistance ... Virtual Infinity.
Surface Restivity ... Virtual Infinity.
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TRY OUR RENOWNED FIXED CONDENSERS.

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86, GRAYS INN ROAD, LONDON, W.C.

Holb. 1856.

TESTED BY OURSELVES—*(Contd.)*

The bent metal strips which form the valve sockets are continued through the moulded material of the holder so as to form long soldering tags.

Three nuts and bolts are provided for fixing this holder to the panel, but it may be mounted on the baseboard if desired.

It was found on test that the method of construction of this valve holder ensured a very easy fit for the valve, while at the same time the spring tension of the socket ensured a good electrical contact with each leg. In soldering connections to the tags these are sufficiently long to render it almost impossible to do any damage to the moulded material through heating.

This valve holder appears to be particularly efficient from an electrical point of view. It is also quite satisfactory for general use, except that it would not appear to be advisable to use the valve holder vertically so that the valve is in a horizontal position, since it might then be possible for the valve to be shaken from its holder by vibration.

This valve holder can be recommended for general experimental and constructional work.

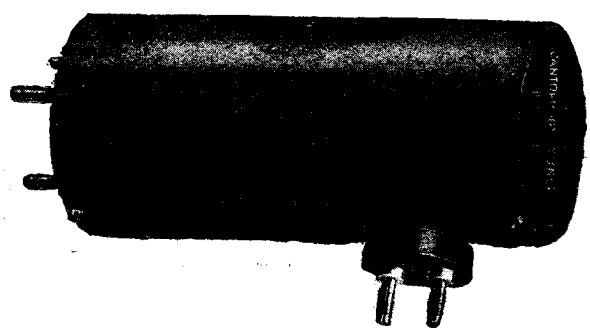
Cantophone Tuner

MESSRS. THE CANTOPHONE WIRELESS CO. have sent us for test and report one of their tuners. The design of this instrument is novel in that the tuner unit comprises a reaction control in each case, the whole being interchangeable so as to cover various ranges. Three ranges are supplied which cover the wavelength bands between 70 and 2,000 metres, the one actually submitted for test being No. 2, which covers 220 to 780 metres. Further, a direct calibration scale is provided for use with a particular make of variable condenser. If a different make is used, of course, the calibration does not quite hold, although it is fairly correct.

When placed on test in the aerial circuit it was found that the tuning range of this component was approximately from 220 to 750 metres, while the reaction control was found to be perfectly smooth when correct values of H.T. and L.T. were employed. The signal strength from distant stations was found to be normal, while a satisfactory degree of selectivity was obtained in view of the fact that no stage of H.F. was employed.

The instrument is well finished and robustly constructed. It is intended for mounting behind the panel, and it is only necessary to drill one hole for the reaction control. Connections are made to the tuner portion of the instrument by means of soldering tags, while two flexible leads finished with metal eyelets are provided for the connections to the reaction coil. This instrument can be recommended for use.

The "Cantophone" tuner is made in different sizes so as to cover various wavelength ranges, and the units may be used if desired in conjunction with a calibration scale.



L.T. Accumulator

MESSRS. THE HART ACCUMULATOR CO., LTD., have sent us one of their "Enduro" accumulators for test and report. This accumulator is contained in a stout glass case, the glass top being sealed in by means of pitch. Two heavily insulated terminals are provided for making connections, the polarity of these being indicated.

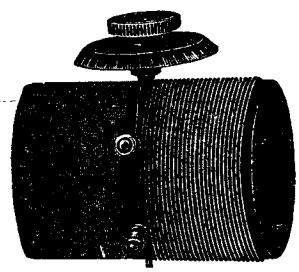
This accumulator was given a thorough charge until gas was being freely evolved from both sets of plates, and on examination the

TESTED BY OURSELVES

(Continued)

colours of these plates were found to be exceedingly satisfactory. The accumulator was then discharged at a rate of 1 ampere, and, though the capacity of this accumulator was only given as 10 actual ampere-hours, a total capacity in excess of this was obtained. At the end of 22 hours the rate of discharge had dropped to .25 amps.; the colour of the plates, however, showed the cell to be in good condition.

Ample space is provided below the plates for the reception of any sediment which may flake away from the plates, while the accumulator is exceedingly well constructed, though perhaps, in view of its capacity, it is a trifle on the bulky side. This accumulator can be thoroughly recommended where a robust battery of low capacity is required.



The "All-Wave" tuner, sent in by Messrs. C. S. Dunham.

"All-Wave" Tuner

MESSRS. C. S. Dunham have submitted to us for test and report one of their "All-Wave" tuners.

This instrument consists of a composition tube 3½ in. in diameter and 5½ in. long which carries two windings, one of thick and one of thin wire.

Tappings are provided so that the various amounts of inductance may be used, while a small rotor revolving within the tube carries a winding by means of which reaction may be applied. Terminals are provided for making connection to the reaction coil, the spindle of which carries a graduated dial and knob for controlling the amount of reaction.

When tested in the aerial circuit

TESTED BY OURSELVES — (Continued)

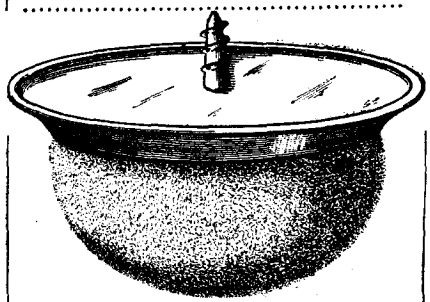
for tuning a three-valve set employing a .0005 variable condenser, the range of this instrument was found to be from 250 to about 2,800 metres, a satisfactory degree of overlap being obtained on each of the tappings.

A blue print is provided by the manufacturer showing the scheme of connections to employ.

Shock Absorbers

WE have received a set of "Absorbos" from Messrs. Eddystone for test and report.

These accessories, which are intended to be fixed underneath a set so as to protect it from shock and vibration, are made in two sizes. A half-sphere of Sorbo rubber is carried in a small metal cap which may be fixed to the underside of the receiver by means of a wood screw. One of these absorbers is fixed to each corner, this operation being done without difficulty. Not only does the resilience of the rubber insulate the set from jars, but it also enables the receiver to be stood upon a polished surface without risk of scratching it. These absorbers are a novel and useful accessory and will, no doubt, commend themselves to many people.



The "Absorbos" shock absorbers are intended to be screwed to the underside of the cabinet.

Rheostat

MESSRS. The Ormond Engineering Co., have submitted to us for test two samples of their No. 4 rheostat, one of 6 ohms for bright-emitter valves, and one of 30 ohms for dull-emitter valves.

The resistance elements of these rheostats are wound on fibre formers about 2½ in. in diameter. A contact arm which can be rotated by means of a moulded knob provides the coarse adjustment. A fine adjustment is also provided by a subsidiary contact arm which slides on a single turn of resistance wire wound on a small insulating former within the larger former.

Terminals and soldering tags are provided for this rheostat, together with a pointer.

It was found on tests that the resistances of these rheostats were of approximately the rated values—namely, 6 ohms and 30 ohms. On passing current through them, it was found that the dull-emitter rheostat of the larger resistance would pass .2 of an ampere without undue heating, but .8 of an ampere made the bright-emitter rheostat rather warm, after it had been in use in a set for some time.

TESTED BY OURSELVES—*(Concluded)*

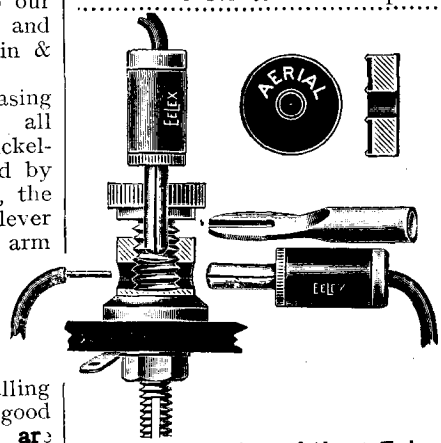
S.P.D.T. Knife Switch

A NEAT and well-made single-pole double-throw knife switch has been sent to our laboratories for examination and report by Messrs. A. F. Bulgin & Co., Ltd.

The switch presents a pleasing appearance when mounted, all visible metal parts being nickel-plated. Contact is established by means of three spring sockets, the centre spring of which has the lever arm mounted on it, and the arm simply slips into the other two sockets as required, the sockets, of course, being fitted one on each side of the centre spring. The box itself is utilised as a drilling template, while a further good point is that soldering tags are provided. When in use a good electrical contact is made; it is simple to mount, and we have no hesitation in recommending it to our readers, who will find it useful for use in circuits requiring meter switches.

Tags and Terminals

MESSRS. EASTICK & SONS have submitted to us for test and report a number of their spade pin tags, plugs, sockets and terminals.



Some examples of the "Eelex" tags and their uses.

The terminals are of a special type, enabling either pin type or spade tags to be utilised. They have a coloured indicating disc on the top, which not only shows the polarity but the function of the terminal. A 2B.A. clearance hole is required for mounting these terminals, while the end of the shank is split, which enables wires to be fixed to the terminal without the necessity for soldering, a lock nut being all that is required.

The spade and pin tags are intended for finishing off flexible leads.

The plugs and sockets are provided with coloured insulating sleeves, and a special fitting is also supplied, consisting of two plugs linked together by means of a short strip of insulating material. The same method is employed to hold two sockets together, both pins and sockets being provided with coloured insulating bushes or sleeves of different colours, thus enabling the plugs to be inserted into the sockets having the correct polarity.

All these components are highly finished, and can be recommended as being of use to the amateur.

THE "COLONIAL" TRANSMITTER

(Concluded from page 334.)

watts. With 200 volts in dry batteries it may be raised to 30 milliamps. without loss of efficiency. Thus a high or relatively low supply voltage may be used, according to which is the more convenient to the reader. A still greater variation in wavelength may be obtained by altering the position of the aerial tapping.

Results

A few of the results obtained by the writer with this transmitter may be of interest. All the work described was carried out on a wavelength of 190 metres. With six watts input, using telephony, three stations at distances between 40 and 70 miles were worked, the average strength of speech at these distances being R5-6. With the same input Morse communication was established with a station 400 miles distant, who reported signals R6. The power was reduced on one occasion to ·36 watt (120 volts 3 m.a.) and a station 20 miles distant reported telephony weak but readable, whereas on 3 watts it was R7.

No difficulty should be experienced in duplicating these results, while the writer will always be glad to hear from readers who succeed in putting up better performances with this transmitter. The aerial system used consisted of a single-wire aerial 65 ft. long and 38 ft. high, with a counterpoise of four wires 60 ft. long by 8 ft. high. Much longer aerials may be used, however, for the 150-200 metre waveband if desired.

Presented FREE with the next issue

The Editor, J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

A WONDERFUL FREE GIFT BOOKLET, THE RAPID STATION GUIDE, will be presented with every copy of the October issue of MODERN WIRELESS. The wavelength redistribution of European stations will make this presentation Booklet so extremely useful that you should go to your newsagent to-day without fail and put this issue on order.

Unless you order you may not be able to buy your copy on the morning of the 1st of October.

The Contents for the October issue will include:

HOW TO BUILD AN EIGHT-VALVE SCREENED-COIL SUPERHETERODYNE
By G. P. KENDALL, B.Sc.

MODERN DESIGN IN SIMPLE SETS
By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E.

HOW TO BUILD AN H.T CHARGING UNIT
By the Staff of the Elstree Laboratories.

MORE ABOUT THE "ELSTREE" SOLODYNE

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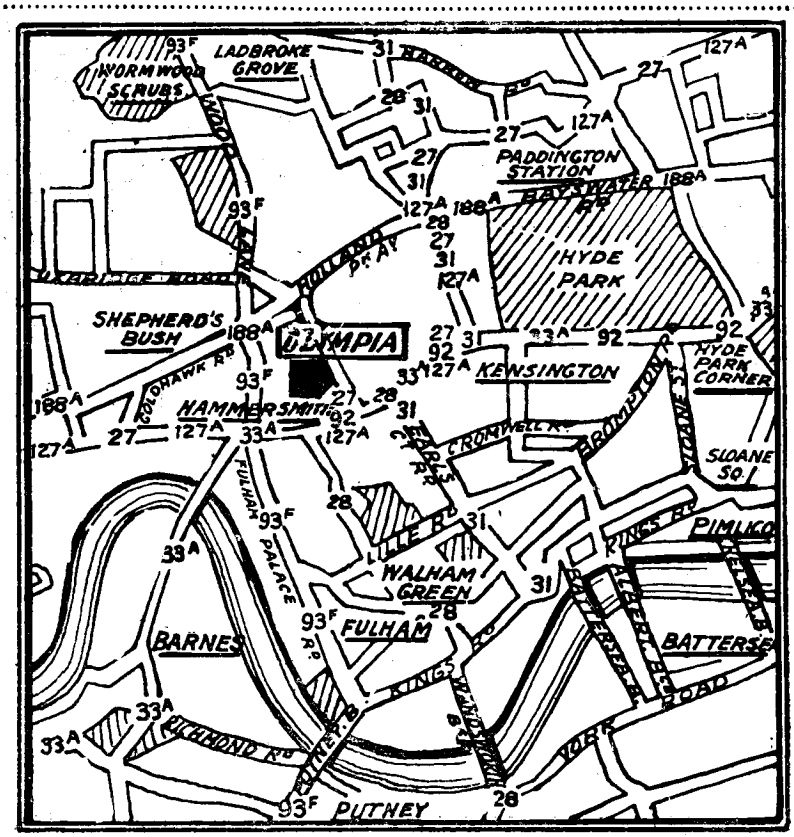
From the nearest Newsagent—

THE NATIONAL RADIO EXHIBITION 1926

The National Radio Exhibition is to be held at the New Hall, Olympia, from September 4th—18th inclusive. Advance information indicates that a number of new components and complete receivers will be shown. The "Elstree Six," the Elstree "Solodyne," the "Mewflex," and several other Radio Press designs may be seen on Stand No. 57.

The following is a preliminary list of exhibitors, together with their stand numbers :—

Name of Exhibitor.	*Stand No.*
Alphian Wireless, Ltd.	12
"Amplion" Magazine	241 (gallery)
Auto Sundries, Ltd.	133
Autoveyors, Ltd.	20
B.S.A. Radio, Ltd.	163
Beard and Fitch, Ltd.	83
Belling & Lee, Ltd.	207 (gallery)
Benjamin Electric, Ltd.	105
Blackadda Radio Co., Ltd.	15
G. Bowerman, Ltd.	205
Bowyer-Lowe Co., Ltd.	126
Brandes, Ltd.	157
Bretwood, Ltd.	93
Britain's Best Crystal, Ltd.	139
British Ebonite Co., Ltd.	81
British L. M. Ericsson Manufacturing Co.	137
British Thomson-Houston Co., Ltd.	127, 130
Brown Bros., Ltd.	120
S. G. Brown, Ltd.	129, 128
Brownie Wireless (of G. B.), Ltd	143
Bullen, W.	42
Burndept Wireless, Ltd.	140-1-4, 209 (gallery)
Burne-Jones & Co., Ltd.	111
Cable Printing & Publishing Co., Ltd.	4
Cables & Electric Supplies	151
Cahill & Co., Ltd.	85
Camden Engineering Co., Ltd.	95
Cassell & Co., Ltd.	99
Celestion Radio Co.	28
Chloride Electrical Storage Co., Ltd.	158 & 233
Clarke Bros. (Leicester), Ltd.	225 (gallery)
Clayton Rubber Co., Ltd.	27
Cleartron Radio, Ltd.	46, 135
Climax Radio Electric Ltd.	148
F. K. Cole	9
Coilinson Precision Screw Co., Ltd.	51
Colonial Technical Press, Ltd.	44
A. C. Cossor, Ltd.	86-87
Darimont Electric Batteries, Ltd.	243
Detex Distributors, Ltd.	2
Dew, A. J., & Co., Ltd.	25 & 26
W. Dibben & Sons	79
D. P. Battery Co., Ltd.	104
Dubilier Condenser Co. (1925), Ltd.	154
Eagle Engineering Co., Ltd.	55
East London Rubber Co.	29 & 30
J. J. Eastick & Sons	54
Edison Swan Electric Co., Ltd.	3 & 134
Electron Co., Ltd.	38
Ever-Ready Co. (G. B.), Ltd.	100
Falk Stadelmann & Co., Ltd.	114



A guide to the approaches of Olympia. Readers may proceed to the Exhibition by any of the numbered 'bus routes indicated. The nearest Underground stations are Hammersmith, West Kensington, and Addison Road.

LIST OF EXHIBITORS—*(Concluded)*

Name of Exhibitor.	*Stand No.*
Fallowfield, Jonathan, Ltd.	1
Folcourt Products, Ltd.	24
Fellows Magneto Co., Ltd.	110
Finston Manufacturing Co., Ltd.	206 (gallery)
The Formo Company	78
Galliers, H. J.	53
A. W. Gamage, Ltd.	156
Gambrell Bros., Ltd.	90
Garnett Whiteley & Co., Ltd.	84
General Electric Co., Ltd.	61, 63 & 214
General Radio Co.	103
Gent & Co., Ltd.	80
Alfred Graham & Co., Ltd.	131-2
Halcyon Wireless Supply Co., Ltd.	59
Hart Accumulator Co., Ltd.	56
Hart Collins, Ltd.	118
Henderson & Co., Ltd.	242
A. Hinderlich	203 (gallery)
Hobday Bros., Ltd.	21-22
J. E. Hough, Ltd. (Edison Bell)	75
Houghton-Butcher (Gt. Britain), Ltd.	69
Igranic Electric Co., Ltd.	72 & 73
Iliffe & Sons, Ltd	108
S. A. Lamplugh, Ltd.	253 (gallery)
The Lisenin Wireless Co.	40
Lissen, Ltd.	160
Lithanode Co., Ltd.	204 (gallery)
London Electric Stores, Ltd.	258 (gallery)
London & Provincial Radio Co., Ltd.	6
M.P.A. (Wireless)	67-5 & 18
L. McMichael, Ltd.	142
Manufacturers' Accessories Co., Ltd.	221
Marconiphone Co., Ltd.	121-2-3-4-5 & 220 (gallery)
Masson, Seeley & Co., Ltd.	52
Metropolitan Vickers Electrical Co., Ltd.	162
The Mullard Wireless Service Co., Ltd.	136 & 138
Odhams Press, Ltd.	47
Ormond Engineering Co., Ltd.	70
Oxford Wireless Telephony Co., Ltd.	112
Paragon Rubber Manufacturing Co., Ltd.	7
Penton Engineering Co., Ltd.	5
Peter Curtis, Ltd.	159
Peto Scott Co., Ltd.	161 & 259 (gallery)
Pettigrew & Merriman (1925), Ltd.	96
Portable Utilities Co., Ltd.	107
Pye, W. G., & Co.	91
H. Quartermaine	45
Radi-Arc Electrical Co., Ltd.	89
Radiax, Ltd.	32
Radio Communication Co., Ltd.	149
Radio Instruments, Ltd.	145-7
Radio Press, Ltd.	57
Radio Reception Co.	208 (gallery)
Radolian Co., The	49
Raybould, M.	227
Rectalloy, Ltd.	202
Redferns Rubber Works, Ltd.	94
L. H. Reid	211 (gallery)
Ripaults, Ltd.	92
Rotax (Motor Accessories), Ltd.	164 & 212 (gallery)
See, J. W., & Sons	11
Sel-Ezi Wireless Supply Co., Ltd.	88
Selfridge & Co., Ltd.	153
Service Radio Co., Ltd.	48
Siemens Bros. & Co., Ltd.	155
Spring Washers, Ltd.	222
A. J. Stevens (1914), Ltd.	116
Stratton & Co., Ltd.	71
Sun Electrical Co., Ltd.	33-34
Sylvex, Ltd.	77
The Trader Publishing Co., Ltd.	8
Trelleborg Ebonite Works, Ltd.	31
Tudor Radio Co., Ltd.	10
Tungstone Accumulator Co., Ltd.	150 & 152
Tunometer Works	16
Universal Bracket Co.	213 (gallery)
C. A. Vandervell & Co., Ltd.	146, 210 (gallery)
Wates Bros., Ltd.	19
Watmel Wireless Co., Ltd.	50
Westam Accumulators	23
Whittingham, Smith & Co.	39
Wilkins & Wright, Ltd.	74
Worsnop & Co., Ltd.	201 (gallery)
Wright & Weaire, Ltd.	224 (gallery)

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