How to Build an EIGHT-VALVE SUPERHETERODYNE RECEIVER

MODERN WIRELESS

1/- MONTHLY

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

Vol. VI. No. 2. JULY, 1926.

In this Issue

ALL EUROPE ON A FRAME

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

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CONTENTS

Vol. VI. MODERN WIRELESS. No. 2

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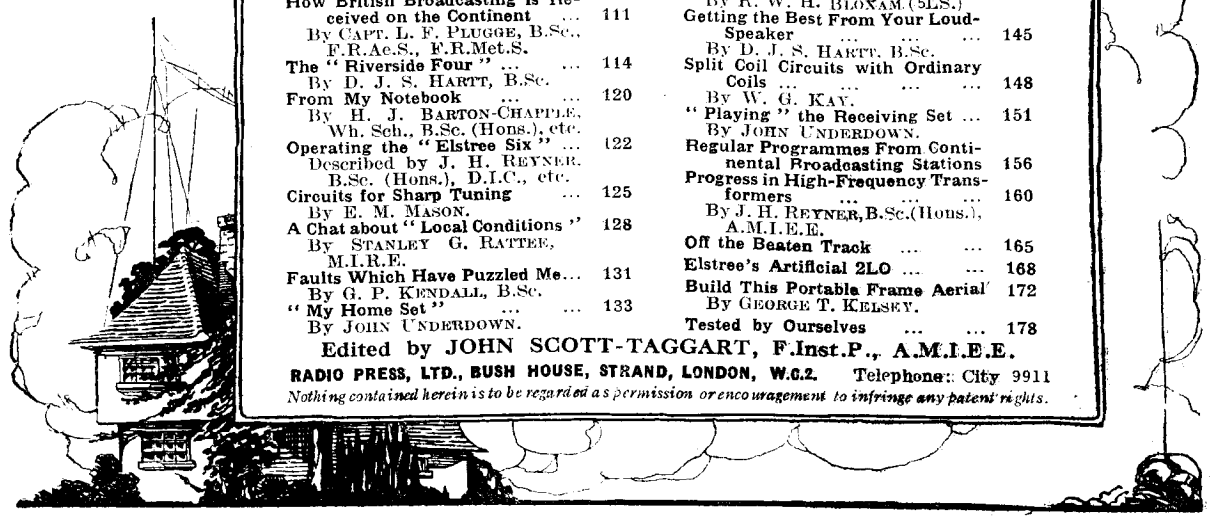

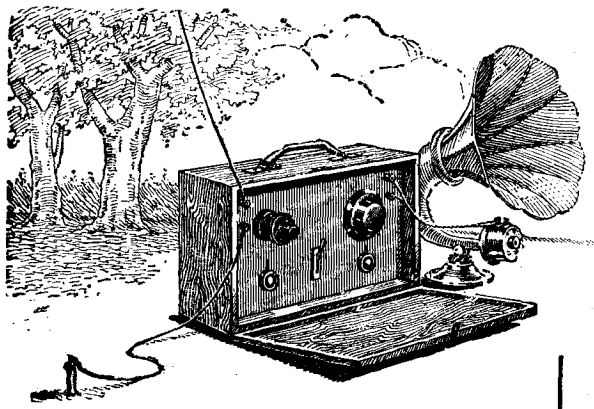

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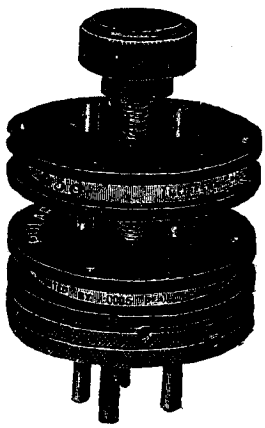

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Illustration is approximately three-quarter size.

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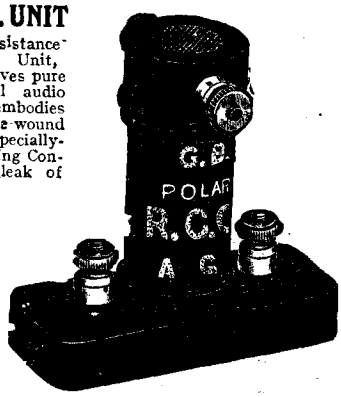

The "Polar" Resistance-Capacity Coupling Unit, complete in itself, gives pure reproduction at all audio frequencies. It embodies non-inductively wire-wound Anode Resistance, a specially-made Dubilier Coupling Condenser and a Gridleak of Mullard type.

20,000 ohms (Red Seal) for all stages of Amplifier (except last) ... 12/6
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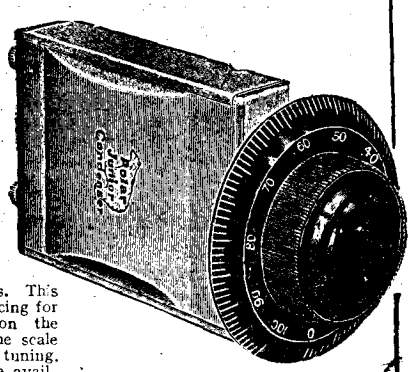

"Polar" Junior is very robustly constructed, and is totally enclosed in dustproof metal case. It has a practically straight-line frequency curve, the scale being engraved to allow a movement of 350 degs. This gives wider Dial spacing for Stations tuned in on the lower portion of the scale resulting in easier tuning. Three Capacities are available—.001, .0005, .0003 m.f.d.—all one size and price 6/6

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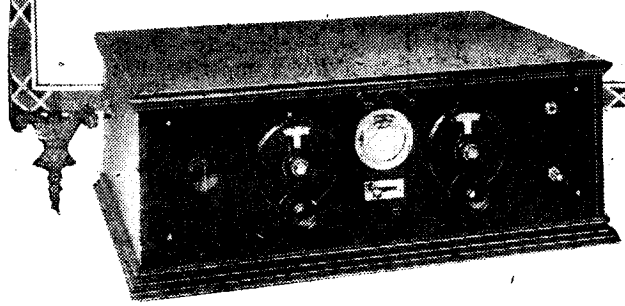
ALL EUROPE ON A FRAME



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

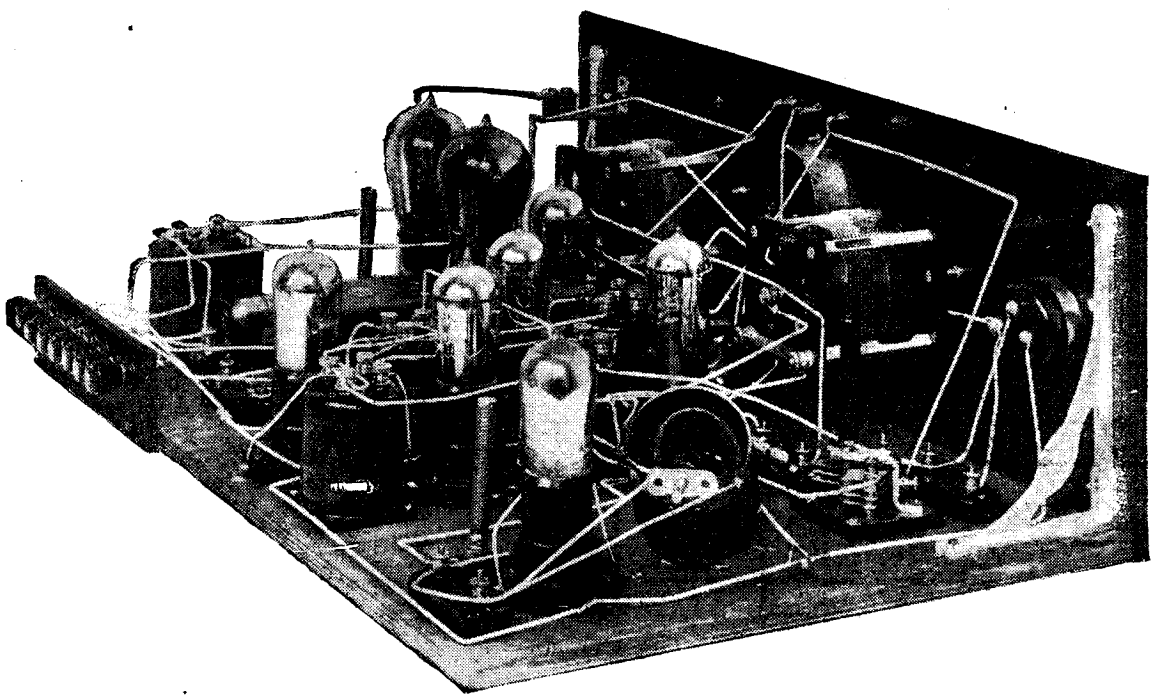
This handsome superheterodyne receiver employs eight valves, and is capable of receiving British and Continental broadcasting stations at full loud-speaker strength on a small frame aerial and without interference from the local station.

MY first practical acquaintance with the supersonic heterodyne receiver began about two years ago, when there was little available information and, so far as this country was concerned at least, no available components of the manufactured variety with which such a receiver could be built up. In order to experiment with the particular method adopted, one had to adapt apparatus designed for a different purpose. The Americans had already started the commercial manufacture of certain essential components, and later British manufacturers entered the field, so that at the present time the experimenter has available both British and American components from which a supersonic heterodyne receiver can be built up.

Last year when I visited the United States I already had, therefore, some little experience in the operation of supersonic heterodyne receivers and was thus very interested to try American built and designed super-heterodynes. During my stay I had the opportunity of trying several entirely different patterns for extended periods.

Features in Design

The design of the instrument to be described in this article is based upon study of both British and American super-heterodyne receivers, and is an attempt to



The valves are carefully arranged on the baseboard in the best positions to ensure a compact layout.

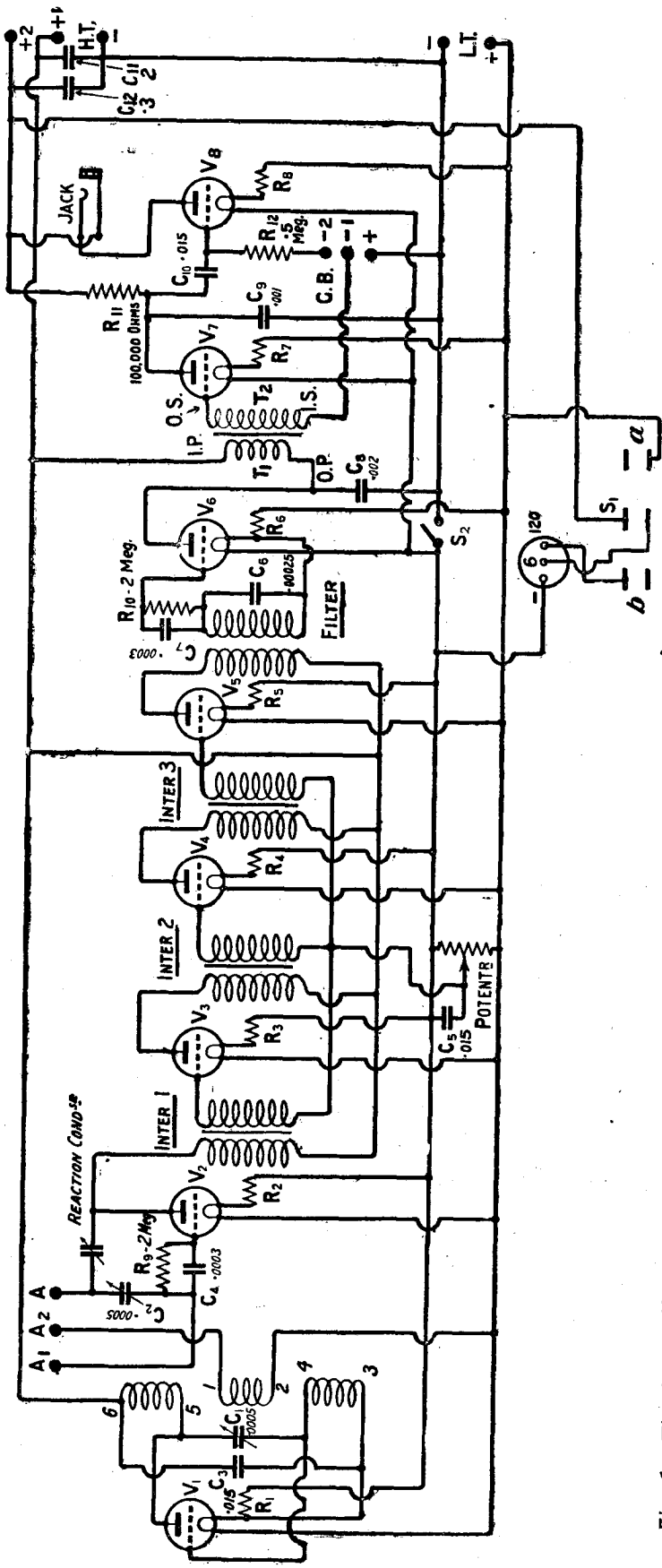


Fig. 1.—The theoretical circuit diagram. Note that the filter is placed before the second detector valve V_6, and that its secondary winding is tuned.

All Europe on a Frame
(Continued)

provide a reliable instrument possessing the following features:

(1). Simplicity of operation.

(2). Particularly sharp tuning even for a super-heterodyne.

(3). A higher quality of reproduction than is usual with such receivers.

(4). A pleasing and compact appearance.

(5). Economy in operation, both in accumulator and high-tension battery current. This is a very important point for the country dweller.

(6). A wavelength range from about 220 metres to well over 600.

Economy in Operation

I would like to draw particular attention to the economy of operation of the present instrument. The total filament current is about one ampere, while the total high-tension current is only eleven milliamperes—a figure which does not require high-tension accumulators for economical running, the larger size dry battery used for high-tension work being adequate. The good quality is obtained by combination of one L.F. transformer and one resistance-coupled valve.

Unusual Layout

In designing this instrument I have adopted a shape of cabinet and general layout somewhat unusual, and the panel used is of standard size, 21 ins. by 7 ins., being exactly the size of panel used recently in this journal for the "Melody Three" and other receivers. By disposing the components in the manner shown, adequate space is provided for everything, while the logical sequence of events in the instrument is not interfered with.

Special Dials

Owing to the sharpness of tuning, special vernier dials are used of a type that has just been originated in the United States. They have certain distinct advantages that I have not found possessed by other dials, and prove exceptionally suitable for use in any super-sonic receiver. It will be noticed that the main dial is turned by the means of a vernier knob above which is placed a small lever which can be set in a number of different notches from left to right. When the lever is placed in the extreme

AN EIGHT-VALVE SUPERSONIC RECEIVER

left notch, the operating knob enables one to turn the dial comparatively quickly. When the lever is placed on the extreme right, a much slower motion of the dial for the same turning movement is obtained. Between these two extremes any ratio can be picked, and the result is one can adjust the degree of dial gearing to suit one's particular requirements. Actually as one requires to swing the oscillator dial backwards and forwards, as one searches with the frame aerial dial, I have arranged my own receiver that the oscillator dial shall be turned quickly (lever on left) while the frame aerial tuning condenser shall be tuned slowly (lever on right).

Switching

No provision is made in the present instrument for switching out certain valves, as I consider the supersonic heterodyne receiver primarily a loud-speaker instrument, as if it is properly designed and built you will get all you want on the loud-speaker without recourse to the telephones. As a matter of fact, at the time of writing—it is after very prolonged tests of the instrument, I have not yet used a pair of telephones with it—every part of the experimental testing having been conducted directly on the loud-speaker.

Potentiometer Control

As the intermediate frequency transformers are all tuned to a definite frequency—they have a tendency to burst into oscillation if not suitably controlled. In order to keep them in the sensitive position but just below the oscillation point, a potentiometer control is provided, and the knob for this is seen on the left of the panel. As frame aerials for supersonic heterodyne receivers are frequently used on top of the cabinet, the three terminals for the frame aerial are placed, not in a conventional position on the left of the panel, but in the middle top.

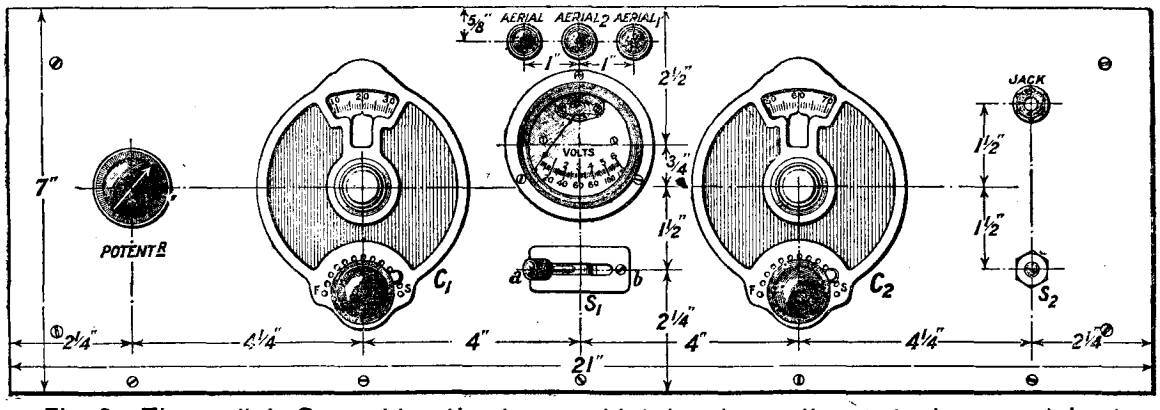
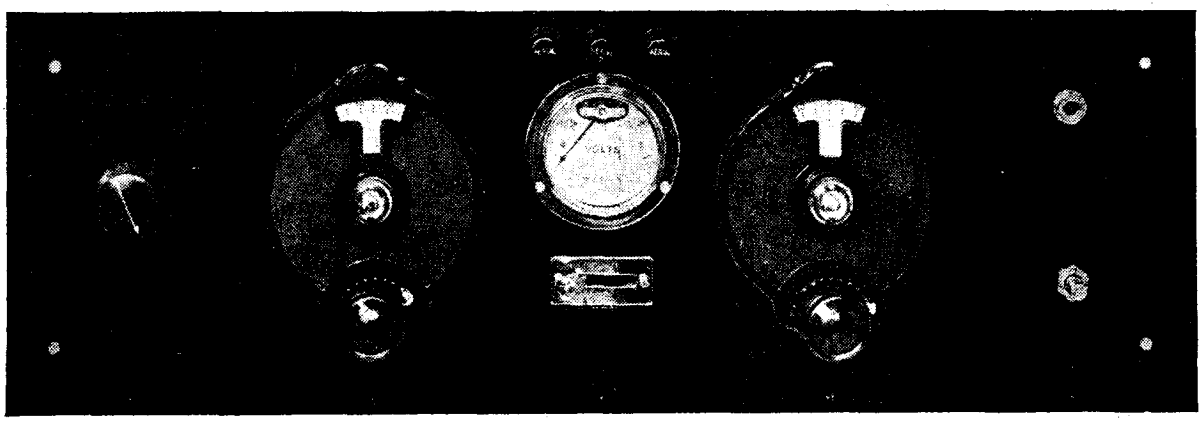


Fig. 2.—The switch S_1 enables the low or high-tension voltages to be ascertained when desired. Blue Print No. 165a (free).

Reaction

Experience has shown that considerable sharpness of tuning and an appreciable increase of signal strength are obtainable in the supersonic heterodyne receiver if reaction is used in the frame aerial circuit. To obtain this I use a centre-tapped loop or frame aerial, the frame aerial tuning condenser being placed across the whole frame, while the centre tap is taken through the oscillator coupling-coil to the filament. From the end of the frame opposite to that connected to the grid a lead goes to a very small variable condenser, and then



The knob on the extreme left controls the reaction effect on the intermediate stages.

ALL EUROPE ON A FRAME — (Continued)

to the anode of the valve. As the value of this variable condenser is increased, the frame aerial circuit is brought nearer and nearer to the oscillation point, and just below this the most sensitive position is arrived at.

Sharpening Tuning

Generally speaking the variable condenser can be said to give a little reaction on the frame, thus sharpening up the tuning and giving an increase in signal strength, and once this position has been found a great deal of tuning and picking up of distant stations can be accomplished without any further attention to this particular adjustment.

For this reason, and in order to give simplicity of control to which I have aimed, the small variable condenser for giving reaction on the frame is placed inside the cabinet, where, as a matter of fact, it can be reached in a moment by lifting the lid. I have picked up 20 or 30 stations successively on the loud-speaker, without needing to touch the frame aerial reaction condenser, and it is only when getting weak and very distant stations or obtaining just that additional selectivity which sometimes helps to clear an interfering station, that I lift the lid to make any adjustment to this particular point.

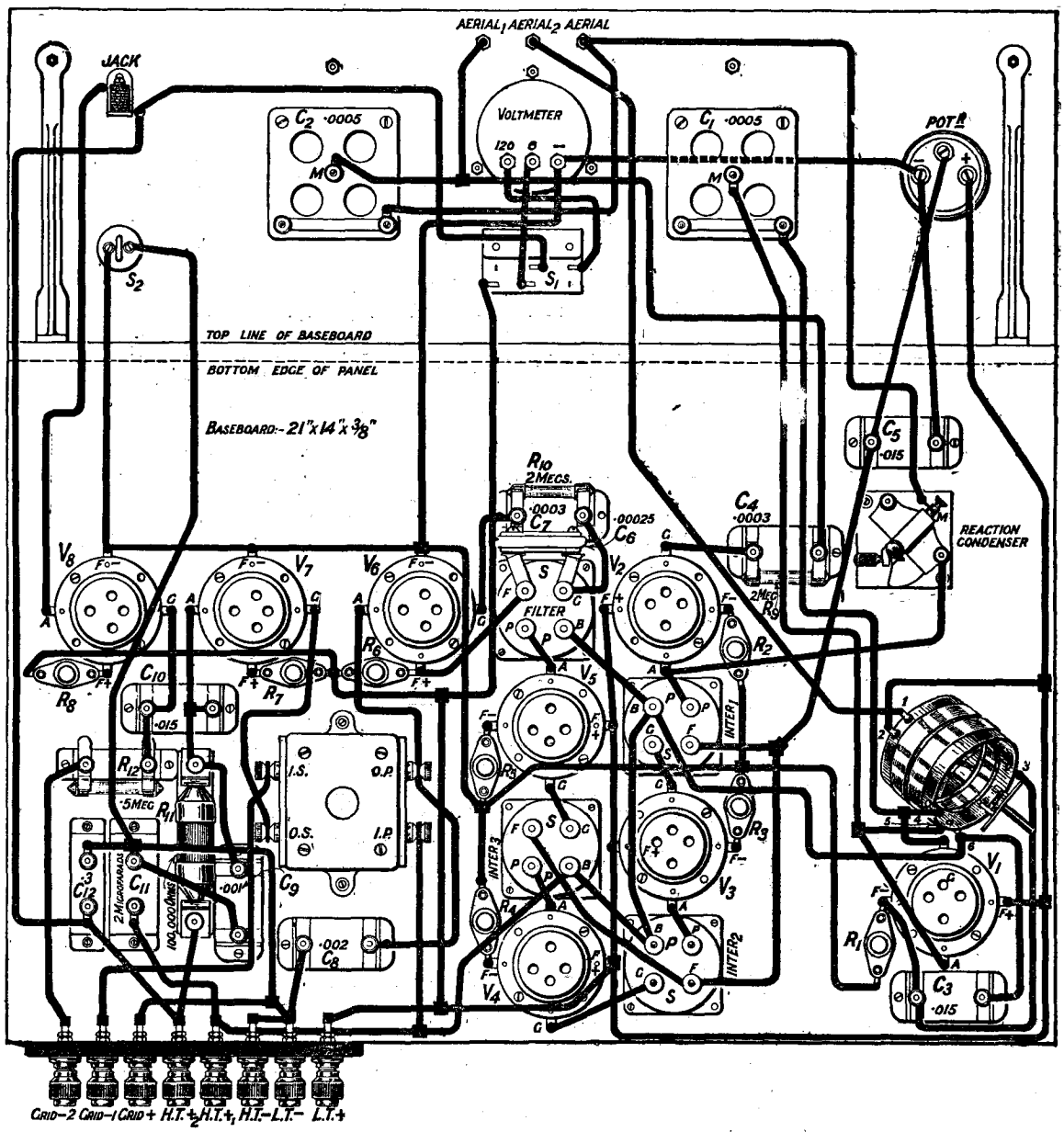


Fig. 3.—The reaction condenser is mounted on the baseboard, and, once set, rarely requires adjustment. Constructors desiring a full-sized wiring diagram should ask for Blue Print No. 165b (free).

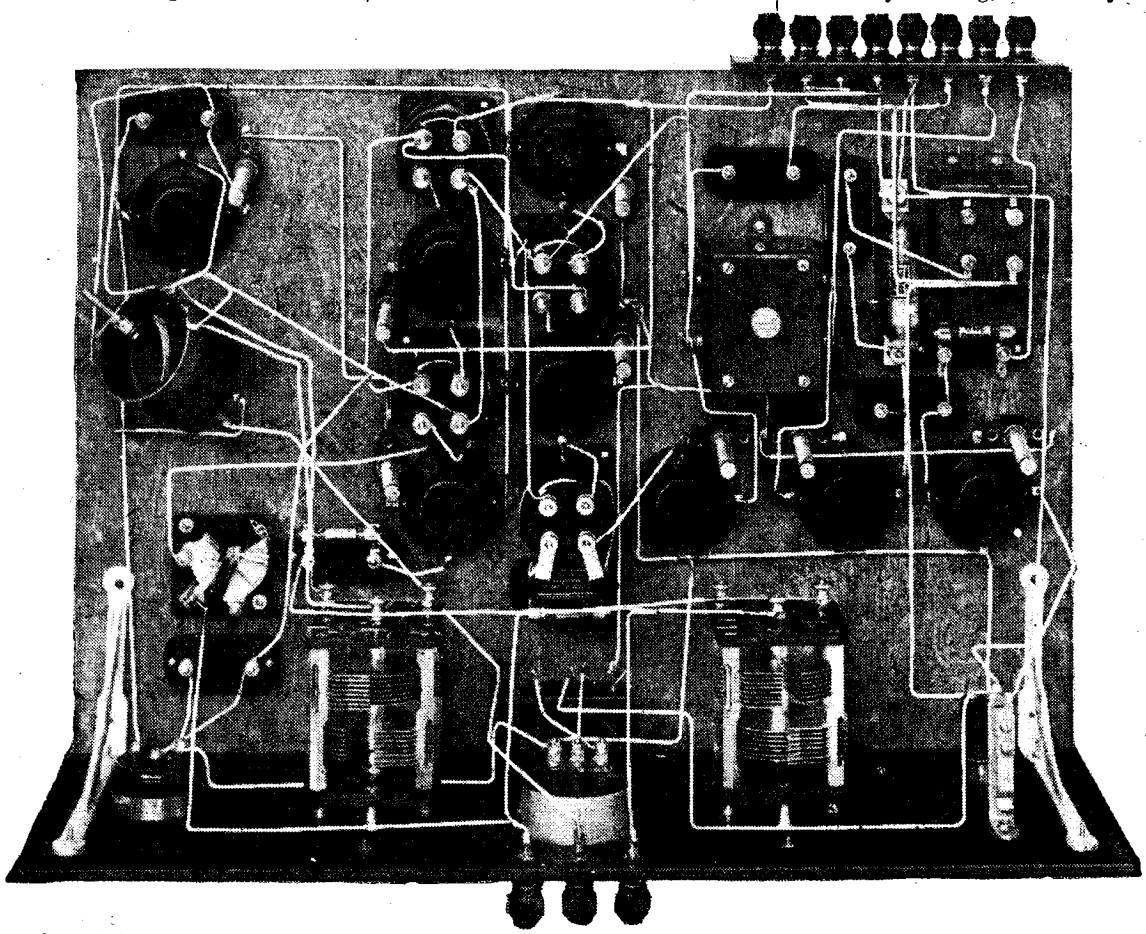
AN EIGHT-VALVE SUPERSONIC RECEIVER

The Voltmeter

In the centre of the panel will be seen a double voltmeter and below this a two-way double-pole switch. Frequently, and particularly in American designs, one sees a milliammeter placed on the panel or a voltmeter for the filament voltage. I think this is the first supersonic heterodyne receiver in which a combined voltmeter has been incorporated in the manner shown, for by throwing the switch to the left an immediate reading is given of the accumulator voltage, while on throwing it over to the right a reading is given of the maximum high-tension voltage used on the set. When the switch is in the centre, the voltmeter (both windings) is out of circuit, so that no current is wasted by keeping it constantly joined up. In actual practice it is very comforting to be able to throw the switch on one side or the other and ascertain in a moment whether one's batteries are "up to scratch," and it is an arrangement which I am sure many readers will like to incorporate in their own sets, whether supersonic or otherwise. The only other remaining components on the panel are the jacks for plugging in the loud-speaker plug and the one hole fixing "on and off" switch.

The Circuit

Technical details of the circuit are given in Fig. 1. The oscillator coils and coupler, the filter and intermediate transformers are a set manufactured by the Remler Radio Corporation, an American firm in San Francisco. The circuit of the oscillator is that recommended by the manufacturers. So far as the arrangement of the intermediates are concerned, notice that the filter is placed at the end, near the second detector, and not at the beginning as frequently is the case in other designs. I have experimented with the filter in both positions and there seems to be very little to choose between the two. Most supersonic filters are arranged to have a fixed condenser across the primary winding, and if such a filter were used at the beginning of the chain in the present receiver, it would by-pass through this fixed condenser the high-frequency current one wishes to feed back to obtain reaction on the frame. However, in the Remler filter it has a condenser across the secondary winding, and in any case, by placing at the end and not at the beginning, we avoid any troubles due to by-passing high-frequency components which we desire to pass in another direction.



In wiring up the receiver care should be taken to allow adequate clearance for the valves when placed in their holders.

Fixed Resistors

Burndept fixed resistors are used as filament controls throughout the set. I am a firm believer in

ALL EUROPE ON A FRAME — (*Continued*)

using fixed resistors of a definite value and leaving them alone. The variable resistors for controlling filament current often lead the user to think that when the voltage of his accumulator drops, he can compensate for this by cutting out some resistance by means of the variable resistance control. Particularly when dull emitter valves are used, the variable filament resistance leads us to the temptation of attempting to discharge a battery below the safe point. If fixed resistances are used, we can get an adequate discharge from the battery and cannot discharge it below the safe point without noticing a very considerable diminution in our signal strength.

Values to Use

The value of fixed resistance used to control the valves will depend upon the valves and the voltage of the accumulator you are using to supply them with current. Personally I have 6-volt accumulators available and I desired to use 6-volt power valves. I therefore obtained filament resistors which would cut down the 6-volt battery to the voltage required to operate the valves throughout the set. For economy I am using ·06 ampere valves for the separate oscillator, the two detectors and the three intermediates, while for the first audio-frequency stage I use a D.F.A.4 Mullard valve specially designed for resistance amplification, and for the last valve a D.F.A.1. The ·06 ampere valves I am using for the first six sockets are the B.T.H. B.5. I have also used with satisfaction the D.E.3's of Marconi's and Osram and a D.E.5.b for the resistance stage with a D.E.5 in the last socket. If you desire to use a 4-volt accumulator, then it is only necessary to obtain the correct resistors for running the ·06 valves from a 4-volt accumulator, and to obtain suitable 4-volt power-valves for the two audio-frequency stages.

Fixed Condensers

Considerable importance attaches to the fixed condensers in the present set, and the reader is not recommended to depart from the values given. It will be noticed that a fixed condenser is shunted from the anode of the second detector valve to the negative filament to by-pass any high-frequency component which may have passed through, and a ·001 fixed condenser is also shunted from the anode of the first low-frequency valve to the filament is a practical solution of a trouble which arose due to some of the high-frequency component getting through.

Components

A complete list of the components used is given on this page. In a number of the components other makes advertised in this

Components Required

Cabinet.
One Camco.

Panel 21 ins. by 7 ins.
One Camco.

Condensers (Variable).
Two ·0005 "Four-Square." Bowyer-Lowe.
One Neutralising. Peto-Scott.

Condenser Dials.
Two National Velvet Vernier. (new type). Rothermel Radio Corp.

Condensers (Fixed).
Three ·015 type 610. Dubilier.
Two ·0003 with clips, type 610. Dubilier.
One ·001 type 610. Dubilier.
One ·002 type 610. Dubilier.
One 2 microfarad. Dubilier.
One ·3 microfarad, Dubilier.
One ·00025 "Sangamo" (supplied with Remler kit).

Grid Leaks.
Two 2 meg. Dumetohm.
One ½ meg. with holder. Dumetohm.

Valve Sockets.
Eight Antiphonic. Burndept.

Resistances.
Six fixed resistors and holders for ·06 amp. valves. Burndept.
Two Fixed Resistors and holders for ·25 amp. valves. Burndept.
One 100,000 ohm anode resistance. Dubilier.

L.F. Transformer.
One First Stage. Gambrell.

Intermediate Transformers.
Three Remler. Rothermel Radio Corp.

Filter Transformer.
One Remler. Rothermel Radio Corp.

Coupler.
One Remler. Rothermel Radio Corp.

Switches.
"On and Off" Switch. Connecticut, Rothermel Radio Corp.

Potentiometer.
One Yesley.

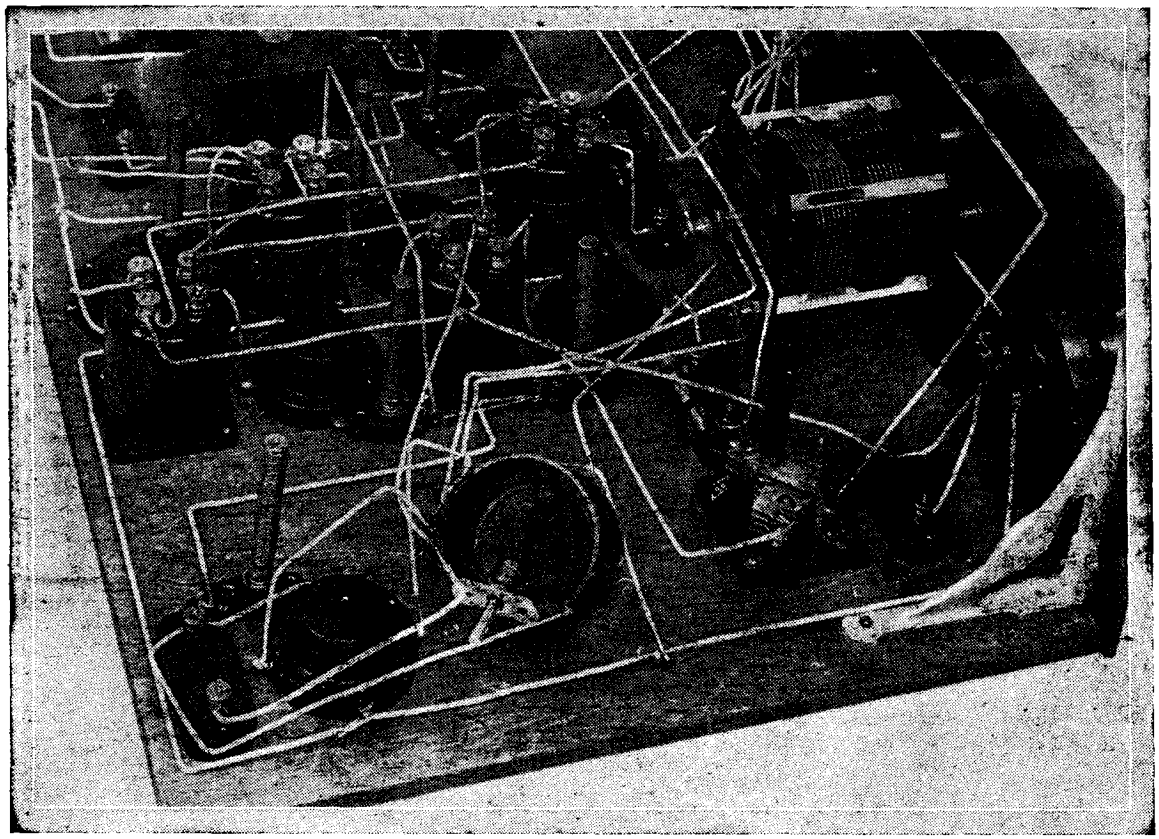
Jack.
One Single circuit. Igranic.

Plug.
One Volume Control Plug. Rothermel Radio Corp.

Change-over Switch.
One Two-Pole Two-Way. Utility.

Voltmeter.
One 6v. 120 v. Combined. Sifam.

Terminals as follows :—
L.T. — L.T.+H.T. — H.T.+1 H.T.+2 G.B.+G.B.—1 G.B.—2.
Aerial, Aerial 1, Aerial 2.
Terminal Strip 6¾ ins. by 2 ins. (Clayton ebonite).
Glazite wire, and two angle brackets.



A close-up view of the separate oscillator which will be found helpful in wiring up the set.

journal can be substituted with equal results, and if the reader is satisfied with the particular type of component he is using at the present time for such matters as valve sockets, variable condensers, L.F. transformers and the like, he can use a similar make of component in this instrument without any detrimental effects. All the components on the base-board are fitted in place by simple wood screws, and the wiring up has been arranged to give short leads wherever these can possibly be provided. Notice that when using Burndept Antiphonic valve sockets it is possible to solder one lug of the base of each fixed resistor to the filament lug, thus economising space and saving wire.

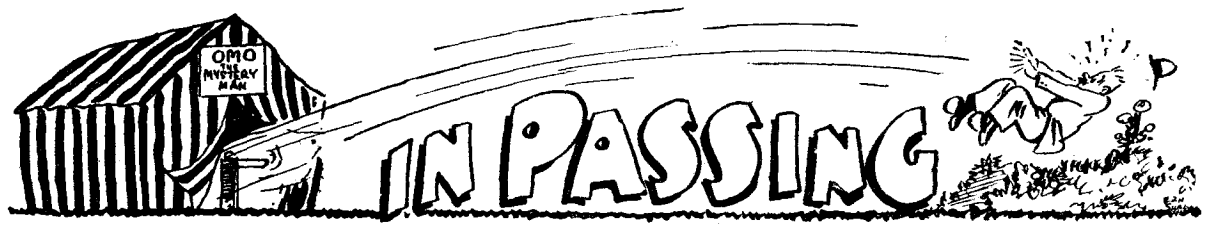
The lay out of the instrument is such that different makes of intermediate-frequency transformers can be used with very little general change, and in an article in next month's issue several alternative arrangements will be shown with both British and American intermediates, The slight modifications necessary in the wiring will be shown by drawings and photo-

(*Continued on page* 171.)

A few representative Stations received at full loud-speaker strength on a two-foot Frame Aerial in a couple of hours.

	Oscillator Condenser (One reading).	Frame Aerial Condenser.
Aberdeen	52½	53
Bournemouth	26½	28
Brussels	49½	50½
Birmingham	48½	49
Belfast	40½	41½
Cadiz	20	22½
Ecole Superieure ...	43	45
Frankfurt	45	46½
German Relay	5	6½
,, ,, ...	8	9
German Relay	10	10½
Hamburg	28	28½
Koenigsberg	43½	45½
London	22½	25
Madrid (Union Radio)	25	27
,, (Radio Iberica)	27	29
Manchester	26	27½
Newcastle	31½	21½
Toulouse	35	37½

NOTE: The actual reading of the Frame Aerial Condenser is influenced half a degree or more by the amount of reaction used.



"I REGRET to announce," said the General gloomily at a recent meeting, "that the club's funds are—er—hrrrmp—at a somewhat low level. I will call upon Mr. Snaggsby, our treasurer, to read a statement on the accounts." So far as I could gather from what Snaggsby said, things seemed to be in a pretty serious condition. I was never good at accounts myself, though I have often tried to keep them when an economy fit came upon me. By making lavish use of the blessed word sundries I have invariably been able to prove to my own satisfaction that I have not spent a single unnecessary penny. The only thing that I could really understand in Snaggsby's statement was cash in hand and at bankers, which amounted to ninepence-halfpenny; and, after all, it is the cash in hand and at bankers that really matters, is it not?

"Ninepence-ha'penny"

Everyone looked pretty blue. We gazed at each other and shrugged our shoulders and exclaimed in pathetic tones, "*Nine*pence-*ha*'-penny." It was obvious that something must be done without delay. Poddleby suggested a whip round among the members, but this met with no support; we were all still suffering from the Income-tax man's whip round. Admiral Whiskerton Cuttle thought we might run a lottery, and some attempt was made to get one up. After four days' strenuous work, however, only four sixpenny tickets had been sold, three of which had not been paid for.

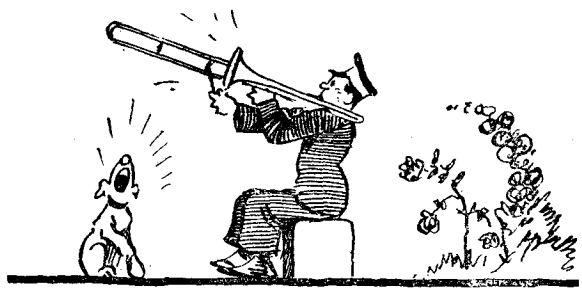
A Bright Idea

And then one evening a really noble idea occurred to me, as (you have no doubt noticed this) such ideas have a way of doing. Dashing down to the club, I found most of the members already there. "Saved!" I cried, flinging open the door and tripping over the mat into Poddleby's arms. "If you mean that you have joined the Salvation Army," grunted Poddleby, thrusting me rudely away, "I trust you won't go practising a trombone or something in your garden." "Idiot," I hissed (idiot is a hard word to hiss; just you try it and see). "I am not speaking of myself. The club is saved, for I have discovered a way out of all difficulties."

Erecting a tea tent on the lettuce bed.

The Meeting Begins

The General at once took the chair, and the meeting began. Rising gracefully to my feet, I said, "We must have a garden fête." Nearly everybody saw at once that it was a splendid idea. But Bumpleby Brown began to raise objections. "Fêtes," he said, "are always given for charity. No one will come if ours is simply on behalf of the Little Puddleton wireless club." I silenced him with one look. "If," I remarked, "you will allow me to elaborate my proposal you will find that I have foreseen your silly objections. One-half of the proceeds of the fête is to be devoted to a most deserving charitable organisation." "What is that?" asked the meeting in unison. "The Wireless Widows' Relief Fund" I told them, and all agreed that nothing could be more suitable.



Practising a trombone in the garden.

It was decided unanimously that a fête should be held, and that the scene of the revels should be Professor Goop's garden. We chose it because none of those present considered his own garden suitable, and the Professor happened not to be there. We resolved not to tell him that the honour had been done him, but to let him discover it for himself upon the posters.

The Arrangements

The Professor, as a matter of fact, was quite nice about it; but Mrs. Goop offered a little opposition, especially when she found Poddleby, Breadsnapp and myself erecting the tea tent on the lettuce bed. We soothed her rising wrath by telling her that the club had unanimously decided to ask her to perform the opening ceremony. The whole of the preliminary arrangements went off splendidly. Never, I think, has such a feast of entertainment and amusement been provided. In the midst of the lawn was the Little Puddleton prize band—the prize was won a

IN PASSING — (Continued)

couple of years ago in a contest with the Bilgewater Magna band, which had to scratch at the last moment owing to an outbreak of bandsman's elbow amongst its trombone players. The Little Puddleton band has only one tune in its repertoire, The Soldier's Chorus; but as it plays this differently every time, the effect is always novel and striking. Around the lawn were grouped the various stalls, whilst the kitchen garden was converted into an amusement park. The organisation of this had been entrusted to me, and I flatter myself that I had provided something to appeal to everyone's taste.

Doing a kind of shimmy-shake.

The Side Shows

One of the most successful of the side shows was the transformer shy. By making a house-to-house collection I had amassed large numbers of the horrible little L.F. transformers that everyone buys in his early days as a wireless man and afterwards wishes he hadn't. These were placed on stands against a background of netting, and the price was sixpence a ball. It proved an enormous attraction to both old and young. The former thought it well worth sixpence to try to annihilate the little beasts, whilst the latter had visions of getting a lovely transformer for the same money.

More Amusements

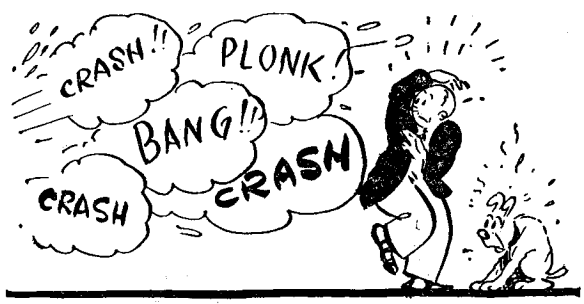
Hard by stood a little tent fixed to which was a vast notice proclaiming to the world that Omo the Mystery Man would answer any wireless question for a fee of half-a-crown. Within, wearing a mask and clad in a robe covered with cabalistic signs, was Professor Goop. Omo would, I think, have been one of the successes of the day, had not the Professor been seized early in the morning with an inventing fit that resulted in the production of an automatic turnstile which he erected at the door of the tent. The turnstile should have opened when Omo's foot pressed a hidden spring, thus admitting the enquirer to his presence; but as often as not the moving part rotated violently in the opposite direction, catching the seeker after truth at about the fifth waistcoat button and sending him spinning backwards into the gooseberry bushes.

The Crazy Kitchen

A show of which I was particularly proud was the crazy kitchen. In the happy days before the War no exhibition was complete without one of these. Possibly you remember them? Upon a dresser and upon other items of kitchen furniture were arranged quantities of china basins, bowls, jugs, teapots, plates, cups, saucers, and so on. On payment of sixpence you were allowed to have three shots at anything you liked with hard wooden balls. I have often longed to instal the crazy kitchen in my own house, for I feel that nothing could equal it as a soother to the feelings on those occasions when you spend four hours trying to trace a mysterious fault and then discover that you had omitted to flick over the earthing switch. I found it quite easy to stock the crazy kitchen, for nearly everyone I called upon when I was collecting materials was only too glad to hand over loathesome vases and things that had been received in the dim past as wedding, birthday and Christmas presents from aunts with Victorian tastes. To these I added a number of burnt-out valves and large numbers of ghastly framed photographs. The crazy kitchen was in fact the one thing to which everyone contributed willingly and lavishly. Our best customer during the day was the General, who is always getting upset about something and retiring to work it off.

Other Attractions

In another tent Poddleby with a gas ring, a hundredweight of soldering paste and a lot of bad language gave lessons in soldering, and next door to him Gubbsworthy was instructing enthusiasts in the art of coil winding. Mr. G. P. Bendall was to have presided over this department, but at the last moment a wire was received from him regretting that he was laid up with an attack of low-losser's rheumatism, which, as you know, is caused by the draughtiness of air-spaced windings. Little Bingo was exhibited as a wireless-haired terrier, and Bumpleby Brown drew crowds to see a valve which was guaranteed to work efficiently without either high- or low-tension batteries. A few of those who entered demanded their money back, but the majority enjoyed persuading their friends to pay sixpence for the chance of examining a bicycle tyre valve. I had hoped to star Mrs. Poddleby as the Fat Lady, but when I approached her tactfully on the subject she turned so nasty about it that I thought it best to let the matter drop.

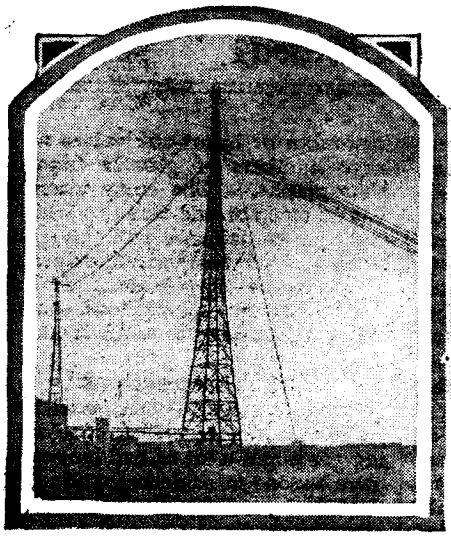


Had ten shillings worth without stopping.

The Greasy Aerial

At noon exactly the fête was opened by Mrs. Goop, after which the General conducted a party of distinguished visitors and of the elite of Little Puddleton round the

(Concluded on page 189.)



SAYING "NO" TO THE LOCAL STATION

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

Those who are troubled by interference from the local broadcasting station will find this article of absorbing interest, since it gives the results of some very successful experiments with auto-coupled wave traps.

SOME months ago I carried out a number of experiments to determine what was the best form of wave trap to employ for the elimination of interference from the local station. The results of these experiments confirmed what I had already found indicated in ordinary reception, results further confirmed by several broadcast listeners who have tried the same type of trap—namely, that the auto-coupled trap was superior to others. Not only did it give more complete elimination of the local station, but the signal strength of other transmissions on a wavelength close to that being eliminated did not suffer to any appreciable extent.

With many traps, indeed, it was found that if the local station was cut out completely so was every other station for wavelengths within 50 to 70 metres either side of it.

Points to Investigate

Having decided that the auto-coupled trap was the best, the next question to determine was what was the best auto-coupled trap. Should the coil be big or small, should the condenser be small or big, should the common portion of the coil be large or small, and how did the portion of the aerial tap affect the functioning of the trap?

These various points being satisfactorily settled, it would next be necessary to design a trap which would be a practical proposition, since it might be found that the optimum results were obtained with an enormous bulky coil of special construction which would be either too expensive or would take up too much room for the average broadcast listener.

An Auto-Coupled Trap

As there may be some amateurs who are not quite clear as to what constitutes an auto-coupled trap, it is shown in circuit form in Fig. 1 connected between the aerial and the receiver.

It consists of an inductance L_1 which is tuned by a variable condenser C_1. One end of the coil is connected to the wireless set, the aerial being connected to a point on the coil near to this end.

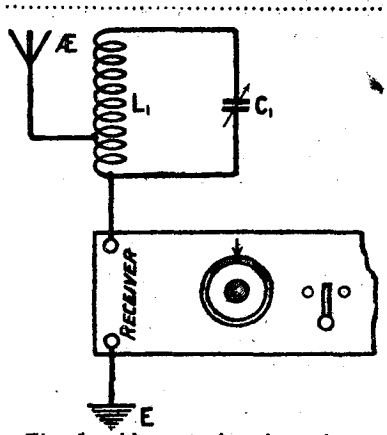


Fig. 1.—How a simple auto-coupled trap would be joined to a receiver.

Source of Energy

It was first decided to make use of 2LO's carrier as a source of energy for the experiments to be carried out, so that both aural as well as visual readings might be taken at the same time. There were, however, several disadvantages in this method, such as fading, variation in signal strength from day to day, limitation of hours when work could be done that made it necessary to adopt other measures.

A local oscillator was, therefore, constructed which could be coupled into the aerial. This was tuned by a small variable condenser having a fixed condenser connected in parallel with it, so that the tuning scale of the dial should be fairly open. In any case, it was only desired to cover a very narrow band of wavelengths, not more than 15 metres either side of 2LO.

Details of Circuit

The full theoretical circuit diagram of the apparatus used in the experiments is shown in Fig. 2.

The trap is shown at L_1, C_1, the points to be determined being the best size of L_1 the best value of L_0 —*i.e.*, the portion of the coil common to aerial and trap circuits, and the best value of C_1. The oscillator is shown at V_1, the grid coil which is tuned by the two condensers C_5 and C_6 being coupled to the aerial by a single turn coil L_4. L_6 the reaction coil was fixed so that once the instrument was calibrated no variation should take place.

L_2 and L_3 represent the aerial and grid coils of a detector circuit, each of these inductances being tuned by a variable condenser. The meter shown in the plate circuit of the detector valve V_2 serves to indicate the signal strength, and in order that a sensitive instrument may be used it is connected with a

SAYING "NO" TO THE LOCAL STATION—(Continued)

small battery and a high resistance in series across it, so arranged as to balance out the steady H.T. current passing though it and the valve. This enables the change in current owing to the signal only to be measured, an amount that may only be a tenth of the deflection produced by the H.T. current which is flowing through the meter.

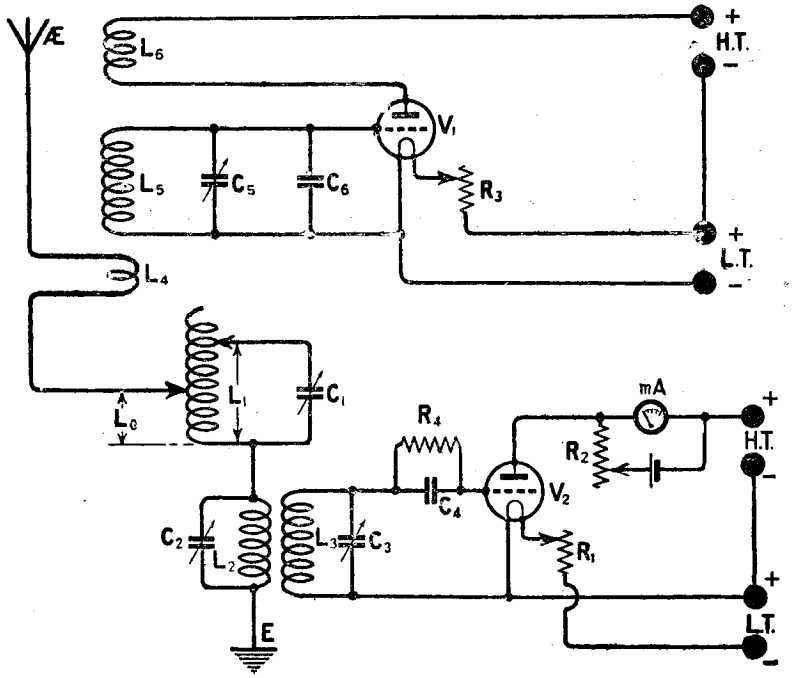


Fig. 2.—The theoretical circuit diagram of the apparatus used in the experiments.

Procedure Adopted

The procedure in making the various measurements was as follows: With the particular trap coil and adjustments being used the local oscillator was tuned to 2LO's wavelength, and with the trap condenser set at zero the largest possible deflection was obtained on the meter and noted. The trap condenser was then rotated till the greatest trapping effect was obtained—*i.e.*, the lowest possible signal reading resulted on the meter.

The trap was then left set and the oscillator was set to different wavelengths and the maximum signal obtainable was read on the meter.

It was thus possible to find out exactly what effect the trap had on signals transmitted on a wavelength close to that of the signal being eliminated as well as the trapping effect on the unwanted signal. The readings obtained were all tabulated and curves drawn from them, but since over two thousand readings were taken further details would only weary the reader and are therefore omitted.

Finding a Suitable Coil

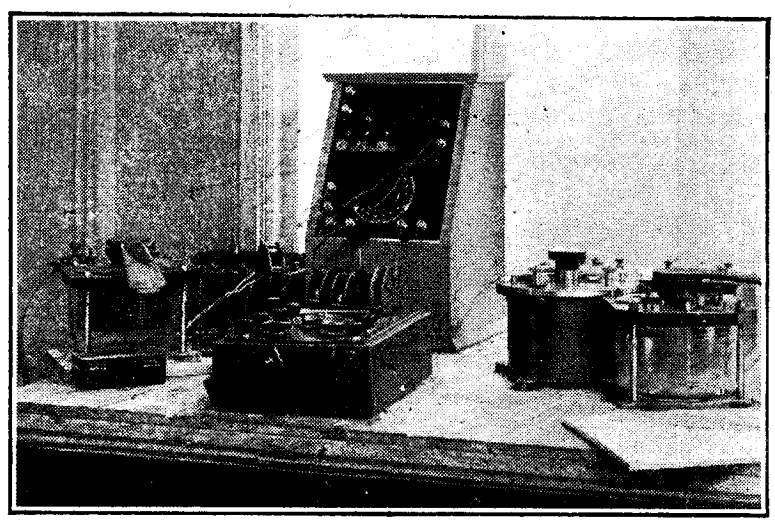
The first point to decide was what was the most suitable coil to use, and for this purpose about a dozen different inductances were constructed of different sizes wound with various gauges of wire, a preliminary series of readings being taken to determine their suitability. The result showed that the most suitable coil was the three-step coil designed by Mr. G. P. Kendall, and this was accordingly used for taking the bulk of the readings.

Information was next required as to the influence on the action of the trap by the position of the aerial tap, and therefore readings were taken starting with the tap at the bottom of the coil at every three turns up to the top. This established the fact that the trapping effect which was very small with the aerial connected to the third turn became greater and greater up to about the 28th turn, at which point the undesired signal was completely eliminated. At the same time the effect on neighbouring wavelengths also became greater. If, for instance, with the aerial connected to the 18th turn a signal on Manchester's wavelength was received with only a reduction of 10 per cent. of its normal value, then if the aerial were connected to the 24th turn a reduction of, say, 25 per cent. resulted.

It was therefore established that the aerial tap must be as near the bottom of coil as possible—*i.e.*, L_t must be as small as possible.

Effect of Resistance

The effect of adding resistance to the trap circuit was next tried, and it was found that the effect was to make it necessary to increase the value of L_0 in order completely to eliminate the undesired signal. This, accordingly, made the recep-



In the investigations on wave traps a separate oscillator was coupled to the aerial by a single turn coil.

SAYING "NO" TO THE LOCAL STATION—(Concluded)

tion of signals on a near-by wavelength more difficult.

The next series of readings taken showed that the position of the aerial tap which just gave complete elimination of the unwanted transmission was to all intents and purposes independent of the size of the trap coil. In the case of the aerial on which all the readings were taken this was located at the 18th turn.

These readings further indicated that as the size of the trap coil was increased, so the curves showing the trapping effect became steeper and steeper—*i.e.*, the effect on near-by wavelengths became less and less.

A Special Coil Tried

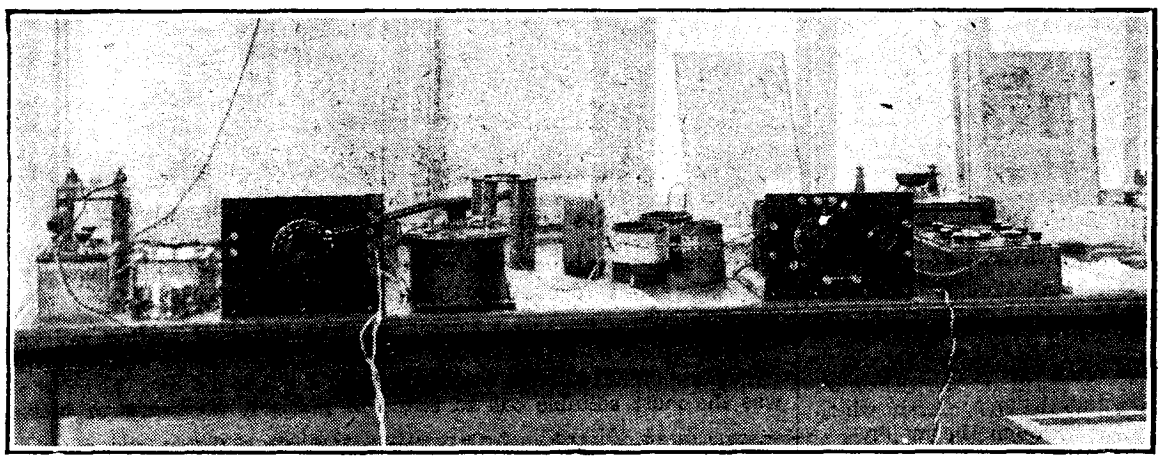
A special three-step coil was therefore constructed, twice the size of the standard one, and readings continued with this. The aerial tap still remained at the 18th turn, and the curves showing the trapping effect became extremely steep. These curves were not symmetrical, but showed that the effect on wavelengths below that of the signal being cut out was greater than that on those above. Thus, when the trap was set to cut out 2LO signals on a wavelength of about 373 metres (approximately the wavelength of Union Radio Madrid) would be received without diminution in strength, but it was necessary to go down to close on 330 metres before the same applied.

A Curious Point

A curious point noted was that when untuned aerial coupling was used signals on the higher wavelengths were received at increased strength when the trap was set than without it, this being due to a partial transference of the trap inductance, and perhaps also its tuning capacity to the aerial circuit proper. This, however, was eliminated when the aerial coil was tuned as shown in Fig. 2.

Since the trapping effect showed a decided improvement with the larger coil, further inductances were placed in series with it till a point was reached at which no further improvement resulted, but rather the reverse.

The results obtained showed that the limit reached in the size of the trap coil was due to the rise in the resistance of the trap circuit, the ideal trap of this type consisting of a very large inductance tuned by a very small capacity.



Some of the apparatus used by the author in his experiments. A number of the coils tried may be clearly seen.

In the experiments carried out the limit was found to be at a value of 750 microhenries for the trap coil. After this the results obtained grew worse.

Between 750 and about 500 microhenries little difference was observable, and from 500 to 200 results fell off slowly; below 200, however, they fell off more and more rapidly.

Results of Experiments

We now come to a brief consideration of some practical work done in actual reception which was carried out in the light of the results obtained above.

The first point noted was that it was not necessary (at a distance of about 12 miles) entirely to cut out 2LO in order to receive Manchester or Cardiff. As long as 2LO was reduced to about 5 per cent. of its normal value both these last stations could be received without interference. This occurred when the aerial tap was connected to the 15th instead of the 18th turn. As was indicated by the readings obtained, stations above 2LO's wavelength were received at greater strength than without the trap, while it was necessary to go down as far as about 330 metres before transmissions were received at normal strength.

Increasing the Turns

With the aerial connected to the 21st turn, however, Manchester became almost inaudible and Bournemouth was greatly reduced in strength, and as the tap was moved up the coil Newcastle was the next to be affected, and so on. This agreed in every way with the results given by the readings.

Effect of Coil Size

Several points of interest were noticed while carrying out the reception tests with the trap. One was that the size of the aerial coil affected the position of the aerial tap on the trap coil. In the case of the particular aerial in use a larger aerial coil allowed the aerial tap to come further down the coil, thus giving a sharper curve and less reduction on neighbouring wavelengths. At the same time the extra resistance introduced by the use of a larger value of inductance tended to produce a flatter curve. The result was that, though not critical, a certain value of inductance was indicated for the aerial coil for the best overall efficiency, this being found by experiment.

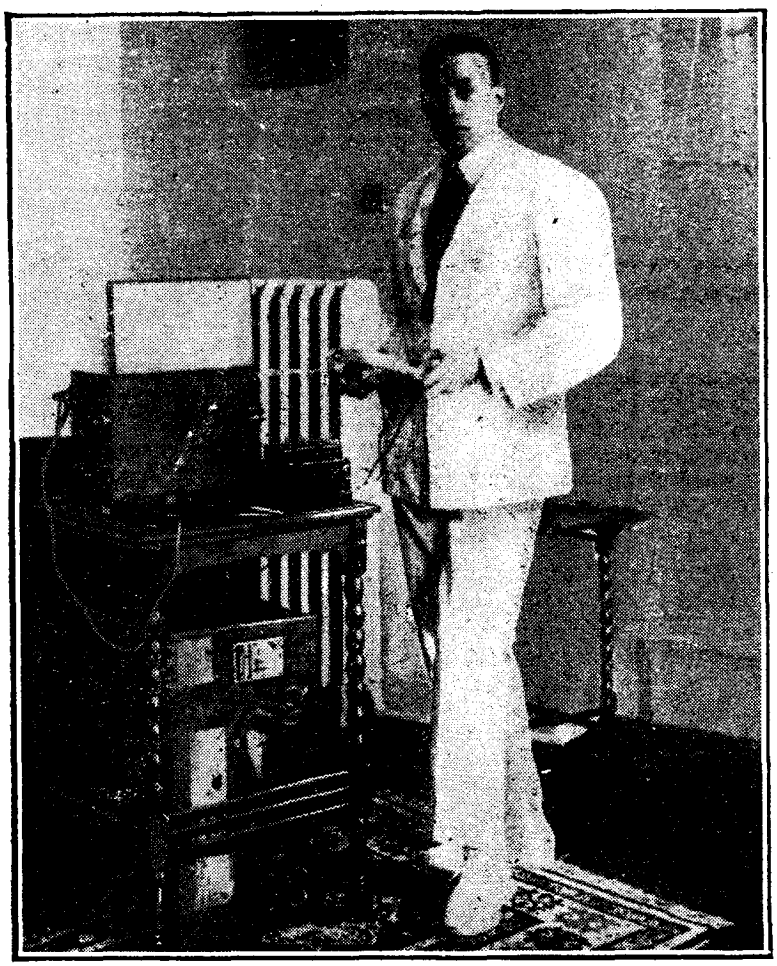
HOW BRITISH BROADCASTING IS RECEIVED ON THE CONTINENT

By

Capt. L. F. PLUGGE,

B.Sc., F.R.Met.S., F.R.Ae.S.

Capt. Plugge, who has travelled extensively in other countries, gives in this article a highly interesting account of his results in the reception of British stations during his travels.



The author with his receiving set during one of his visits to Italy.

THE value of propaganda was very much exemplified during the late war, and probably at no other time during our existence has its value been more readily realised. In those days broadcasting had not reached the advanced stage which it has attained to-day, and it is an interesting matter of conjecture as to what effect broadcasting would have had on the war had there existed such a service as we enjoy at present. It is not impossible that the whole course of the war might have been altered thereby.

Effect of the War

With a number of citizens possessing licences such as there is to-day, it would have been a very difficult matter to forbid the use of wireless receiving apparatus, and if any such law had been passed it would certainly have been disregarded by many, with the result that each of the countries which were at war could have poured out an enormous amount of propaganda for use in other countries. This would no doubt have had great influence on the morale of some of these countries.

British Prestige

Such remarks are to illustrate more important points which I wish to elaborate. There is in war as in peace no more thorough method of propaganda for a country than broadcasting. To those of the British public who always remain in England the value of such propaganda may not be so readily evident, but to the one who travels in the numerous countries of the Continent the value to British prestige of the British broadcasting services at once appears.

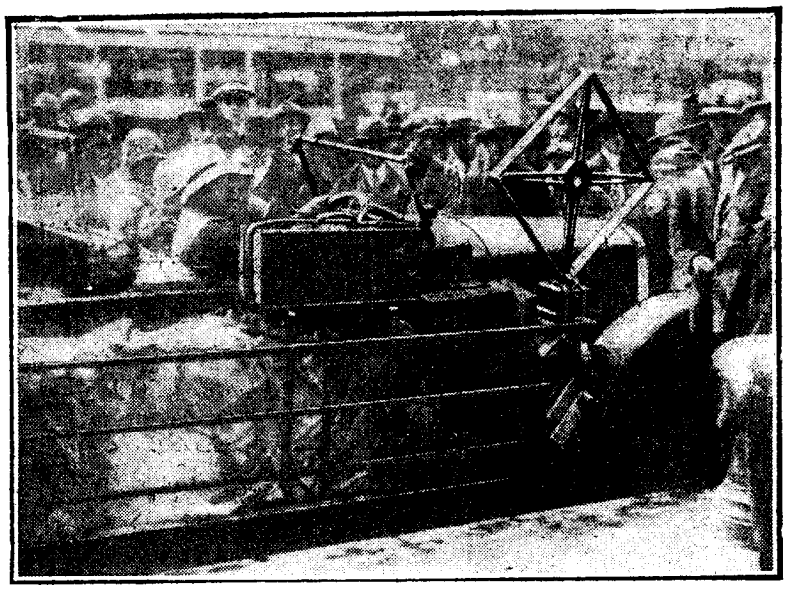
Long Waves Popular

Two years ago I was busy testing from abroad the working of our minor stations, and probably some of my readers who have seen my previous writings may remember my journey through central Europe with a portable set. During these travels I was struck by the popularity of British transmissions in Europe, where I found that there was hardly a listener in all the countries I visited who did not recognise and appreciate them. It was easy to explain this, because most countries had not adopted the system of a great number of stations but were more in favour of the idea of high-power stations, few and far between. Nearly all listeners therefore possessed instruments constructed with valves, together with a large aerial and large inductance coils. Reception of 5XX was possible in Germany, Austria, Hungary, Italy, Spain, France, Belgium and Holland on a one valve set using reaction.

These early days, although only two years back, seem far behind to-day, as the new science of wireless develops with giant strides. But so was it in the past, and we must be proud of the position so early gained by us in the radio world.

The Present Tendency

To-day conditions of reception abroad have still further developed



In one of his travels on the Continent Capt. Plugge carried a superheterodyne receiver provided with a special attachment for securing it to his car.

and although Daventry is listened to to a very great extent, other smaller stations of the British Broadcasting Company have become very popular with many Continental listeners. This comes from the fact of the increase in the maximum range of receiving instruments, and also the greater skill of their operators, and for this reason a great number of listeners abroad tune in the smaller stations preferably. There is yet another reason: several great centres are places near to a local high-power station using a long wave; under these conditions the more distant shorter wave stations can be heard better than the high-power ones.

An Example

As an example I might mention Paris, where the proximity of both the Eiffel Tower and Radio-Paris make it rather difficult for a French listener to tune in Daventry, whereas he can more easily tune in Bournemouth, which, by the way, is one of the British stations most listened to in the western and southern countries of Europe. A similar condition exists in the Scandinavian and other more northerly countries, where stations such as Edinburgh, Newcastle, and Aberdeen are the favourites.

Sweden and Denmark

During last winter I travelled in Sweden and Denmark, taking with me a seven-valve supersonic heterodyne with a frame aerial, and I was then able to make many interesting experiments on the reception of British stations from across the North Sea. I listened both while travelling by rail and also in the various towns, and found reception of many of our smaller stations, as well as of Daventry, extraordinarily good.

Forethought

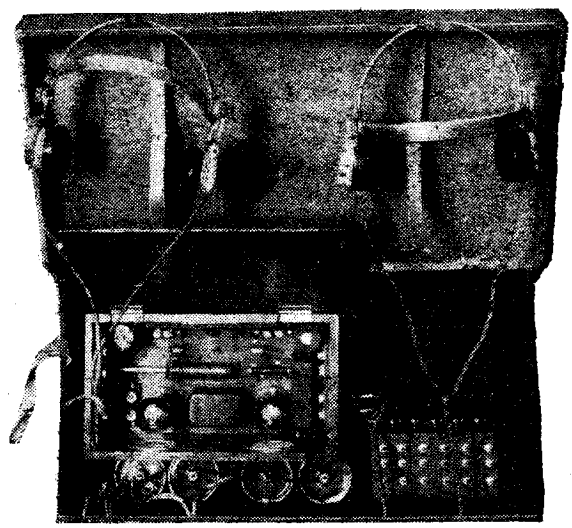
In Gothenburg, for instance, it was not difficult to tune in to British transmissions, as the Gothenburg station itself is situated some three miles out of the town, in order to permit reception from long distances without undue interference from the local station. The same forethought has been employed in the erection of the Malmo and Sundsvall transmitting stations. Sweden ranks with Britain and Germany among the foremost nations of Europe in radio matters, and it is interesting to meet in every town, as the Briton travelling there is bound to do, wireless enthusiasts who are quite familiar with the affairs of Britain as transmitted from her broadcasting stations.

Relaying our Programmes

The Swedish broadcasting service itself has helped greatly to foster this interest in foreign radio, by frequently relaying some of the best British programmes, thus making it possible for the crystal user to become acquainted with the excellence of these programmes.

Closing Down Times

There are many reasons which made British stations popular among the inhabitants of the continent of Europe. The first one, no doubt, is the excellence of the programmes and their variety, and the fact that British language, taste and culture are much admired throughout Europe. But there are other reasons. We in this country are situated at the western end of Europe, and consequently our normal time, Greenwich mean time, is behind the time used in most European countries which work their clock on Central European time. The result of this is that all our programmes which are correspondingly timed by the clock continue one hour later in Central European time, and this of course brings our closing down time to the early morning.

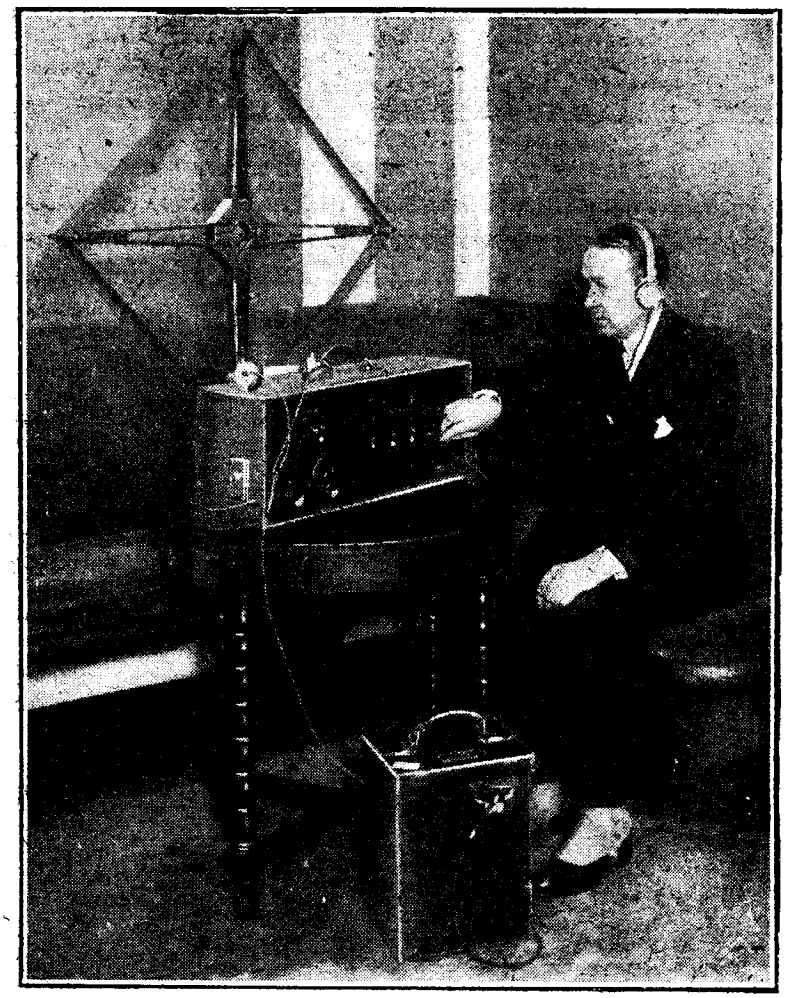


During his early investigations on Continental broadcasting the author used the small portable set illustrated.

How British Broadcasting is Received on the Continent—(*Concluded*)

Good Propaganda

In addition, the broadcasting provided locally in some of these countries not being as extensive as the service we provide, many of such stations close somewhat early. This also makes the amount of British broadcasting available with non-selective sets greater still. In such countries as Sweden, Switzerland, Austria and Italy, where stations offer short programmes, enthusiasts are still able to listen to British stations until one and sometimes three in the morning, giving them a clear three to five hours of clean ether in which to tune in British stations, and consequently gradually to get an insight into our activities, and to appreciate what we are doing over here. What more wonderful propaganda could we give? Twenty stations of ours working practically alone on the ether for three hours every day, with the great majority of listeners on the Continent tuning in to them.



Here we see Capt. Plugge listening to British broadcasting at the time of his visit to Scandinavia.

Reception in Rome

When I was in Rome last year I had with me my greatly travelled supersonic heterodyne, and used it on several occasions in the lounge of the hotel where I was staying. This room was on the ground floor in the centre of Rome. During a time when the dance bands were playing in London, I tuned in every British Broadcasting Company's station, and I found the following to be the order of strength in which the stations were received, everything else being equal, and comparisons being made every half hour. The most powerful station was Bournemouth, after this came Birmingham and then London, Glasgow and Aberdeen, which came in almost equally. Then came Newcastle, Manchester, Cardiff and some relay stations. Daventry, which I expected to be loudest came third, before 2LO, but was not so strong as Bournemouth and Birmingham. I might mention here that Cardiff was one of the most difficult stations to listen to, and this has been the case in many countries where I have tried to tune in this station. Everywhere in the east, in the west and in the south of Europe, Bournemouth appears to be the best of all our British stations for long distance reception. This may be caused, to a large extent, by its geographical situation, on the south of England, on the sea shore; but it must be partly due also to the technical excellence of its construction, and also doubtless to the fact that its aerial is on high ground.

In Sweden

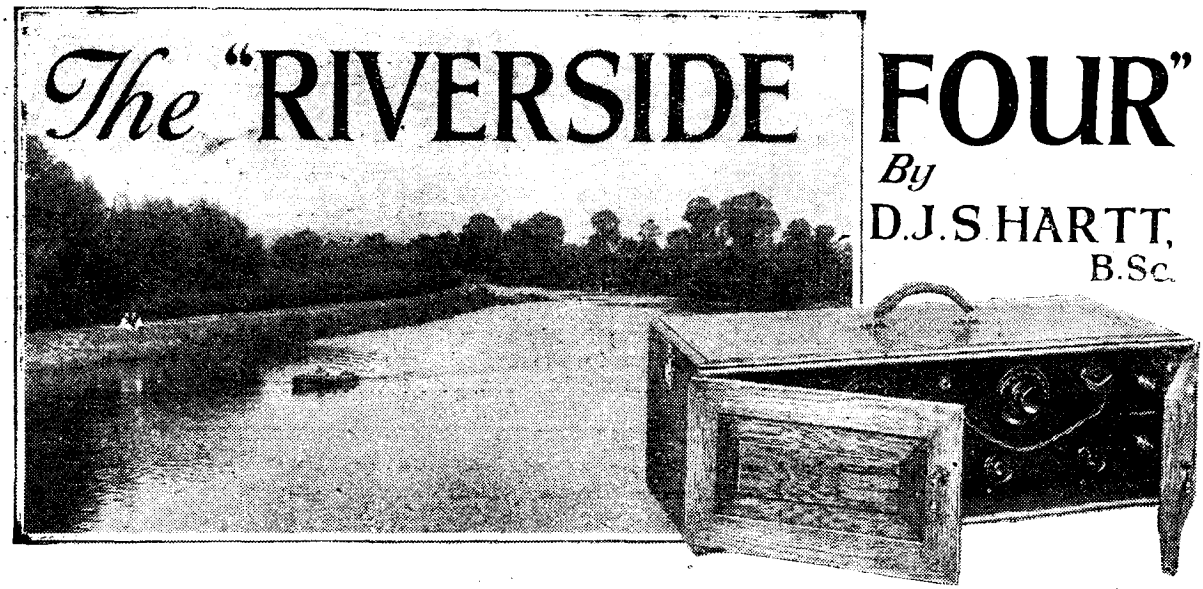
When I was in Sweden, I naturally received, in the manner I had anticipated, some of the northern stations such as Edinburgh and Aberdeen very well; but here again, to my astonishment, Bournemouth was also very powerful. There is certainly something in connection with the Bournemouth station which makes it what I might term a "low power long range station."

In Holland

Every amateur I met during my travels through Europe was always a listener to the British stations, knew the names of the announcers, knew by heart the hours and length of transmissions, because they consistently listened to our service. When I was in Holland I was speaking to a well-known wireless amateur while his loud-speaker was working straight on Daventry. It is the British Broadcasting Company's service which really provides the backbone to wireless industry abroad, and if amateurs abroad do listen to their own stations, they listen equally as much to the British stations as a rule. The value of this propaganda from the point of view of British ideas, British institutions, British methods, and British industry is enormous.

The "RIVERSIDE FOUR"

By D. J. S. HARTT, B.Sc.

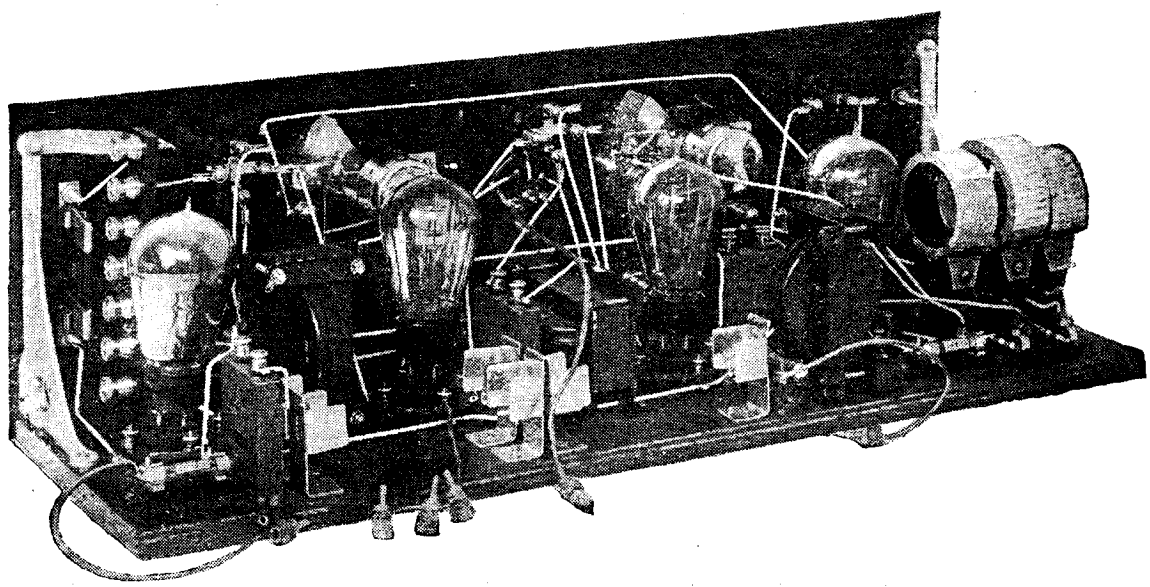


This attractive four-valve receiver employs three stages of choke-coupled low-frequency amplification, and is capable of giving great volume from the local station. By means of a simple switching arrangement it is possible to use two, three, or four valves as desired.

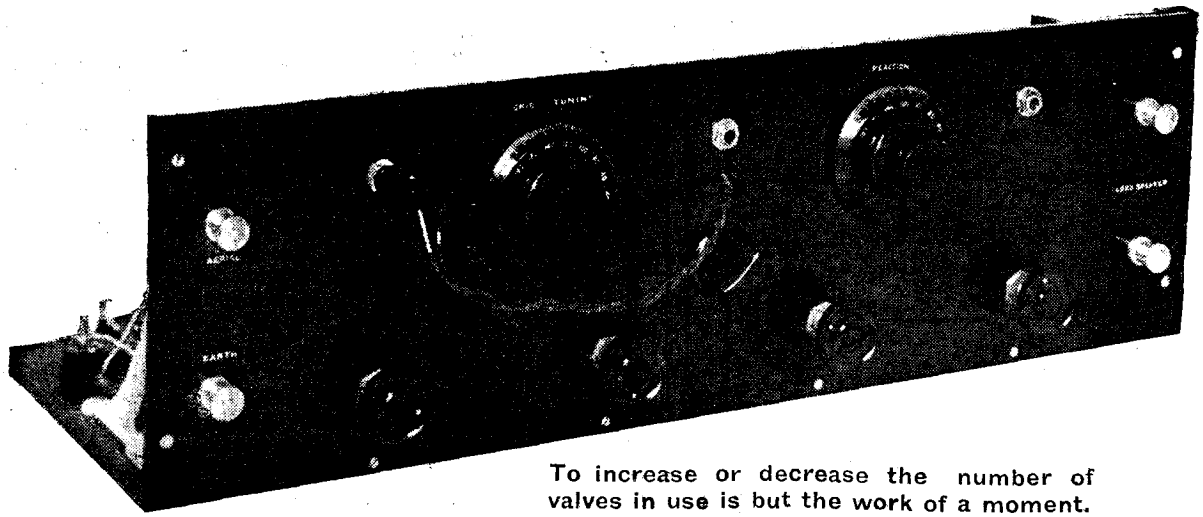
THERE are many occasions on which the need is felt for a set capable of giving considerably more volume than is required for ordinary domestic purposes. This is particularly so during the summer months, when even the most ardent wireless enthusiasts experience the call of the open air just like any other persons. Experience shows that the average set which gives perfectly satisfactory loud-speaker volume for a moderate sized room is somewhat inadequate to supply the necessary volume for entertainment at a river party or at the tennis club, particularly if the loud-speaker is installed in the open air. Undue forcing to increase the volume is never satisfactory, since the quality of reproduction usually suffers.

A Powerful Set

It was to fulfil the need for a powerful receiver giving sufficient volume even for outdoor purposes that the present set was designed. Up to about fifteen or twenty miles from a main station this set should satisfy most requirements for loud-speaker work, while the quality of reproduction, even when working on full volume, should satisfy the most fastidious. The set has been in use on numerous occasions to entertain a large number of people, both out in the open and in a fairly large hall, and many have expressed surprise at the excellent reproduction.



The metal clips seen in the foreground are for the purpose of holding the grid-bias batteries.



To increase or decrease the number of valves in use is but the work of a moment.

An All-Enclosed Cabinet

Inspection of the accompanying photograph will show that the receiver has been built up into a cabinet which can be completely closed up, so that the set can be totally enclosed to protect it from dust and the effects of strong light. Hinged doors, opening to show the panel, are provided at the front, while the lid is hinged at the back and opens completely to give access to the interior. Aerial, earth, and loud-speaker connections are made to terminals on the panel; the battery connections are made to a number of terminals on an ebonite strip supported vertically inside the set, a small hole drilled in the right hand side of the cabinet allowing these leads to be brought through to their respective batteries.

The Circuit

Let us now turn to the consideration of the circuit diagram shown in Fig. 1. It will be seen that there is a detector valve with gridleak and condenser rectification and three choke-coupled low-frequency amplifying valves. Condenser controlled reaction in the manner first introduced, I think, by Weagant, is provided on the detector valve.

The Switching Scheme

In addition, several interesting features are incorporated. By means of the jacks J_1, J_2, J_3 and the plug P, it is possible to use two, three or four valves, but whatever combination is in use the valve V_4 is always in use as the last valve, so that a special loud-speaker valve may be employed here. With some other systems of jack switching where the loud-speaker is inserted in the anode circuit of each valve in turn, the valve which is used as the last valve in some combinations is not necessarily suitable for the purpose, so that the system employed here possesses distinct advantages. In any case the valves which are not in use may be turned out on their rheostats.

Volume Control

It is often found with a powerful set that, say, three valves give a trifle too little volume but four valves perhaps slightly overload the loud-speaker. It is in such cases that some form of volume control is desirable. Some people

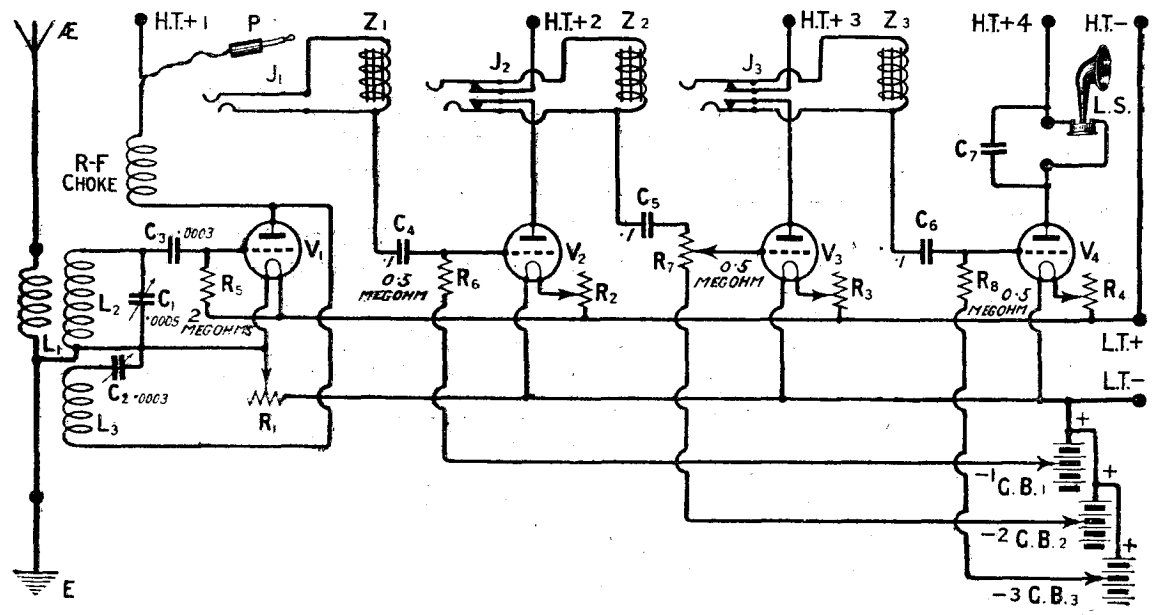


Fig. 1.—The variable resistance R_7 enables the volume to be adjusted to suit the wishes of the listener.

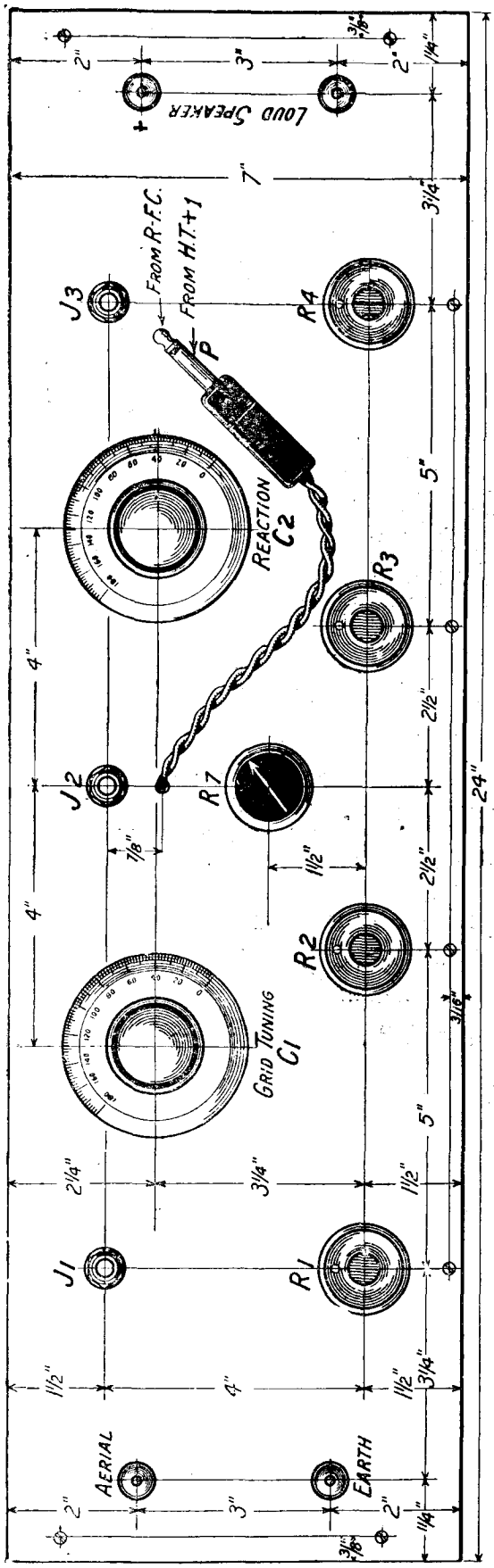


Fig 2.—The symmetrical panel layout makes the marking out a simple and speedy operation. Blue Print No. 166a (full size) may be obtained free.

The "Riverside Four"—(Contd.)

resort to turning down the valves a little, reducing the high-tension voltages or detuning slightly. With the exception of the latter method, such schemes are unsatisfactory. The method adopted in the "Riverside Four" is particularly interesting. The half megohm grid-leak on the third valve is made in potentiometer fashion, having three terminals, two for connection to the resistance and one connected to a sliding contact. When the movable contact is at the top end of the resistance (that end connected to the ·1 condenser) full volume is obtained; and this is reduced gradually to a mere whisper by rotating the knob on the "modulator."

Low-Frequency Chokes

Now a word or two about the iron core chokes. It is important that these should be wound to a high impedance, and those used are manufactured by W. G. Pye & Co., Cambridge. These have an inductance of 110 henries, and thus have an impedance of nearly 700,000 ohms at 1,000 cycles, and about 70,500 ohms at as low a speech frequency as 100 cycles.

Grid Bias

It will be noted that separate grid-bias batteries are used for the last three valves, a practice the author favours in multi-valve low-frequency amplifiers, since it eliminates a possible source of interaction between the stages.

A tone control condenser C_7 is provided across the loud-speaker terminals. The best value for this will depend as usual on the particular conditions in operation and may vary from ·002 to ·008 or even ·01. A good average value is ·005, and although this value is specified in the list of components, it is wise to try a range of values here.

FixedCoils

Although the receiver is intended primarily for loud volume and good quality from the local station or 5XX, it is nevertheless quite suited for the reception of the more distant stations. For this reason a tight-coupled aerial has been employed, consisting of the usual small coil L_1 coupled to the secondary L_2. With this scheme it is thus possible to employ three plug-in coils, L_1, L_2, and L_3, mounted on the base-board in fixed positions relative to each other.

Use as Amplifier

Another feature of the set worthy of mention is that the instrument may be used as an L.F. amplifier merely by inserting a plug from the output into any of the jacks J_1, J_2 or J_3 according to the number of valves it is desired to use, those not in use being switched off by their respective rheostats.

Terminals for a separate high-tension tapping to each valve have been employed, so that each valve may be adjusted for the best operating conditions.

This may seem an unnecessary complication, but it is useful to have some such scheme in practice, and in any case the terminals may be linked if it is thought that so many separate tappings are unnecessary. It is, however, essential to have a separate tapping for the detector valve.

MAXIMUM VOLUME WITH GOOD REPRODUCTION

Materials Necessary

For those who desire to duplicate the receiver exactly, a complete list of the necessary materials and the names of manufacturers or trade-marks is appended. Certain of the components may be interchanged for others of good quality, but before any such step as this is taken, the constructor should make quite certain that there is adequate room for the particular component in question.

Three single coil mounts (L. McMichael, Ltd.).

One single open circuit jack (Ashley Telephone Co., Ltd.).

Two double closed circuit jacks (Ashley Telephone Co., Ltd.).

One telephone plug (Ashley Telephone Co., Ltd.).

Three Mansbridge condensers, 0·1 microfarad (Dubilier).

One fixed condenser, ·0003 microfarad (Dubilier).

One "centralab modulator," 500,000 ohms (Rothermel Radio Corporation).

Four large terminals.

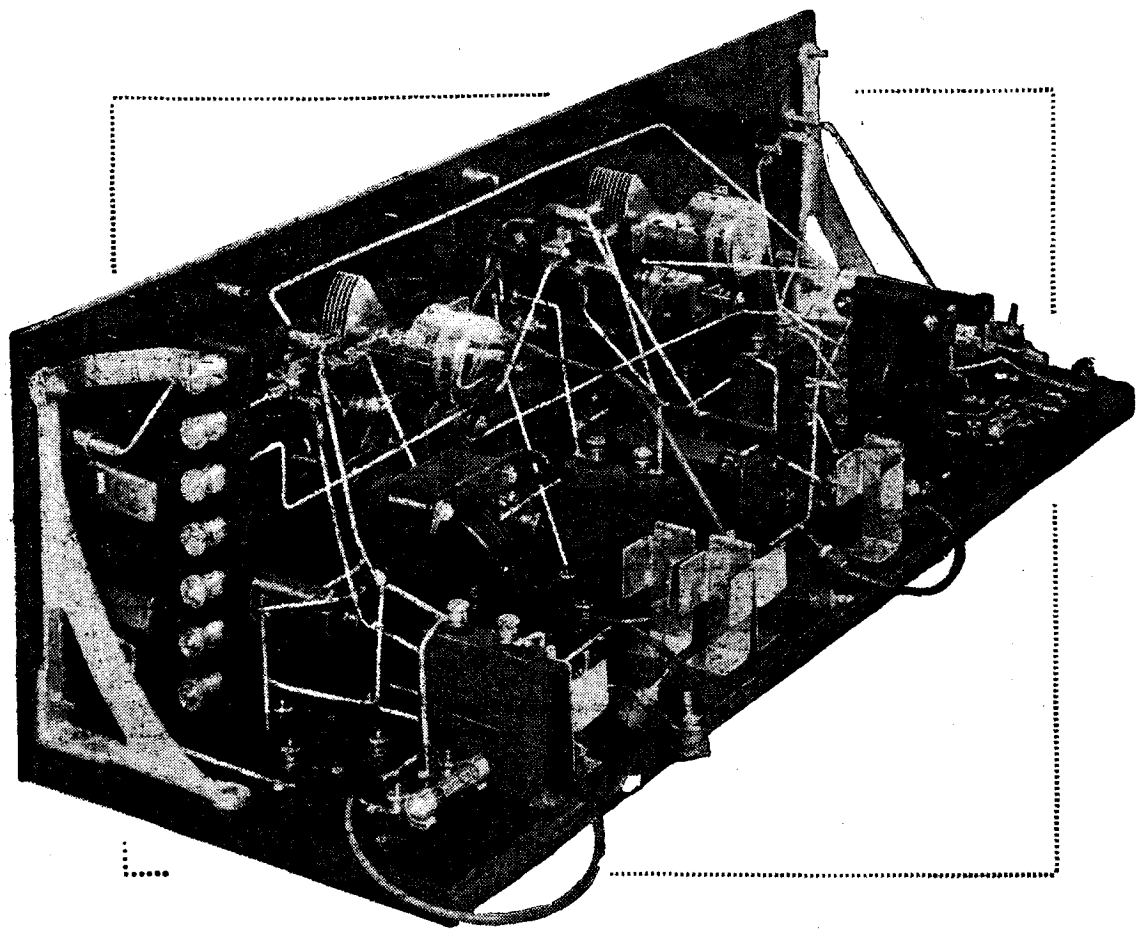
Seven W.O. type terminals.

One fixed condenser with clips, ·005 microfarad (L. McMichael, Ltd.).

Three pairs grid battery clips (A. F. Bulgin and Co.).

One cabinet as illustration (Pickett Bros.).

Radio Press panel transfers.



The terminal strip is secured by two short lengths of strip brass, the one at the baseboard end being bent to form a small angle bracket.

Three low-frequency chokes (W. G. Pye and Co.).

Four valve holders (Lotus).

Four filament resistances, 10 ohms (C.A.V.).

One variable condenser, ·0005, friction geared type (Ormond Engineering Co.).

One variable condenser, ·0003, friction geared type (Ormond Engineering Co.).

One radio-frequency choke (Lissen, Ltd.).

One grid leak, 2 megohms (Dubilier).

Two grid leaks, 0·5 megohm (Dubilier).

Three "Dumetohm" mounts (Dubilier).

One panel, 24 ins. by 7 ins. by 3/16 in. polished black (American Hard Rubber Co.).

One baseboard, 24 ins. by 8 ins. by ½ in. (Pickett Bros.).

One pair angle brackets (Peto-Scott Co.).

Wood screws, Glazite for wiring, rubber covered flex and six wander plugs for grid bias.

The Construction

The construction of the receiver should present no difficulty to anyone. First of all collect all the components together and assemble them on the baseboard to make quite sure there is ample clearance.

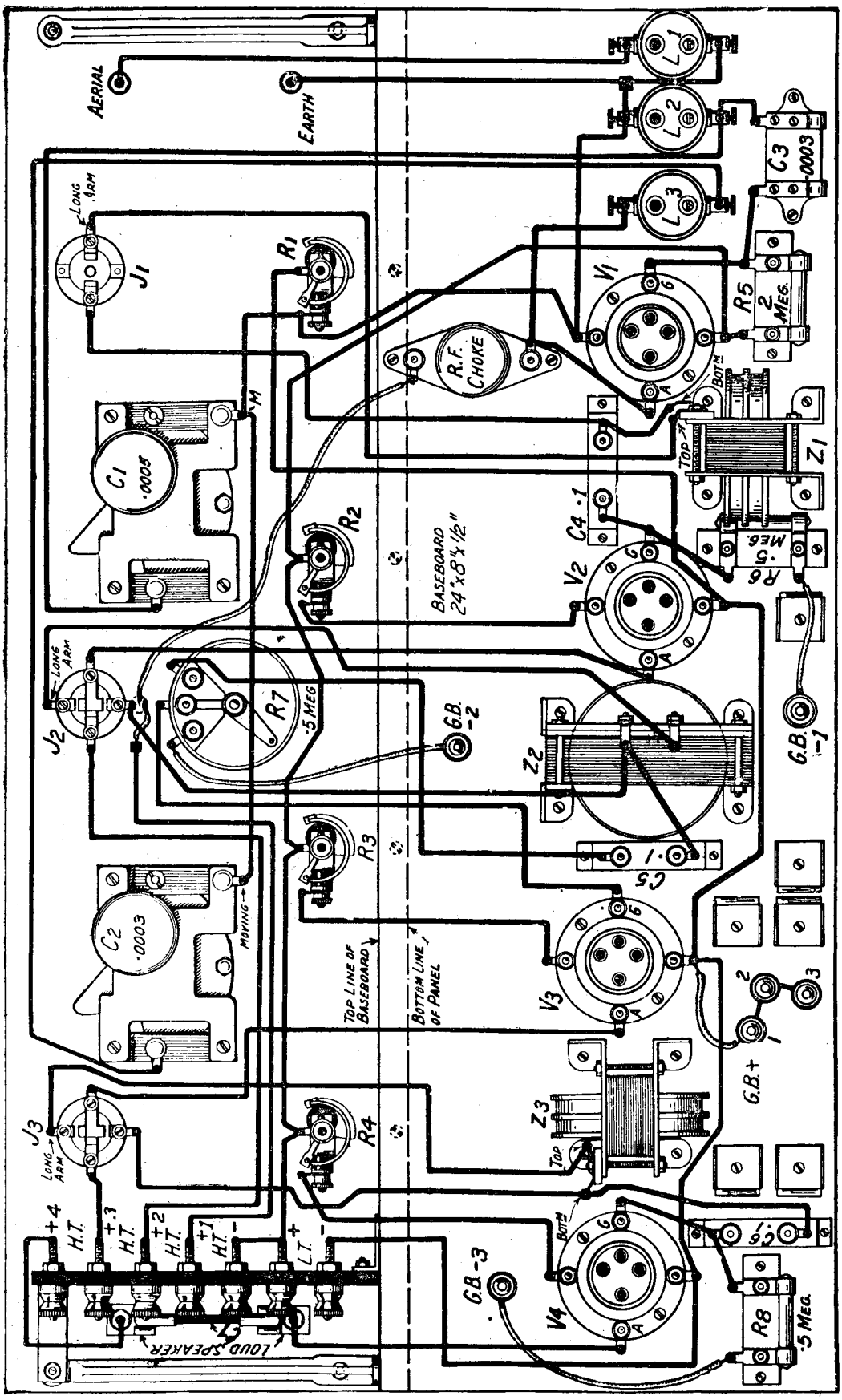


Fig. 3.—Note how the components have been arranged in order to ensure easy wiring, combined with adequate clearance. Constructors should ask for wiring Blue Print No. 166b (free).

THE "RIVERSIDE FOUR"—(*Concluded*)

Having satisfied yourself on this point, proceed to mark out and drill the panel from the drilling diagram.

Mounting the Components

After marking out the panel on the reverse side, drill the necessary holes, not forgetting those to take the fixing screws for the angle brackets. Drill and countersink also four suitable sized holes to take wood screws to secure the panel to the the front edge of the baseboard. Finally mount the components on the panel and secure the panel to the baseboard. After having cleaned and dusted the remainder of the parts mount them on the baseboard in the positions indicated on the wiring diagram and in the photographs. Notice particularly the positions in which the three low-frequency chokes are mounted.

The Terminal Strip

There remains only the terminal strip to be made before commencing the wiring. This strip should be cut 6 ins. by 1 in. by $\frac{1}{4}$ in. Holes are drilled at each end to take the screws securing the strip to the brackets. The lower bracket is simply an ordinary right angle brass bracket, while the upper one is easily made from a piece of strip brass. One end of the upper bracket is secured under the top fixing screw of the right-hand panel bracket.

Preliminary Tests

Having completed the wiring and made the conventional tests to ensure that the low-tension and high-tension circuits are quite correct, connect up the aerial, earth and loud-speaker, and insert the plug into J_3, thus bringing two valves into operation.

When you have tested out this combination of valves, try out the others by putting the plug into J_2 and J_1 successively. While each combination is being tried make adjustments of H.T. and grid bias to secure the best operation of each valve. At least 120 volts should be used on the last valve with suitable grid bias, say 6 to 9 volts. About 100 volts will suffice for V_3 and possibly 80 for V_2. Keep the high-tension voltage on the detector valve down as low as possible consistent with good results. About 60 volts should be regarded as maximum, but voltages as low as 30 will usually serve satisfactorily.

Valves to Use

The detector valve and V_2 should be of the high-impedance high-amplification ratio type, such as the special H.F. valves or those designed specifically for resistance capacity amplification; V_3 may also be of the same type, but if you are very near to the station this valve should be preferably one of lower impedance. In any case, the last valve should always be a low impedance valve of the D.E.5 type. When particularly loud signals are being handled V_3 may be a small power valve and V_4 a valve like the D.E. 5A.

Suitable Coils

A No. 25 or 30 coil will serve for L_1 for the broadcast range; the larger size may possibly be found of advantage on the upper part of the band. For L_2 a No. 60, or a 50 and a 75 should be used, while the reaction coil may be a No. 50, or smaller still if reaction over the whole tuning range can still be obtained.

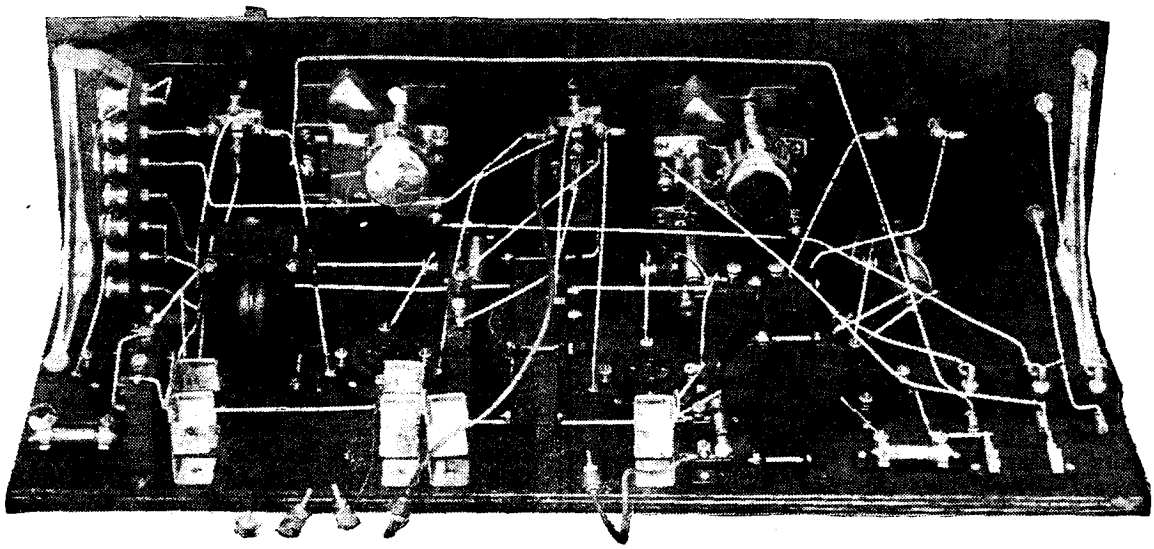
For 5XX, L_1 may be a 100 or 150, L_2 a 200 or 250, and L_3 a 150 or 200.

Use on Small Aerial

On a very small aerial consisting of about 50 feet of No. 22 enamel covered wire, suspended about 5 or 6 feet above the ground at 10 miles from 2LO, the set gives ample loud-speaker volume for the open-air.

Distant Stations

Other stations heard on the loud-speaker during the course of tests were Bournemouth, Newcastle, Birmingham, Glasgow, Radio-Paris, Berne, Eiffel Tower, Daventry, Petit Parisien, Berlin, and San Sebastian. Many others have been heard successfully on the 'phones. Radio-Paris and Eiffel Tower are hardly distinguishable from the local station.



Th low-frequency chokes have been placed in such a manner as to minimise the possible effects of interaction.

From my Notebook

By H. J. BARTON-CHAPPLE, Wh.Sch., B.Sc.(Hons), *Etc.*

FREQUENTLY in wireless matters we can trace a very interesting cycle of events which brings us back to some of the early types of apparatus which have been looked upon as obsolete. A typical example is found in the case of coils which originally were of the single-layer type ; then rapid developments occurred, during which many ingenious arrangements were adopted to reduce self-capacity and inherent losses and yet make the resultant inductance in a compact form. There is a tendency now to revert to the single-layer type, thin wire (or stranded wire) being employed to keep down the final coil size and produce an efficient component.

I am reminded of this and similar examples by reading that an earnest experimenter in Australia is devoting a great deal of time and energy in an effort to perfect a receiving set which will require neither crystal nor valve for reception purposes. The details whereby rectification and amplification are made possible are naturally not yet available, but encouraging results are claimed up to the present. Is this another case of coherer, crystal, bright emitter valve, dull emitter valve and—— ?

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THE growth in the number of wireless receiving licences proceeds apace, as the total given recently by the Postmaster-General for this country and Northern Ireland was 2,050,000. This colossal figure is indicative of the manner in which wireless has become an accepted part of our daily life, giving inestimable benefit to old and young alike.

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NOW that the summer months are with us it is essential to pay due attention to the increased possibilities of evaporation and its resultant effect on reception. There are two main sources of trouble, viz., the accumulator and the earth system. It is surprising how the electrolyte evaporates if the stoppers are not replaced in the accumulators after "topping." So when the batteries are collected from the charging station note that the stoppers are in position.

In addition, every effort must be used to ensure that the earth system is kept in a damp state. The time spent in frequent waterings will reflect itself in the resulting improved signal strength if this is borne in mind.

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AT some of the foreign broadcasting stations there are regulations in force which restrict political observations being made over the ether, except on special occasions when a permit has been obtained. This fact was brought home to some listeners recently when a minister was preaching a sermon. Suddenly the service appeared to stop, and the voice of the announcer was heard informing listeners that the preacher was touching on a political side of his subject and consequently the discourse had been cut off. After a few minutes' pause the minister returned to the religious aspect and the remainder of the sermon came through without interruption.

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BEFORE taking the loud-speaker into the garden to enjoy the wireless programme in a more congenial environment while the warm evenings are with us, it is necessary to ensure that the volume of sound coming from the loud-speaker is adequate. The absence of the walls of the room and the consequent sound reflections will have the effect of reducing the apparent volume, and a re-adjustment of the receiver controls will probably be necessary to compensate for the sound waves which are now directed into space.

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ON many occasions recently I have had an opportunity of listening to a superheterodyne receiver working with seven valves direct from alternating current mains. The signals

FROM MY NOTEBOOK—(Continued)

were particularly free from that unpleasant hum which is sometimes associated with mains units.

On the L.T. side the rectifier charging unit was in circuit with the accumulator in a "floating" condition across the output, the procedure adopted being to work with the unit functioning on alternate days while employing the accumulator alone on the remaining days. On the H.T. side a special valve rectifier device was doing yeoman service in a particularly satisfactory manner.

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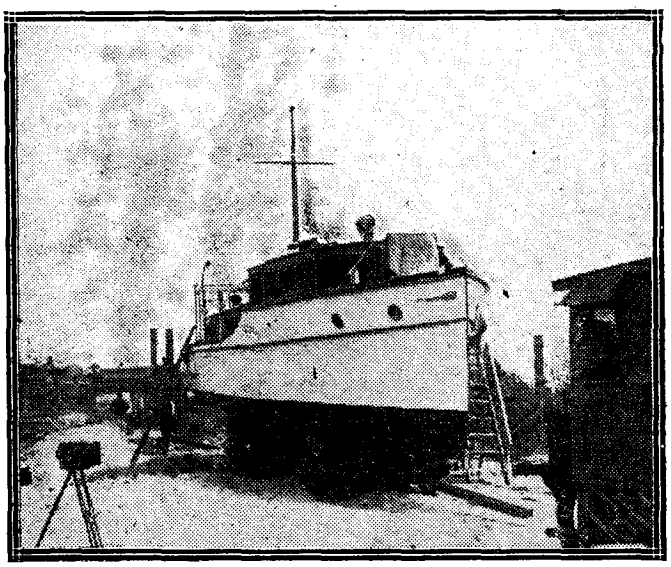
A LARGE number of the aerial-earth switches which one sees in the houses of wireless listeners give one the impression that little attention has been paid to this detail. An efficient switching arrangement should always be installed, especially if careful attention has been given to the aerial system as a whole in an effort to improve reception. Many people prefer the type of switch which earths the aerial outside the house when the receiving set is not in use, so that if lightning should by chance strike the aerial, its passage to earth will not be through the wooden framework of a window (or similar positions) and partly inside the house, but wholly external.

This is a point which merits attention, and contacts which are exposed to the full benefit of the weather need periodic cleaning. Many switches now incorporate patent lightning devices, thus giving a measure of safety under all conditions whether the set is in use or not.



The "MU—I," which is operating in American waters. This ship has been allotted the call letters WRMU and will work as a regular floating broadcasting station.

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HAVE you ever considered what happens to the energy broadcast from the transmitting station? It travels outwards in all directions, and some of the energy is lost in overcoming the resistance offered to its progress, or, in other words, we say the wireless waves become attenuated. Now these wireless waves travel round and round the world and in their progress become attenuated, reflected and refracted, but theoretically the energy available is never reduced to complete zero.

Is it then possible to receive a wireless message that was transmitted, say, a month ago? Some scientists have said it is possible, but the probabilities of such reception are in the realms of imagination until the super-sensitive receiver is designed.

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IT is stated that Mexico is to improve the efficiency of her communication with other parts of the world by installing a new short-wave station. It is to be located in Chapultec Park, Mexico City, and the power is rated at 500 watts, trans-oceanic service being the main reason for the erection of the station.

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GREAT strides have been made in the development of what we may term "talking pictures," and in the latest phonofilm each film carries its own sound record, which runs down one side of the individual photographs which go to make up the complete film.

The problem of synchronisation between sound and picture, which previously had been an extremely difficult one, thus appears to have been solved satisfactorily. A special device translates the varying currents from the microphone into light of varying intensity which is made to effect the specially prepared cinematograph film, thus making a permanent record. An ingenious arrangement is adopted to prevent the sounds of the projector mechanism from reaching the microphone, and thus being instrumental in producing an unwanted sound record on the film.

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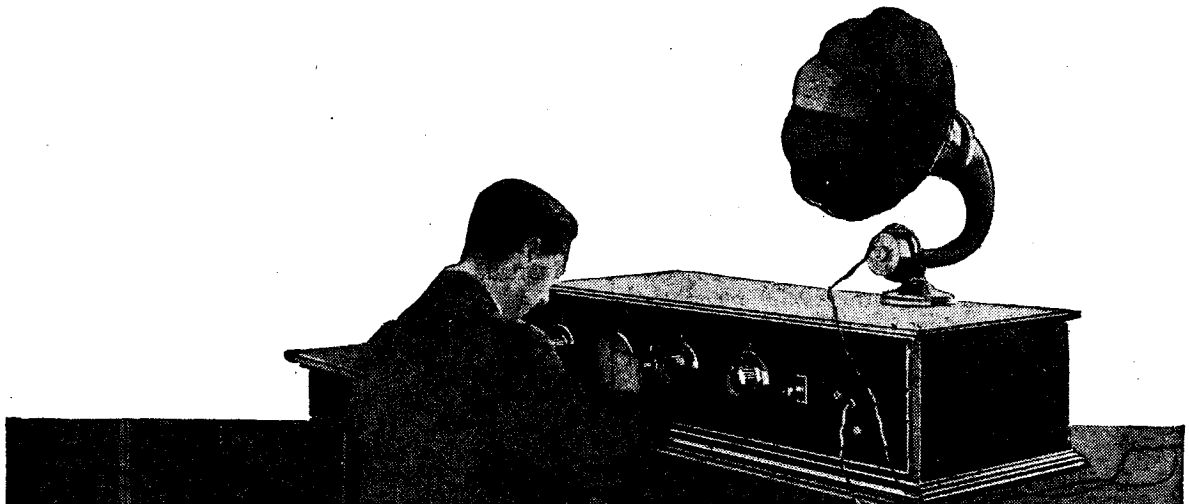
WHEN examining any wireless component before purchase is made make quite sure that it gives every indication of fulfilling its particular function *both* mechanically and electrically, for it is only by this ideal combination that the receiving set will ultimately be capable of achieving the purpose for which it is designed.



OPERATING THE "ELSTREE SIX"

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

PRACTICAL DETAILS OF ADJUSTMENT AND NEUTRALISATION

Testing the Set

THE testing out of the receiver will be found at first to be a little difficult. This is because searching has to be accomplished on all four tuning dials, and it takes a little time to get used to the handling of so many tuned circuits. The process, however, is considerably simplified by the fact that all the dials read approximately the same.

Neutralising

The best procedure is as follows: Disconnect the aerial from the receiver, and place all the dials at approximately the same reading. It will probably be found that the receiver oscillates violently. Adjust the last neutralising condenser until the oscillation ceases. A position will be found that will check the oscillation as far as the last condenser is concerned, but the third condenser will still probably cause the set to go in and out of oscillation.

This oscillation may now be checked by an adjustment of the second neutralising condenser, and finally the stabilising may be completed by adjusting the first condenser until oscillations cease in the first part of the circuit.

When this state of affairs has been reached, it will be found that if any one of the neutralising condensers is varied, there is a small band over which the receiver is stable, but on each side of this oscillations set in. The neutralising condenser may then be left at approximately the middle position of this stable band. If this is done on all the three neutralising condensers, then the tuning condensers may all be moved together from top to bottom of the scale, and it should be found that however these condensers are varied, no oscillations are produced at any part of the scale. The receiver is then completely stable, and the aerial may be connected preparatory to receiving signals.

The "ELSTREE SIX," first described in the June "Modern Wireless," has taken the World of Wireless by storm.

Within a few days of publication hundreds of readers availed themselves of the Editor's invitation to visit Elstree and hear the set at work and without exception expressed themselves delighted.

This article tells you how to get the best out of the set with the minimum of trouble.

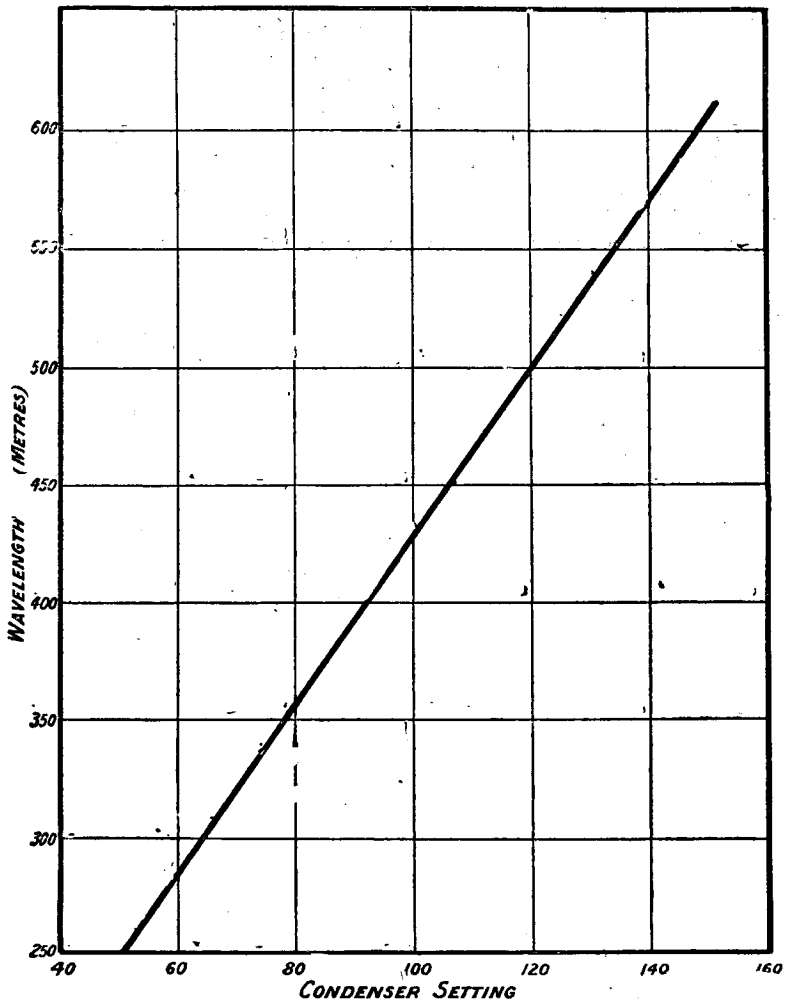
A Useful Hint

If Peto-Scott neutralising condensers are employed, it will usually be found that the stable conditions appear when the condenser is about one-third of the way in, *i.e.*, one-third of the maximum capacity. The position is illustrated in the wiring diagram. It should be noted that the reaction condenser must be at the minimum during the stabilising operations, as otherwise the last circuit may oscillate, and, of course, such oscillations would not be checked by the neutralising condensers.

Trying Out

Having obtained a satisfactory adjustment of the receiver, it may be tried out upon the normal broadcast waves, and in this connection the test report given in the last issue of MODERN WIRELESS will be of considerable assistance in showing the approximate positions at which the stations may be

ALL RELAYS IN DAYLIGHT



This tuning chart will help you to adjust your "Elstree Six." The wavelengths given are for Range 2.

expected. It will be understood that the actual dial readings may vary slightly because the wavelengths of the stations have in many cases varied since that test report was published. The accompanying chart, therefore, will supplement the information already given. This diagram shows the actual wavelength to which the receiver will tune at any given dial setting. If, therefore, the actual wavelength of a station is known, it is a comparatively simple matter, by referring to this graph, to ascertain the receiver setting at which the station may be expected.

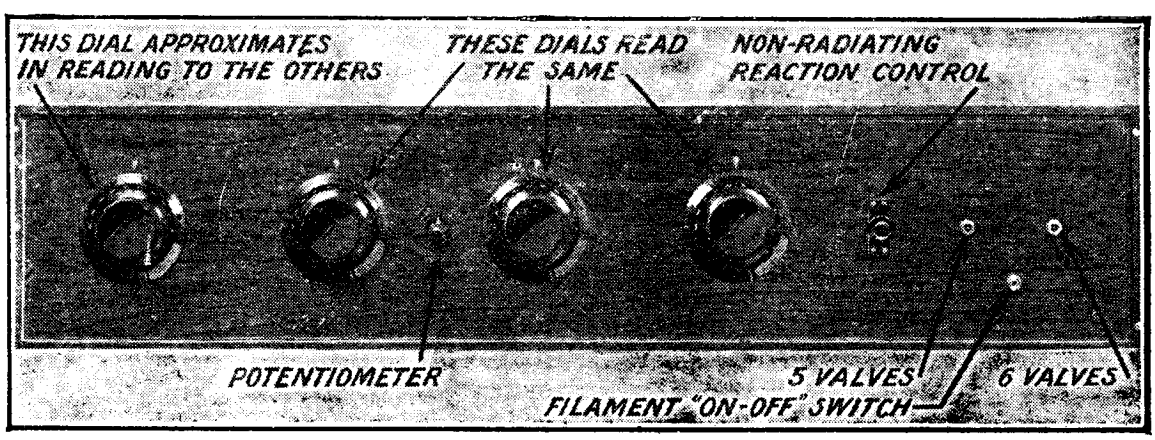
Long Wave Reception

The question of the reception on the higher ranges of wavelengths is also one of considerable interest. There are many stations now operating on wavelengths between 1,000 and 3,000 metres, and in order to facilitate the tuning in of such stations a test report has been drawn up to cover this range.

Valves to Use

Some recommended combinations of valves were given in the last issue, but as was stated there the set is not particularly critical as regards the valves employed. The low-frequency stages are similar to any transformer coupled arrangement and suitable power valves of course should be used in these stages.

The detector valve requires special attention, because anode bend rectification is utilised. A valve having a high amplification ratio and a steep characteristic should be used for this purpose, and there are large numbers of valves to choose from. Provided the correct grid bias is obtained for the particular one in use (this being a matter which can best be settled by actual practical trial) little difference will be noticed between the various types of high-impedance valves.



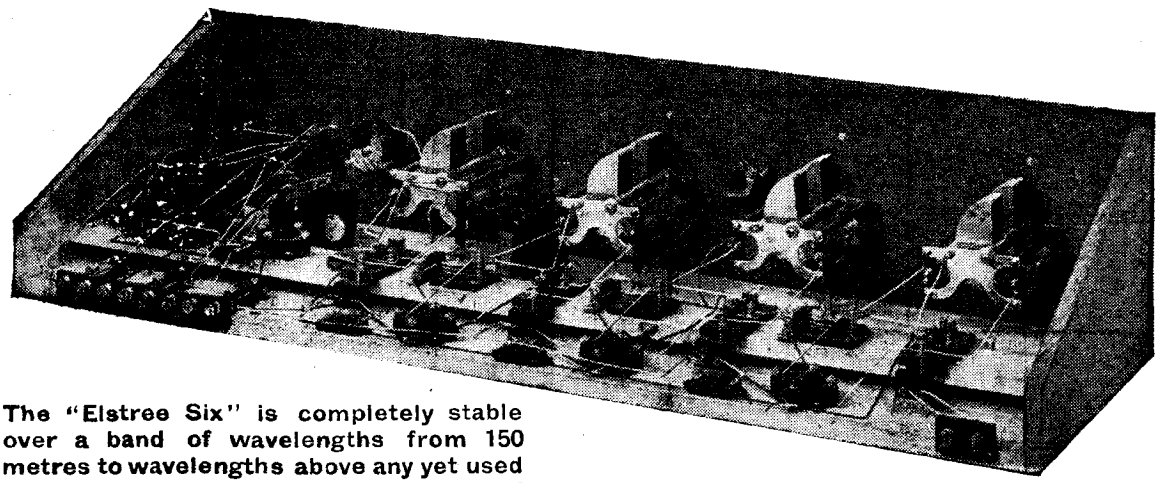
The "Elstree Six" has received sixty stations on the loud-speaker in one hour. Your "Elstree Six" will do the same.

FULL REACTION — NO INTERFERENCE

H.F. Stages

The high-frequency stages in this particular receiver are not as critical as is usually found to be the case. The coupling between the primary and the secondary of the high frequency transformers is fairly loose, and the effect of this is to render the use of special valves less necessary. Due to the weak coupling existing between the primary and the secondary, the effective impedance of the transformer considered as a whole is considerably less than that of the valve. In such cases there is little advantage in using a high-impedance valve, because its effective amplification, taking into account the low external anode impedance, is little if any more than would be obtained with the low-impedance low-amplification ratio valve. It is impossible to go into this question in greater detail at the present stage, but the whole aspect of the subject was discussed in an article which appeared in MODERN WIRELESS for September, 1925.

Even on the question of selectivity, the high-impedance valve does not show to such great advantage as is usually the case, because the anode damping is to some extent removed from the tuned circuit by the weak coupling existing in the transformer. Practical experience shows that there is a definite small improvement in the selectivity when a high impedance valve is used, but this is not very marked, and excellent results can be obtained from ordinary general purpose valves.



The "Elstree Six" is completely stable over a band of wavelengths from 150 metres to wavelengths above any yet used for broadcasting. No readjustment of the neutralising condensers is necessary.

General Purpose Valves

As this receiver is bound to have a widespread appeal to the public, many of whom will wish if possible to utilise their existing valves, some tests have been made as to the effect of various valves in the circuit. General-purpose bright-emitter valves were first tried, and groups of valves made by various manufacturers were inserted in the receiver, and its performance was gauged in comparison with the normal. There was very little difference to be detected. The stations which are tuned in every day as a matter of course were obtainable equally well with bright-emitter valves, and even if a more or less mixed assortment of valves were used, provided of course that all the valves were in good condition.

Other Types

A type of valve which gave very good results was the Cosmos Short-path Valve. The S.P.18 green spot was used for the high-frequency stages, and the S.P.18 red spot for the low-frequency stages.

(*Continued on page* 175).

The "Elstree Six" dial readings for the long-wave Broadcasting Stations:

Range 4. Secondaries Dimic No. 3A. Primaries, No. 300 plug-in coils. Aerial Coil No. 150 below 1500 metres. No. 200 above 1500 metres.

Station.	Wavelength.	Dial Reading.	Station.	Wavelength.	Dial Reading.
Hilversum	1050	40	Amsterdam	2125	110
Hjorring	1250	51	Soro	2400	126
Karlsborg	1350	59	Eiffel Tower	2650	140
Daventry	1600	80	Berlin	2900	160
Radio-Paris	1780	90			

CIRCUITS FOR SHARP TUNING

By E. M. MASON

How to increase the selectivity of a receiver without adding to the number of controls is frequently somewhat of a problem. This article shows how this desirable feature may be achieved in the case of simple single or two-valve circuits.

A SYSTEM of Trap tuning some while ago was developed by Mr. John Scott-Taggart, by means of which it was possible to get an appreciable improvement in selectivity without the use of loose coupling, and a number of conventional circuits was shown adapted for use with this system.

A considerable field for experiment was opened up and a typical circuit is shown in Fig. 1. This represents a two-valve receiver employing a stage of H.F. amplification followed by a valve rectifier; the tuned anode scheme of H.F. coupling is employed, both this and the aerial tuning being transformed to Trap tuning.

Tight Coupling

It will be seen that the two inductances shown at L_2 and L_3 consist of only a few turns each, the tuning being effected by coupling them tightly to tuned circuits L_1C_1 and L_4C_2 respectively. When these two circuits are tuned to the desired signal L_2 and L_3 behave as if they themselves were tuned. In this way the signal is applied to the grid of V_1 and then in amplified form to V_2. When, however, either of the two tuned circuits is not in tune with a signal impulse L_2 or L_3 is merely an inductance of a few turns which virtually short circuits the signal. In this way interference is eliminated to a far greater extent than would otherwise be the case.

A Drawback

A drawback, which though actually only a small one, is that it is difficult to determine the degree of coupling which should exist between the untuned coils L_2 and L_3 and their tuned circuits, and also the best number of turns to use in order to get maximum signals with the highest degree of selectivity.

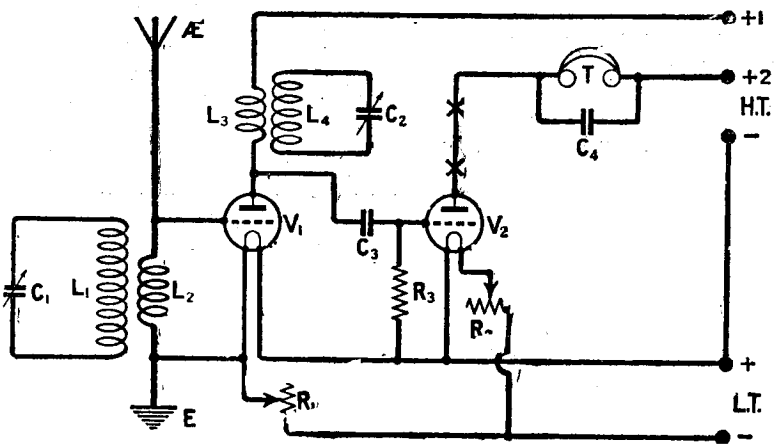


Fig. 1.—A reaction coil may be connected in this Trap-tuned circuit at the points XX, and coupled to L_3 or L_4.

A simple adaptation of the principle of Trap tuning makes it an easy matter to determine the best conditions for any given set of circumstances and also enables different degrees of selectivity to be obtained to suit varying conditions. This gives the system great flexibility and enables experimental work to be carried out in the shortest possible time.

Auto-Coupling

The method employed is shown in Fig. 2, and may be called auto-coupled Trap tuning. The tuned circuit is shown at L_1C_1, and instead of the small inductance being loosely coupled to it auto-coupling is employed, a number of taps being provided, so that the degree of coupling may easily be adjusted. This is indicated by the arrow on the aerial-grid lead.

The application of this principle to practical receiving circuits presents one or two difficulties, and some circuits are therefore shown that have been tested in actual practice and proved suitable.

A Single-Valve Circuit

A single-valve circuit using reaction is shown in Fig. 3. The inductance L_1 consisted of 90 turns of 22 S.W.G. D.C.C. copper wire wound on a 3 in. former taps being taken every five turns. The portion of the coil between A and C was tuned by a variable condenser C_1 of ·0005 capacity, the earth being connected to the point C. The point B at which the aerial is tapped on to the coil may be varied according to

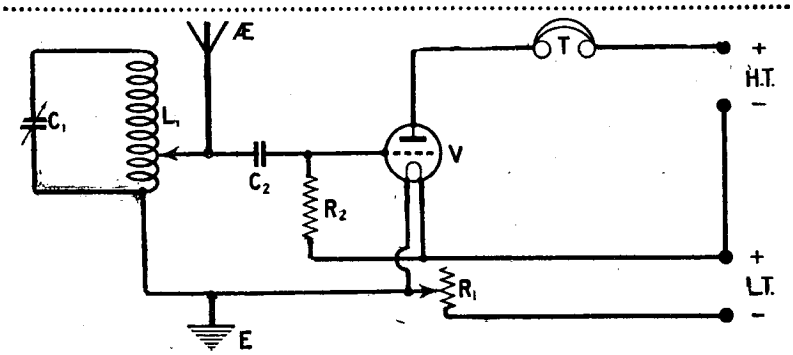


Fig. 2.—Auto-coupled Trap tuning may be regarded as a simplified form of ordinary Trap tuning.

CIRCUITS FOR SHARP TUNING—(Continued)

the degree of selectivity required. The nearer it is to C the greater will the sharpness of tuning be. A good average value is about 15 to 20 turns. Below 15 turns signal strength falls off badly, and tuning becomes exceedingly critical.

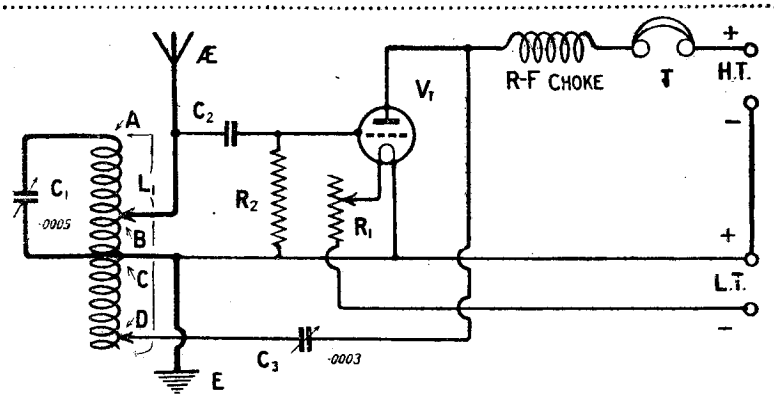


Fig. 3.—A useful single-valve circuit containing an auto-coupled Trap-tuned grid circuit, and employing Reinartz reaction.

Reinartz reaction was employed, and it was found that the number of turns between C and D did not need to be more than 20 with a medium resistance aerial, but with a high resistance aerial a few more turns would no doubt be required. A very smooth control of reaction was given by this circuit and at a distance of about 12 miles from 2LO Bournemouth could be received practically free of this station's transmissions in daylight.

Short-Wave Oscillation

A slightly different method of applying reaction is shown in Fig. 4, but this suffers from the disadvantage of short-wave oscillation; in fact, a short-wave test from station DCN Fort d'Issy les Moulineaux was copied with this circuit which was intended for broadcast reception.

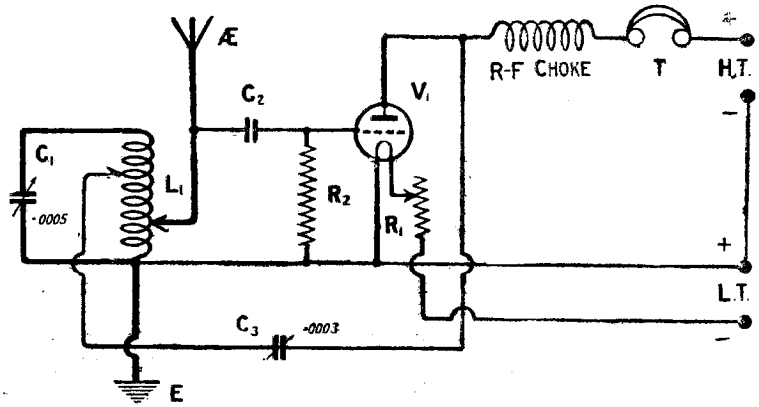


Fig. 4.—Combining the reaction and tuned coils of Fig. 3 into one coil introduced the trouble of short-wave oscillation.

Another Circuit

The next circuit to be evolved was one using two valves as H.F. and detector, and a very successful one is shown in Fig. 5. Tuned anode H.F. is employed, and reaction is applied to the tuned anode inductance.

In this circuit L_1 and L_2 consisted of two screened coils wound on threaded formers of the type used by Mr. Reyner in his "Magic Five" receiver (described in *Wireless*, Vol. IV., No. 1) so that the effect might be tried of screening the coils from each other. The tuning condensers C_1 and C_2 were .0005 each, while the reaction condenser was .0001. This circuit was found to be highly selective, the tuning being exceedingly sharp, and when tested in daylight, Manchester was received free of all interference from 2LO while Cardiff had only a slight background from this station.

The circuit was found to be exceedingly stable and even with the coils unscreened it was only at the lower readings of the tuning condensers that it was found in any way necessary to move the slider of the potentiometer from the negative end of the winding.

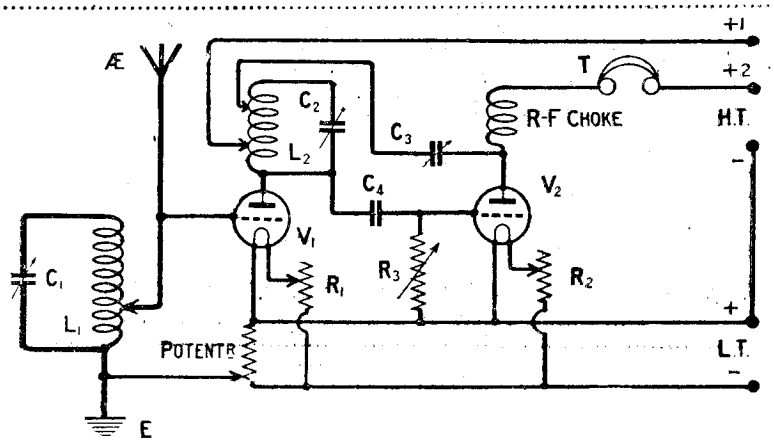


Fig 5.—A selective H.F. and detector circuit in which both grid circuits are auto-coupled.

A Satisfactory Method

After this, work was carried out on the application of auto-coupled Trap tuning to H.F. and detector, using transformer coupling. The circuit shown in Fig. 6 was found to be satisfactory not only as regards selectivity but also signal strength. The inductance L_1 as before consisted of a screened coil while the grid coil of the detector valve was a

CIRCUITS FOR SHARP TUNING—*(Concluded)*

single-layer solenoid of 70 turns on a 3 in. former, L_2 being a small diamond weave coil coupled to one end, the reaction coil L_4 being variably coupled to the other end.

The use of magnetic reaction was found to give a marked improvement in signal strength over Reinartz reaction the control remaining perfectly smooth. It was found that the left at the negative end of the winding over the whole waveband covered by the coils and their condensers.

Tuning was sharp and an excellent degree of H.F. amplification was obtained.

Alternatively in the Fig. 6 circuit an advantage might be obtained

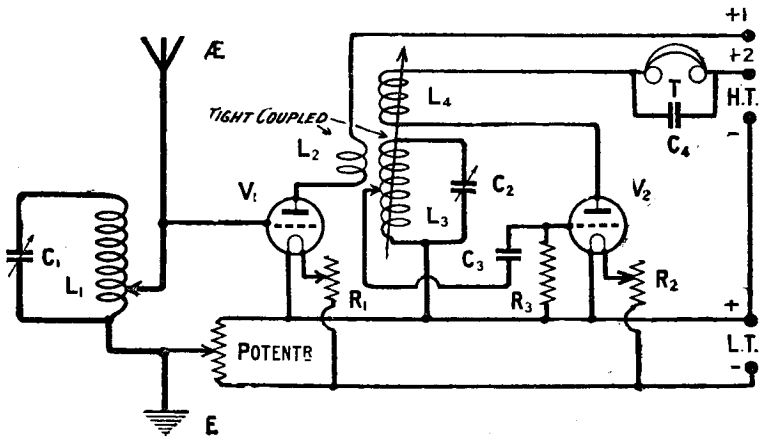


Fig. 6.—The substitution of transformer inter-stage coupling and magnetic reaction in the Fig. 5 circuit produces the highly satisfactory arrangement shown here.

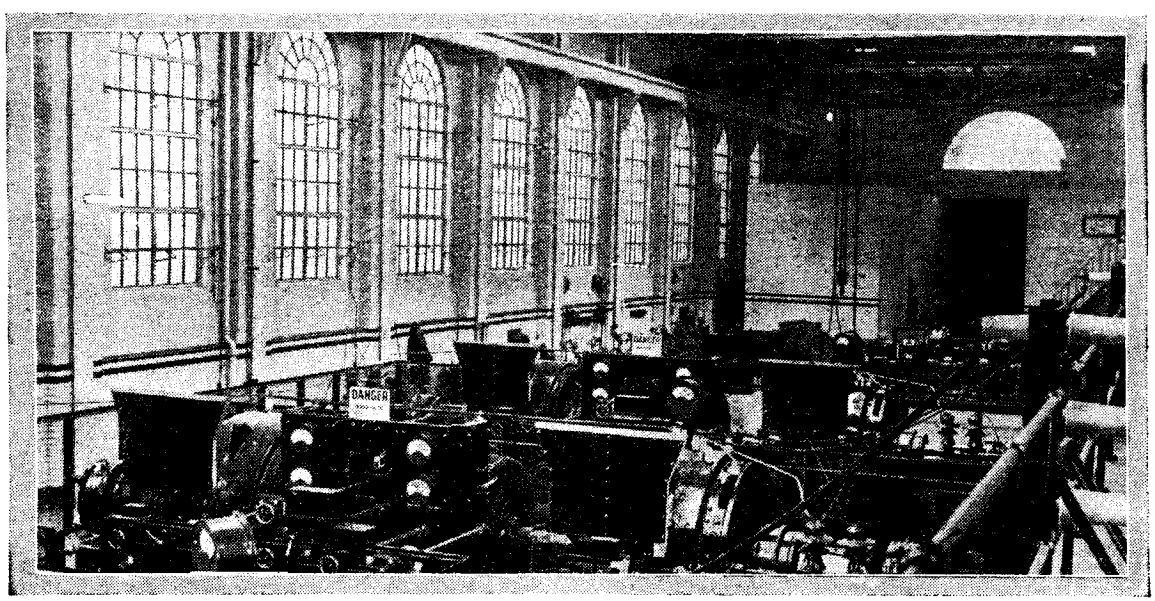
grid tap of the detector valve should not be more than 20 turns down from the top of the inductance L_3 or a noticeable loss in signal strength resulted. This circuit was found to be perfectly stable, the slider of the potentiometer being by coupling the reaction coil to the aerial coil.

Sizes of Coils

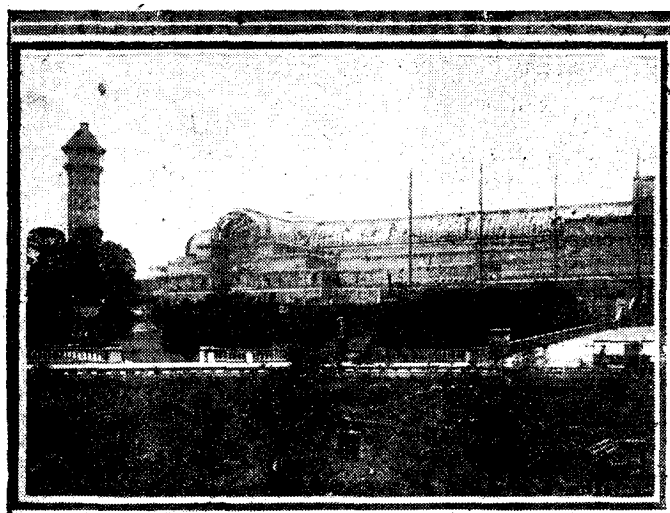
A simple method of determining the right sizes for the tuning inductances is by noting the point on the condenser dial at which the local station is tuned in. With a 180° dial and a .0005 condenser readings approximately as given below will show the coil to be suitable. If the condenser reading is much higher, the coil is too small and *vice versa*. Intermediate wavelengths will come in at intermediate readings which are simply determined, and the figures given act as a rough guide to the experimenter.

Birmingham	140°	479 metres.
Newcastle	100°	404 metres.
2LO	70°	365 metres.

It must be remembered that these figures are largely affected by the self-capacity of the coil, the lay-out of wiring, etc., while the valve used also has an influence on them. It will, therefore, be no indication of incorrect functioning of the set if having tuned Newcastle in at 100° on the dial, you do not find that Birmingham is exactly at 140° or even perhaps within 10° of it.



The high-power station at Rugby has been carrying out experiments in two-way telephony communication with New York. Above we see a portion of the generator room at this well-known station.



A CHAT ABOUT "LOCAL CONDITIONS"

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

Who describes in an interesting manner some of his experiences of "screening" in different localities, and suggests that the owner of a well-designed set whose results are not all that he expects should look to the "local conditions" for a solution.

IT is not always realised by listeners how greatly their receiving range can be governed by "local conditions," and as an indication of how serious this may be some instances will be given.

In the days before the war, when the well-known station at Poldhu was working, a transmission of press news used to be made at 11.30 p.m. G.M.T. for the benefit of ships at sea. The station was in those days regarded as being one of high power and its signals could invariably be received half-way across the Atlantic, as far south as the Canary Islands and as far east as Malta. Cases have been known when it has been possible to read Poldhu even as far east as Karachi in India, but these may be looked upon as somewhat exceptional.

Audible Weakening

From these remarks it may be understood that the transmitting range was fairly considerable, yet vessels in as near a locality as the Mediterranean Sea were often unable to hear even the Poldhu signals. One of the localities where this effect was most noticeable was in waters near to the Rock of Gibraltar and vessels so situated that the Rock was between them and Poldhu were often able to detect the signals gradually weakening in strength as their positions relative to Gibraltar changed somewhat.

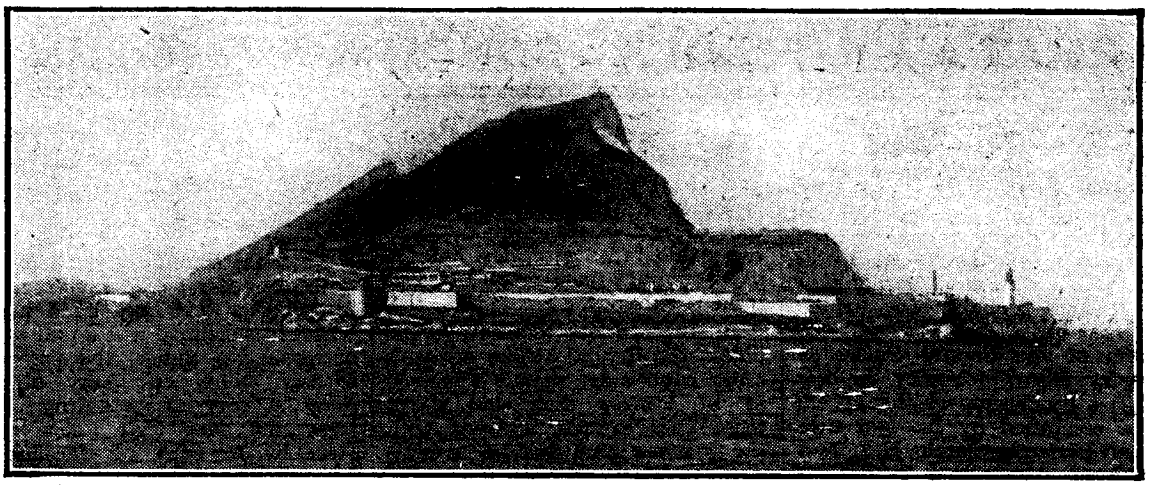
In positions where the distance from the Rock was about 5 miles, should the Poldhu station lie beyond Gibraltar so that the latter place came between, then Poldhu was completely inaudible and remained so for several hours steaming either in an easterly or westerly direction. After leaving the Rock about ten miles astern signals would gradually approach their normal strength as the distance became greater.

In one case given by the author very poor reception from the local station was obtained with a single-valve set in the neighbourhood of the Olympia building.

The Effect of Trees

Another somewhat interesting experience in the matter of screening was encountered on the River Amazon. As readers probably know, the banks of this river are very heavily wooded; further, the river is a very winding one, notwithstanding the fact that it is very broad. At times the course of the river assumes the shape of the letter S and it was at one of these bends that the following incident happened.

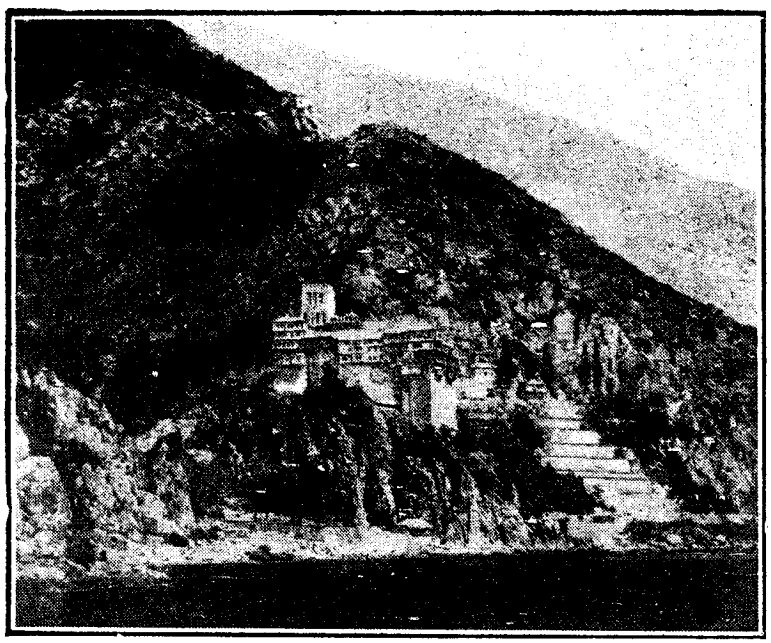
Two vessels, each fitted with 5 k.w. transmitters, and known to be about fifty miles apart as the crow flies, were proceeding along the course of the river in opposite directions so that they would eventually meet. Circumstances made it necessary that these two



The well-known Rock of Gibraltar in certain circumstances produces an audible weakening upon signals received by ships in its vicinity.

ships communicated with each other, and though all attempts at establishing communication had been made neither could hear the other.

As the vessels approached each other they suddenly arrived at one of the "S" bends referred to, and though each ship was actually in sight of the other even then neither could hear the other by wireless, the distance being approximately three miles. It was not until both ships were in the "straight" portion of the bend that they became audible to each other, by which time the message had been passed by visual signals.



The effect of Mount Athos, in the Aegean Sea, upon ships nearby has been known to render the transmission and reception of messages exceedingly difficult.

The Listener's Position

These two instances of "local conditions" are admittedly unlike those encountered by the average listener, but they nevertheless go to illustrate how appreciably reception may be affected; and to give an example of how somewhat similar conditions may be found, the following is of interest.

Those readers who know London will already know that the houses at Queen's Gate in the South Kensington district are unusually large, and in one of these houses a friend of mine was endeavouring to receive 2LO on a really sensitive frame aerial receiver. The set was situated on the ground floor, and though it appeared to be working satisfactorily the London station could not be heard. Various experiments with respect to the position of the set, however, finally resulted in perfect reception being obtained, but only when the receiver was used on the top floor of the house.

A Possible Cause

An experience somewhat similar to this was brought to my notice in the neighbourhood of the Olympia, the building where the next Wireless Exhibition is to be held. In this case the set was a single-valve arrangement and an outdoor aerial was used. Reception of certain stations appeared to be normal whereas others were altogether inaudible, the local station being at a strength well below what would be expected for such a comparatively short distance.

Various arrangements of aerials were tried but all of no avail. Finally the set was tried on another aerial in another district, when not only the local but other stations were received at a strength consistent with a good single valve set.

These results rather confirmed the opinion that the presence of the iron structure of the Olympia had some bearing upon the reception in the particular locality where the listener resided, and upon connecting the set to its original aerial, reception was just as poor as ever.

A CHAT ABOUT "LOCAL CONDITIONS"—(Concluded)

The Crystal Palace

In my own particular case, reception is extremely difficult and nothing I have tried yet, with the exception of a super-heterodyne, will receive all the main B.B.C. stations. The reason for this poor reception is probably due to the fact that one of the 200 odd foot towers of the Crystal Palace is in very close proximity to my aerial, a conclusion which appears to be confirmed by the fact that with a perfectly simple H.F. and detector set connected to another aerial under a mile away, practically all the main B.B.C. stations can be heard.

The locality of the Crystal Palace, it should be remembered, is well above the level of the City of London and certainly within ten miles distance, yet reception of 2LO upon an averagely good crystal receiver is a decidedly uncomfortable proceeding. The concentration and attention demanded before one is able to follow the programme is indeed a fatiguing occupation. Nevertheless, the same crystal set used upon an aerial under a mile away will give signals of perfectly normal volume.

"Screening" in certain parts of the River Amazon is so bad that on one occasion two ships actually in sight of one another were unable to communicate by wireless.

A Peculiar Effect

Experiments with a frame aerial set in a car in the neighbourhoods of Penge, Anerley and Sydenham go to show that the presence of the Crystal Palace has a most peculiar effect upon reception, the station chosen being 2LO. In the Penge district, which places the Crystal Palace roughly between the receiver and the London station, reception is decidedly below the average until a distance of some two miles lies between the receiver and the Palace, still keeping the latter in a straight line between the set and 2LO. Outside these two or so miles reception appears to be normal once more and free from peculiarity.

In the Anerley district, which places the Crystal Palace on one's right hand side, signals appeared to be weaker than one would reasonably expect, whereas with the receiver immediately in front of the Palace so that there was nothing in the way of tall buildings between the London station and the set, signals became too loud for comfort. (As a matter of interest it is possible on a clear day actually to see the masts of the London station from this position.)

Continuing past the front of the Crystal Palace which gradually places the building between the set and 2LO, signals decrease in strength until about three-quarters of a mile from the North Tower, in an easterly direction, signals begin to increase in volume until normal is reached.

Local Conditions

These facts are interesting, to say nothing of being instructive, for whereas one may build a set which it is claimed will do all sorts of attractive things, the personal success which one may obtain may be very disappointing; not from the fact that one's construction or copy of the design is poor, but disappointment may arise from local circumstances not allowing the set to do what it ought to do.

If your results are not all that you expect, look to the "local conditions" in search of a solution. Is the aerial buried in a forest of trees? Is it within a valley of tall buildings? And so on.

It is a fact that many listeners blame the B.B.C. for poor service when actually the reason is nearer to hand.

FAULTS WHICH HAVE PUZZLED ME

by G. P. KENDALL, B.Sc.

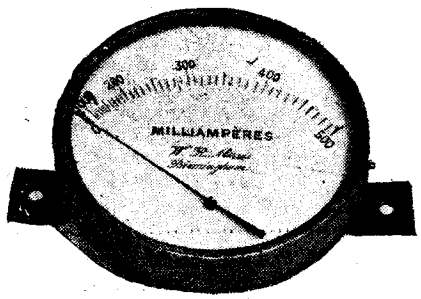
Who tells how he traced and remedied some very mystifying troubles. Owners of multi-valve receivers will find this article very interesting reading.

READERS who are interested in superheterodyne receivers will have noticed that in my article last month describing various modifications and refinements in the "open air" superheterodyne, I gave a warning as to the value of the fixed condenser which is shunted across the primary winding of the low-frequency transformer. (This condenser is actually connected directly from the anode of the detector valve to the filament circuit.) Now, this condenser is one of the most important ones in the whole superheterodyne receiver, for its function is to by-pass any stray high-frequency currents which may get past the detector valve and prevent them entering the low-frequency circuits where they would be amplified and lead to instability on the part of the whole receiver.

A Common Trouble

Experience seems to indicate that a great deal of the trouble which can be experienced with a superheterodyne is due to just the trouble which I have described, and since a fault of this nature occurred in the superheterodyne in question quite recently, an account of the symptoms and cure may be helpful.

The set had been working perfectly normally for some while, when I began to get a suspicion that signals were not coming in quite as they should, and, moreover, there was a crackling and hissing going on which did not seem quite natural, and it was necessary to set the potentiometer of the intermediate-frequency amplifying valves much further towards the positive end to stop oscillation on the part of the amplifier than was normal. This went on for some time, and I was becoming rather puzzled as to its cause, when finally the noise became very much more pronounced and it seemed obvious that the low-frequency transformer was to blame.

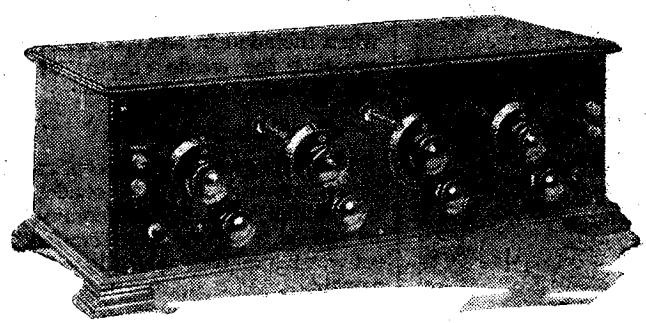


A milliammeter should always be shunted with a condenser when kept in circuit during reception.

A Puzzling Fault

I therefore replaced it with another, and found that the noise had entirely disappeared, leaving the set quite silent when the aerial was disconnected. The receiver, however, was still not acting properly, for signals were not up to normal, and the potentiometer of the long-wave amplifier still had to be set back too far towards the positive, and, moreover, the set made objectionable noises when the potentiometer was turned to send the long-wave amplifier into oscillation; instead of passing smoothly into oscillation it growled and barked.

This condition proved very baffling, and much time was spent on making various tests and alterations, all of which were of no avail, until it was noticed that when the finger was placed upon one of the loud-speaker terminals the set broke into a howl.



Multi-valve sets may become unstable when an unshunted milliammeter is used.

The Solution

This seemed to indicate fairly clearly that high-frequency currents were getting into the low-frequency amplifying circuits and attention was therefore turned to the capacity of the condenser across the primary of the low-frequency transformer; the size of this had been adjusted to suit the particular make and ratio of L.F. transformer, and the change here, although only a slight one, was evidently capable of upsetting the required capacity. With the new transformer it was found that a capacity of ·001 practically removed the trouble, while one of ·0015 or ·002 completely restored the set to its correct functioning.

A Transformer Trouble

Another fault which has occurred to my certain knowledge in two sets made up by readers from the same design as that in which the last fault occurred is also somewhat interesting, because the symptoms were unlike anything which I had previously met.

Both the receivers appeared to be functioning fairly satisfactorily but there was a general deadness and failure to pick up really distant stations, which led their constructors to feel that they were not getting the full results of which the set was alleged to be capable, and they each paid a visit to Bush House. In both cases, their only symptom, in addition to the general poorness of results, was that the first valve

FAULTS WHICH HAVE PUZZLED ME—(Concluded)

would not oscillate at any position of the potentiometer, even when a valve of the freely oscillating type was used.

The Oscillation Test

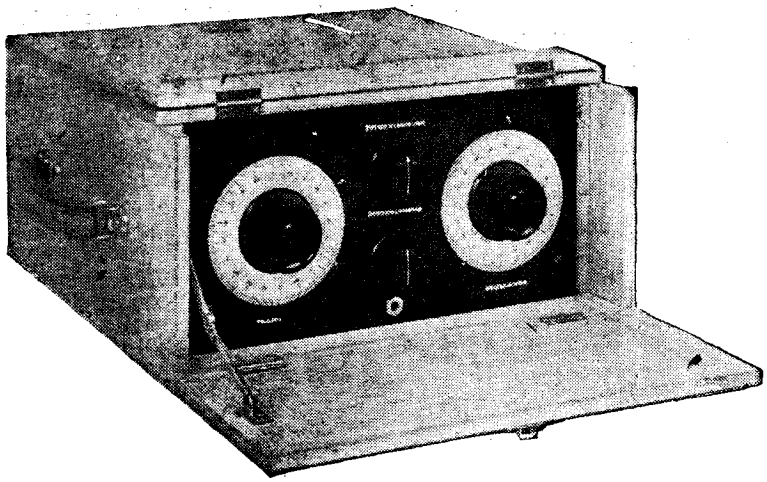
Suspicion naturally fell on the aperiodic H.F. transformer, but the usual rough test of this component did not reveal any trouble, the windings being proved to be continuous, and perfectly insulated from each other. Nevertheless, this seemed the only location for the fault, and the loan of an H.F. transformer of the correct type and known to be in good working order proved this surmise to be correct in both cases.

In this set, or in any other using a high-frequency valve of the "aperiodic" type with potentiometer contact, it should be noted as a definite rule that if the first valve will not oscillate under the conditions described (on a frame aerial), then there is almost certainly something wrong with the aperiodic transformer, if it is of the common type now marketed by several firms for use in superheterodyne receivers. It may be merely as a matter of faulty design, or actually of shorted turns, broken windings, and so on, but whatever the cause, the experiment should be tried of inserting another transformer of known condition, and preferably of another make, to eliminate the possibility of wrong design.

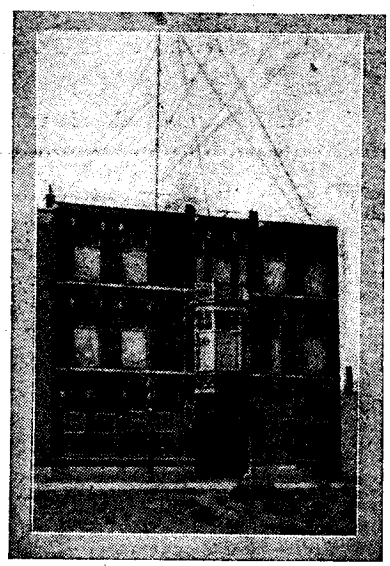
A Curious Affair

I once had an experience in using a milliammeter with a multi-valve receiver for the purpose of measuring the total anode current consumption which drew attention to a particular trouble which, although not strictly speaking a fault, might perplex many experimenters, just as it perplexed me. The set had been tested upon one evening, and found to be working particularly well, and had then been switched off for the night.

The next evening, desiring to measure the total H.T. consumption of the set, I inserted a milliammeter in the negative H.T. lead, and switched on the receiver with a view to picking up a distant station and adjusting it to the usual operating condition. Imagine my surprise on finding that the set which had been working perfectly the night before was now behaving in a most unaccountable manner, oscillating violently over a particular waveband, so violently indeed that it was absolutely impossible to control. I spent quite a while looking for broken leads in the grid circuits, trying a new H.T. battery, and all the usual things, before it occurred to me that the inclusion of the milliammeter in the circuit was quite capable of making the set oscillate on certain wavebands, since, obviously, its windings must be inductive, and must be capable of producing a reaction effect when included in the common lead carrying the anode current of all the valves.



Mr. Kendall describes an interesting fault which he has experienced with the "Open-Air" superheterodyne described in the May issue of "Modern Wireless."



The Hague broadcasting station "PCGG," which is about to re-commence a regular service.

Confirmation

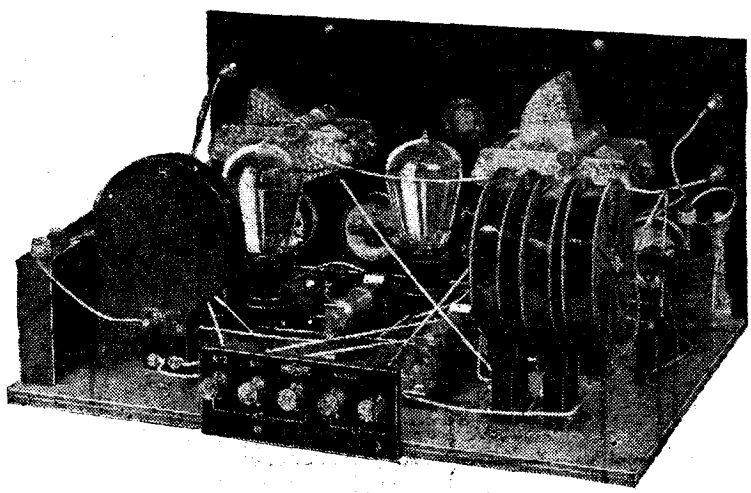
This diagnosis was confirmed by connecting a large condenser in parallel with the milliammeter to act as a shunt, whereupon the set was restored to perfectly normal working. As a matter of interest, the milliammeter was next connected in the anode circuit of a single-valve receiver, without any reaction coil being provided, and it was observed that when the set was removed from aerial and earth, it would actually oscillate when tuned to a wavelength in the neighbourhood of that of 2LO.

"My HOME SET"

By JOHN UNDERDOWN

This handsome three-valve receiver has been specially designed with a view to giving pure reproduction from the local station or 5XX. A filter circuit is employed—a great advantage when it is desired to run very long loud-speaker leads to some other part of the house, or into the garden during the summer days

"WHAT receiver shall I leave permanently wired up for family use?" is a problem which confronts every genuine experimenter, and is one which should receive much more careful thought than is usually the case. Working on the basis of anything will do is far from satisfactory for all concerned. The true experimenter, if forced to use the set for his own amusement when it is desired to hear some particular programme when the experimental hook-up will not work, will find this exasperating, and will start to make improvements at once with the probable result that no receiver is available for several days. If a quiet life is desired this should not be allowed to happen.



The high-frequency choke should be a plug-in coil of suitable size.

What Shall It Be?

The choice of a suitable circuit will depend largely on one's position relative to the local station and 5XX, due consideration being given to the "——ities," namely, simplicity, reliability, purity of reproduction, selectivity and sensitivity. In order of merit, or rather of desirability, I think that it is difficult to differentiate between the qualities of reliability, simplicity and good reproduction. Provided that the tuning is not made unduly difficult, there is no reason why efficiency should be sacrificed, since the provision of an "on and off" filament switch will allow the set to be put in and out of operation by any member of the family once the local station, or 5XX, has been tuned in.

Good Reproduction

With a set which will be permanently installed no pains should be spared in obtaining the highest degree of purity in reproduction, and although until recently I was counted among the school which considered that the quality from a good transformer-coupled set left nothing to be desired (here I am referring to a detector and one L.F. type set, which in my position gives adequate loud-speaker volume from 2LO and Daventry) I now think that there is an improvement in quality which makes up for slight loss of volume. In this comparison I am referring to a test made between a 3-valve receiver with cumulative grid rectification, and two note magnifiers coupled respectively by a transformer and a choke, with the set about to be described, in which latter lower bend anode rectification is employed.

Selectivity

A high degree of selectivity is not required for local work, but if this quality can be obtained without unduly complicating the set, and sacrificing volume, it is well worth while. In my "Home" receiver, therefore, I have adopted the employment of the so-called "semi-aperiodic" aerial tuning

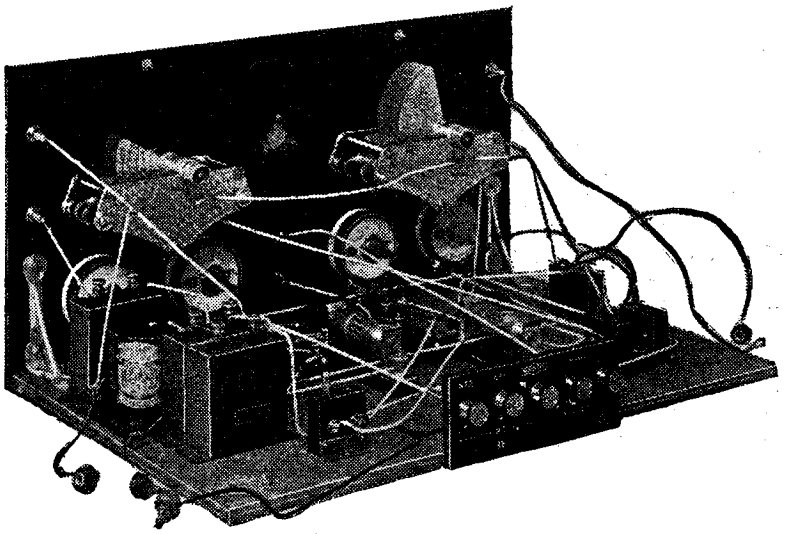
"MY HOME SET"—(Continued)

system, which gives added selectivity without the necessity for a further tuning control.

Anode Rectification

Anode rectification, besides its desirability on the score of purity, has the added advantage over cumulative grid rectification in that the damping of the grid circuit is lessened, giving a noticeable increase in selectivity.

have employed the Reinartz system of connections here. With correct adjustment of the high-tension voltage applied to the detector valve, of its filament current, and of grid bias it is possible to attain that delightful state of affairs where one can hang on the edge of oscillation without actually oscillating, in which state the receiver is most sensitive for the reception of very weak transmissions which it may be desired to hear occasionally. Smooth reaction control is always of advantage, although for general work it is *not* advisable to have to force every ounce out of the receiver by working on the verge of oscillation.



Space for the low-frequency amplifier grid-bias battery is allowed in the left-hand corner of the baseboard.

The Circuit

Having outlined the conditions which I think should be fulfilled by the family receiver of the experimenter within, for example, a ten to fifteen miles radius of a main station, there is little need to dwell in detail on the theoretical circuit which I have used. The receiver employs three valves, the first a detector, working on the lower bend of its anode characteristic curve, whilst the two note magnifiers are resistance-coupled. Anode resistances of 100,000 ohms, coupling condensers of ·015 microfarads and grid leaks of ·5 megohm being incorporated. Fine adjustment of the grid bias applied to the detector valve, which in turn determines the position on its characteristic curve on which it functions, is effected by means of a potentiometer, whilst a single dry cell serves for G.B.1.

A Filter Circuit

In the plate circuit of the last note magnifier V_3, an L.F. choke coil Z is wired, and this, in conjunction with the 2 microfarad condenser C_6, forms a filter circuit which prevents the loud-speaker having to carry the direct anode current supply to V_3. This minimises the danger of a breakdown in the loud-speaker winding, and tends to give better reproduction, since there is less likelihood for the

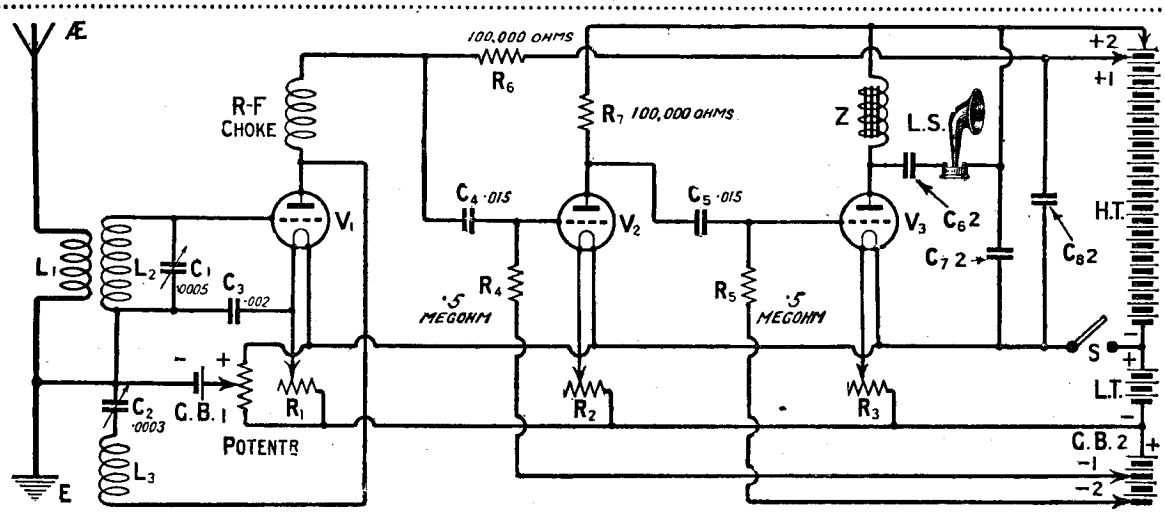


Fig. 1.—Anode bend rectification and resistance-capacity coupling enable maximum purity to be obtained.

Reaction Control

For the reception of distant stations, on telephones, it is necessary that fine control of reaction be possible, and for this reason I

"MY HOME SET"—*(Continued)*

condition of saturation to be approached by the magnets of the loud-speaker. Another advantage is that the loud-speaker can be employed at a considerable distance from the receiver, only one lead being necessary if an earth return is employed. In this case the terminal of the loud-speaker which is shown connected to H.T. + 2 will be taken to an earth connection instead. The tendency towards muffling where very long loud-speaker leads are used is thus obviated.

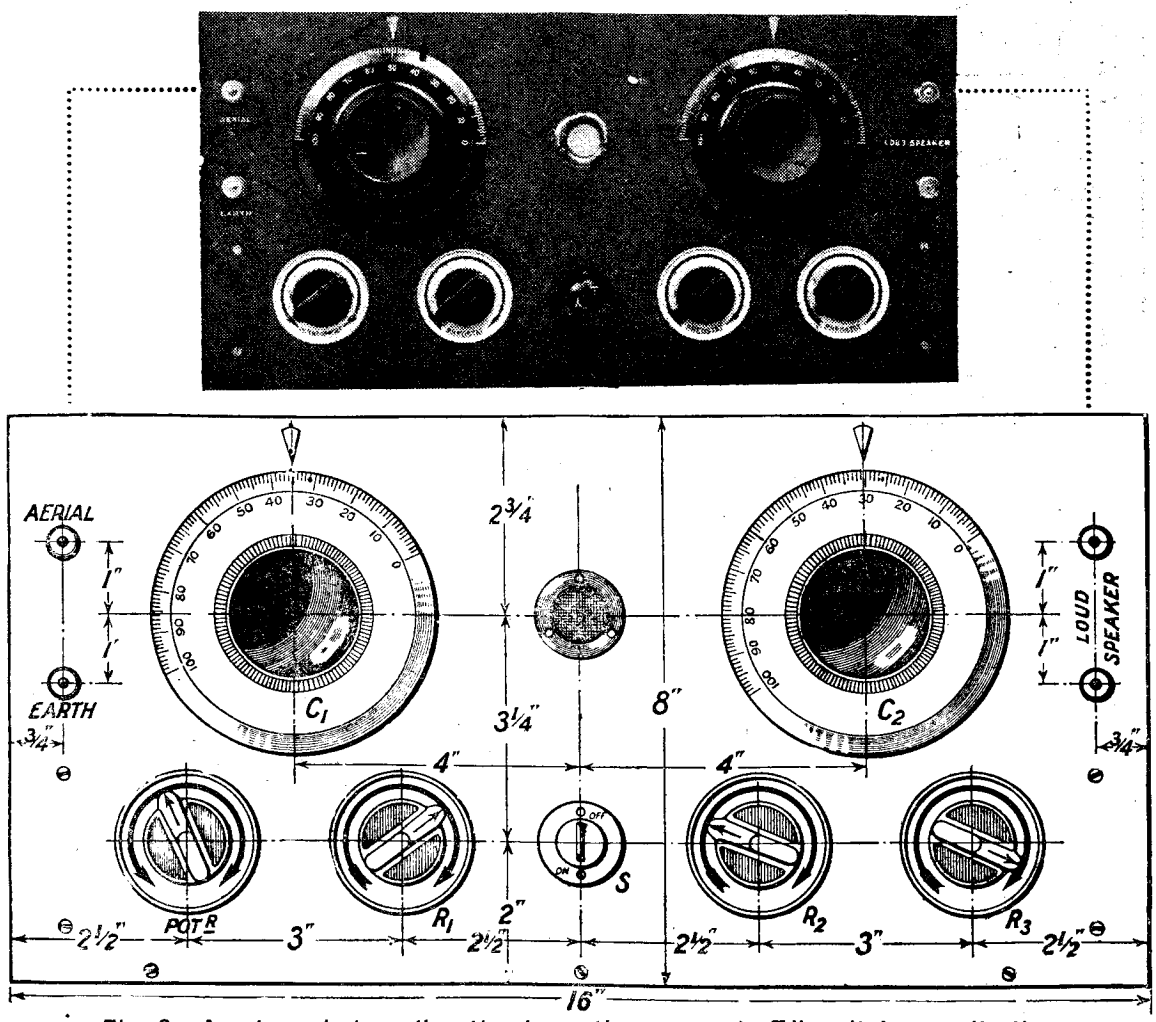


Fig. 2.—A valve window directly above the "on and off" switch permits the receiver to be switched off easily in the dark. Readers may obtain the full-sized drilling diagram (Blue Print No. 167a) free of charge.

Components

The components which I have employed are given in the following list, and although it is not absolutely essential to adhere to these, if ones of good make are substituted, others which take up much space or are of doubtful quality, should not be incorporated.

One "Paragon" Matt Ebonite Panel, 16 in. by 8 in., by ¼ in. (Paragon Rubber Co., Ltd.).

One Oak Cabinet to take above panel and a baseboard 11 in. deep. (Carrington Mfg. Co., Ltd.).

Two Igranic Variable Condensers, one ·0005 and one ·0003. (Igranic Electric Co., Ltd.).

One Igranic-Pacent Potentiometer, 400 ohms. (Igranic Electric Co., Ltd.).

Three Igranic-Pacent 6-ohm Filament Resistances. (Igranic Electric Co., Ltd.).

Two .5 megohm "Dumetohm" grid leaks. (Dubilier Condenser Co. (1925), Ltd.).

Two "Dumetohm" holders. (Dubilier Condenser Co. (1925), Ltd.).

Three Fixed Condensers, two ·015, Type 610, and one ·002, Type 620. (Dubilier Condenser Co. (1925), Ltd.).

Two 100,000 ohms Anode Resistances. (Dubilier Condenser Co. (1925), Ltd.).

Three "Anti-phonic" valve holders. (Burndept Wireless, Ltd.).

One "Success" Standard Audio Choke. (Beard and Fitch, Ltd.).

Three "Magnum" Single-coil holders. (Burne-Jones and Co., Ltd.).

"MY HOME SET"—(Continued)

Three 2-microfarad Mansbridge Condensers. (Dubilier Condenser Co. (1925), Ltd.).

One "Frost Toggle" Filament "on and off" switch. (Rothermel Radio Corporation of Gt. Britain Ltd.).

One pair of "Magnum" small aluminium brackets. (Burne-Jones and Co., Ltd.).

Two "Decko" Dial Indicators. (A. F. Bulgin and Co.).

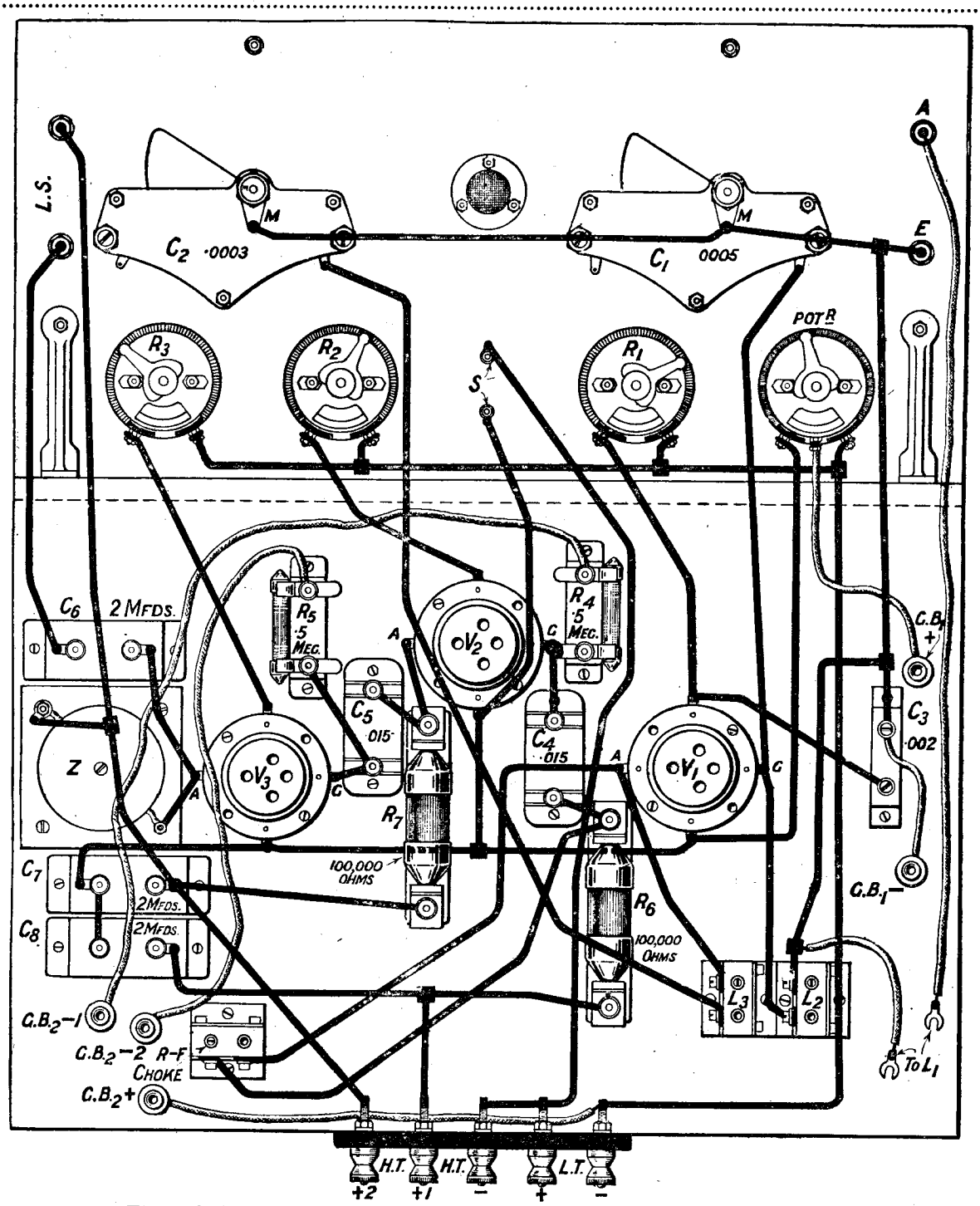


Fig. 2.—The grid-battery G.B1 in most cases can be a single dry cell. A full-sized wiring diagram may be obtained free upon written application to our Sales department (Blue Print No. 167b.)

"MY HOME SET"—*(Concluded)*

One small Oxydised-copper Valve Window. (Grafton Electric Co.).

Four 2 BA "Magnum" Nickelled Terminals. (Burne-Jones and Co., Ltd.).

One No. 1 Magnum Terminal Strip. (Burne-Jones and Co., Ltd.).

Quantity of Glazite, rubber-covered flex and small wood screws.

Radio Press Panel Transfers.

Drilling the Panel

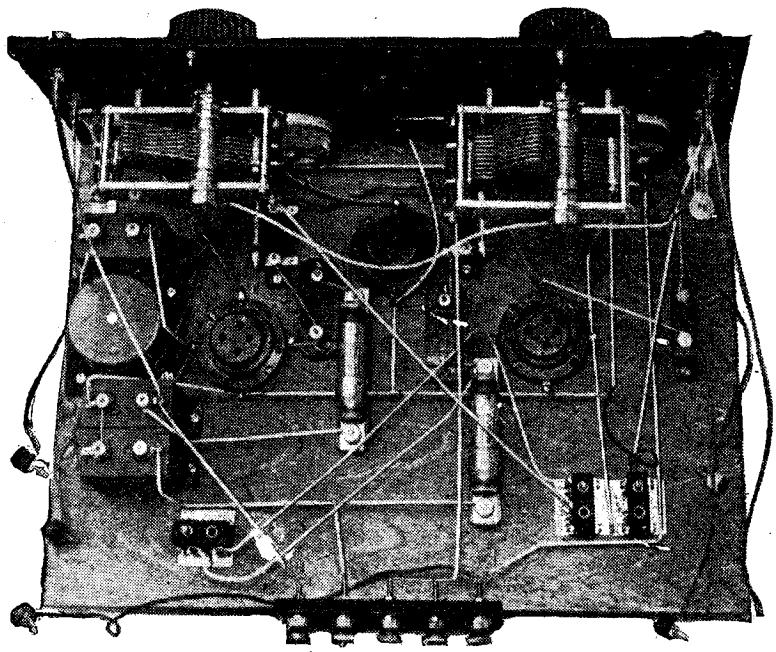
To drill the panel with the minimum of trouble reference should be made to the front of panel drilling diagram and the templates supplied with the two Igranic condensers should be utilised.

Wiring

The wiring of the set is a comparatively simple matter if undertaken methodically and systematically. I would strongly recommend that all of the components on the ebonite panel be wired as far as possible before the panel is fixed to the baseboard.

Flex Leads

From the photographs it will be observed that there are a number of flexible leads terminated either by spade terminals or by battery plugs. That from the aerial terminal of the set goes to one of the terminals of a Gambrell Trap



The aerial coil L, has two terminals, to which the aerial and earth connections are made with the aid of flexible leads.

Baseboard Layout

The layout of the components on the baseboard should be carefully followed by reference to the wiring diagram, where it will be observed that the two shunting condensers C_7 and C_8 of 2 microfarads each are arranged to allow sufficient room for the insertion of a 9-volt grid bias battery.

The terminal strip seen in the photograph is a standard No. 1 Magnum, but from it the portion on which are located two grid-bias terminals has been sawn off.

coil, which I employ for L_1. The other short flex lead terminated by a spade terminal and taken from the plug of the L_2 coil block goes to the other terminal of the coil L_1. The flex lead from R_4 is joined to a battery plug and serves for the grid-bias negative tapping for the first amplifying valve. The flex lead from R_5 is the grid-bias negative lead for the last valve. From the low-tension negative terminal a further flex lead is taken to the grid-bias battery placed on the left-hand side of the baseboard, and serves for grid-bias positive.

Valves

In working the receiver I habitually use 5-6-volt type valves, such types as the D.E.8 H.F., D. E. 5b, D.F.A.4., etc., being inserted into the V_1 and V_2 valve sockets with a B.4, D.E.5, D.F.A.1 or P.V.5 D.E. for the last valve V_3. On the detector valve an H.T. voltage of the order of 100 should be employed, whilst on V_2 and V_3 120 volts proves suitable. G.B.—1 should be inserted into the $1\frac{1}{2}$-volt tapping of the 9-volt grid-bias battery and G.B.—2 into the 6 or $7\frac{1}{2}$-volt tapping.

Coils

During various tests I have carried out I have used Gambreli coils of the following sizes:—For the lower broadcast waveband L_1 has been an "a/T," L_2 a "B," L_3 an "a" or "A" and the radio frequency choke coil an "H." For Daventry L_1 has been a "D/T," L_2 an "F" and L_3 a "D," with the radio-frequency choke coil an "I" or "J."

Where numbered types are employed L_1 should be a number 25 or 35, or may consist of a hank wound coil of ten to twenty turns of 24-gauge cotton-covered wire, wound to the diameter of the grid coil L_2, to which it should be tied. L_2 should be a number 50, 60 or 75, and L_3 a number 25 or 35. The radio-frequency choke should be a number 250 or larger coil. For Daventry L_1 may be a number 75 or 100, L_2 should be a number 250, L_3 should be a number 150 or 200, and the radio-frequency choke should be a number 300 or 400 coil.

Results

It is not proposed to give a lengthy list of stations received, since the main purpose of the set is to give really good quality reproduction from the local station and 5XX, from both of which stations real loud-speaking was obtained upon my aerial, which is a good one situated about twelve miles south-east of 2LO.

After dark I have obtained a large number of both Continental and British stations at good telephone strength, whilst, when testing with the loud-speaker connected, Nottingham, free from any trace of 2LO in the background, a German station, Birmingham, Belfast, Newcastle, Radio-Paris, and several unidentified stations were heard.

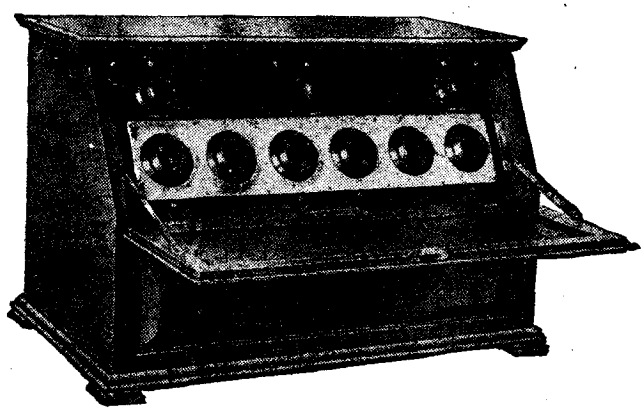
CALIBRATING YOUR RECEIVER

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

In this article the well-known chief of the Research Dept. of Marconi's Wireless Tel. Co., Ltd., describes simple methods which enable the listener to adjust his receiver to any required wavelength.

THE last few finishing touches on a multi-valve receiver very often make a lot of difference in the satisfaction one obtains from it, and a great increase of satisfaction can be obtained by proper calibration of the condenser dials.

What percentage of people using sets (of course I do not refer to amateurs) can read a dial easily. For one thing it is rather trying even to one used to doing it to be continually reading off from the finely divided scales—but a very large number of people unused to decimal notation do not quite grasp the method of reading. Then if in addition a calibration chart or set of curves has to be looked up it makes searching out rather a painful process, and impossible to many except by guess work.



The "Straight Eight" receiver utilises a scale calibrated in wavelength and secured behind the condenser dials.

Three Dial Receivers

Suppose you have constructed a five valve neutralised receiver with three tuning handles. Two of these handles at least can easily be made to move in an identical way and by using a low aerial tap the aerial condenser can be made to swing with nearly the same law.

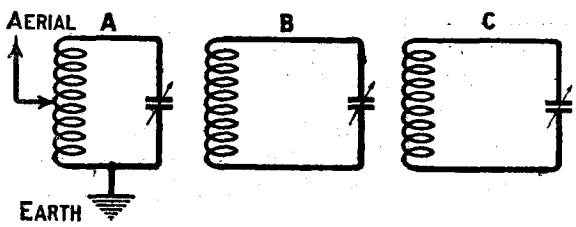


Fig. 1.—An adjustment of the values of the inductances in circuits B and C as indicated will enable approximately the same readings to be obtained on two of the condensers.

Let us consider A, B and C as the three circuits (Fig. 1). When you are in tune with a station which is at the top of the condenser scale, two of the condenser readings can be equalised by some slight readjusting of the inductances of B and C.

Equalising the Readings

Personally I wind coils as nearly equal as possible, and then I arrange that a few turns on each can slide relatively to the remainder—which gives a fine adjustment for final setting. Through the rest of the scale the condensers should run pretty well together, unless some accidental capacity has strayed into one circuit more than into the other.

If the aerial is tapped down the first coil, as is usual now, it alters the law of the first condenser practically as though a fixed parallel condenser of smaller value than the aerial was across the variable condenser, and consequently the simplest way to bring all the condenser motions into line is to put parallel fixed condensers across B and C

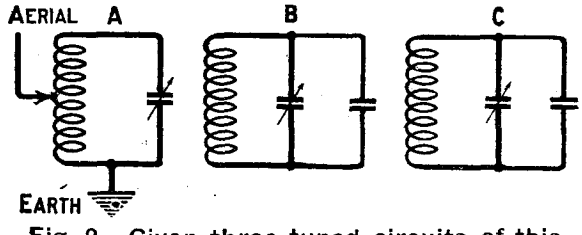


Fig. 2.—Given three tuned circuits of this type it is possible very nearly to equalise the condenser readings by joining suitable small fixed capacities in parallel with the tuning condensers as shown in B and C.

CALIBRATING YOUR RECEIVER.—*(Continued)*

(Fig. 2). Given a wavemeter and patience this can easily be done. The total wavelength range is slightly decreased by this method. Of course even with the utmost care it will be almost impossible to make A, B and C move absolutely together so that they could link up for one handle, but they can be got sufficiently close to link together providing small vernier condensers are arranged in parallel with all three circuits to do a final tuning with.

All this work is not likely to be undertaken except by a very few, but to those with patience I can recommend the subject of obtaining single handle tuning as a very fascinating hobby.

Separate Calibration

A simpler method of finishing off a receiver is to make out wavelength scales for each condenser and to stick these in position, but even here it is nicer to get the condensers running, fairly well together first.

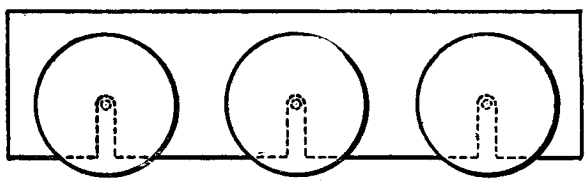


Fig. 3.—By using a sheet of white material, shaped as above, a wavelength scale can be placed on the panel without having to disturb the condenser dials.

For those with a buzzer wavemeter which can be relied on the process is easy, but one point must be noticed. If you set a buzzer up near a set, although it may be set to a certain wave, that wave is comparatively flat—rather like a spark signal, and you will be liable to tune up all your circuits accurately to one another, but not to the maximum of the wavemeter, so that after tuning up you must turn the wavemeter handle until the loud-speaker gives out a maximum of sound. This gives a wavelength which is usually an odd figure, so that if you obtain, say, five points on your scales you will have to plot them out on squared paper and draw a best line through the points, and from that line read off the values at, say, every 50 metres.

The Wavelength Scale

Suppose your mark on the panel to read against is opposite the zero on the moving scale when the condenser is at a minimum. If it is not shift the condenser handle. Now you can stick the wavelength scale you have made on to the dial if you like, but I prefer to stick it on to the panel.

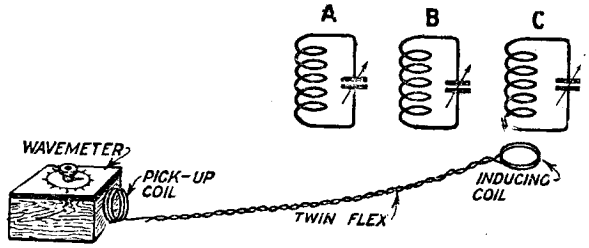


Fig. 4.—A sketch showing the author's method of calibrating three tuned circuits with the aid of a buzzer wavemeter.

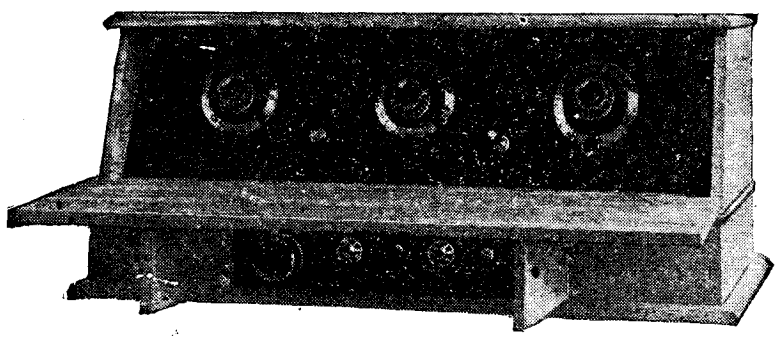
Whatever the material for the scale you use screw or stick it in position behind the dial.

A piece of white material shaped like Fig. 3 avoids having to take handles off when mounting.

An arbitrary point must now be chosen on the dial as a mark—say, the division marked 90°—so as to give the actual range of the wavelength scale in a convenient position.

Now set the pointer on the panel opposite the different important waves on the scale as you read them from your chart, at each setting marking on the panel scale a line opposite this 90° and labelling it with its wavelength—mark in, say, 250, 300, 350, 400, 450, 500 metres, and then you can divide these into the tens by eye if you are using straight-line-wavelength condensers. Any serious errors will show up to the eye in scale irregularities.

In a well-designed three-dial receiver at least two of the condensers will give practically the same readings.



The Aerial Condenser

I think it is usually enough to calibrate condensers B and C, as given these in tune the aerial is easily swung to the right position, but if you are not likely to alter your aerial you may do the aerial condenser in the same way.

CALIBRATING YOUR RECEIVER.—(Concluded)

In Europe at present it is wiser to use straight-line-wavelength condensers rather than straight-line-frequency condensers as everybody talks in wavelengths, and if straight-line frequency condensers are calibrated in wavelengths the scale will be very irregular.

Another Method

A method I use which saves a lot of trouble, is to set my wavemeter on the floor and

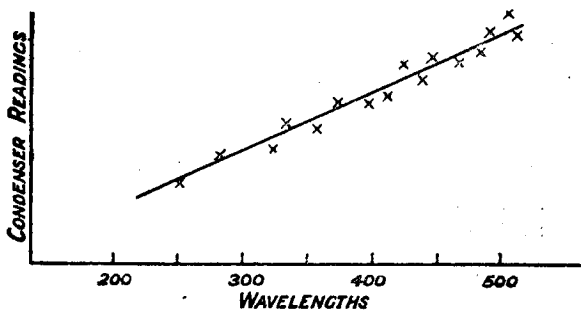


Fig. 5.—If a wavemeter is not available a chart can be plotted by marking off points obtained from stations of known wavelength.

near it put a coil of 20 or 30 turns connected by a twin flex lead to a similar coil (Fig. 4). I set the wavemeter to, say, 500 metres, and hold this second coil near circuit C, tuning this to a maximum. Then I put it near B; tune that up to a maximum, then near A and tune again.

In this way there is no fear of mistuning to the buzzer maximum. The main points, say, every 50 metres, can be quickly marked this way directly on the panel scale, and then the tens filled in by eye. Any error of reading will again be shown up by an unevenness of scale and the process should be repeated if the divisions are not evenly spaced.

Material for Scales

In this latter way there will be no need to use the decimal scales on the dial during the calibration, so that a plain dial with one pointer mark will be the best thing. I rather like to have two pointer marks opposite each other, the top one pointing to the calibration in wavelength, the bottom one to a sheet of writing material on which stations' positions can be noted—so that if a station is heard but unidentified at the moment it can be noted and afterwards returned to. If your scales are already cut the 0 and 180° form two pointer marks opposite each other. Rough white celluloid is rather good material for both the wave marking and for writing on. The wave marks can be cut in with a knife and filled up with a black or red enamel. The white celluloid cleans easily with wet rubber after marking with pencil.

Calibration from Stations

Now for those who have no wavemetres calibration by using B.B.C. stations is quite easy, but should be done with care, and a few weeks spent in making out charts and checking them before the wave scale is cut or pasted on.

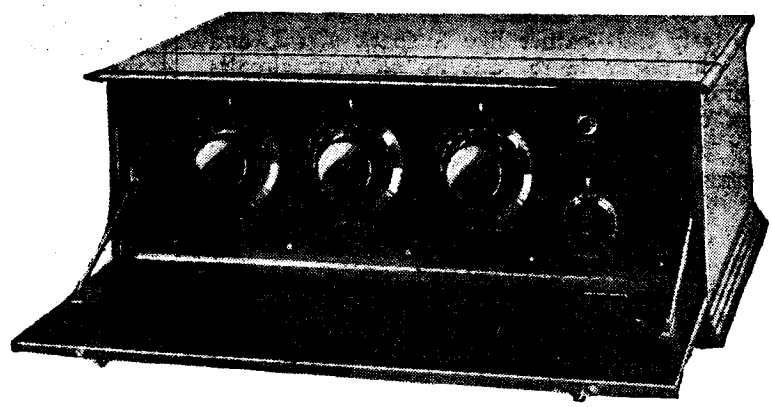
The difficulty usually is to get points below Cardiff or 2LO with accuracy, as no main stations are working below those values, but Brussels, 265 metres, is fairly steady and easily obtained. Other stations such as Hanover can also be used.

I should advise making a chart out like Fig. 5 for each condenser and day after day plotting in new stations as obtained. with the aid of their published wavelengths. Finally, a best line can be drawn through all the points obtained, and from this a uniform scale marked out and the process previously used in the first wavemeter method carried out.

A Simple Procedure

If two main stations such as 2LO and 5IT can be picked up at once, these can be plotted down, and if straight-line-wavelength condensers are being used a straight line drawn through these will indicate the approximate positions of other stations. The chart will be of advantage in finding other stations for making your calibration chart.

If you have vernier condensers in parallel with your main condensers then remember to calibrate with these set at zero, and always set the receiver to the required wavelength with them in this position.



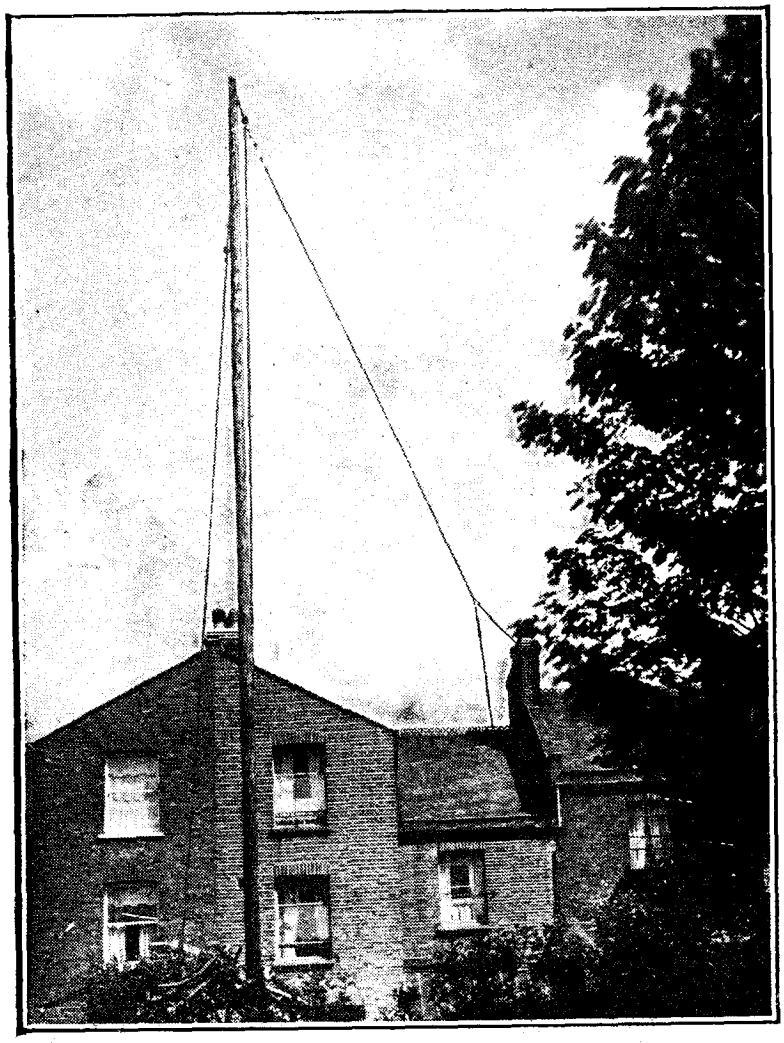
With a receiver such as this it is a very simple matter to adopt the author's scheme of using a wavelength scale of white celluloid behind the condenser dials.

SOME NOTES ON 45-METRE TRANSMISSION

By

R. W. H. BLOXAM

(5LS).



Some idea of the height and length of the author's final form of aerial may be gained from this photograph.

OF all the operating wavelengths allotted to the transmitting experimenter in his "downward" progression (upward, in K.C.!) perhaps the most interesting is the 45 metre band.

This wavelength is by all accounts the best that has ever fallen to our lot, at any rate from the point of view of "miles per watt," but it is the most fickle, conditions being most inconsistent and rapidly changeable. It has been noted at 5LS that, particularly during winter, the conditions vary from night to night. One night the conditions for Trans-Atlantic working may be excellent, U.S.A. amateur signals being strength R7 to R8, often, however, accompanied by atmospherics. The very next night may be a complete "blanket," no U.S.A. amateurs or any distant signals being audible. This effect is so marked that high power short wave stations in U.S.A. are exceedingly weak, and the newcomer to 45 metres (6,667KC) may be led to think that something has gone wrong with his receiver. Observations during the last six months have shown that on nights when U.S.A. signals are good the South American and Porto Rico signals are weak. Conversely, when U.S.A. signals are weak the South Americans are exceedingly strong, many Brazilian stations being received R8.

It is exceedingly difficult to account for this phenomenon and to line up any weather, barometric, or other conditions governing it.

A Difficult Problem

The system employed at the transmitter for radiating presents a problem which in itself incurs many difficulties, chiefly on account of the fact that it is not easy to tell when the maximum transference of energy to the aerial circuit is being obtained. It is possible to get a high aerial current indicated, with moderately low anode current, but still the system may not be in proper resonance, and the actual radiation poor.

The first question one is asked by other workers on the 45 metre band is, "What sort of aerial are you using?"—this being a direct result of the fact that the same system will not apparently give the same results in different localities.

Available Radiating Systems

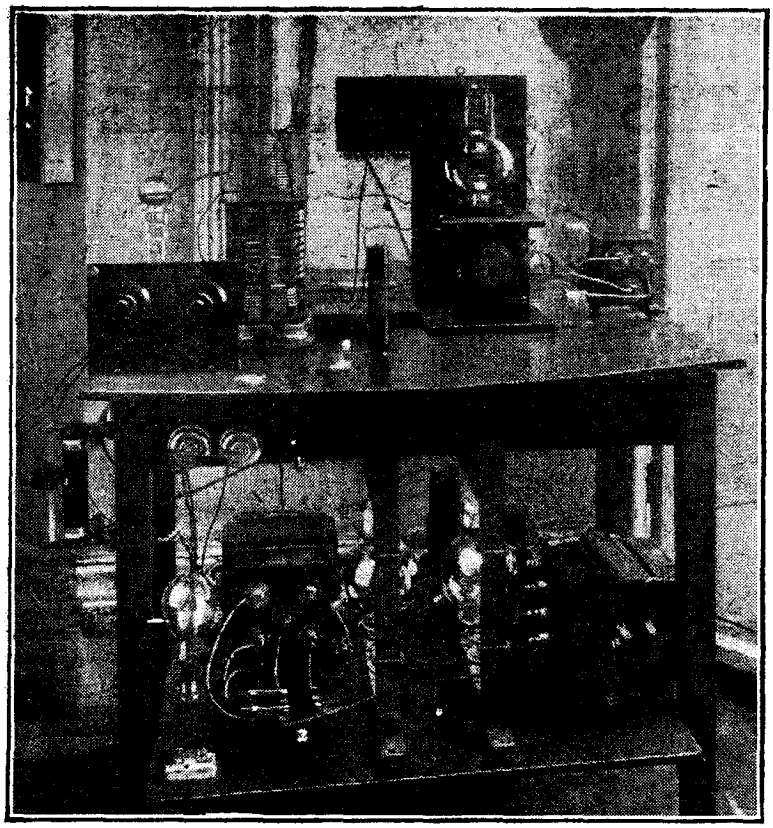
At the present time the available radiating systems may broadly be divided into three types—

1. Antennæ operating at fundamental wavelength.
2. Antennæ operating at fundamental wavelength, Hertz type.
3. Antennæ operating at third harmonic.

It has taken four months at 5LS to discover the best system and obtain really efficient working, and since all the above and a few other radiating systems have been tried, it is thought that, with a few details

Some Notes on 45 Metre Transmission

(Continued)



The transmitting apparatus used by the author in his experiments. The transformers and rectifying valves may be seen in the lower portion of the picture.

of the station as a guide for comparison, the results obtained will be of interest to all transmitters.

Fig. 1 shows the dimensions of the aerial system. It will be noted that the maximum possible horizontal length of aerial is 40 ft. A little over this length is available for counterpoise, with a width of 18 ft. The circuit in use in all the experiments is shown in Fig. 2, being the usual coupled Hartley with parallel anode feed. The tube in use is an Osram, type T.250. The H.T. is supplied at 800 and 1,700 volts, being valve-rectified and smoothed A.C. at 50 cycles, from 200 volt mains. The valve filament is heated by A.C. at 12 volts. The maximum power input is 150 watts.

Natural Wavelength

It was reasoned that if an aerial system could be set up, having by itself a natural wavelength around 69-70 metres, this could be reduced by means of series condensers, either in both aerial and counterpoise leads, or in one lead only, thereby securing operation at the fundamental of 45 metres. The natural wavelength of an aerial is approximately 4·2 times the length in metres, measured from the transmitter to the free end, this only applying, of course, when an earth is in use.

An aerial was erected consisting of a practically vertical wire 35 ft. long plus the 14 ft. horizontal lead-in, which, unfortunately, cannot be avoided. According to the formula the natural wavelength should be approximately 63 metres, but the building is fairly close and there is the counterpoise and its capacity to earth to be taken into account. No difficulty was experienced in getting this radiating system to work. The antenna current was 2·0 amperes with a power input of 150 watts. The counterpoise used was the same length as the aerial and supported 4 ft. above ground.

Current Measurements

It should be noted that all current measurements must be taken at the same place, in order to get reliable indications for each system, and the aerial ammeter used in all tests was connected 6 in. from the aerial end of the aerial circuit inductance. Further observations on this point will be found later on in the article.

By opening the aerial switch S (Fig. 2), an arc was obtained $\frac{1}{4}$-in. long. The system was used over a period of three weeks, during which time conditions were good, but contact could not be established with U.S.A. or any distance over 1,000 miles, although the daylight signals were reported to be good, varying from R5 to R7 in Great Britain.

The conclusion arrived at with regard to this type of antenna system is that it would be excellent

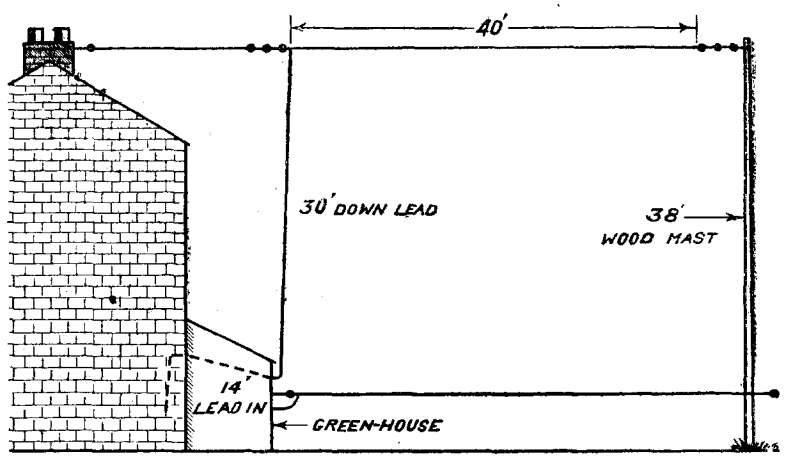


Fig. 1. The down-lead is as nearly vertical as possible, and the aerial is parallel with the counterpoise.

SOME NOTES on 45-METRE TRANSMISSION—*(Cntd.)*

in a situation entirely away from all buildings, and where long horizontal lead-in wires can be dispensed with, thereby securing the maximum proportion of the antenna wire "in the air" and giving maximum height. The form factor is improved considerably in such case.

The Hertz Antenna

Much has been heard lately of this form of antenna, and some stations are obtaining good results by its use. It, however, appears largely a matter of local conditions, this type being useless at some stations, for reasons not always apparent.

at a given instant is shown at C (Fig. 3). It becomes necessary with this type of aerial to tune the closed circuit of the transmitter to resonance with the aerial, instead of the usual method, in which the process is reversed.

The dimensions of the aerial govern the wavelength, which is therefore "fixed." In some respects this is a disadvantage, since the wavelength cannot at any time be changed to avoid interference, etc.

The radio-frequency feeder connects to a "pick-up" coil coupled to the closed circuit inductance, the

5LS, the remainder being brought down vertically to the ground. This arrangement did not work at all satisfactorily, most likely owing to the fact that although the difficulty of the long lead-in had been overcome, the whole object of this type of aerial had been defeated, due to the presence of the building and the ground, near the vertical portion.

The extremities of the aerial, it must be remembered, are at a high potential to earth, and therefore liable to considerable losses through any capacity introduced. In order to overcome this diffi-

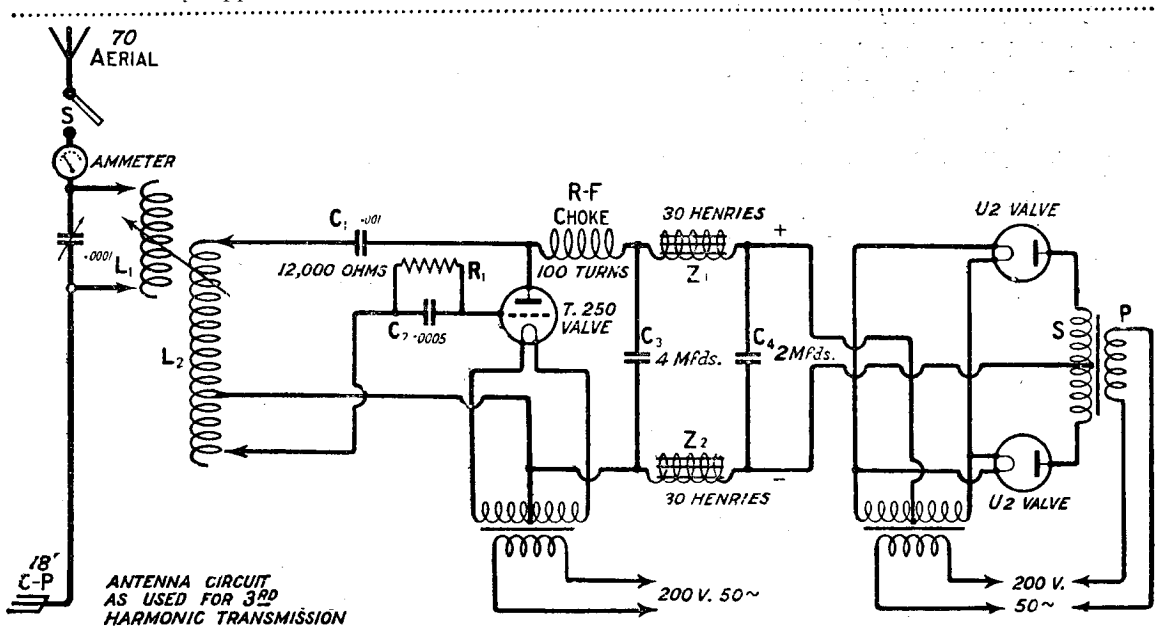


Fig. 2. The transmitting circuit used at 5LS for 45-metre transmission. Power is obtained from 200 volt 50 cycle A.C. mains.

The present application of the principle is shown in Fig. 3. It will be seen that the whole antenna system is raised aloft, and the aerial is excited by means of the radio-frequency feeder. Since it is not practicable to put an aerial ammeter in the aerial proper, it is usual to insert a small lamp at L to act as an indicator.

An ammeter in the R.F. feeder will show current, but will not indicate whether the antenna is in true resonance.

Current Distribution

The antenna wire of the Hertz aerial is exactly half a wavelength long, and the distribution of current

end of this furthest from the closed circuit coil being left blank.

Increasing Radiation

It was found of considerable advantage to connect a variable condenser across the pick-up coil, this arrangement increasing the radiation indicated by the lamp, and rendering the tuning much easier. The condenser must be spaced sufficiently to stand the high potentials set up across the pick-up coil.

Since the aerial requires to be half a wavelength long, or approximately 73 ft. for 45 metres, it was only possible to get a little over 40 ft. in a horizontal position at

culty of limited space, a rather interesting form of the Hertz antenna was tried. This consisted of a "3rd harmonic" arrangement—if such it may be termed—the antenna being a 15 metre Hertz (24 ft. long approx.) and the driver oscillating at 45 metres, with usual pick-up coil arrangement.

Adjusting the Transmitter

It was found difficult to get this scheme into proper working order, and careful wavemeter measurements were necessary in adjusting the transmitter, it being possible to secure radiation indications at several "jazz" frequencies. Once set, however, fairly good results

Some Notes on 45 Metre Transmission

(Concluded)

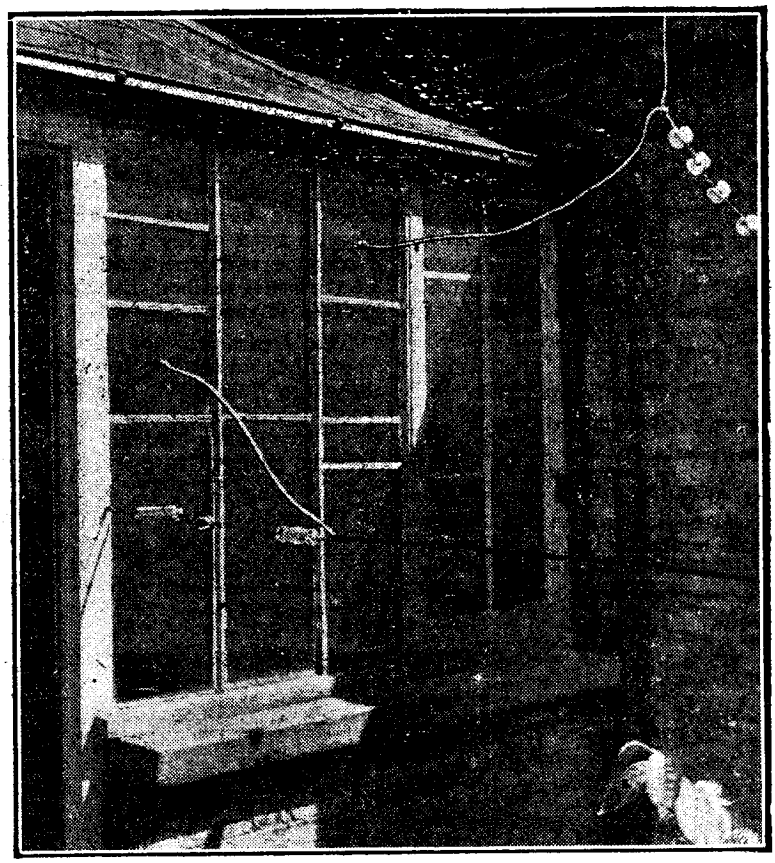
were obtained, signals being reported R4 to R5 in U.S.A. Several antenna lamps "went west" until suitable values of "shunts" were found! The difficulty with the lamp indicator in the Hertz aerial is that it is not easy to arrange the value of the shunt so that some indication is given with low power input, and high power does not burn out the lamp.

Third Harmonic

This method has proved the most satisfactory of all, and is at present in use. The aerial consists of the full 40 ft. horizontal portion with 30 ft. down lead, plus the 14 ft. lead-in from the outside of the building. The counterpoise is 18 ft. long. The aerial is No. 12 s.w.g. single wire, but all other leads, including the counterpoise itself, are $\frac{3}{8}$ in. copper strip.

This has the great advantage that the efficiency of the aerial for broadcast reception, or short wave reception, is not diminished by reason of a small aerial, or an aerial with the lead-in "off-centre."

Now the so-called "third harmonic" of 45 metres is 135 metres, and it is therefore necessary to tune the aerial circuit to this wavelength, in order to radiate properly. If the aerial circuit is tuned to a wavelength several metres below this, it is still possible to obtain some radiation, although small, and it was some time before it was realized that really efficient working was not being obtained, although signals were reported R5 in U.S.A. Series condensers were in use.



The lead-in arrangements for aerial and counterpoise are kept as well apart as is practicable.

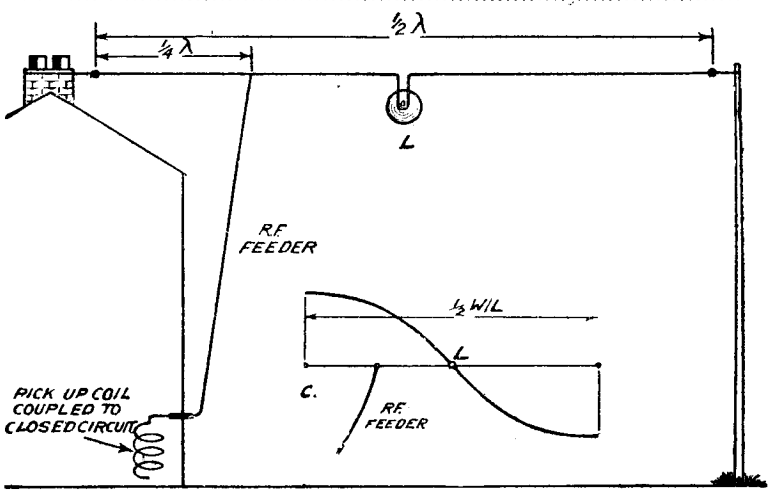


Fig. 3.—The method of arranging a "Hertz" type aerial is clearly seen from this diagram.

The Tuning Condenser

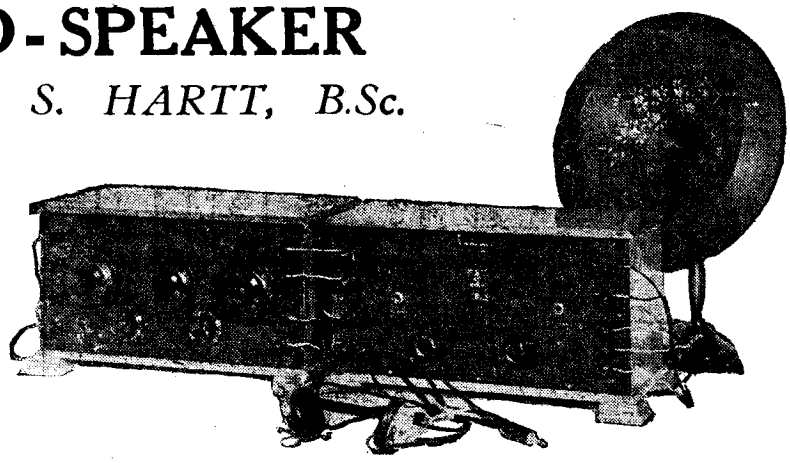
The usual arrangement appears to be a five or six turn coil with series variable condenser. Now with a small, or low capacity aerial, the maximum wavelength obtainable with a series condenser is well below 135 metres, especially if high power is used and the condenser double spaced, giving a capacity less than ·0004 mfd.

The tuning condenser should therefore be in parallel with the aerial inductance, and this applies to most amateur aerial systems, unless very long or of high capacity. As usual in all parallel circuits, it is desirable to increase the ratio of inductance to capacity as much as possible. Fifteen turns spaced $\frac{1}{8}$ in. and 3 in. diameter were found suitable with a ·0001 mfd. condenser, the turns being adjusted so as to keep the condenser setting less than 20°. The tuning is fairly sharp, and at resonance the aerial current is doubled. At 5LS a current of ·8 amp. is obtained with an arc $\frac{3}{4}$ in. long at the antenna switch.

With the other arrangements it was difficult to prevent heating of the anode of the valve.

GETTING THE BEST FROM YOUR LOUD-SPEAKER

By D. J. S. HARTT, B.Sc.



In this article Mr. Hartt gives a number of well-tried "quality" circuits, together with many helpful hints upon tone control.

LOUD-SPEAKER design has progressed to a large extent within the last two years and a good modern instrument used in conjunction with a suitably designed amplifier gives very creditable reproduction with remarkably good fidelity to the original. Nevertheless, the reproduction one hears from a good many loud-speakers operated both for demonstration purposes and for domestic entertainment is not always too good, and the distortion is often of a type which can be "corrected" by very simple means.

It is the purpose of this article to indicate the most suitable types of circuits to use if you want to do full justice to your loud-speaker, and to discuss in somewhat more detail the common methods of tone control.

Resistance Amplification

The circuit of Fig. 1 shows a conventional arrangement of detector valve with three stages of resistance-coupled amplification. This circuit, if correctly proportioned, gives perhaps the nearest approach to a straight line amplification curve it is possible to obtain; in most cases it is by no means a straight line. Such a curve often contains a fair number of pronounced peaks, indicating resonance at a number of definite frequencies. Thus, although your amplifier may be practically perfect, the overall effect may not be uniform. However, as will be seen later, such lack of uniformity can to a certain extent be corrected in a fairly simple manner.

Values for Components

Several sets incorporating this type of circuit have been described in this journal, and for further

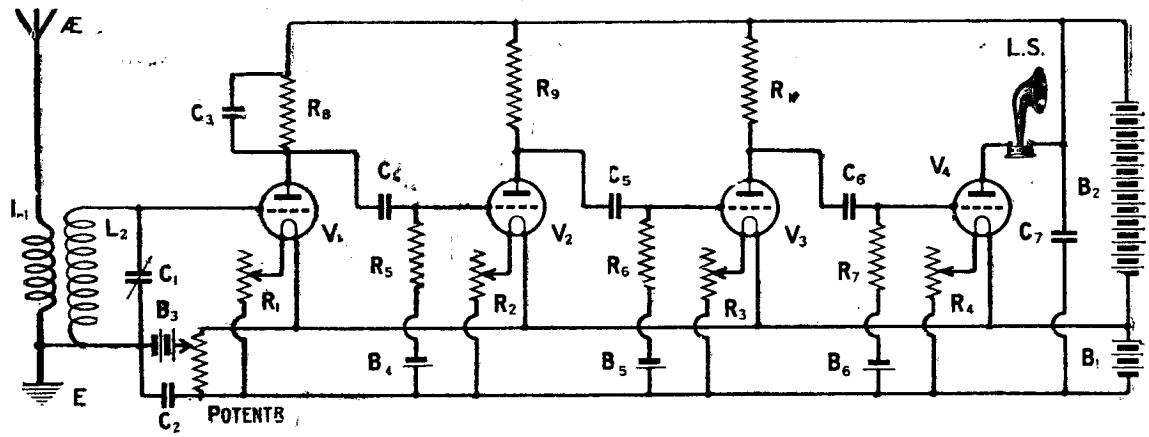


Fig. 1.—A circuit of this type employing resistance-capacity coupling is capable of giving extremely good reproduction.

Bad Impressions

Distorted loud-speaker reproduction for demonstration purposes is an extremely bad advertisement, and not only does it do harm to the dealer concerned but has a more far-reaching influence on the art in general.

that is to say, it makes possible uniform amplification over practically the whole of the range of speech and music frequencies. What the overall amplification curve would be like, considering the loud-speaker as well, would depend on the latter, and it may surprise some people to know that

details the reader is referred to these articles. It will be sufficient if I indicate here some values for the more important components. The anode resistances R_8, R_9 and R_{10} should be wire wound and non-inductive and have a resistance of the order of 100,000 ohms. The coupling condensers

GETTING THE BEST FROM YOUR LOUD-SPEAKER

(Continued)

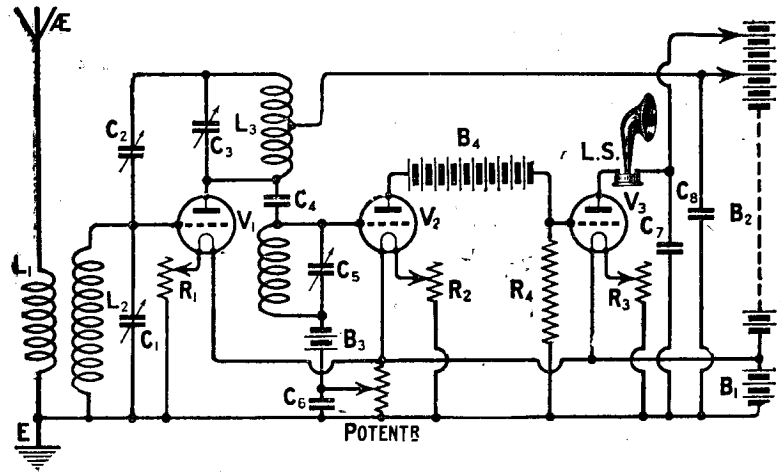


Fig. 2.—A modification of the Prince circuit, from which both good quality and volume are obtainable.

C_4, C_5 and C_6 may have values of 0.1 microfarad, and the grid leaks R_5, R_6 and R_7 should be about 0·5 megohm. If three valves of the resistance-capacity type and one of the small power-valve class for the last valve are used, the same value of H.T., say, 120 volts, may be used on all the valves. In this circuit anode rectification is shown, but the gridleak and condenser method could be used just as well.

An Interesting Circuit

Fig. 2 shows a circuit perhaps less familiar to many readers. It is essentially a Prince circuit, embodying a stage of neutralised high-frequency amplification, and is capable, with proper adjustment, of giving exceedingly good quality. The second valve has in its grid circuit arrangements for adjusting the negative grid potential to a suitable steady value, while its anode is connected to the positive of a coupling battery B_4, the negative of which is taken directly to the grid of the last valve. A grid leak R_4 of 0·25 to 1 megohm is provided on the last valve.

The value of the coupling battery B_4 is not critical and usually anything from about 12 to 20 volts will serve quite well. Using, say, two valves of the D.F.A.4 or D.E.8 H.F. type for V_1 and V_2, and a power valve for V_3, it should be possible to obtain excellent loud-speaker strength and quality at distances up to 20 miles from a main station, providing a reasonably good aerial is available.

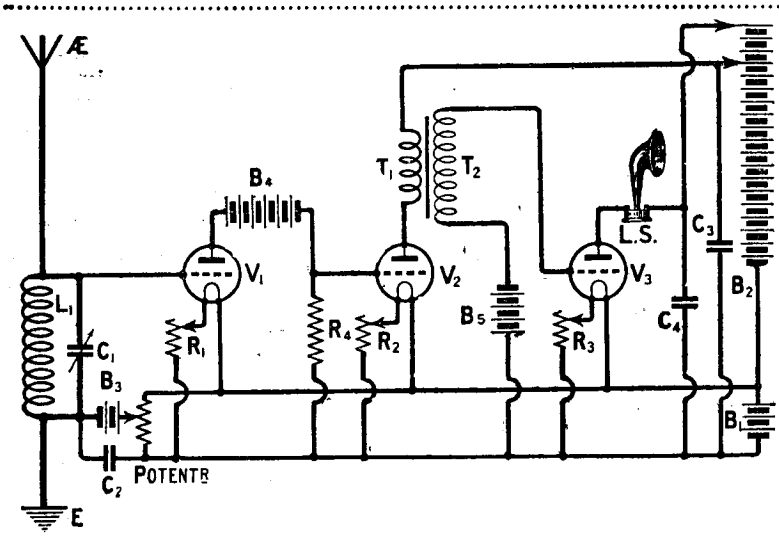


Fig. 3.—Another example of the Prince circuit. In this case the last valve is transformer-coupled and no high-frequency stage is employed.

A Modification

In Fig. 3 is shown another interesting modification of the Prince circuit, having the usual two valves but followed by a stage of transformer-coupled note-magnification. The same remarks as to the choice of valves for V_1 and V_2 apply as for V_2 and V_3 in the previous circuit. V_3 should be a power valve with ample H.T. and suitable grid bias. A first-class 6 to 1 ratio transformer may be used for T_1 T_2.

Choke-Coupling

Fig. 4 shows a choke-coupled circuit which some may prefer

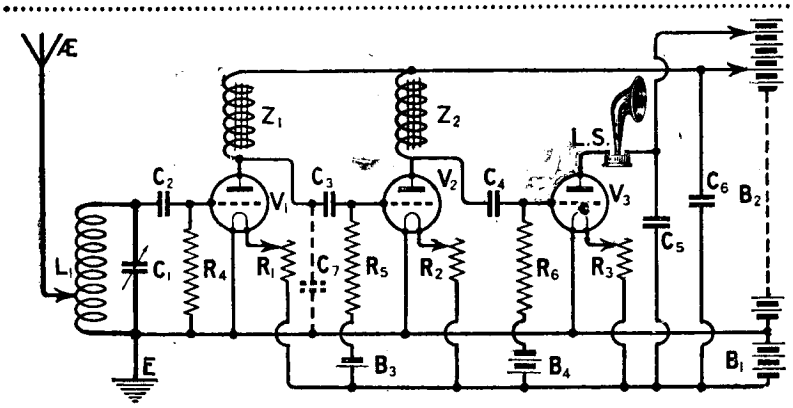


Fig. 4.—In a choke-coupled circuit of this type the chokes Z_1 and Z_2 should have a high inductance value if the best results are desired.

GETTING THE BEST FROM YOUR LOUD-SPEAKER

(Concluded)

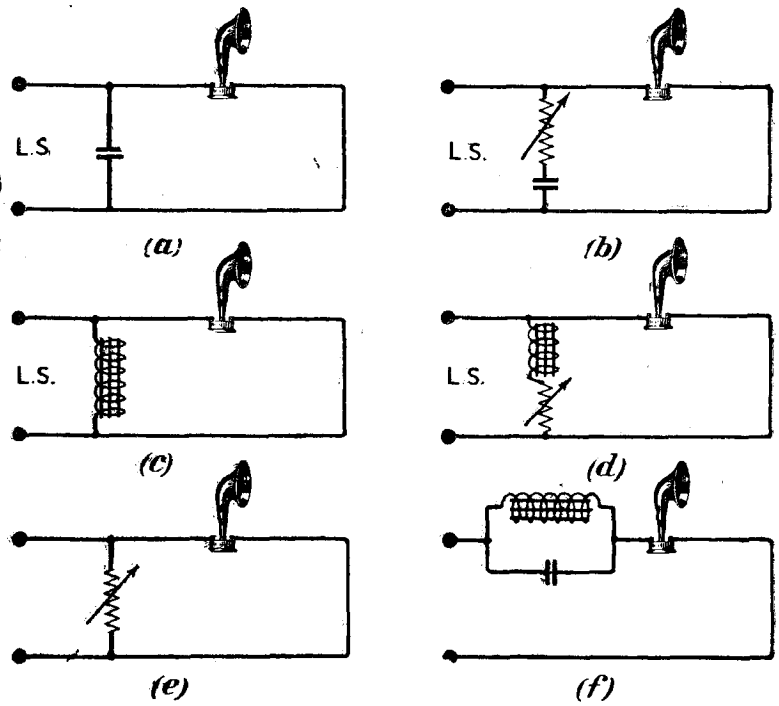


Fig. 5.—Various methods for raising or lowering the tone are suggested by the author. A suitable resistance across the loud-speaker as in Fig. 5e is useful as a volume control.

to the resistance-coupled arrangement on the grounds of a slight economy in H.T. current and a quality of reproduction which falls a little short of that given by the latter method.

The choke should be of the best quality and have an inductance of the order of 100 henries. The values of the coupling condensers C_3 and C_4 and the gridleaks R_5 and R_6 are as for the resistance-coupled circuit.

Tone Correction

Now with regard to methods of tone control, let us first examine what are found in practice to be the most common defects of loud-speaker reproduction. Unquestionably the one most commonly met is a predominance of the higher pitched notes giving a certain unbalanced effect which results in high-pitched, thin reproduction.

Shunting Condensers

In bad cases where all notes below a certain frequency are entirely suppressed it is impossible to correct the defect, but a more balanced effect, perhaps more pleasing to the ear, can be obtained by shunting the loud-speaker with a condenser of suitable value. It is well known that the higher the value of a condenser the less is its impedance to currents of a definite frequency, so that a small condenser will allow higher-frequency currents to pass more readily than those of lower frequency. By the provision, then, of a suitable condenser across the loud-speaker windings we can by-pass a certain proportion of the higher frequency impulses which do not therefore affect the loud-speaker.

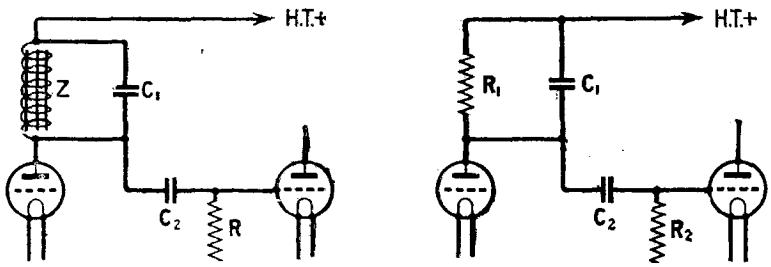


Fig. 6.—With choke or resistance-coupled amplifiers a satisfactory control of the higher pitched notes may be obtained by shunting a small condenser across the choke or resistance.

Muffled Music

The ultimate effect of carrying this to the extreme by making the condenser too large is to produce a muffled "woolly" tone. Values for this parallel condenser for different loud-speakers used on various sets lie within fairly wide limits, which may be taken roughly as between .002 and .01, but .005 is a fair average value.

Additional Control

If we include a resistance in series with the by-pass condenser (Fig. 5*b*) we can still further vary the extent to which the currents of higher frequency are by-passed.

A very much less common defect is absence or lack of the higher-frequency notes; but if this should occur, it must be corrected by applying a low-frequency by-pass across the loud-speaker windings.

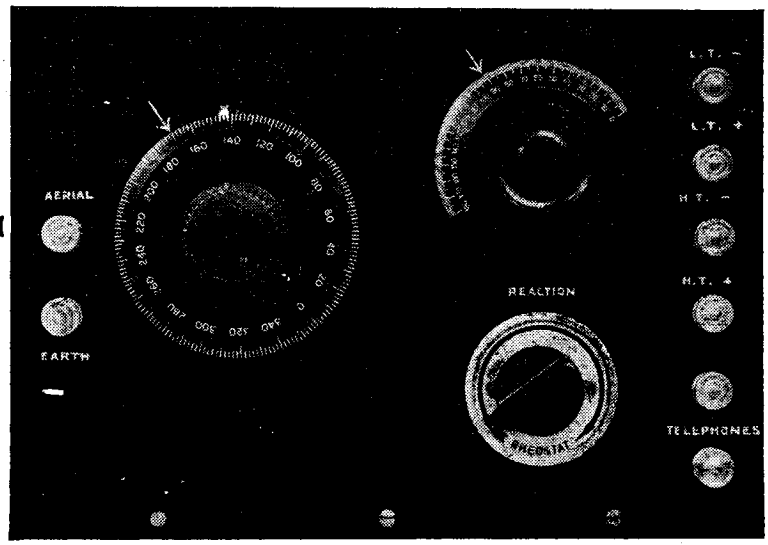
The low-frequency by-pass may consist of a choke coil connected in parallel with the loud-speaker windings. As tapped chokes would probably have to be made by the experimenter himself, the expedient of inserting a variable resistance of, say, 0—0.5 megohm in series with a choke of, say, 15 or 20 henries may be tried. (Fig. 5*d*.)

Resonance Effects

A more frequent cause of distortion is due to resonance peaks at a number of different frequencies in the overall amplification curve, due to the loud-speaker. In some cases the amplification may be so out of proportion as to cause the diaphragm to rattle and so render the defect most obvious. The remedy, of course, is to interpose a circuit which will have the effect of partially cutting out currents of that frequency before they reach the loud-speaker. This may be effected by connecting in series with the instrument a parallel combination of a choke coil and condenser (Fig. 5*f*) having such constants that the combination tunes to the frequency in question.

SPLIT COIL CIRCUITS WITH ORDINARY COILS

by W. G. KAY



This simple and efficient little set is suitable for use on both long and short wave lengths. By means of a novel feature the constructor is able to obtain the special advantages of split coils with coils of the ordinary plug-in type.

WITHIN the past few months many types of circuits have been devised which make use of coils having tappings either at the centre or at some other point on the coil. In many cases these circuits are primarily designed to operate on the shorter broadcast wavelengths, and the question of obtaining satisfactory reception from Daventry is very often considered only as an afterthought.

Daventry

There are, however, many people who live at a considerable distance from the nearest "local" station, distances of 80 to 100 miles separating the listener from his nearest source of broadcast energy. In such cases the reception from Daventry is as important as that from the stations operating on the lower wavelengths, even if not considerably more so. Consequently a circuit which will operate at full efficiency on the Daventry wavelength is greatly to be desired.

Novel Features

It was as the result of some experiments carried out on these lines that the present circuit was evolved. The arrangement to be described has several novel features. The circuit is as efficient on the longer waves as on the short, and the method of reaction control adopted is one which gives smooth and progressive amplification up to the point of oscillation.

Another very useful feature is that the circuit itself is in effect a split-coil circuit, but no tapped coil is employed, nor is any special condenser employed for the tuning. This enables one to obtain the full benefit of split-coil arrangements while using makes of plug-in coils which are not provided with any tapping. There are several new makes of coils now on the market, and many readers must have wished that such coils could be used in some of the split-coil arrangements which have been developed.

The features incorporated in this receiver enable this to be done, and actually some of the "Lewcos" plug-in coils, wound with Litzendraht wire, have been utilised.

The Circuit

The circuit itself is shown in Fig. 1. It will be observed that it is similar in every way to the now conventional circuit employing centre-tapped coils. One end of the coil L_1 is connected to the grid, the other end is connected to the anode through a small variable condenser C_4, while the "centre tapping" is connected to the filament of the valve.

Balancing Condenser

In this particular case, instead of taking the filament connection to the coil itself, a small balancing condenser has been connected across the whole coil. This is a component comprising two sets of fixed plates with a set of moving plates which can be rotated in between the banks of fixed plates. In one position the moving plates are interleaved with one set of fixed plates, and as the condenser is turned through 180 degrees so the plates gradually leave the one set of fixed plates and start to interleave with the other set.

Mr. G. P. Kendall has suggested that by the use of an arrangement

such as this it should be possible to achieve the same results by electrical means as would be obtained by the usual tapping on the coil. Messrs. Peto-Scott, Ltd., have made up a balancing condenser on the lines suggested, and the preliminary experiments seem to show that the electrical method does not produce quite the same results as actual tapping of the coil in all cases.

There are, however, some circuits in which the desired effects can be produced, and the present circuit appears to be one of this class. The connection to the filament, therefore, is not taken to any point on the coil itself, but is taken to the moving plates of the balancing condenser, the two fixed plates being connected across the whole coil as shown.

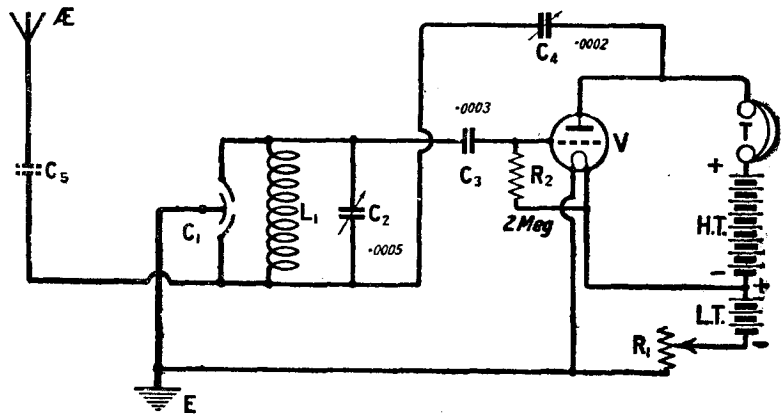
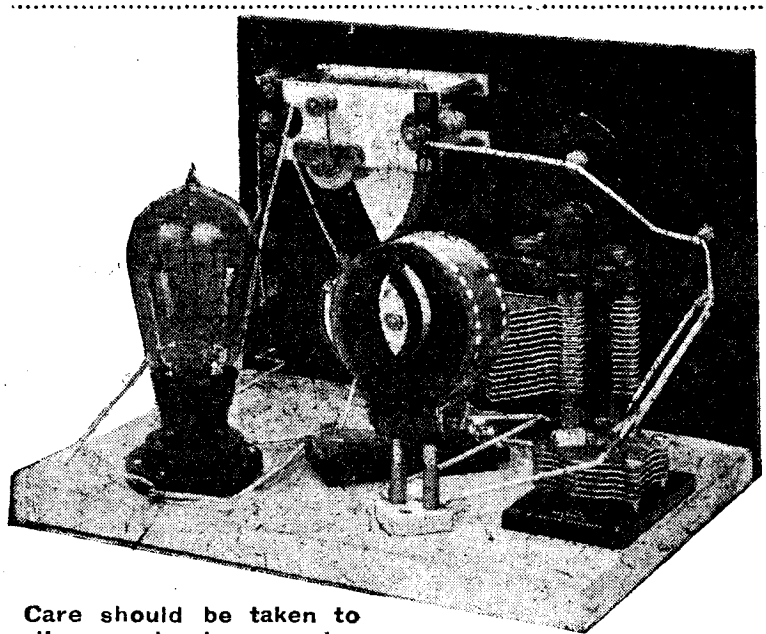


Fig 1.—The theoretical circuit of the receiver. It will be noticed that no radio-frequency choke is included in the anode circuit, since better results were obtained without it.



Care should be taken to allow ample clearance between the various leads and the moving vanes of the condenser C_2.

With a suitable setting of the balancing condenser a position can be obtained where the reaction condenser C_4 controls the oscillation easily and smoothly from top to bottom of the range of the variable condenser C_2.

Reaction Control

At first an ordinary neutralising condenser was used for C_4 and a choke was inserted in the anode circuit. This was not found altogether satisfactory as there were positions where the receiver did not oscillate at all, particularly when the coil L_1 was replaced by one serving the Daventry wave band. Better results were obtained, therefore, by omitting the high-frequency choke and increasing the size of the condenser C_4.

In practice a .0002 condenser has been employed, and it is then comparatively easy to find a setting of the balancing condenser C_1 for which the receiver can be controlled throughout the whole range of the tuning condenser C_2 irrespective of the coil L_1. In laying out the set, however, space has been left for the insertion of the high-frequency choke, should any reader

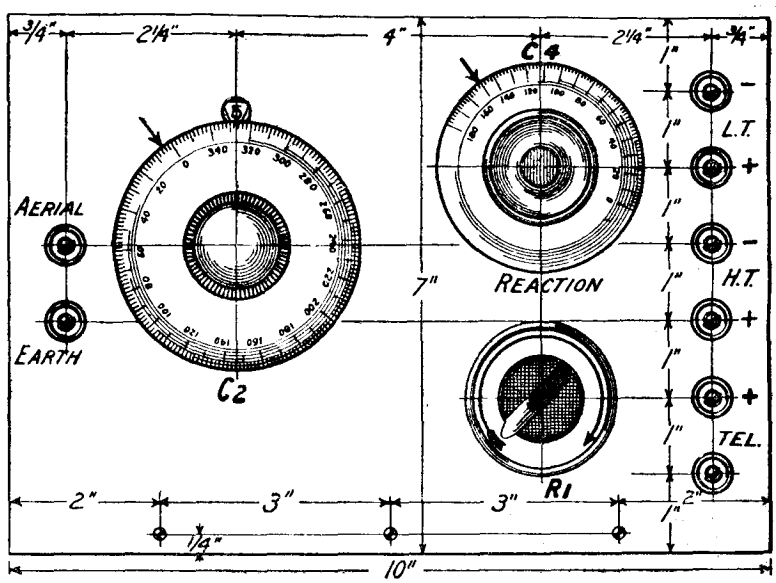
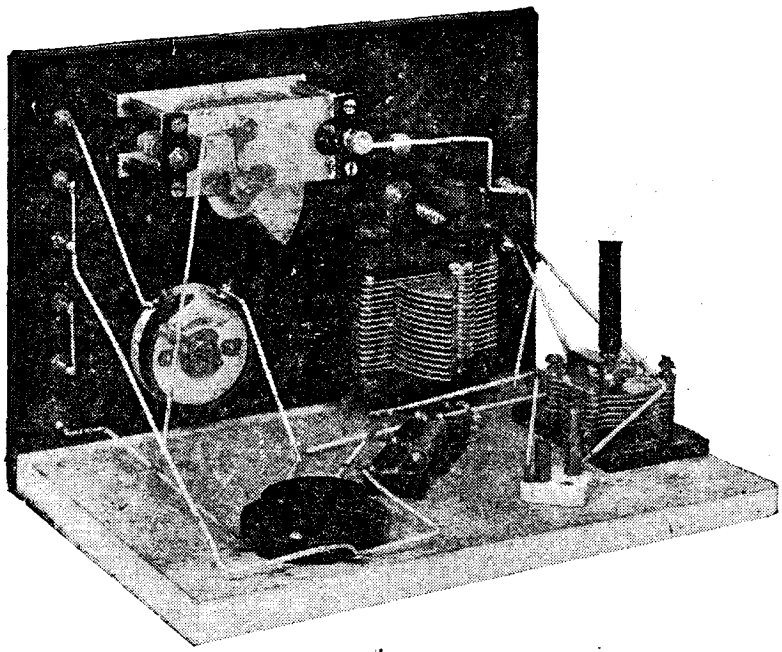


Fig 2.—The panel layout is delightfully simple. If you desire a full-sized drawing, ask for Blue Print No. 168a, which may be obtained free.



The complete receiver may be constructed in a single evening.

find it desirable, although in the case of the particular receiver described definitely better results were obtained without the choke.

Aerial Damping

The aerial circuit is connected to the bottom end of the coil L_1, the earth being connected to the negative of the filament. This arrangement results in the aerial being connected, in effect, across half the coil, but one of the effects of the balancing condenser C_1 is to remove the aerial damping from the circuit to some extent. The aerial has been connected to the bottom end of the coil to avoid the direct action of the aerial through the valve itself, a phenomena which is often responsible for a loss of selectivity, resulting in the local station being heard over a considerable range.

Since this receiver is designed primarily for use at a considerable distance from the local station, however, this point is not of very great importance. Those readers who desire to experiment for themselves can try the effect of inserting a C.A.T. condenser in the aerial circuit, as shown dotted as C_5. This will result in a slight increase in the selectivity, but quite satisfactory results will be obtained without this additional complication.

Components

The components required are as follows:

One cabinet (Peto-Scott Co., Ltd.).

One ebonite panel, 10in. by 7in. by ¼in. (British Ebonite Co.).

One baseboard, 10in. by 7in.

One Colvern selector variable condenser .0005 (Collinson's Precision Screw Co.).

One square-law variable condenser .0002 (Jackson Bros.).

One filament rheostat, to suit the valve (Igranic-Pacent).

One fixed coil holder (Atlas).

One "vibratory" valve holder (Lotus).

One fixed condenser .0003 (Dubilier).

One 2-megohm leak with grid-leak attachment (Dubilier).

One balancing condenser (Peto Scott Co., Ltd.).

Eight W.O. type 4 B.A. terminals.

One packet Glazite wire.

One packet Radio Press panel transfers.

(*Continued on page* 191).

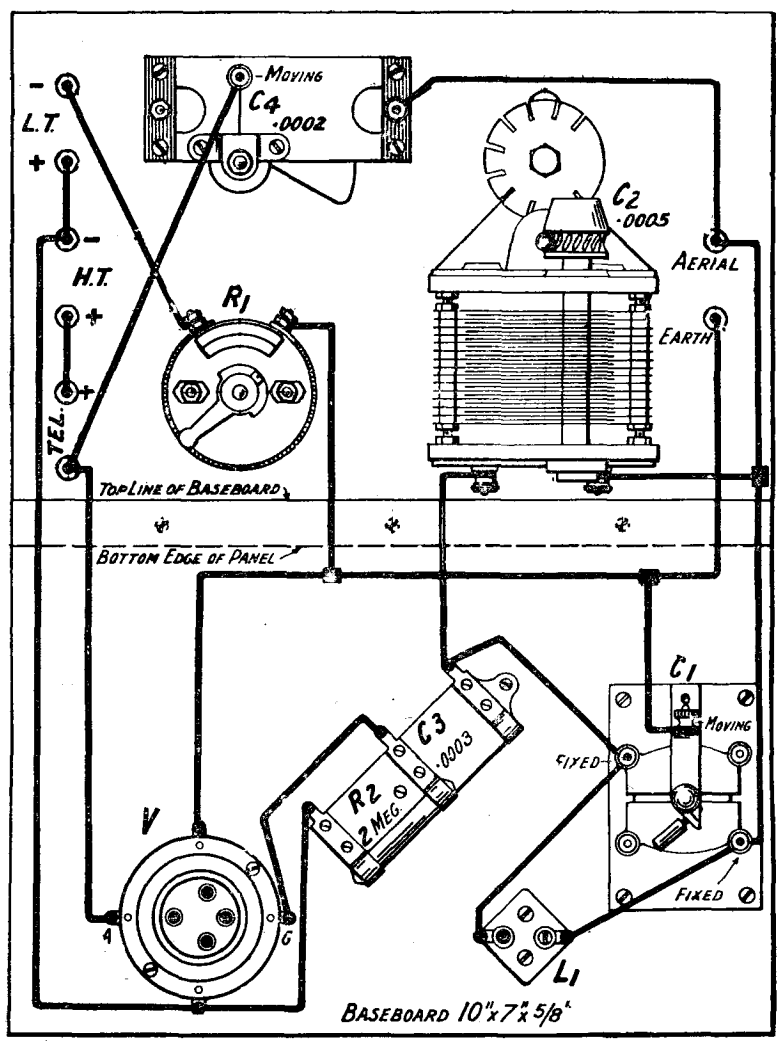


Fig 3.—This easy wiring diagram should present no difficulties. A full-sized blue print, No. 168b is obtainable free.

"PLAYING" THE RECEIVING SET

by
JOHN UNDERDOWN

To obtain the best from any receiver requires practice and delicacy of handling. Some of the finer points are dealt with in this article in a simple and clearly understandable manner.

IN many cases the letters which I receive indicate that readers obtain better results than those mentioned by the author in his test report, owing to the fact that generally a conservative one is given deliberately, since the sets may be employed in poor positions which I have investigated personally, lack of skill on the part of the operator has been responsible.

Delicate Tuning Required

No one who had never previously played a piano would expect to duplicate the playing of the experienced pianist without constant and delicacy of touch and the correct sequence of tuning adjustments have been fully mastered.

Sequence in Tuning

My experience is that readers handling a loosely-coupled receiver with a high-frequency stage, neutralised by any of the present

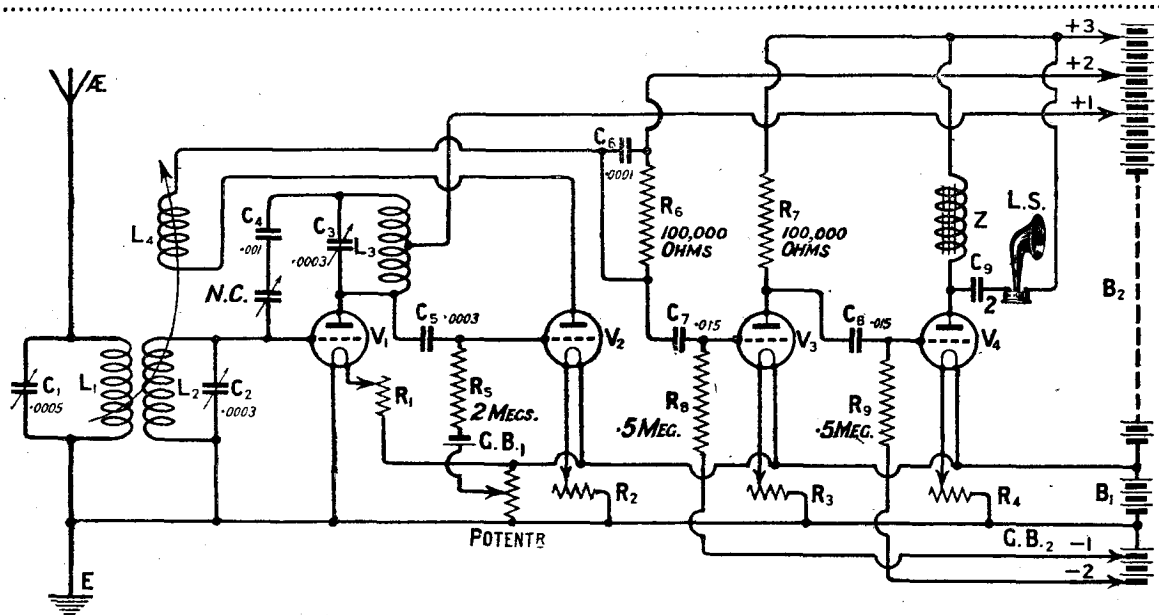


Fig. 1.—Logical sequence should be followed in tuning, if the maximum results of which the receiver is capable, are to be obtained.

and disappointment would be caused to constructors in these cases. Occasionally, however, it is complained that it is impossible to obtain results approaching those given, despite careful attention to all details, the employment of the valves, H.T. and types of coils used, and in several such cases, protracted practice, and the proper handling of the receiving set is a parallel case. By this I do not mean to indicate that good results may not be obtained from the beginning, since this is possible; but the highest degree of selectivity and the last ounce of range and power will not be obtained until methods, are somewhat at sea as to which is the best adjustment to make first. For the sake of illustration, therefore, the circuit diagram shown in Fig. 1 is given. The circuit is that of a loosely-coupled 4-valve set, consisting of a high-frequency amplifier, a detector and two resistance-coupled note

magnifiers. The coupling of the high-frequency valve is of neutralised tuned anode type, whilst magnetic reaction is incorporated on to the secondary coil, in order that once the receiver has been neutralised for a given wavelength range, this adjustment need not be upset, all reaction effects being obtained by means of the reaction coil L_4.

Battery Adjustments

Assuming that one has completed the wiring of a set, and has the necessary coils, valves and batteries, the order of the adjustments which should be carried out is as follows:

In the V_1 valve holder a high-frequency type valve should be inserted, whilst a similar type valve will prove suitable also for the detector V_2. For V_3 a resistance-coupling type is required and in the last valve socket, V_4, a small power-type must be used if really good loud-speaker volume is to be handled.

First connect up the L.T. battery and make certain that the brilliancy of all valves is controlled properly by their respective filament resistances, when the next step should be to insert appropriate coils in all positions excepting L_1 and L_4. The L_4 coil socket should be short-circuited by a suitable plug at this juncture. In the secondary coil socket, that is, the L_2 position, a coil suitable to cover the required wavelength range in conjunction with the secondary condenser C_2 should be placed, and a similar size of coil will be required for L_3, but in this case it must have a centre tapping.

H.T. Voltages

With the loud-speaker connected in position the three H.T. positive terminals should be joined together, whilst a lead from H.T. negative should be taken to the negative terminal of the high tension battery. If now the combined H.T. positive lead is tapped into a voltage of 6 volts or so, and the valves do not light more brilliantly the three positive tapping plugs may be taken to suitable voltages in the H.T. battery. On the H.F.

"PLAYING" THE RECEIVING SET (Continued)

valve voltages between 40 and 60 are usually satisfactory with most types of H.F. valves and H.T.+ should be inserted into some intermediate tapping between these limits.

In the case of the detector valve there is an anode resistance in its plate circuit which will necessitate a fairly high value of H.T. and here a voltage of the order of 100 will probably be suitable. On the note magnifiers 100 to 120 volts is generally to be advised with grid bias of the order of $1\frac{1}{2}$ or 3 volts for V_3 and 6 to $7\frac{1}{2}$ for V_4.

Anode Rectification

It will be observed that the detector valve has been arranged to rectify on the lower bend of its anode-current grid-volts characteristic curve, a single cell being shown for grid-bias purposes. A single cell only is required in the case of a number of the new H.F. type valves, but if you are not certain of this point obtain a tapped grid-bias battery of 6 or 9 volts.

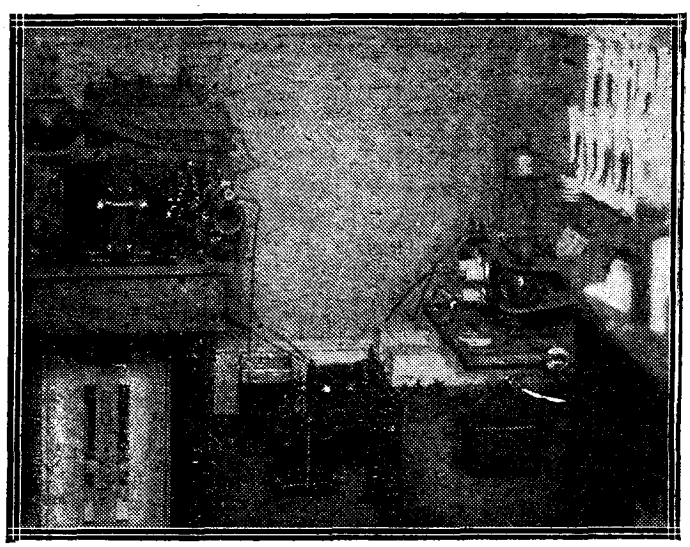
Neutralising

The receiver, as now connected, that is, with coils in the L_2 and L_3 coil sockets, L_4 shorted, no coil in the L_1 socket and aerial and earth disconnected, is ready for neutralising. If the secondary condenser C_2 is left set at some intermediate value, say, for example, 50 degrees, upon swinging the tuned anode condenser C_3 "plops" should be heard from the loud-speaker as the set goes in and out of oscillation. It is our object to eliminate these "plops" by suitably adjusting the neutralising condenser NC,

Method Used

You should not expect to hear heterodyne whistles, such as are obtained with an oscillating set upon an outside aerial, oscillation being indicated by "plops" only. Start first with the neutralising condenser at its minimum setting, and gradually increase its capacity periodically, swinging C_2 backwards and forwards and noting whether the positions of the two "plops" on the C_3 scale have come nearer together. By careful adjustment of NC a point should be obtained where no movement of C_3 will give audible "plops."

Having obtained this condition of affairs, now try altering the setting of C_2 as well as that of C_3, and if at either of the extremities of the scale of these two condensers slight "plops" reappear, slight alteration of the setting of NC should allow stability to be obtained all over the range of wave-lengths covered by the two tuning coils and their associated condensers.



The amateur transmitting station 2WJ owned by Mr. R. L. Royle. Mr. Royle is an enthusiastic short wave experimenter.

A Point of Interest

Certain readers may be puzzled by the fixed condenser C_4 placed in series with the neutrodyne condenser, and I would explain that its function is to prevent any short circuiting of the H.T. battery if a type of neutrodyne condenser whose plates may touch is used. The capacity of C_4 is not critical and any values above .0003 or so, prove suitable, since they will have negligible effects in reducing the maximum capacity of NC.

On the Aerial

With the receiver neutralised correctly connect aerial and earth to the appropriate terminals and in the aerial coil block place a suit-

Another great contribution to the Science of Radio by Cossor

Red Top:
For H.F. use.

Plain Top:
For Detector or L.F. use.

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The new Cossor Point One

—the ·1 amp. Valve which utilises Co-axial Mounting

Cossor Stentor Two
Power Valve
Consumption ·15 amp

18/6
For 2-volt Accumulators.

IT was a flash of genius that enabled Simpson eighty years ago to discover chloroform. Genius, too, helped James Watt to read the lesson of the steam engine in the escaping steam from his mother's kettle. Assuredly it was genius that caused Montgolfier to visualise in the floating remnants of a burning paper bag the world's first balloon—the prelude to man's conquest of the air.

And once again a touch of genius has been responsible for an entirely new method of valve construction that bids fair to produce results which, but a year ago, would have been considered impossible.

The new series of Cossor valves employ—for the first time in the history of Radio—a method which, accurately and for all time, ensures perfect alignment for the filament, grid and anode. At the same time it provides a shockproof support for the filament.

Thus throughout the whole life of the valve its working characteristics cannot alter. Age cannot cause filament sag nor can hard wear disturb the exact relative positions of the filament, grid or the anode.

But this is not all. The improved Cossor filament consumes but a moiety of the current required by other Dull Emitters—its consumption at 1·8 volts being barely one-tenth of an ampere. A seven-valve Super Heterodyne, for example, using these new Cossor Point One Valves would not consume as much current as a little one-valve set using a single bright emitter.

As can be imagined, the filament used in this new Cossor is no ordinary filament. Owing to its exceptional length and its scientific method of preparation a great latitude in working voltages is permitted. Satisfactory results are obtainable at a voltage as low as 1·2, so that the valve can, if required, be used with dry cells. Further, its operating temperature is lower than that of any other valve on the market. And everyone knows that low temperature means long life.

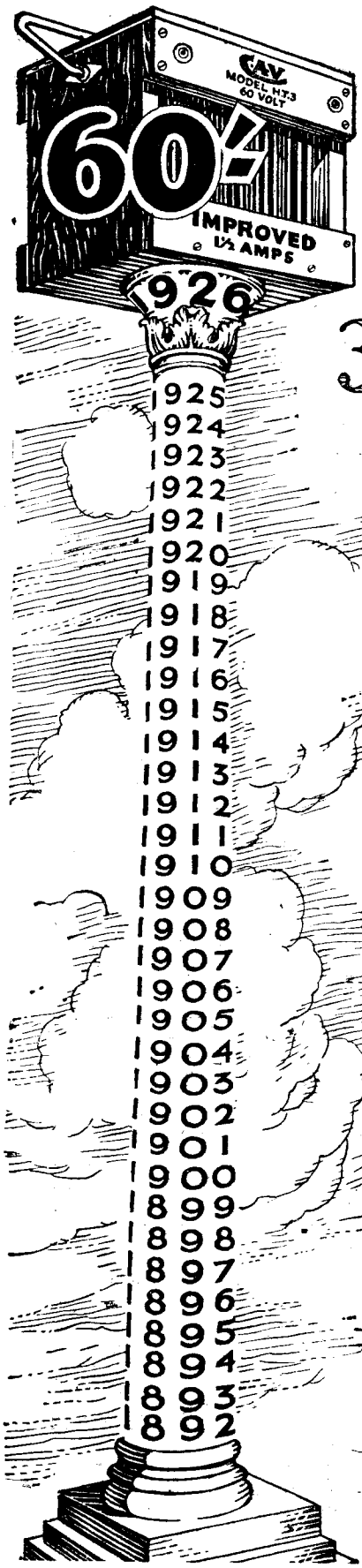
The Cossor system of Co-axial Mounting has now finally abolished the last bug-bear of dull emitter valves—microphonic noises. Individual movement of either the grid or the anode in the Cossor Point One is utterly impossible. The seonite insulator holds them both in a vice-like grip which defies the hardest shock.

With its handsome pipless glass bulb, its re-designed low loss moulded base, and its new positive contact pins the introduction of these new valves represents one of the most important events in the progress of the Valve. See your Dealer about them to-day—we can promise you new delights in radio reception. A greater economy, improved sensitivity, a wonderful richness of tone, with a length of life and uniformity of performance which will positively astonish you.

Cossor Valves

—The new Dull Emitters with the long-life ·1 amp. filament.

Issued by A. C. Cossor, Ltd., Highbury Grove, London, N.5. *Gilbert Ad. 5297*



C.A.V.

Car Equipment Manufacturers by Appointment to H.M. THE KING.

Pedestal of 35 Years Experience

C.A.V. H.T. ACCUMULATORS are not built of the ordinary test tubes but tubes of special design and material assembled to eliminate intercell current leakage, which is so common amongst block form accumulators of much greater capacity; which large capacity is, in many cases, superfluous. An H.T. Accumulator need not necessarily have a large ampere hour capacity, because the current taken by the average broadcast receiver is comparatively small, and therefore the greatest feature must be the absence of intercell current leakage and consequent maximum retention of charge. The C.A.V. H.T. ACCUMULATOR possesses this most important feature, the path of intercell leakage being more than 9 in.—an exclusive design.

That is why the leading experimenters, such as—

Mr. W. K. Alford, radio 2 DX.
Mr. V. E. M. Oliver, B.A., A.M.I.E.E., radio 6 BV.
Mr. J. A. Partridge, radio 2 KF.
Mr. E. J. Simmonds, M.I.R.E., F.R.S.A., radio 2 OD.

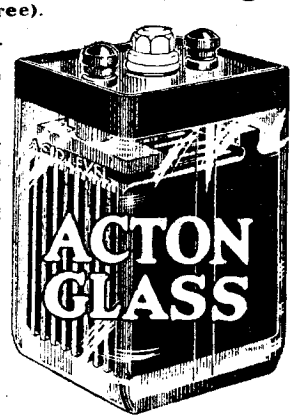
use them when carrying out noteworthy experiments.

C.A.V. H.T.3.—60 Volts 60/-

C.A.V. H.T.4.—30 Volts 30/-

All C.A.V. H.T. Accumulators are supplied fully charged (First charge free).

For your L. T. supply— "ACTON" ACCUMULATORS in glass.



The specially designed stout moulded glass jar has many important features in addition to its transparency. It prevents the risk of fire, eliminates frothing, is clean and of good appearance. No separators are fitted between the plates which are correctly spaced by grooves moulded in the sides of glass jar. The plate sections are suspended from the ebonite lid which is sealed in position. Screwed vent plugs are made of porcelain and therefore easily cleaned.

2-VOLT SINGLE CELLS.

TESTED CAPACITY. IGNITION.	ACTUAL.	WEIGHT. LBS. DRY.	WET.	PRICE. s.	d.
60	30	7	8	13	6
80	40	9	10½	16	0

4 and 6-volt assemblies at proportionate prices.

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'Grams: "Motolite-Newcastle-on-Tyne." 'Phone: City 306
LEEDS.....(ROTAX).....117, PARK LANE
'Grams: "Rotax, Leeds." 'Phone: 26788

able coil, temporarily leaving the L_4 coil block short circuited. Adjust the angles of the aerial and secondary coils so that they are separated by approximately 45 degrees and you are ready to tune. With three condenser dials to adjust simultaneously and only two hands to do it with would seem to present insuperable difficulty, but this is not so in practice since the tuning of C_1, that is, the aerial condenser, will be comparatively flat when compared with the secondary and tuned anode circuits.

The Best Procedure

The best procedure to adopt therefore is to set C_1 at some intermediate value, near the bottom of its scale divisions, whilst tuning C_2 and C_3 in unison as far as possible. C_2 and C_3, since they tune similar size coils, will read fairly close together, and therefore if these two condensers are advanced by approximately the same number of degrees at a time a condition will be reached when C_1, C_2 and C_3 are all approximately in tune, this condition being denoted by a rustling or slight hissing noise as the set becomes sensitive.

If now the reading of C_1 is

"PLAYING" THE RECEIVING SET —(*Concluded*).

advanced by one or two degrees at a time whilst C_2 and C_3 readings are increased by suitable amounts it should be found possible to maintain the set approximately in tune, by listening for the rustling or slight crackling mentioned. Proceeding in this manner you will obtain the local station at good strength and it will be seen how nearly C_2 and C_3 read.

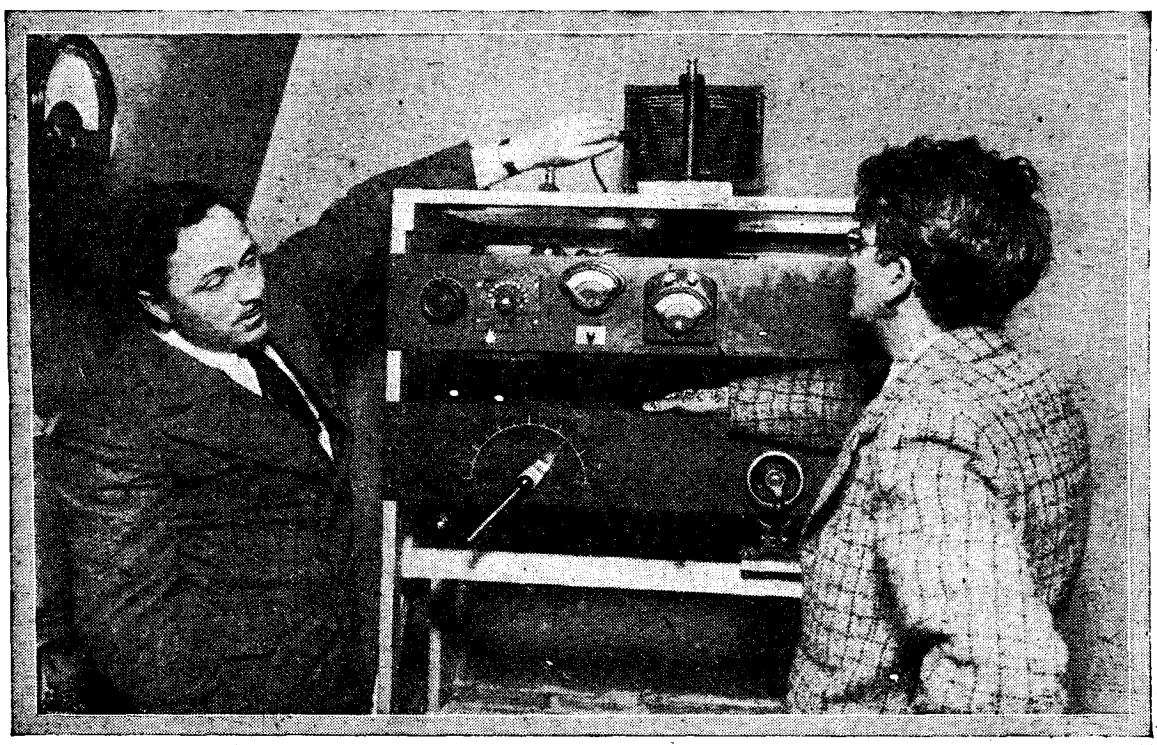
Adjustment of Coupling

So far we have said nothing about adjusting the coupling between L_1 and L_2 for either maximum signal strength or maximum selectivity. The highest degree of selectivity will, however, be obtained with very loose coupling between aerial and secondary coils, that is, with these well separated. With practice it should be found possible to work with these two coils almost at right angles, when severe interference is experienced. Each variation of the coupling will necessitate slight retuning on both C_1 and C_2.

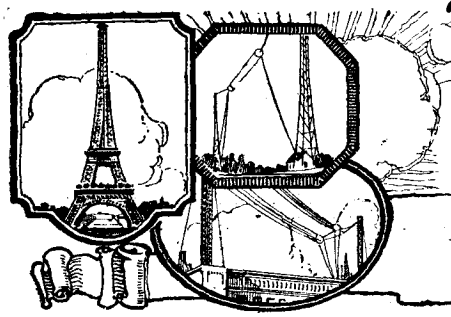
Reaction

When you have become accustomed to adjusting the three condensers and the coupling between aerial and secondary coils the next step is to employ a very small reaction coil, and, for example, upon the ordinary broadcast wavelengths, I find a ten turn coil amply large. If desired, of course, you can dispense with the reaction coil and obtain reaction effects by slightly unbalancing the neutrodyne condenser NC; but I personally prefer to leave this set, when once adjusted, and to obtain all reaction effects by means of L_4. With tightening of the coupling between L_1 and L_2, it will be found necessary to tighten the reaction coupling also, whilst slight retuning will be necessary on both aerial and secondary condensers. Similarly on loosening the coupling between aerial and secondary coils it will be found necessary to loosen the reaction coupling.

All of this sounds somewhat complicated, but with practice the "feel" of the set will be obtained and the slight complications will give you the thrill of mastery rather than be of annoyance.



Mr. J. L. Baird, who for a considerable time has been conducting experiments in television, has now developed a method of transmitting and receiving both objects and speech simultaneously. Mr. Baird is here depicted with his chief engineer, adjusting some of his apparatus.



Regular Programmes from Continental Broadcast Stations

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

Times reduced to British Summer Time.

Corrected up to June 20th, 1926.

WEEKDAYS.

B.S.T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
a.m.			
7.30	Eiffel Tower ..	FL 2650 m.	10 mins.
8.5	Eiffel Tower ..	FL 2650 m.	15 mins.
8.56	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
9.40	Eiffel Tower ..	FL 75 m.	10 mins.
9.55	Amsterdam ..	—— 1950 m.	10 mins.
10.25	De Bilt ..	KNML 1100 m.	5 mins.
10.25	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
10.40	Radio-Paris ..	CFR 1750 m.	10 mins.
11.30	Eiffel Tower ..	FL 2650 m.	20 mins.
11.40	Hilversum ..	NSF 1050 m.	10 mins.
p.m.			
12.30	Eiffel Tower ..	FL 2650 m.	10 mins.
12.30	Radio-Paris ..	CFR 1750 m.	2 p.m.
12.35	De Bilt ..	KNML 1100m.	5 mins.
12.57	Nauen	POZ 3100 m.	8 mins. Sp.
2.45	Eiffel Tower ..	FL 2650 m.	10 mins.
3.0	Königswusterhausen	AFT 1300 m.	5.30 p.m.
3.50	Eiffel Tower ..	FL 2650 m.	10 mins.
4.0	Zurich	—— 513 m.	6 p.m.
4.0	Union-Radio .. or Radio-Iberica..	EAJ7 373 m. EAJ6 392 m.	6 p.m.
4.0	Radio-Castilla...	EAJ4 340 m.	6 p.m.
4.0	Voxhaus ..	b 504 m. and 571 m.	6.30 p.m.
4.5	Amsterdam ..	—— 1950 m.	10 mins.
4.30	Milan	1MI 320 m.	6 p.m.
4.30	Radio-Paris ..	CFR 1750 m.	5.40 p.m.
5.0	Kiev	—— 780 m.	7 p.m.
5.0	Salamanca ..	EAJ22 405 m.	9 p.m.
5.0	San Sebastian ..	EAJ8 343 m.	7 p.m.
5.15	Eiffel Tower ..	FL 2650 m.	10 mins.
6.0	Leningrad ..	—— 940 m.	9 p.m.
6.0	Stuttgart ..	—— 446 m.	7.30 p.m.
6.0	Breslau ..	—— 418 m.	7.30 p.m.
6.0	Hamburg ..	ha 392.5 m.	7.30 p.m.
6.0	Konigsberg ..	—— 463 m.	7 p.m.
6.0	Union-Radio ..	EAJ7 373 m.	8 p.m.
6.0	Munster ..	m s 410 m.	7.30 p.m.
6.0	Radio-Barcelona	EAJ1 325 m.	7 p.m.
6.10	Hilversum ..	NSF 1050 m.	7.10 p.m.
6.15	Frankfurt ..	—— 470 m.	8.0 p.m.
6.15	Stuttgart ..	—— 446 m.	7.15 p.m.
6.30	Eiffel Tower ..	FL 2650 m.	7.55 p.m.
6.30	Moscow ..	—— 451 m.	8 p.m.
6.30	Leipzig	—— 452 m.	8 p.m.
7.0	Brunn	—— 521 m.	9 p.m.
7.0	Oslo	—— 382 m.	7.45 p.m.
7.0	Radio-Cadiz ..	EAJ3 357 m.	9 p.m.
7.0	Voxhaus ..	b 504 m and 571 m.	Midnight.
7.0	Munich	—— 485 m.	11 p.m.
7.25	Hilversum ..	NSF 1050 m.	10 p.m.
7.30	Stockholm ..	SASA 430 m.	11 to 12 p.m
7.45	De Bilt ..	KNML 1100 m.	5 mins.
8.0	Stuttgart ..	—— 446 m.	11 p.m.
8.0	Goteborg ..	SASB 287 m.	10.30 p.m.
8.0	Malmo	SASC 270 m.	10.30 p.m.
8.0	Sundsvall ..	SASD 545 m.	10.30 p.m.
8.0	Boden	SASE 1200 m.	10.30 p.m.
8.0	Oslo	—— 382 m.	10 or 12 p.m.
8.0	Hamburg ..	ha 392.5 m.	11 p.m.
8.0	Lausanne ..	HB2 850 m.	9.30 p.m.
8.0	Copenhagen ..	—— 347.5 m.	11 p.m.
8.0	Berne	—— 434 m.	11 p.m.
8.0	Radio-Wien ..	—— 531 m. and 582.5 m.	10.30 p.m.
8.0	Prague	—— 371.5 m.	10.30 p.m.
8.0	Radio-Paris ..	CFR 1750 m.	10 p.m.
8.0	Eiffel Tower ..	FL 2650 m.	15 mins.
8.0	Radio-Bruxelles	SBR 486 m.	10.10 p.m.
8.0	Bratislava ..	—— 300 m.	10 p.m.
8.0	Bilbao	EAJ9 415 m.	9.30 p.m.
8.0	Ecole Sup. des Postes	FPTT 458 m.	11 p.m.
8.0	Munster ..	ms 410 m.	10.45 p.m.
8.0	Radio-Cartagena	EAJ16 335 m.	10 p.m.
8.10	Konigsberg ..	—— 463 m.	10.15 p.m.
8.15	Zurich	—— 513 m.	10 p.m.
8.15	Leipzig	—— 452 m.	2 to 3 hrs.
8.15	Frankfurt ..	—— 470 m.	11 or 12 p.m.
8.15	Breslau ..	—— 418 m.	10 p.m.
8.15	Geneva	—— 760 m.	10 p.m.
8.30	Mont de Marsan	—— 390 m.	10 p.m.
8.30	Konigswusterhausen	AFT 1300 m.	Midnight.
8.30	Radio-Toulouse	—— 430 m.	11 p.m.
8.30	Budapest ..	—— 560 m.	11 p.m.
8.30	Rome	1RO 425 m.	11 p.m.
8.30	Marseilles ..	PTT 351 m.	9.30 p.m.
8.55	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
9.0	Soro	—— 2400 m.	9.30 p.m.
9.0	Milan	1MI 320 m.	11 p.m.
9.0	Ra dio-Béziers ..	—— 95 m.	1 hour.
9.0	Radio-Viscaya ..	EAJ11 418 m.	11.30 p.m.
9.0	Radio-Barcelona	EAJ1 325 m.	2 to 3 hrs.
9.0	San-Sebastian ..	EAJ8 343 m.	11 p.m.
9.0	Radio-Catalana	EAJ13 462 m.	Midnight.
9.0	Salamanca ..	EAJ22 405 m.	11 p.m.
9.10	Eiffel Tower ..	FL 2650 m.	11 p.m.
10.0	Radio-Iberica.. or Union-Radio ..	EAJ6 392 m. EAJ7 373 m.	1 a.m.
11.20	Eiffel Tower ..	FL 2650 m.	5 mins.
11.44	Eiffel Tower ..	FL 2650 m.	3 mins. Sp.
a.m.			
12.57	Nauen	POZ 3100 m.	8 mins. Sp.

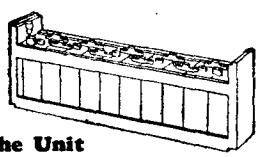
SUNDAYS.

B.S.T.	Name of Station.	Call Sign and Wavelength.	Closing Time or Approx. Duration.
a.m.			
8.56	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
9.53	Hilversum ..	NSF 1050 m.	11 a.m.
10.25	Eiffel Tower ..	FL 2650 m.	5 mins. Sp.
11.30	Konigswusterhausen	AFT 1300 m.	12.20 p.m.
p.m.			
12.14	Eiffel Tower ..	FL 2650 m.	10 mins.
12.45	Radio-Paris ..	CFR 1750 m	1.45 p.m.
12.57	Nauen	POZ 3100 m.	8 mins. Sp.
4.0	Radio-Iberica .. or Union-Radio ..	EAJ6 392 m. / EAJ7 373 m.	6 p.m.
4.0	Zurich	—— 513 m.	5 p.m.
4.30	Hilversum ..	NSF 1050 m.	6 p.m.
4.30	Milan	1MI 320 m.	6 p.m.
4.40	Bloemendaal ..	—— 315 m.	2 hrs.
5.0	Munster ..	ms 410 m.	7.30 p.m.
5.0	Rome	IRO 425 m.	6.30 p.m.
6.0	Leningrad ..	—— 940 m.	9 p.m.
6.0	Radio-Castilla ..	EAJ4 340 m.	8 p.m.
6.0	Radio-Barcelona	EAJ1 325 m.	8 p.m.
6.30	Bilbao	EAJ9 415 m.	8.30 p.m.
6.30	Eiffel Tower ..	FL 2650 m.	7.55 p.m.
7.0	Brunn	—— 521 m.	11 p.m.
7.0	Hamburg ..	ha 392.5 m.	8 p.m.
7.0	Breslau ..	—— 418 m.	8 p.m.
7.0	Helsingfors ..	—— 318 m. and 522 m.	9.30 p.m.
7.0	Warsaw	—— 480 m.	10 p.m.
7.0	Munich	—— 485 m.	10.30 p.m.
7.0	Radio-Cadiz ..	EAJ3 357 m.	9 p.m.
7.15	Goteborg ..	SASB 287 m.	10.30 p.m.
7.15	Stockholm ..	SASA 430 m.	10.30 p.m.
7.15	Sundsvall ..	SASD 545 m.	10.30 p.m.
7.15	Boden	SASE 1200 m.	10.30 p.m.
7.15	Malmo	SASC 270 m.	10.30 p.m.
7.30	Leipsig	—— 452 m.	Midnight.
7.30	Voxhaus ..	b 504 m. and 571 m.	Midnight.
7.30	Bratislava ..	—— 300 m.	9.30 p.m.
7.40	Hilversum ..	NSF 1050 m.	10.30 p.m.
8.0	Oslo	—— 382 m.	Midnight.
8.0	Berne	—— 435 m.	11 p.m.
8.0	Prague ..	—— 371.5 m.	10.30 p.m.
8.0	Radio-Wien ..	—— 531 m. and 582.5 m.	10.30 p.m.
8.0	Lausanne ..	HB2 850 m.	9.30 p.m.
8.0	Radio-Cartagena	EAJ16 335 m.	10 p.m.
8.0	Hamburg ..	ha 392.5 m.	11 p.m.
8.0	Stuttgart ..	—— 446 m.	11 p.m.
8.0	Budapest ..	—— 560 m.	Midnight.
8.0	Radio-Agen ..	—— 318 m.	15 mins.
8.0	Radio-Paris ..	CFR 1750 m.	10.45 p.m.
8.0	Eiffel Tower ..	FL 2650 m.	10 p.m.
8.10	Konigsberg ..	—— 463 m.	10 p.m.
8.15	Copenhagen ..	—— 347.5 m.	11 p.m.
8.15	Zurich	—— 513 m.	10 p.m.
8.15	Geneva	—— 760 m.	1 hour.
8.15	Leipzig	—— 452 m.	10 p.m.
8.15	Radio-Bruxelles	SBR 486 m.	10.10 p.m.
8.25	Breslau	—— 418 m.	Midnight.
8.30	Marseilles ..	PTT 351 m.	9.30 p.m.
8.30	Konigswusterhausen	AFT 1300 m.	Midnight.
8.30	Rome	IRO 425 m.	11 p.m.
8.30	Ecole Superieure	FPTT 458 m.	11 p.m.
8.30	Radio-Toulouse	—— 430 m.	11 p.m.
8.30	Frankfurt ..	—— 470 m.	Midnight.
9.0	Milan	1MI 320 m.	11 p.m.
9.0	Soro	—— 2400 m. 1500 m. and 1150 m.	9.30 p.m.
9.0	Radio-Viscaya ..	EAJ11 418 m.	11.30 p.m.
9.0	San-Sebastian ..	EAJ8 343 m.	11 p.m.
9.0	Radio-Catalana	EAJ13 462 m.	Midnight.
9.10	Eiffel Tower ..	FL 2650 m.	11 p.m.
9.15	Petit Parisien ..	—— 333 m.	10.30 p.m.
10.0	Radio-Iberica .. or Union-Radio ..	EAJ6 392 m. / EAJ7 373 m.	1 a.m.
11.44	Eiffel Tower ..	FL 2650 m.	3 mins. Sp.
a.m.			
12.57	Nauen	POZ 3100 m.	8 mins. Sp.

SPECIAL DAYS.

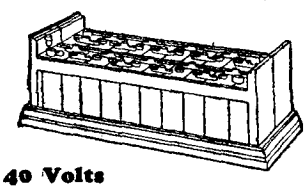
B.S.T.	Name of Station.	Call Sign and Wavelength.	Situation.	Nature of Transmission.	Closing Time or Approx. Duration.
p.m.					
5.0	Radio-Bruxelles ..	SBR 486 m.	Brussels ..	Tues., Thurs., and Sat., Concert, followed by News	6 p.m.
7.0	Nijni Novgorod ..	—— 860 m.	Russia ..	Tues. and Thurs., Concert and Opera ..	11 p.m.
7.0	Sokolniki ..	—— 690 m.	Russia ..	Mons., Wed., and Fri., experimental Transmissions	8.30 p.m.
8.30	Ryvang	——1160 m.	Denmark ..	Tues., Wed. and Sat., Concert	10.30 p.m.
8.30	Le Matin ..	——1750 m.	Paris	Saturday, Special Gala Concert	11 p.m.
9.15	Petit Parisien ..	—— 333 m.	Paris	Tues., Thurs. and Sat., Concert (Items announced in English as well as French)	11 p.m.
10.0	Lucien Lévy ..	LL 350 m.	Paris	Mon., Wed., and Fri., Concert	11 p.m.
10.30	Copenhagen ..	——347.5 m.	Denmark ..	Thurs. and Sat., Dance Music from Restaurant Nimb	12.30 a.m.
11.0	Oslo	—— 382 m.	Norway ..	Wed. and Sat., Dance Music from Hotel Bristol	Midnight.

The only H.T. Accumulator built on the principles of the expanding Bookcase



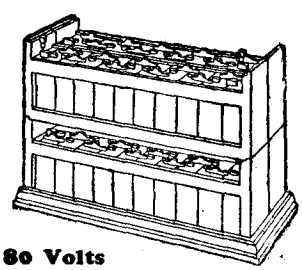
The Unit

Each unit consists of 10 glass cells making a total of 20 volts. Each individual cell can be tapped—thus ensuring extreme flexibility of voltage control. A stout oak framework protects the cells against damage.



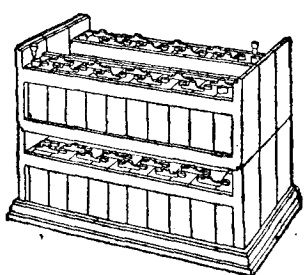
40 Volts

For 40 volts two units are required clamped side by side and mounted on a handsome solid oak base. For 60 volts as in large illustration above three units would be required.



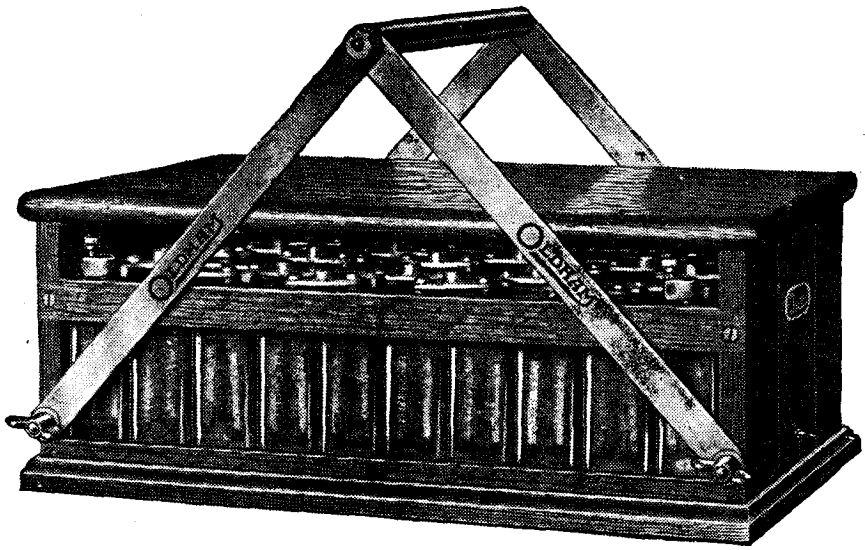
80 Volts

Two tiers of two units each are required. The same base and lid are used as for 40 volts.



100 Volts

Two tiers are used—the bottom one containing 3 units and the upper one containing only two units with blank end pieces to separate them. For 120 volts the end pieces are removed and a complete unit is substituted.



Put some "pep" into your Wireless Set

IF your Receiving Set seems to have lost some of its vitality—if it is not so responsive to weak signals as it used to be—if foreign stations are more difficult to pick up—if the local station has fallen off in quality and volume—if cracklings and sizzlings are the usual accompaniment to every programme—then suspect our old friend the H.T. Dry Battery. In all probability he is the offender. A plentiful supply of H.T. current is necessary to obtain the best results. The average H.T. dry battery will lose voltage steadily even if unused. How rapidly then will its voltage fall if it is used with a big multi-valve Set.

Wireless enthusiasts all over the country are discarding their H.T. dry Batteries and changing over to the wonderful new Oldham H.T. Accumulator. And immediately they are obtaining an amazing improvement in reception. The Loud Speaker takes on a new standard of tonal purity—stations which couldn't be heard at all are received at full strength, cracklings and noises entirely disappear. This wonderful change is entirely due to the unfluctuating flow of H.T. current which only an Oldham Accumulator can give.

Stop wasting money on Dry Batteries —invest in an Oldham H.T. Accumulator instead

You waste money every time you buy a Dry Battery because it can never be recharged. And when you buy it you don't know how long it has been in stock. A dry battery starts working the moment it is made. Not so an Oldham H.T. Accumulator. When you choose an Oldham you buy wisely—you get long service. An Oldham will last for years. It can be recharged for a shilling or two again and again. It will save its cost very quickly. But if you want the best results be sure it is an Oldham for only Oldham has the Special Activation Process—the method which ensures a plate holding its charge for several months without the risk of sulphation.

Only Oldham has the expanding unit idea. You can buy your units just as you require them and add to your voltage with the minimum of expense. Look at the compactness and convenience of the Oldham H.T. Accumulator shown above. Note its extreme portability and workmanlike appearance. Observe its stout glass cells—each one is instantly available for examination—and its thick buckleproof plates. Then go to your Dealer and ask him to show it to you—we are confident you'll never use another H.T. Dry Battery.

10d. per volt

40 volts	£1 13 4	60 volts	£2 10 0
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Complete with lid and handles.
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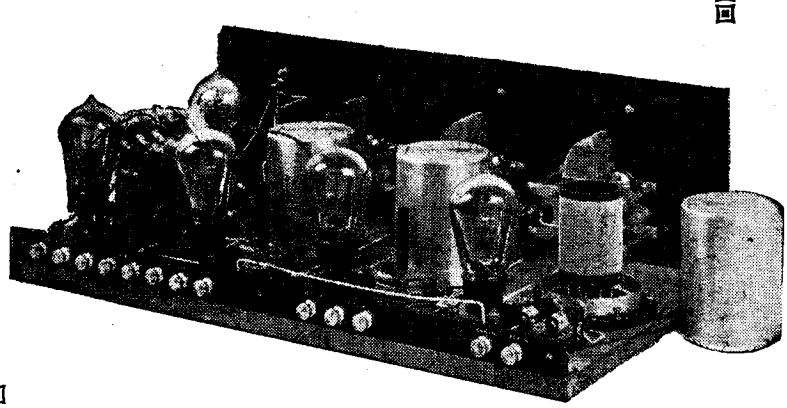
PROGRESS IN HIGH-FREQUENCY TRANSFORMERS

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

How the science of high-frequency amplification has advanced.



With screened transformers, a very compact layout is possible without loss of efficiency.

IT will be universally agreed that if any branch of radio reception has developed more than another during the past year it is the science of high-frequency amplification, and in consequence of this a component which has undergone considerable improvement is the high-frequency transformer. Research into the design and construction of high-frequency transformers has been carried out at Elstree for some considerable period, and as a direct outcome of this research we have such excellent receivers as the "Elstree Six."

Logical Development

This receiver is the result of logical development along a particular line of research, but experiments along allied lines have been proceeding at the same time, and I propose to review in this article some of the outstanding facts which have come to light concerning the design of an efficient high-frequency transformer.

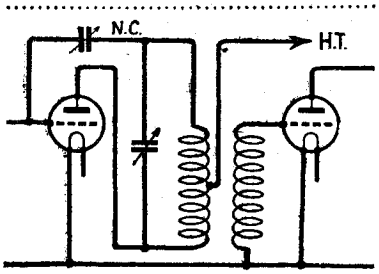


Fig. 1.—The tuned primary split coil type of circuit.

We have a double object in view when designing such an instrument. First and foremost is the claim to selectivity, but the question of the signal strength of the resulting arrangement must not be lost sight of. The particular question to be settled in any given case is how far the consideration of energy transfer is important, and how much strength we can afford to lose if a gain in selectivity is the result.

Parasitic Oscillations

The design of a high-frequency amplifier is complicated by the tendency towards the production of parasitic oscillations. This is more particularly the case where the tuned circuits of the receiver are centre-tapped in order to obtain the neutralising voltages. Difficulties of this kind were encountered in the "Remarkable Five-Valve" receiver, and the "Elstree Six," and in each case were overcome by a different method. Apart from these difficulties, however, the actual design of the transformer is very nearly the same whether one employs one transformer or three or four, and I propose therefore to review the various circuits more or less in skeleton form, indicating in each case whether the arrangement is suitable for an indefinite number of valves, or for one stage only.

Main Types

In general there are three main types of transformer employing the symmetrical methods of neutralising which are at present in vogue. They are as follows:—

(1) Tuned primary transformer with neutralisation by splitting the primary winding.

(2) Tuned secondary transformer with neutralisation by splitting the secondary winding.

(3) Tuned secondary transformer with neutralisation by splitting the primary winding.

There are other types of transformer which I shall not discuss in the present instance; notably there is the tuned secondary transformer with grid-to-grid neutralisation. This was one of the original schemes suggested by Prof. Hazeltine, which, for various reasons, has been slightly modified. This type is similar, except as far as the neutralising is concerned, to class (3).

The Split-Coil Method

The three types cited above, therefore, are the principal ones in use in this country, and it is with these arrangements that I shall deal in this article. The first type of transformer, namely, tuned primary with split-coil neutralisation, is very similar to the simple tuned-anode circuit and suffers

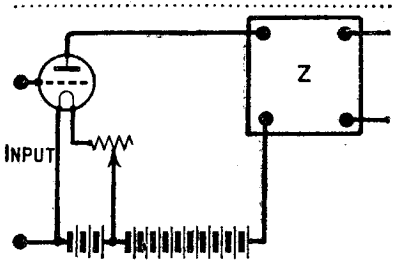
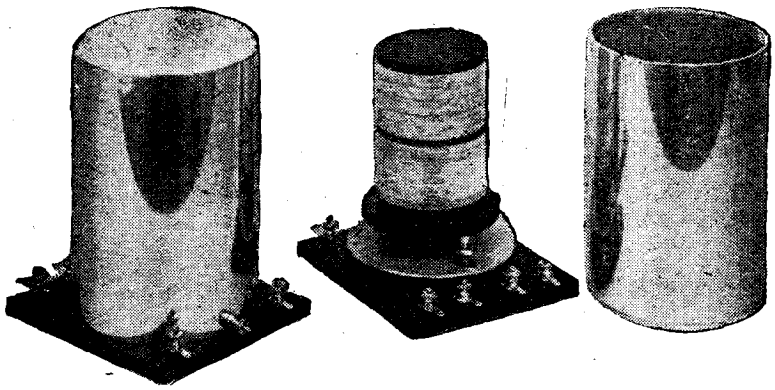


Fig. 2.—In order to obtain efficient amplification the primary impedance of the transformer must be high compared with that of the valve with which it is associated.

PROGRESS IN H.F. TRANSFORMERS—(Continued)

from the same disadvantages, except that it is not necessary to hand on the energy to the next grid circuit through a coupling condenser. This method (illustrated in Fig. 1) was tried out and

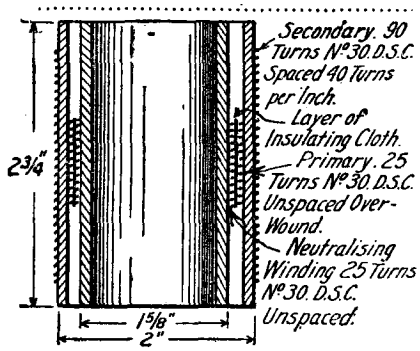


The "Magic Five" transformers are completely shielded by an aluminium screen.

used by myself in the long-range screened-coil set described in *Wireless Weekly*, one of the first sets employing the new screened coils. I subsequently abandoned this method for the time being for two reasons. Firstly, it was difficult to obtain adequate selectivity, and, secondly, the arrangement was not satisfactory if more than one stage was employed.

Tuned Secondary

The majority of cases, therefore, belong to the last two classes, both of which are provided with a tuned secondary winding, neutralisation being effected in one case by splitting the secondary, and in the other case by splitting the primary.



Constructional details of the "Magic Five" type transformer.

Whichever type of neutralisation is employed we have two further classifications. In the one case the primary and secondary are coupled comparatively loosely, while in the second type the coupling between the two windings is as tight as possible. There are also, of course, transformers which fall in between the two definite categories, in which case they partake partly of the characteristics of both types. We will review these various types in more detail.

The Loose-coupled Type

Considering first the loose-coupled type of transformer, the selectivity obtainable by this means is usually fairly good because the actual energy picked up by the secondary from the primary is comparatively small, and an appreciable response is thus only obtained at the particular frequency to which the secondary is tuned.

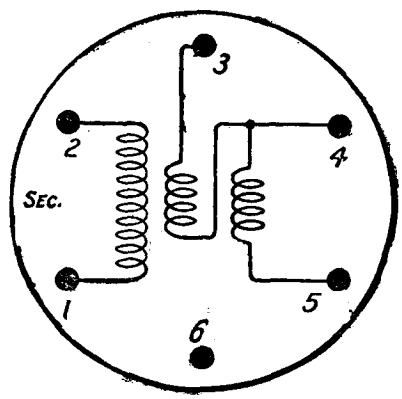
This type of transformer, however, suffers from one serious disadvantage, namely, that the overall amplification of the transformer with its associated valve is not high. In an article in MODERN WIRELESS for September, 1925, I showed that the actual amplification of a valve depended very considerably upon the external impedance in the anode circuit. In order to obtain good results the impedance must be high compared with that of the valve.

Now the impedance of an ordinary coil of wire of, say, 50 turns at a frequency of 750 kilocycles is only of the order of 1,000 ohms, which is very much less than that of the valves in use to-day, even when power valves are employed. In the case of a loose-coupled transformer, therefore, the primary coil has a very low impedance compared with that of the valve, and the overall amplification of the complete stage is low.

As we shall see later, the secondary exercises some effect upon the primary winding at the frequency to which the secondary is tuned. Full use is made of this fact in a tight-coupled transformer, but in the loose-coupled arrangement the effect of the secondary is comparatively small. Even allowing for this the impedance of the primary winding is below that of the valve, so that efficient results are not obtained.

Reaction Essential

For this reason, in order to obtain satisfactory results with this type of transformer, it is essential to employ reaction on the secondary winding because the overall amplification of the transformer stage by itself is small. If reaction is employed, however, very good results can be obtained with one stage of transformer coupling.



The "Magic Five" transformers incorporate a special winding which can be used for neutralising or introducing reaction.

With a single stage such as this either of the methods of neutralisation may be utilised satisfactorily. Fig. 3 shows the circuit in which the secondary winding is centre-tapped, neutralisation being effected by the usual means; while in Fig. 4 we have a similar circuit employing a split primary winding. This latter circuit, in particular, is only satisfactory if reaction is provided on the secondary, and disappointing results will ensue if this is not done.

A Source of Trouble

When using the loose-coupled type of transformer for more than one stage great care has to be taken.

PROGRESS IN H.F. TRANSFORMERS—(Concluded)

The neutralisation is the chief source of trouble, and practical experience indicates that it is essential to obtain the neutralisation on the tuned winding. The "Elstree Six" is a case in point, neutralisation in this case being effected by centre-tapping the tuned secondary winding. Additional complications introduced into this circuit were, of course, necessary in order to free the circuit from parasitic oscillations, but these are not relevant to the present discussion.

The use of the other type of loose-coupled transformers, employing neutralisation on the primary, is not satisfactory. Trouble occurs in practice with the neutralising, and for this type of circuit the tight-coupled type of transformer is to be preferred.

Signal Strength

In all cases where the loose-coupled transformer is employed, however, the signal strength is definitely less than that which can be obtained with a tight-coupled transformer. On the other hand, it was thought for a long time that selectivity was not obtained if tight coupling was used.

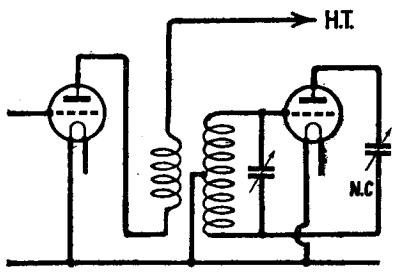


Fig. 3.—In this case the secondary is centre-tapped and tuned, whilst the primary is untuned.

This has proved to be fallacious if due care is taken, and the modern tendency is towards the use of the tight-coupled type of transformer.

Effect of Secondary

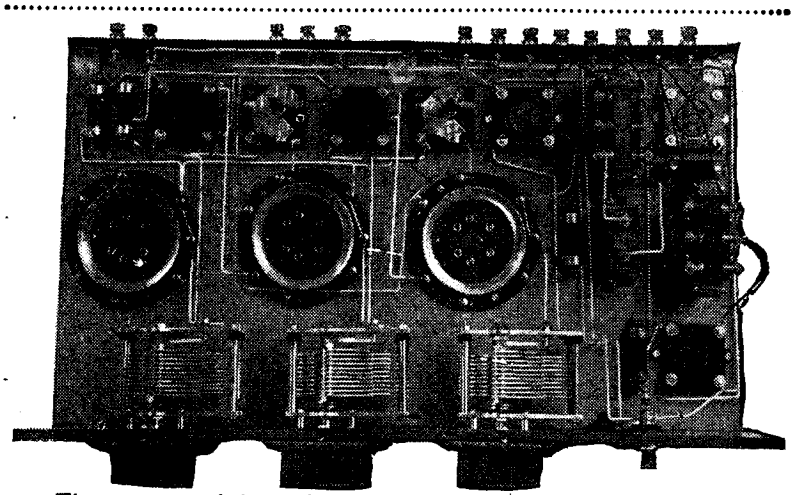
The conditions under which the tight-coupled transformer operates are essentially different. Here the effect of the secondary winding upon the primary is appreciable, and it results in a very material increase in impedance of the primary winding. The result, therefore, is that the valve operates efficiently and the overall amplification of the transformer-coupled stage is good. To achieve this result it is necessary for the primary winding to be as closely coupled as possible to the secondary winding up to a limit where the capacity coupling between the two windings becomes appreciable. One of the reasons for the development of the loose-coupled transformer was the elimination of capacity-coupling, which, as Mr. Harris pointed out some time ago, was responsible for considerable loss of selectivity. It was thought that with tight coupling the capacity between the windings would be too great, but with proper care this does not appear to be so.

In order to reduce capacity coupling the primary winding is wound in a small space and placed in the centre of the secondary winding, but it is as tightly coupled as possible. This means that the diameter of the former on which the primary is wound should be the largest that will go conveniently inside the secondary former.

Excellent Selectivity

Transformers of this type were utilised in the "Magic Five" receiver, which was recently described in *Wireless* and which gave very good overall amplification consistent with excellent selectivity. In this receiver the effect of the secondary winding was calculated mathematically, and the number of turns on the primary was reduced to the point at which the amplification was just beginning to fall off. The practical results justified the assumptions completely, adequate signal strength being obtained with very good selectivity.

The tight-coupled transformer is capable of being used in circuits in which the secondary winding is split for neutralising purposes, and experiments are actually proceeding at the present time with such transformers in circuits very similar to the "Elstree Six," with excellent results. The selectivity is quite as good as that obtained with a loose-coupled arrangement.



The screened transformers used in the "Magic Five" receiver ("Wireless," Vol. IV. No. 1) were arranged so as to be interchangeable.

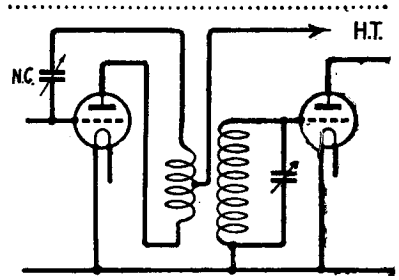


Fig. 4.—A circuit of this type is more satisfactory when reaction is provided on the secondary winding.

The General Trend

These remarks will serve to indicate the general trend of the high-frequency transformer design. In discussing this question of course any question of possibility of interaction between the various transformers has not been considered. One satisfactory solution is shielding the transformers by placing them in screened containers.

OFF THE BEATEN TRACK

I WONDER how many owners of broadcast sets ever give a thought to the reception of the broadcast stations on the *lower* belt? For this lower belt contains all the real "DX" stations likely to be received in these days of interference. With the rapid increase in the number of European stations as well as the hours in which they work, it is becoming much more difficult to receive the Americans on their upper wavelengths, by which I mean the usual broadcast band, that is, wavelengths between 200 and 600 metres.

Luckily, however, quite a number of the American stations now run a short-wave transmission as well as their normal programme, and many of these short-wave stations come across the Atlantic with truly surprising "pep."

Don't let the words "short waves" frighten you with visions of "skeleton sets," with valves removed from their bases and extension handles a yard long. These fearsome pieces of apparatus are things of the past, for the short-wave receiver of to-day is quite a neat affair, and its efficiency depends chiefly upon the use of a certain amount of commonsense in the design and layout. It is also a very simple matter to convert your ordinary broadcast receiver to receive these stations on the lower belt.

Most of those who own broadcast receivers must sometimes wonder what is going on outside the usual "broadcast band"; so on these pages we shall review from month to month the more interesting transmissions off these wavelengths, both above and below.

A Wavemeter Invaluable

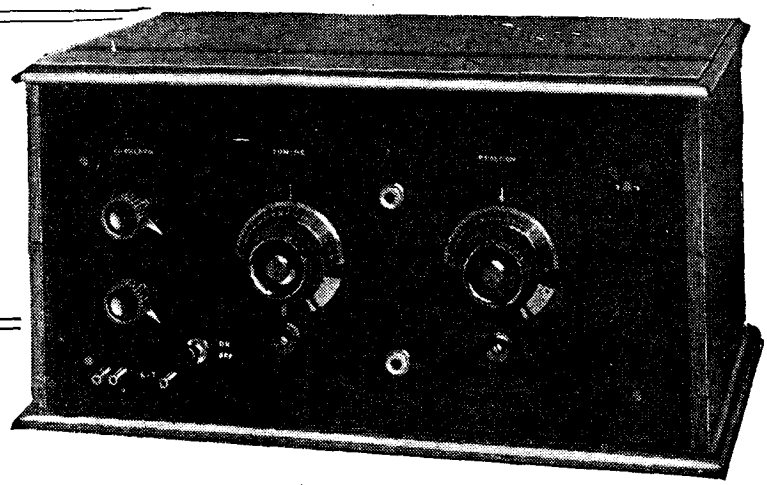
THE chief difficulty in front of you in tackling short waves for the first time is to find out just where you are. A heterodyne wavemeter, which is an extremely useful instrument to have about the house at any time, becomes a true friend in need. I have one which cost altogether a sum not exceeding about 35s., and it is extremely reliable. The variation in one month has not yet been more than ·05 metre, although it is by no means a precision instrument. If you use your ordinary broadcast receiver for "getting down to it," you will need a coil of about six or seven turns as A.T.I., with a ten or twelve turn coil as reaction. The coils are very easily wound with thick wire, about No. 14 gauge, which is simply wound as tightly as possible round a former of suitable diameter (say, about 3½ inches), the turns then being slipped off the former and tied together with string. This makes a really solid coil, which may either be mounted on a standard socket to fit the coil-holder of the broadcast set (although I cannot say I recommend this), or fitted up in some special home-made holder which should be so designed as to have the minimum of capacity.

Variable Condensers

REALLY good tuning on the shorter waves requires fairly small variable condensers—nothing larger than ·00025 or ·0003 should ever be used, and sometimes those with capacities as low as .0001 are quite suitable. If you are using, say, a .0005 at present, all that is necessary to halve its capacity is to connect a fixed condenser of ·0005 *in series with it*. The effective capacity of the variable will then be reduced to ·00025. This will make tuning quite a simple matter, provided that either a slow-motion condenser or some good make of geared dial is used. You can then look forward to

OFF THE BEATEN TRACK

(Continued)

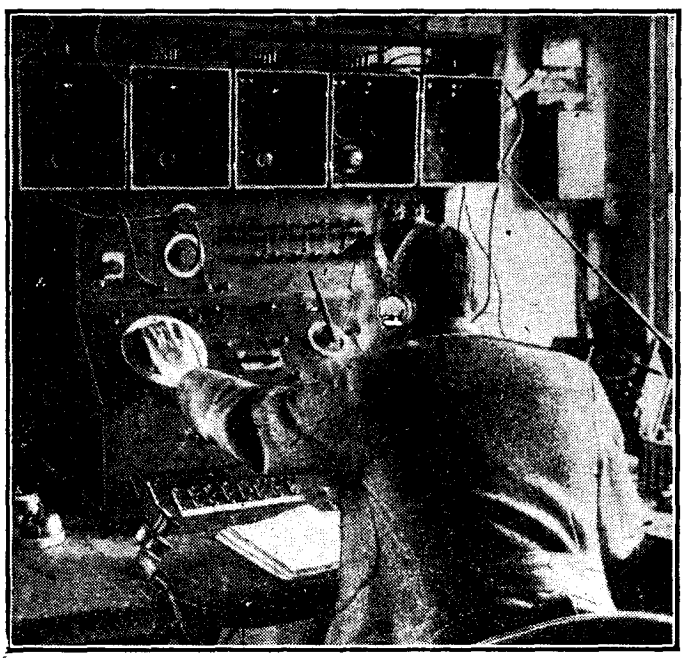


A short-wave set can be quite neat in appearance and is not difficult to construct.

some really good loud-speaking on KDKA (60 metres) and WGY (40 metres).

150-200 Metres

THE amateur telephony on 150-200 metres is a great improvement over some of the weird noises that used to be heard on that wavelength. It is quite interesting to listen on these wavelengths at some time, such as a Sunday evening, when there are a lot of amateur stations working, and to compare your own opinions with those of other people. I often hear one amateur carrying out two tests, and asking for reports, and find that my preference is quite different from that of another station who replies to him. Of course, distance makes quite a lot of difference in these matters, as does the type of receiver used.



Low Power Transmission

I CAN'T help thinking that the amount of noise that an amateur station can make with an input of 10 watts is increasing steadily week by week. Whether improved makes of components, increased knowledge and experience, or a change in the value of the watt is responsible for it, I really can't say.

One station about five miles from me is absolutely overpowering on two valves, and I happen to know that when he says his input is 8 watts, he really means it. I called on him a few weeks ago, and found him working straight off the 220-volt D.C. mains, with no other form of power supply in use, or, in fact, available. He uses a small power valve of the 6-volt ·25-ampere type for all his work, and his telephony is often clearly heard in Aberdeen and Glasgow. What would the B.B.C. stations sound like on this wave, I wonder?

Unselective Receivers

INCIDENTALLY, I am surprised at the number of broadcast listeners who still imagine that if they hear an amateur's telephony coming through

Listening to Croydon and the other Air Stations on 900 metres forms an interesting occupation out of broadcasting hours. Here we see the operator at the Croydon Station adjusting his direction-finding apparatus.

on top of the broadcast programme, he must be working on the same wave as the broadcasting station. Of course, if an unselective receiver is used, you will hear a nearby amateur, even if he is working on a wave as low as 45 metres! With a loose-coupled receiver no interference at all should be experienced. There was a time when my next-door neighbour (whose aerial runs right underneath my own, and parallel to it) complained of being completely "wiped out" whenever I switched on my transmitter (tuned to 90 metres). I found that the set, a two-

OFF THE BEATEN TRACK — (*Concluded*)

valver, employed a direct-coupled circuit, and fitted him up with a loose-coupled aerial circuit. The result was that he lost none of the sensitivity of his receiver, and gained enormously in selectivity. He now cannot tell me whether I am transmitting or not.

A Good Performance

I HEAR that a Belgian amateur has put up a very fine performance just recently. He applied to the Belgian Government for a licence to work a private service with the Belgian Congo, which might be used as an alternative to the cable. This was not granted, but for some weeks past he has been in direct wireless *telephonic* communication with the Congo, using an absurdly low power compared with that employed by the Government long-wave stations, and reports the communication to be as easy and reliable as if he were using the cable. Needless to say, "a short wavelength" was used.

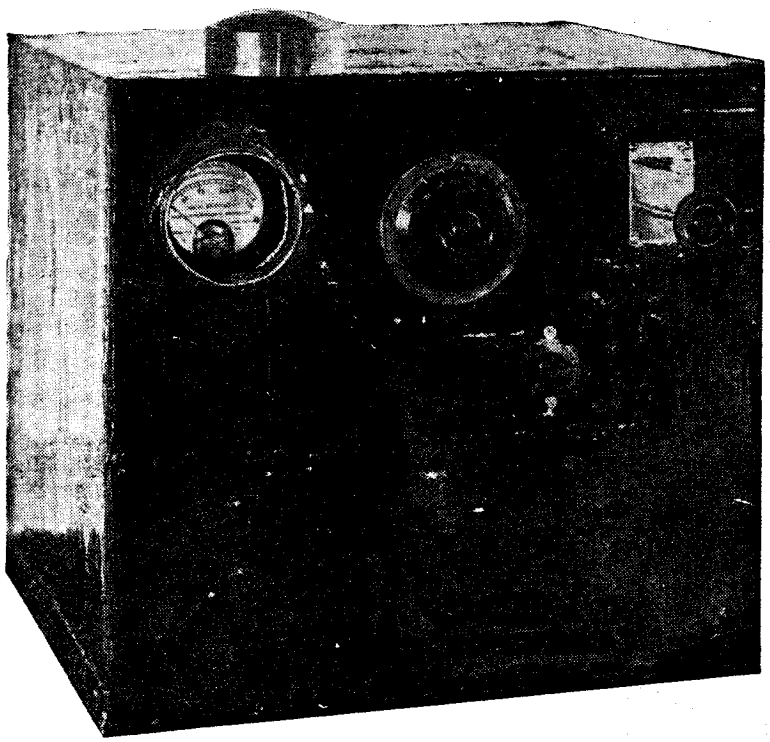
PCGG

LEAVING short waves for the present, I wonder how many of my present readers remember the joyous pastime of listening to "The Dutch Concert" on 1,050 metres on a Sunday afternoon? I am extremely glad to see that our old friend PCGG is starting up again very shortly, but I am afraid that he will never mean the same to me in the present critical age. I expect many listeners will scorn these concerts from the Hague, as not being a great enough "DX." By our present-day standards, the old transmissions certainly left much to be desired, but they will, no doubt, have improved considerably when we next hear them. We only want old "2-Emma-Toc - Writtle - near - Chelmsford" back again on 400 metres to complete this reminiscence of old times.

Croydon

LISTENING to Croydon and other Air Stations, to say nothing of the aeroplanes themselves, used to be another favourite occupation of mine. In fact, my old 900-metre coils seem to be the only relic of old times that remain in the "junk-cupboard." They are truly wonderful affairs, literally soaked in wax, and *varnished on top* of that. They were of the basket type, connections being made to small plugs of the household lamp type, with short lengths of flex. One of these days I am going to ask Mr. Reyner to measure the R/L ratio of one of them. My present "Croydon coils" are simply two of a well-known plug-in variety. W. L. S.

ELSTREE'S ARTIFICIAL 2LO



A description of the method adopted by the Elstree laboratories which enables actual signals to be imitated and the results obtainable with different types of circuits to be predicted.

The oscillator when in use is completely enclosed in a copper-lined screening case.

IN many occasions during the research work at the Elstree Laboratories, it is desirable to provide an artificial signal which duplicates as far as possible the signals normally received from a transmitting station. In such cases it is a comparatively simple matter to arrange a local oscillator, if necessary modulated by some suitable means, but the disadvantage of the straightforward arrangement is that the energy is not completely under control, and the results of any particular experiment may be completely nullified by stray coupling.

As a particular example of this, the question of the coupling coils in various positions was being systematically investigated comparatively recently, and during the preliminary experiments an ordinary buzzer wavemeter was employed to provide the artificial signal. Little by little the buzzer was moved further and further away from the actual experiment, until eventually it was placed over 12 feet away, and still the results were not satisfactory. Finally the screened oscillator to be described in this article was used for the experiment, and successful results were immediately obtained. The ordinary oscillator, therefore, is not satisfactory, due to this possibility of stray coupling, and consequently it was decided to develop a completely shielded oscillator. Although the instrument in question is essentially for laboratory use, its construction will probably be of interest to our readers, as also will some brief indication of some of the experiments in which it has been employed.

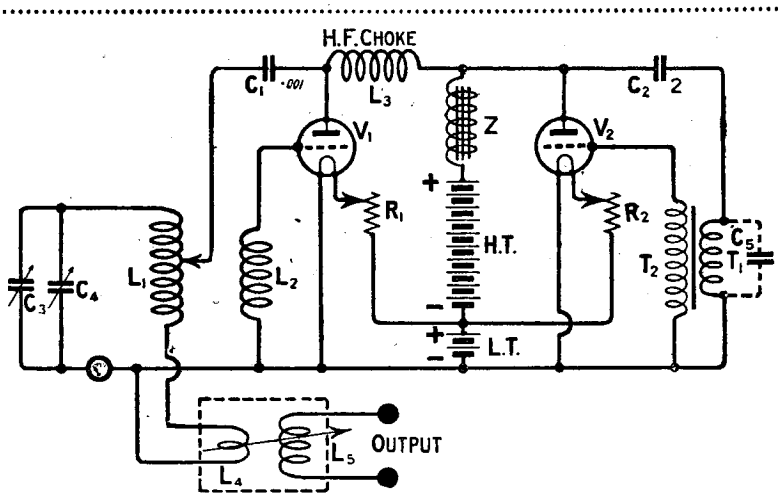


Fig. 1.—The oscillator valve is tapped across only a portion of the coil L_1.

Interchangeable Coils

In the first place it is desirable that the high-frequency current produced by the oscillator shall be suitably modulated at an audible frequency, in order that it may be heard in the telephones. To this end a second low-frequency modulating valve has been incorporated, as will be described later, and the signals emitted by the oscillator resemble the B.B.C. tuning note in character. Obviously, in order to increase the possible range of utility, it is desirable that it shall be made suitable for a range of wavelengths, so the particular coils employed have been made interchangeable.

The Circuit

The actual circuit employed is shown in Fig. 1. It will be seen to resemble very closely the ordinary choke-controlled transmitter circuit

ELSTREE'S ARTIFICIAL 2LO—(Continued)

The two filaments are supplied from a common battery with separate rheostats to each one, while the high-tension supply is obtained by means of a parallel feed supplied through a common low-frequency choke. On the one valve we have the high-frequency oscillating circuit, and on the other valve we have a circuit arranged to oscillate or buzz at an audible note. It will be observed that in each case the anode winding is tuned, while the grid winding serves to provide the necessary reaction. The two fixed condensers C_1 and C_2 are for the purpose of preventing the high-tension from short-circuiting through the various coils, as is usual with this type of arrangement.

The L.F. Oscillator

For the low-frequency oscillator a B.T.H. transformer was found to be satisfactory, the self-capacity of the winding being sufficient to tune it to an audible frequency when it was arranged in the particular manner shown. The fixed condenser in this case, therefore, has been shown dotted. For the high-frequency circuit a special coil was wound upon one of the formers used for the high-frequency transformers in Mr. Harris's "Special Five." It will be seen that the anode circuit of the valve is connected across a part of the coil only. This is in accordance with regular transmitting practice, the maximum oscillating current being obtained when the impedance of the tapped portion matches that of the valve. The correct tapping is found by trial, and then made permanent for each particular coil. A high-frequency choke is in circuit in series with the H.T. feed to the high-frequency side of the apparatus, as this was found to give improved results. As far as the circuit is concerned, therefore, there is little of special interest, the arrangement being straightforward and in accordance with the usual practice.

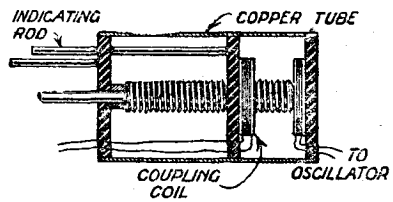


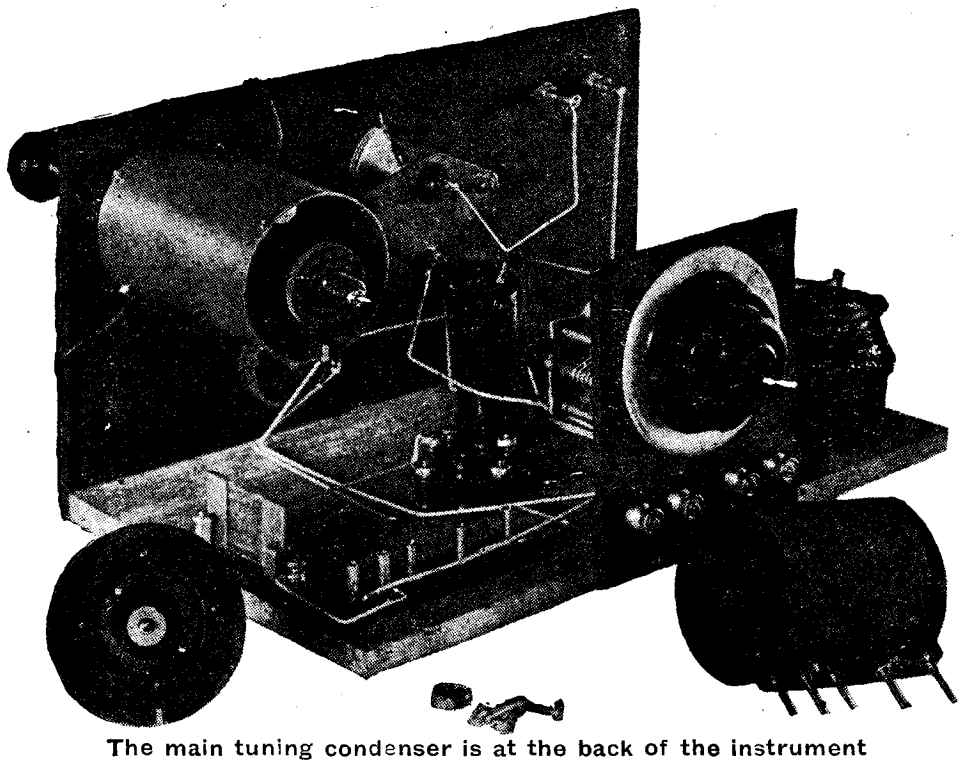
Fig. 2.—Details of the special method of oscillator coupling used.

An Interesting Point

It is in the actual mounting of the instrument that the particular interest arises. There are two points of special note. The first is that in order to ensure that no energy at all was allowed to escape from the oscillator except by means of the coupling coil provided, the whole instrument was included in a case covered with copper sheet. The actual construction will be made clear from the photographs illustrating this article, from which it will be seen that the oscillator proper has been made up on a baseboard, with the condensers, resistances, and the ammeter mounted on an ebonite panel.

Vernier Control

The main tuning condenser is not normally varied in actual use. It is set to some particular frequency and maintained constant for any given set of experiments. This condenser, therefore, has been mounted on a subsidiary panel at the back of the instrument, and is provided with a slow motion dial. It is often necessary, however, to vary the frequency over a small range (when taking resonance curves, for example), and to this end a vernier condenser has been provided in parallel with the main condenser. This condenser is mounted on the front panel, and is connected by means of a special interlocking coupling to a knob and dial mounted on the outside of the screening case. It is thus possible to operate this vernier condenser from the outside of the case, while the whole oscillator may if necessary be withdrawn without affecting the mechanism in any way.



The main tuning condenser is at the back of the instrument and employs a slow-motion dial.

The Milliammeter

As will be seen from the photograph, a milliammeter is also

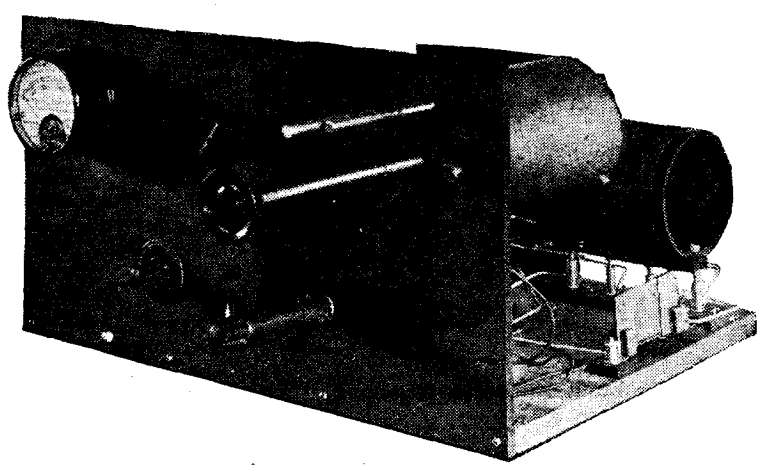
ELSTREE'S ARTIFICIAL 2LO—(Concluded)

mounted on the front panel, and this can be viewed by removing the cap seen on the left-hand side of the case. The resistance in the filament circuit of the high-frequency valve is provided with a long extension handle which comes through the front of the case, and in practice the current may be adjusted within reasonable limits by suitable variation of this filament control. Actually the current is adjusted to 70 milliamps, and this value is maintained throughout the experiment.

The back of the case is also copper lined, and is made removable, being held in position by four terminal screws. Two switches are mounted on the back, enabling either the high-frequency valve alone or both valves to be switched on at will, so that pure C.W. or a modulated output can be obtained. The copper screening laps over the edges of the case and round the edges of the cover at the back, so that a good copper-to-copper joint is obtained when the cover is screwed on tight. This is necessary in order to ensure adequate screening.

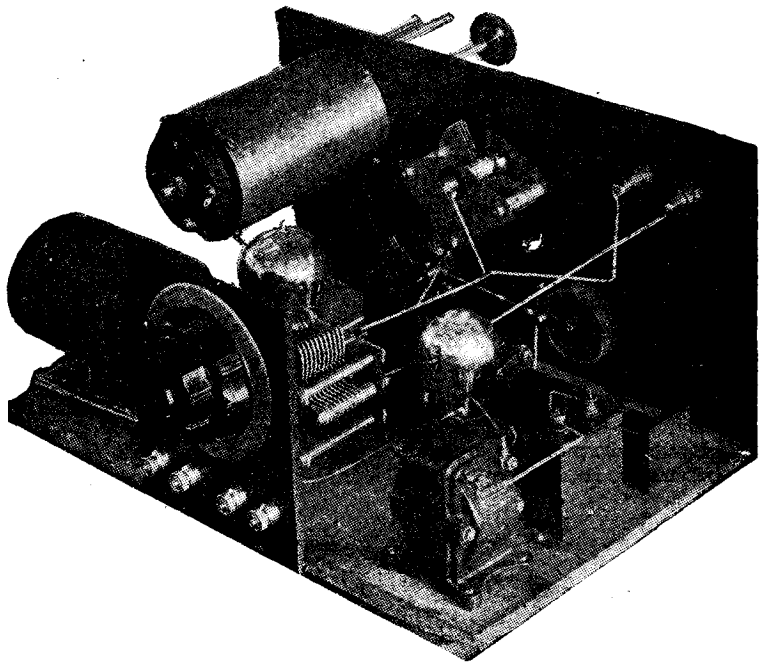
Coupling

The only other point to be described is that of the coupling to the oscillator. The ordinary swinging coil type of coupling was not satisfactory, because it was desired to have a control of the coupling over a wide range of strength. It is necessary, for example, to duplicate the signals from 2LO at a distance of one mile only in order to get adequate tests on the selectivity of any particular receiver, while at the same time it is necessary to go to the other extreme and obtain a signal strength equivalent to that of one of the relay stations during daylight. This is a very wide range, the actual voltage on the aerial being over one hundred times stronger in the former case.



To enable adjustments to be made when the instrument is in its screening case, long extension handles are fitted.

After some experiment it was found that the method of having two small-diameter coils consisting of one or two turns only, and moving them relatively nearer or further apart, gave a satisfactory control of signal strength. It was necessary, however, to devise some method of arranging the movement of the two coils relative to each other such that a definite calibration of the signal strength could be obtained in a reliable manner.



In practice most of the tuning is carried out with a small condenser joined in parallel with the main condenser.

The Method Used

The method finally adopted is in principle exhibited in Fig. 2. One coil connected in the oscillator circuit is fixed, and the coupling coil is mounted on a disc fitted with an internally threaded collar. Through the centre of this collar a threaded ebonite rod is fitted, and rotation of this rod therefore causes the movable coil to move relatively nearer or farther away from the second coil. The moving coil is prevented from rotating by a pin running in a slot, while a small indicator rod is attached to this moving coil. This mechanism has been calibrated in H.F. volts output, and the calibration has been found to remain practically constant.

It is possible by this means to duplicate the various transmitting stations both in this country and on the Continent, and to obtain definite comparative tests on the merits of different circuits.

ALL EUROPE ON A FRAME

(Continued from page 105.)

graphs, and separate test reports in the different arrangements will be given by the Radio Press Laboratories at Elstree.

Constructional Details

The first step in the construction of the instrument should be taken by marking out the front panel and drilling it to take the components mounted thereon. When these are mounted the brackets can be attached and the whole front panel screwed to the baseboard in the manner indicated. Soldered joints should be made wherever possible, but it is permissible to loop the wire under the terminals of the intermediate-frequency transformers and the filter, provided the terminals are afterwards screwed up tight on the bare wire.

The general wiring up will be found a very simple task if the diagrams are carefully followed.

(To be continued)

A CURIOUS TROUBLE

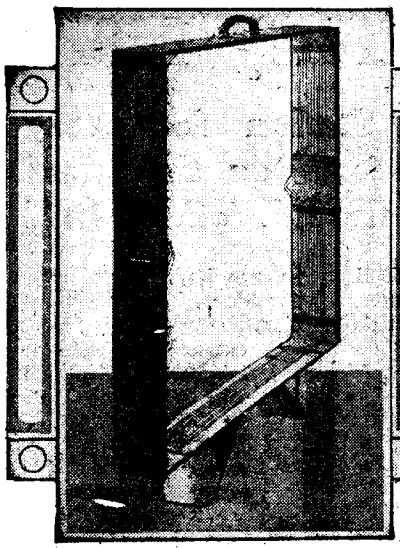
SIR,—Can any of your readers suggest a solution to a little problem that has been worrying me for some time past? I have a single-wire aerial 60 feet long and 38 feet high, and directly under it are two other aerials belonging to my neighbours (put up, I might mention, since the erection of my own). In one of these there is an extremely bad connection between the horizontal portion and the lead-in. It is simply a twisted connection and is not even protected from the atmosphere by tape or covering of any sort.

In windy weather, when this aerial swings—my own, being properly guyed, does *not* swing—I suffer from tremendous crackling noises in my 'phones or loud-speaker. That these are not due to any faulty connection in my own aerial is obvious from the fact that they still continue when I use an indoor aerial, and are only present in windy weather. It is certain that it is the neighbour's aerial that is the cause of the trouble, but he refuses point-blank to attend to it, although I have repeatedly pointed out to him that his own reception would be improved by it.

Is there any way of getting rid of this nuisance?—Yours truly,

"EXASPERATED."

Cheltenham.



BUILD THIS PORTABLE FRAME AERIAL

By GEORGE T. KELSEY

This useful and compact frame aerial might almost be called the "Double-purpose frame," for, in addition to its use in the home, it has the merit of being really portable, and is, in fact, just the thing for your portable set.

A FRAME aerial can always be regarded as a useful acquisition to the wireless outfit, but at this season of the year when great interest is centred on reception out of doors, it has a very special merit—namely, that of portability. To be claimed really portable, the frame must be constructed in such a manner that it can be folded up to fairly small dimensions, thus rendering it suitable for carrying.

In the following article I propose to describe in detail a frame aerial which can truly be called portable, in that it folds up very small and possesses a carrying handle on the top. The photographs will give a general idea of the finished frame, both folded up and opened ready for use.

The Choice of Wood

The actual framework is made from thin wood which has been well dried. In the frame illustrated I have used ready planed oak planking, as this wood will not split very easily. There are, however, many other woods which will serve quite well, as, for example, three-ply wood. If you buy the wood in planks, it should be four inches wide by a quarter inch thick, and about ten and a half feet in all will be required. It is always wise to buy a little more than is required, and the length given allows for about six inches waste.

Brass Hinges

Eight fairly substantial brass hinges will be required, and these should be from 1½ in. to 2 in. in length. The screws for securing should be obtained with the hinges, and, if possible, ¼ in. screws should be purchased. With the acquisition of a suitable carrying handle, the contruction of the framework can be commenced. The actual wire round the frame and the fixing thereof will be dealt with at a later stage.

The Framework

With the aid of a steel set-square and ruler mark out the plank as follows: Two pieces 2 ft. 3 in. long, four pieces 1 ft. 1¼ in. long and two pieces 6 in. long. When sawing these pieces off, great care should be taken to keep the saw

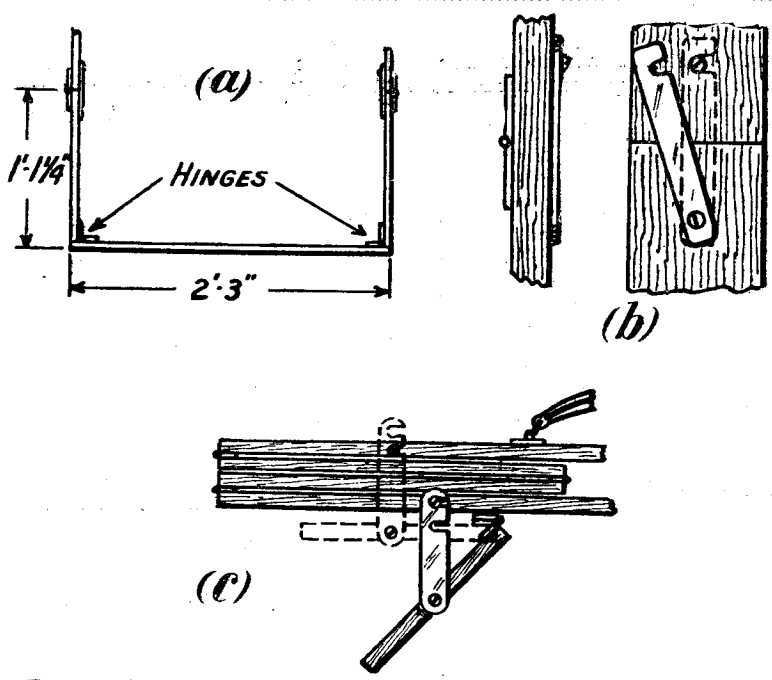


Fig. 1.—Constructional details of the hinged portions of the frame.

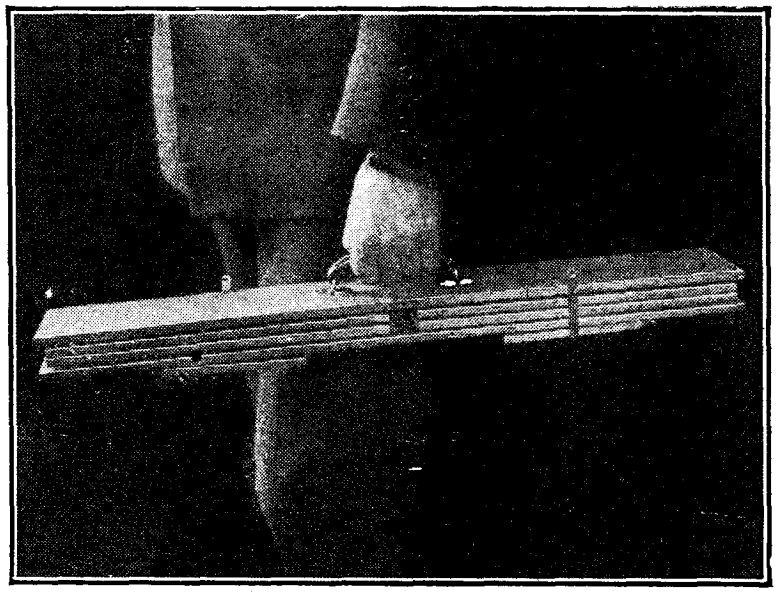
BUILD THIS PORTABLE FRAME AERIAL
(continued)

cuts dead square, otherwise the frame will be out of square when completed. The edges may now be very lightly smoothed with a medium grade of sandpaper. It is advisable to use this round some form of square block in order to keep the edges true. To assemble the framework, begin by taking the base (one of the 2 ft. 3 in. lengths) and fix at each end of this, by means of a hinge, one of the 1 ft. 1½ in. lengths. These will form half of each side. Fig. 1*a* will help you to understand how this is carried out. The remaining 2 ft. 3 in. length, which is to form the top of the frame, should be equipped in a similar manner. Two of the halves forming one side should now be secured end to end by means of a hinge on the outside, and the two forming the other side treated in a similar manner. The result should be a square frame which can collapse into the shape shown in one of the photographs.

The Next Step

To hold the frame open, it is necessary to fix a brass tag on the inside at each side, the functions of which will be gathered from Fig. 1*b*.

The two remaining pieces of wood are to form the feet of the frame. At one end of each piece of wood fix a hinge, the other arm of the hinge being fastened to the under-side of the baseboard. One leg is fastened at eight inches from each end. A brass tag serves to hold each foot open, and also to hold the whole frame together when it is folded up ready for carrying. The handle should be affixed to the top at the correct point of balance, which if the wood is of uniform thickness and weight should be at the centre.



The frame when folded makes an exceedingly neat and convenient portable aerial.

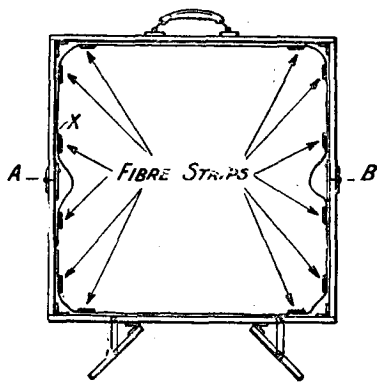


Fig. 3.—Fibre strips should be secured at the points indicated by the arrows.

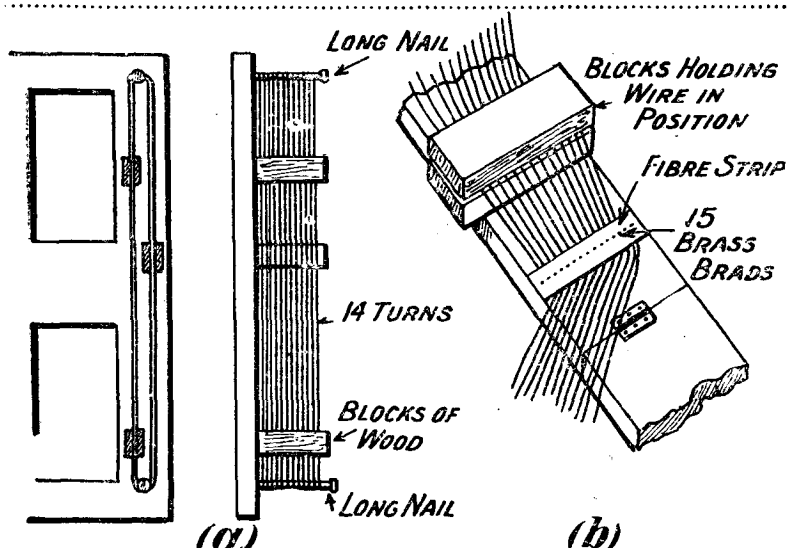


Fig. 2.—The novel method of winding is shown at (*a*) and at (*b*) the means adopted for placing the turns in position on the frame itself.

The Winding

The wire for the actual winding will be required next, together with 2 oz. of ¼ in. brass brads and some thin fibre strip. Regarding the aerial wire, this can be of any suitable rubber covered flex, but whatever is chosen, it should be fairly thin. About 110 to 120 feet in all will suffice.

At first glance fixing the wire in position may seem to be an almost impossible task. Admittedly, some care will be required, but if the following method is employed even this should not be found difficult.

The Method Employed

Firstly, measure fairly accurately the distance round the inside of your framework. Add on to this, say, 2 inches to allow for the bends when the frame is closed. In some convenient vertical wall or door knock two long nails at a distance apart which is half the total. Now take the wire and temporarily fix one end to one of the nails. Proceed by winding round the nails 14 turns slightly spaced apart. Before removing the nails, secure this winding in its correct order—that is, one turn, two turns, three turns, etc.,

(*Continued overleaf.*)

Build this Portable Frame Aerial

(Concluded)

by clamping two pieces of wood together with the wire running between them. This should be repeated in two or three other places.

Securing the Wire

Cut out next from the fibre 12 strips, each 4 in. long by ½ in. wide, and on each of these mark 15 holes equally spaced and allowing a small margin at each end. Take one of these strips and punch small holes at the points marked (an ordinary wire nail is quite suitable). To come back to the wire, place one of the points where it is held in its correct order against any position inside the frame and tack down lightly the wire by means of the punched fibre strip. Great care should be taken to see that the wire is secured in exactly the same order as it comes out of the temporary securing strips (see Fig. 2*b*). As to where this fibre strip is fastened, it must be at one of the points indicated in Fig. 3. In practice, I found it most convenient to start at that marked X in this figure. Proceed by securing the wire in a similar manner at all the points indicated in Fig. 3, keeping the turns in the same order all the way round.

Tightening Up

Assuming the wire to be secured, before knocking the brass brads right home, it is necessary to tighten the winding. Allowance has to be made at the centre of the two sides which fold in, and for tightening purposes two pieces of wood of suitable dimensions can be placed between the wood and the winding. This is at the two points *A* and *B* in Fig. 3.

Secure one end of the wire, and work all round the frame, tightening the wire as you go. The brass brads can now be knocked home, taking care not to damage the wire in so doing. One point to note here is that the brass brads do not touch the wire, but simply fix the fibre strip in position, which latter secures the wire.

Each end of the winding is finished off with a spade terminal, after having allowed a suitable length for connecting up. The frame is now complete and ready for use.

OPERATING THE "ELSTREE SIX"

(Concluded from page 124.)

With this combination the receiver was distinctly lively, although quite under control. Various other types of valves were employed, including the 60 milliampere and the 100 milliampere class, and in all cases satisfactory results were obtained subject to the reservations previously mentioned that slightly better results are obtained with high-impedance valves for the high-frequency stages, and that a suitable valve must be employed for the rectifier.

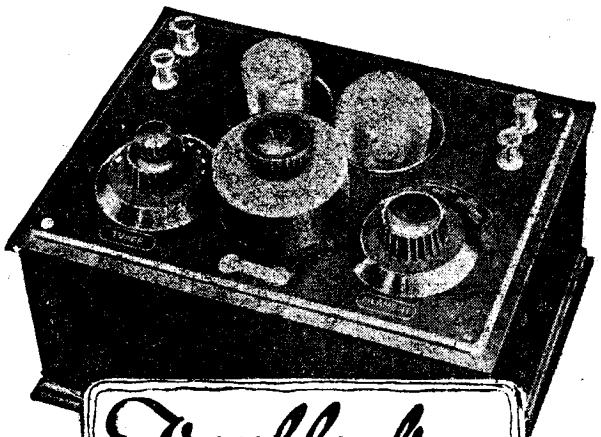
Follow the Lay-out

One or two readers have raised the question concerning the size of the receiver, and have wondered whether it is possible in any way to reduce the overall dimensions. This aspect of the question has not been neglected by the Elstree Laboratories, but it must be remembered that this is the first receiver to produce the unparalleled results which are obtained with this set. There is every indication that as we progress further in the art we shall be able to obtain similar results in a rather more compact form but with the present arrangement, it is absolutely essential that the lay-out given shall be followed faithfully.

Remarkable Stability

It will be appreciated that no screening whatever has been incorporated in the receiver. The effect of stray coupling has been dealt with on several occasions, and very encouraging results are being obtained by the use of screened circuits. In the absence of any such control of the stray coupling, however, it is essential to place the tuned circuits relatively far apart, and this has been done in the "Elstree Six." The remarkable stability which is obtained is due in no small measure to the spacing of the various parts which were decided upon after careful experiment, and any attempt to vary the lay-out given would bring in the same difficulties which have been very carefully avoided in designing this receiver.

For the same reason, if the results published last month are required, then the transformers must be made up in the manner specified. That is to say, the secondary windings should be Dimic coils, and the primary windings plug-in coils of the value given.



Trouble-free Radio

Here is a set that will give you perfect broadcast reception without any trouble or untidiness. Behind the case is a neat multiple cable, with indicating tags for battery connections. The only panel connections are for aerial and earth. The circuit is extremely simple, but the method of operating is even more simple. In the hands of the veriest novice, perfect results are easily obtained. Good Loud Speaker strength is given from any main B.B.C. station up to a distance of 20 to 25 miles, with corresponding greater range from the high power station. The valves are mounted on a special anti-vibration device, and are sunk into the panel to minimize the risk of accidental breakage. The filament control is arranged to permit the use of *either bright or dull-emitter valves.*

The great simplicity of this receiver is combined with a high degree of selectivity.

PRICE.

Receiver only	£5	0 0
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Buy the set with the Monogram (B T-H)

2 Valve L.F. Receiver

The British Thomson-Houston Co. Ltd., Crown House, Aldwych, W.C.2

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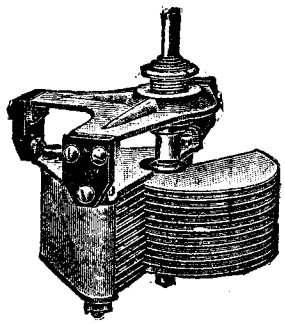

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are now offered you at a lower price. "Utility" quality is still maintained as is the famous "Utility" Guarantee to replace or repair any defective component without charge. "Utility" Low Loss Condensers are truly low loss because there is only one end plate and all solid insulation is external to the electrostatic field. Ask to see them at your Dealers.

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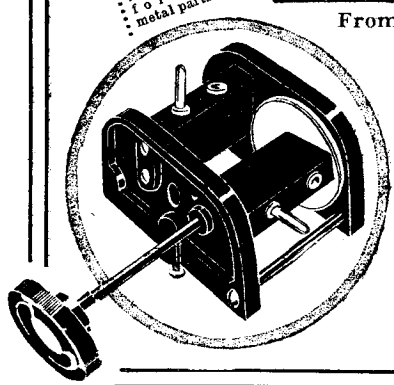

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Makers of the new improved "LOTUS" Valve Holder.

LETTERS OF INTEREST
FROM OUR READERS

Improvised Aerials

SIR,—With reference to the helpful article by Mr. A. V. D. Hort, B.A., in the May issue of MODERN WIRELESS, on "Improvised Aerials," possibly your readers will be interested to hear that I have obtained very good results indeed with a portable three-valve receiver (detector and two stages of L.F.) and an aerial rigged up as follows:

One can easily procure an old ex-Army 50-1 modulation transformer for a few shillings. I happened to have one of these lying about "out of work," and had commenced to unwind the outside winding, which is of about No. 24 gauge D.C.C. I simply attached one end of this to the set and carried the bobbin up a tree, or even slung it over a tree from the ground, leaving the unused part of the wire still wound round the bobbin—this seemed to have little effect upon the efficiency of the aerial. No earth was used, but about 50 feet of No. 16 D.C.C. was run along the ground as a counterpoise; no insulators being used for either the aerial or the counterpoise.

With this arrangement excellent signals were obtained; in some cases they were distinctly better than the normal signals obtained with the portable set and other forms of improvised aerials—in no case were they inferior.

Perhaps some other readers have tried similar arrangements; if so, I should be glad to know of their experiences.—Yours truly,

C. J. DALE.

Douglas, I.O.M.

A Wavemeter Trouble

SIR,—I should be glad if you could help me over a difficulty that has cropped up since I constructed the six-valve superheterodyne, described in the May issue by Mr. G. P. Kendall, B.Sc.

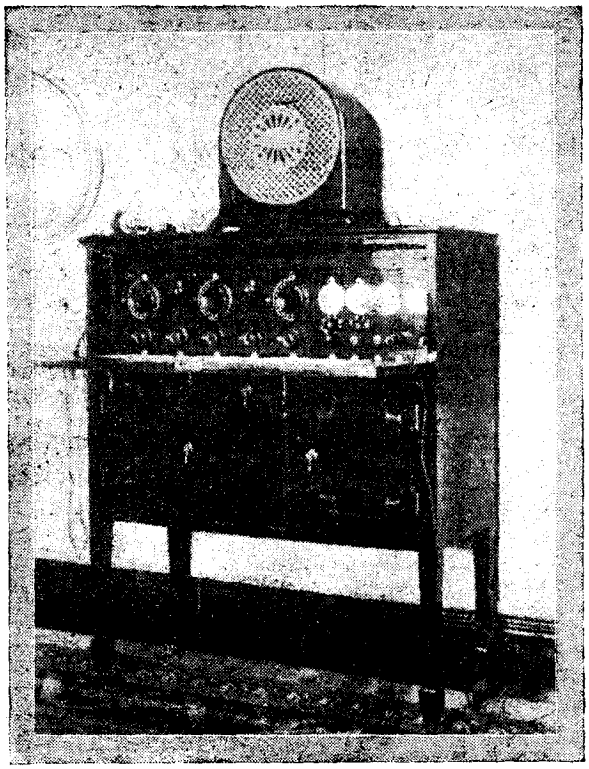
I have a very accurate heterodyne wavemeter and find great difficulty in obtaining good readings with it when the superhet is in use, as I get four or five separate "chirps" on swinging the wavemeter condenser.

I have no doubt that there is some means of curing this, and should like to compare notes with other readers.—Yours truly,

C. L. BAYLISS.

Carlisle.

[Our correspondent might try the effect of an absorption wavemeter placed near the frame. This type has been found to function satisfactorily.—ED.]



The handsome "Special Five" receiver with which our correspondent has received fifty different stations on an indoor aerial.

The "Special Five"

SIR,—I have pleasure in forwarding you the enclosed photograph, together with brief particulars of my experience with the "Special Five" receiver.

The set has been in constant use for about six months, and undoubtedly is a highly efficient receiver, representing as it does a considerable advance on similar receivers employing a like number of valves.

My aerial is an indoor one, but I have been successful in bringing in 50 stations, approximately 25 of these at good loud-speaker strength, including all main B.B.C. stations and a large number of the relays; the most distant station received on the loud-speaker being Rome.

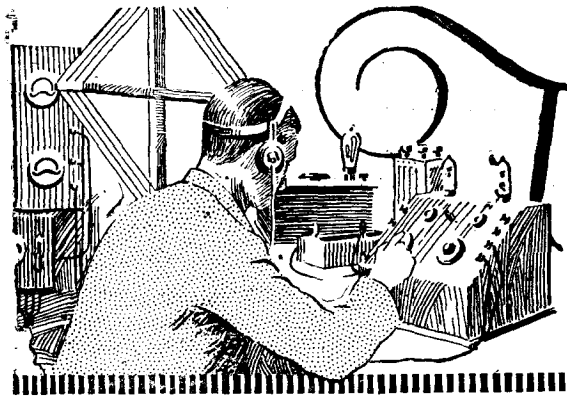
Sensitivity, selectivity, and quality of reception are really excellent features, and once the art of manipulating three tuned stages has been mastered, the operation of the receiver is simple even for the uninitiated.

The assembly of the set follows on the general lines of those recommended, the exceptions in my case being the inclusion of separate filament rheostats together with the arrangement of voltmeters with selector switches for checking the filament and plate volts of the respective valves, and an ammeter and milliammeter for the indication of filament and plate current. Further additions are a jack for the first L.F. amplifying valve and a variable grid leak on the last valve.

It is found that these additions, more particularly the measuring instruments, greatly contribute to the general efficiency and satisfactory operation, permitting the valves used—viz., P.M.4 and P.M.3—being correctly run. This is considered very desirable, in view of these valves showing no visible glow and being otherwise concealed in the cabinet.

In conclusion, may I add my tribute to Radio Press, Ltd., for this excellent receiver, and wishing you every success.—I am, yours truly,

No. L.531,301
(Birkenhead).



Tested by Ourselves

"Erla" Fieldless Coils

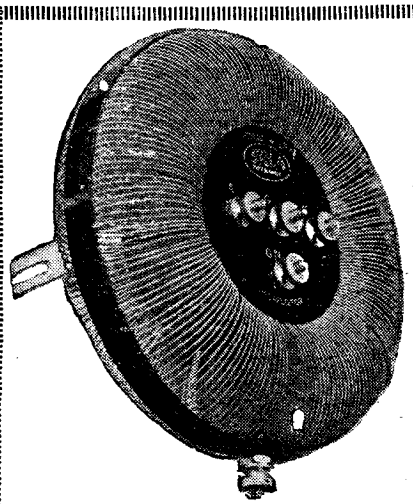
TOROIDAL coils have been received from Messrs. C. G. Vokes & Co. They are known as "Erla" balloon circloid couplers, and on test were found to be practically fieldless. One coil was intended for aerial coupling and the others for H.F. stages. It was found that absolute stability was obtained over the whole 200–500 metres band, while a satisfactory degree of H.F. amplification resulted. The coils are robust in construction, have a satisfactorily low H.F. resistance, and are provided with brackets for fixing purposes.

"Neutrovernia" Condenser

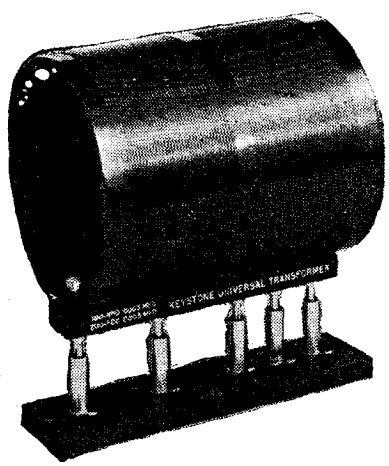
MESSRS. Gambrell Bros., Ltd., have submitted for test a "Neutrovernia" condenser. The change from the minimum capacity of about 1 micro-microfarad to the maximum of 28 micro-microfarads is accomplished by the rotation of a long insulating handle, which causes a brass cylinder to slide inside another. Six complete revolutions are necessary to cover the capacity range. On test, this neutralising condenser gave every satisfaction, the movement being smooth and easy. The mechanism is completely enclosed in an insulating case.

"Keystone" Universal Transformer

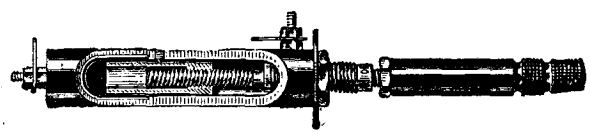
MESSRS. the Peto-Scott Co., Ltd., have sent us one of their "Keystone" Universal transformers. It consists of two windings of insulated wire on an ebonite tube 4 in. long and 3 in. in diameter. Five split pins are mounted on a strip fixed to the tube, these being for connecting purposes and plugging into a holder. The component can be used for a variety of purposes, but is especially intended for H.F. coupling. Satisfactory results were obtained in use in aerial tuning and H.F. coupling circuits, and the H.F. resistance was found to be low.



The "Erla" toroidal coil which was designed to reduce interaction between the H.F. stages in valve receivers.



The "Keystone" Universal transformer can be used in numerous ways for H.F. coupling purposes.



A sectional view of the Gambrell "Neutrovernia" condenser.

Fixed Condenser

WE have received from Messrs. Falk, Stadelmann some samples of their new mica fixed condensers. These condensers, stated to be their new pattern, appear to be well and solidly constructed.

We were pleased to note that one was supplied in section, to show complete assembly, and another complete condenser was also sent, but minus the case, to allow of inspection of the manufacture preparatory to casing.

It is claimed that good quality mica is used, measured for thickness by a micrometer, and then for size with a steel gauge.

The method of construction is explained in a brief notice, and after assembly in skeleton form the condensers are tested on a capacity bridge, after which each is inserted into a moulded case and filled in.

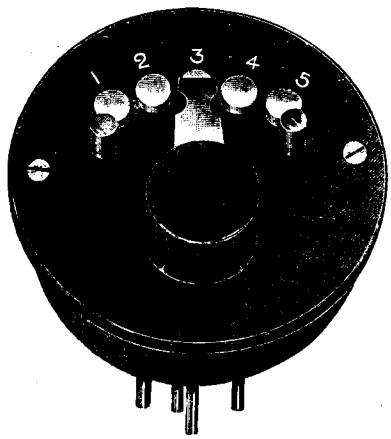
(*Continued on page* 180.)

TESTED BY OURSELVES—(Continued)

Before going into stock these condensers are again tested on a capacity bridge.

Variable H.F. Transformer

THE Trix variable plug-in transformer sent for test by Messrs. Eric J. Lever, plugs into an ordinary valve holder and carries a five-point switch. The wavelength range was found to be 230 to 3,000 metres, a ·0003 variable condenser being used for tuning the secondary winding. In an actual receiver test the H.F. amplification appeared to be up to the average, and although the amplification is not quite so high as

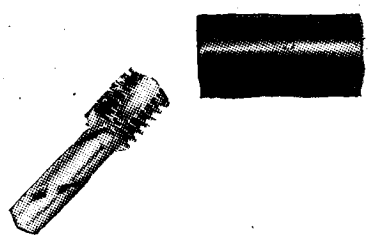


The Trix variable plug-in H.F. transformer.

that given by an H.F. transformer designed to cover a narrow waveband, nevertheless it can be recommended for use. It affords a means of obtaining H.F. amplification on both short and long waves combined in one instrument.

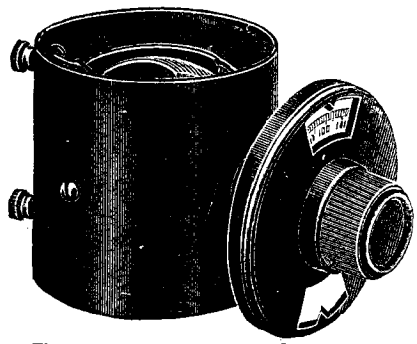
Clix Wander Plugs

THE Clix wander plugs supplied by Messrs. Autoveyors, Ltd., are intended for taking tappings from H.T. and



The Clix battery wander-plug can be obtained coloured black or red.

G.B. batteries, being constructed with two spiral slots on opposite

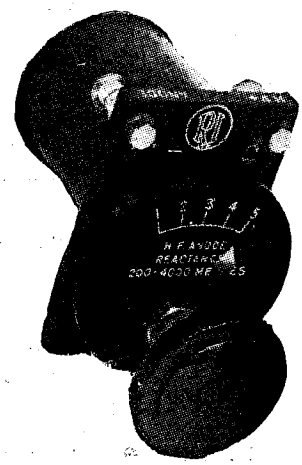


The windings of the Igranic variometer are both self-supporting and protected.

sides of the plugs. Red and black coloured insulating sleeves are provided to fix the leads on to the metal body of the plug and indicate polarity. These plugs proved to be an excellent fit in various H.T. battery sockets, and are admirable for their particular purpose.

Igranic Variometers

TWO variometers have been sent for test by Messrs. The Igranic Electric Co., Ltd. They are constructed on similar lines, the windings being self-sup-



The "R.I." H.F. Anode Reactance unit is compact and neat in appearance.

porting, but protected by a tubular case of insulating material. The type B variometer was found to have a tuning range of from 260 to 450 metres, while the BL type (intended for long-wave work) covered

(*Continued on page* 183.)

Special Wireless Cabinets to Customer's orders

Cabinets that at any time are illustrated or described by the Editor of this Journal we can make to order. Ask for prices. Delivered free anywhere in the United Kingdom.

Hundreds of readers of this Journal have expressed their satisfaction with workmanship and price of our cabinets

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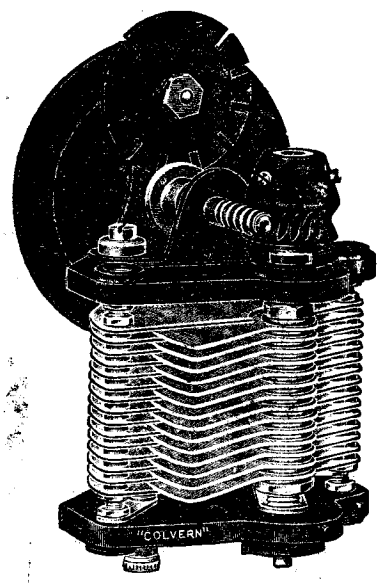

In this advertisement we print a letter of remarkable interest:—

"I consider your Selector to be the only Variable Condenser which is suitable for the 'Split Coil Neutrodyne' Circuits. Both the rotor and stator are at High Frequency potential and with most Condensers this means that hand capacity effects are so troublesome as to make the circuit 'not worth while.' I find however that your Selector—even in this circuit—is quite free of hand capacity."

A Dual Selector Condenser for the Elstree Six. Price £6 Set of Four (32/6 each).

Connecting Bar and additional support for Converting 2 Selectors into Dual Selector, 5/-.

The Colvern Selector Low Loss. Reading to 1/3,600th capacity.
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Type F. without gear attachment.
Capacity .0005 mfd. 15s. 0d. .0003 mfd. 14s. 0d.
One hole fixing. Other capacities if required.
Descriptive folder upon request.
Colvern Independent Vernier - Price 2s. 6d.
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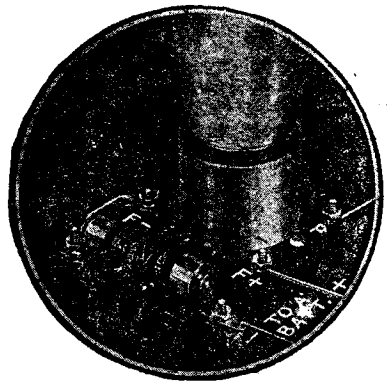
Coll'nson Precision Screw Co., Ltd.
Walthamstow, London, E. 17.
Provost Works, Macdonald Rd.
Telephone—Walthamstow 512.

AMPERITES *for the* ELSTREE SIX



There are six Type 1A Amperites specified in the ELSTREE SIX RECEIVER because they eliminate hand rheostats, simplify wiring and ensure perfect automatic filament control.

Type 1A. For 5 volt .25 valves on a 6 volt accumulator.
Type 4V-199. For 3 volt .06 valves on a 4 volt accumulator or 4½ volt batteries.
Type 6V-199. For 3 volt .06 valves on a 6 volt accumulator.

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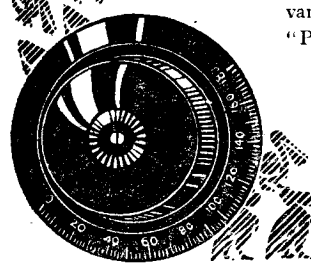
The march of THE PELICAN UNIVERNIER



The Pelican Univernier is steadily moving on to more panels because it *does* give absolute vernier control.

Simply take off the dials of your variable condensers and put on the "Pelican." Price **6/-**

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[RED YELLOW BLUE · BLACK WHITE *and* GREEN]

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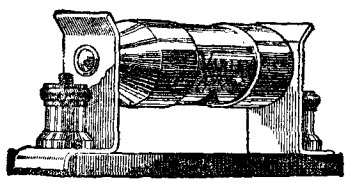
The LONDON ELECTRIC WIRE Co & SMITHS Ltd
Playhouse Yard Golden Lane, London, E.C.1.

Makers of Electric Wire *for over 40 years*

TESTED BY OURSELVES
—(*Continued*)

the 700 to 2,400 metres band. Both models are soundly constructed and efficient and can be thoroughly recommended. A special graduated



The "Varley" Anode Resistance is of the wire-wound type.

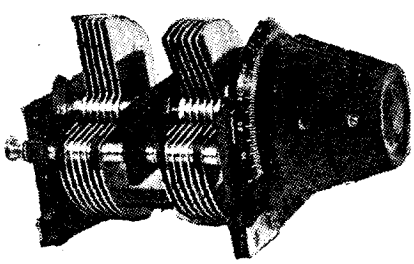
dial and knob is provided with each.

"R.I." H.F. Anode Reactance

THIS anode reactance, made by Messrs. Radio Instruments, Ltd., is intended for H.F. intervalve coupling. It consists of a barrel-shaped case carrying a front panel fitted with a switch arm and studs, and covers (with a ·0003 condenser) wavelengths of from 200 to 4,000 metres. One-hole fixing is employed and a knob and dial provided. The component came successfully through all tests, is very well made, and can be recommended.

"Varley" Anode Resistance

FROM Messrs. the Varley Magnet Co. (proprietors, Oliver Pell Control, Ltd.) we have received a number of their Varley wire-wound resistances. They are of standard size, and may



The Devicon Bridge Condenser.

be had in various values, with or without clips and base.

On test, each resistance was found to be exactly of the value specified and perfectly silent in use as an anode resistance in a

(*Continued overleaf.*)

TESTED BY OURSELVES—(Continued)

resistance-capacity L.F. amplifier. These resistances are well made and finished, and can be thoroughly recommended.

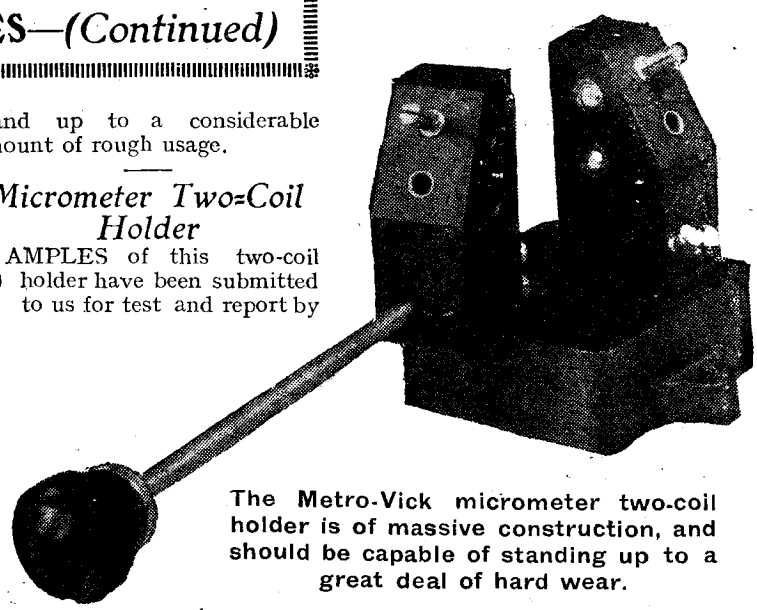
Devicon Bridge Condenser

WE have received a Devicon bridge condenser for test and report from Messrs. Autoveyors, Ltd. This condenser is constructed on low-loss principles, being provided with metal end plates, two sets of fixed plates which are electrically connected, and two sets of moving plates insulated from one another. The two sets of moving plates are controlled by two concentric conical knobs each provided with a white line for indicating the setting against a fixed graduated scale.

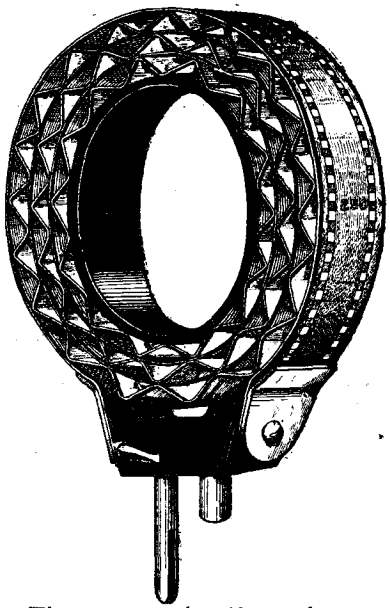
Test figures show a maximum capacity of .00027 between each set of moving vanes and the respective set of fixed vanes, while the insulation resistance was infinity. Careful examination of this condenser showed that it was well constructed and sufficiently robust to stand up to a considerable amount of rough usage.

Micrometer Two-Coil Holder

SAMPLES of this two-coil holder have been submitted to us for test and report by Messrs. Metro-Vick Supplies, Ltd. This coil holder, which is constructed of black insulating material, is mounted on a base 2½ in. square, two lugs being provided on opposite sides by means of which it may be mounted on a baseboard. This base carries two coil sockets, one fixed and one moving, which are slightly inclined to be vertical. The moving coil holder may be adjusted by means of a long metal rod provided with an insulating knob at the end. This gives a convenient leverage for



The Metro-Vick micrometer two-coil holder is of massive construction, and should be capable of standing up to a great deal of hard wear.

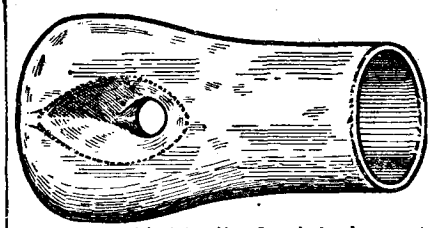


The layers in the "Lewcos" plug-in coils are separated by corrugated celluloid.

TESTED BY OURSELVES—(*Continued*)

making comparatively fine adjustments. In order, however, accurately to control the movement of the moving coil, the spindle which passes through a slot in the base of the moving coil holder is provided with an eccentric, so that when the spindle is rotated the moving coil holder swings through the arc of about 10 degrees for one half revolution of the knob.

Several standard makes of plug-in coils were tried in this holder, and all proved to be an excellent fit, whilst when placed on test the insulation resistance between the plug and sockets of both the holders proved to be infinity. The instrument is robustly constructed and has a pleasing matt and nickel finish. If anything it is a little on the heavy side, but this will enable it, no doubt, to stand up to a great deal of hard wear and usage.



The "Hobbs" Aerial Insulator.

"Lewcos" Coils

FROM Messrs. The London Electric Wire Co. & Smiths, Ltd., we have received several of their new "Lewcos" plug-in coils. These are wound with special Litz wire, the layers being separated by corrugated celluloid and fastened to the standard plug by a celluloid band. The coils were found to be extremely efficient, robust in construction, and pleasingly finished, and can be thoroughly recommended for use.

"Hobbs" Aerial Insulators

HOLLOW porcelain aerial insulators have been sent in by Mr. J. A. Brassington, jun., for test. They are made so that the aerial wire is carried inside, while an eye for the halyard is formed at one end. By this means a large insulating surface is provided, while the inside of the insulator will remain dry under the severest conditions.

(*Continued on page* 187.)

TESTED BY OURSELVES

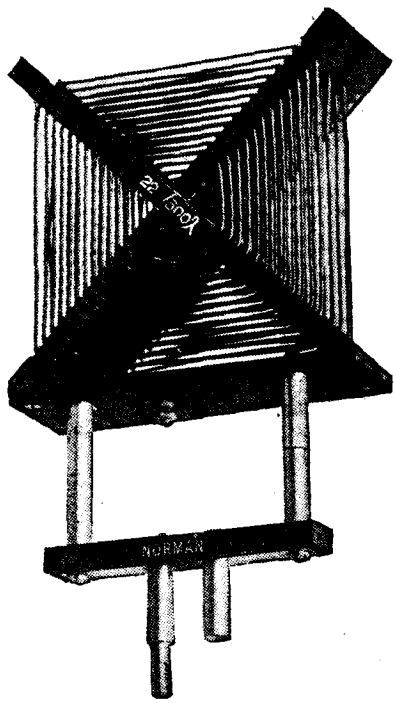
(Concluded)

On test, with the halyards and insulators made soaking wet, the insulation resistance was found to be infinity, while with the roughest usage only a small flake could be broken off the insulators. They can be thoroughly recommended.

Low-Loss Coils

WE have received from Messrs. the Norman Radio Co., Ltd., several of their low-loss coils.

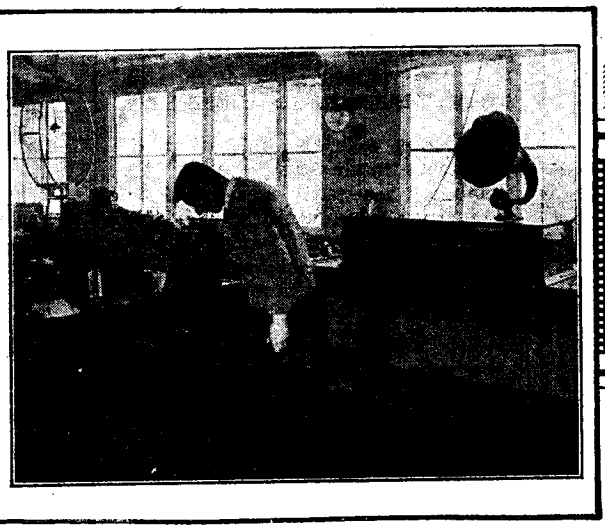
They have special low-capacity mountings, but adapters are provided by which they may be



One of the low-loss coils, together with its adapter, submitted for test by Messrs. the Norman Radio Co., Ltd.

inserted in the usual coil holder. The largest of the coils submitted consists of four of these pancake coils connected in series, and is wound to cover a range of frequencies from 857 to 577 kc. (350 to 520 metres) in the aerial circuit.

The high-frequency resistance of these coils is satisfactorily low, and they certainly provide an efficient coil for the broadcast band. They are specially suitable, however, for the shorter waves, owing to the absence of dielectric, and the special low-capacity mounting is an advantage.



At the Elstree Laboratories: Checking up the calibration of the ELSTREE SIX with the Famous Crystal Controlled Wavemeter.

THE Elstree Laboratories have again demonstrated their value to the Industry by producing The ELSTREE SIX—the Star Receiver of the year. This set has had a most enthusiastic reception, as a result of which the Industry is now experiencing a phenomenal demand for apparatus.

As the Trade organ of the Radio Press THE DEALER is invaluable to you for this one reason among many—that subscribers receive advance news of developments being pursued at the Radio Press Laboratories. Information of this kind keeps you abreast of your competitors.

Produced for the Wireless Trade by exclusively wireless publishers, THE DEALER is the established pre-eminent monthly journal essential to every trader.

Send for a specimen copy now and realise what you miss by not seeing a copy regularly.

Contents of the July issue include in addition to regular features:— Further Details of the London and Birmingham Exhibitions, an Exclusive Interview with a leading West-End Retailer, an article on "The Art of the Cabinet Maker," and "The Wireless Dealer Service and Testing Set."

THE WIRELESS DEALER

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All enquiries to the Sales Manager, Radio Press, Ltd., Bush House, Strand, London, W.C.2.

IN PASSING—(*Concluded from page 107*)

grounds. At the entrance to the amusement park I met them and proceeded to introduce them to its delights. Several casualties were sustained at Omo's automatic turnstile, but otherwise the tour of inspection passed off without a hitch until we came to the last and greatest of all the attractions. The greasy aerial mast was a special brain wave of my own. A long pole was arranged horizontally above the duckpond. At the far end was a pulley. Competitors were required to take with them a piece of clothes-line and to pass it through the pulley. In order to ensure that the mast should live up to its name I had coated it overnight with a mixture of gearbox grease and graphite. All the other side-shows were doing a roaring trade within a few moments of the opening ceremony; the greasy mast alone appeared to be hanging fire. "All we want," I said, "is somebody to give us a start. Now, if only our President . . ." The General pulled out his watch and said that he was afraid he must be going. Such, however, was the pressure brought to bear upon him, especially by the feminine members of the party, that the General, always a ladies' man, reluctantly consented to make the first attempt.

The General Tries

A very handsome figure he made as he went, pale but determined, from the bank. Cheered to the echo, he made his way further and yet further out. Then the band struck up the Soldier's Chorus, and true to his military training, the General stepped right out with his left foot. Next moment he was doing a kind of shimmy-shake, which was followed by a very beautiful high kick. Just as his face came into contact with the mast the clothes-line which he had been brandishing wound itself into mazy coils, lashing him firmly to it.

The Result

Under the force of gravity he rotated gently till he was beneath the mast, then having removed with his one free hand as much as possible of my patent compound from his mouth and eyes, he endeavoured to climb back. This he accomplished at last, but his final effort was a little too strong and he slipped round once more. He was completing his eleventh circuit of the pole when the clothes-line broke and the waters closed over him.

Hearing the splash, Little Bingo, rushed from his tent, dived in and seized him by the collar as he broke the surface, thus pulling his face under once more. It is extraordinary how cowardly men can be at times. I do not think that Poddleby would have gone in to help the General if I had not overcome his reluctance with a hearty push behind. When we got him out the General made straight for the crazy kitchen and had ten shillings worth without stopping.

Success !

So successful was the fete that the Little Puddleton Wireless Club is now in a thoroughly sound financial position. We have decided that the best way of relieving the local wireless widows is to send them all free of charge for a fortnight's holiday at the seaside. This will give their husbands a chance of putting in some real experimental work.

"ARTIFICIAL ATMOSPHERICS"

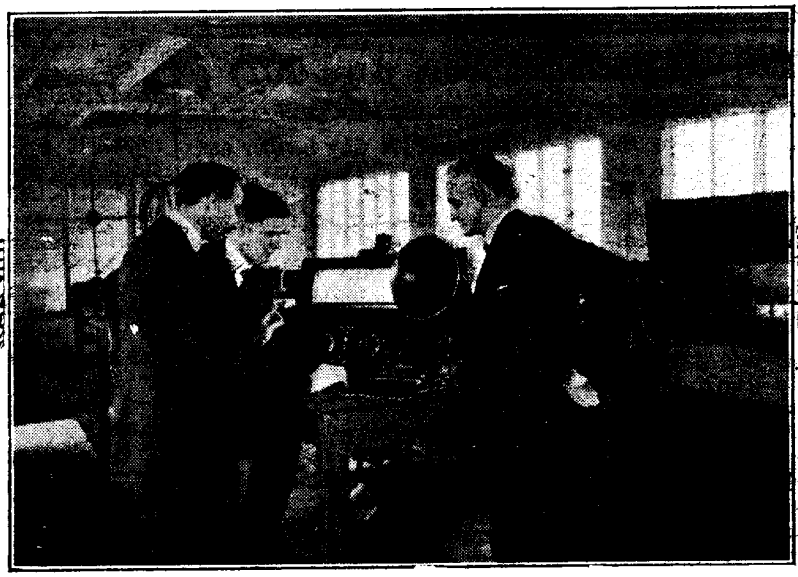
SIR,—No doubt a large number of your readers are afflicted with interference in some form or other, and it seems to me that if all those who are martyrs to "artificial atmospherics" from electric trains, trams, or machinery of various kinds could only get together through the medium of MODERN WIRELESS, they could be of considerable assistance to one another.

I am sure the area of ether round my aerial is the "noisiest spot on earth" as far as wireless is concerned. If only others in similarly bad positions would publish their experiences in trying to eliminate their own brand of interference, they would be doing a great service to many of their "fellow-sufferers."

I am sure you would not mind placing a small amount of your space at the disposal of such a cause as this.—Yours truly,

L. R. BEATON.

Clapham Junction.



Presentation of the first prize in "Cartoonigrafs" Competition No. 6 at the WIRELESS Laboratories

BY entering into the "Cartoonigraf" Competitions any reader of WIRELESS may be the fortunate winner of one of the many handsome prizes.

The first prize consists of a well-known complete receiver, while the second and third prize winners receive such valuable apparatus as Super-Heterodyne Kits, H.T. and L.T. Accumulators, Valves, L.F. Transformers, etc. In addition, 50 Consolation Prizes consisting of Radio Press Handbooks are awarded to commendable entries.

Buy your copy of "Wireless"—the weekly journal which provides a new outlook for every home constructor—containing full particulars and entry form for the "Cartoonigraf" Competitions, only one of its many attractive and interesting features.

2D. WEEKLY **WIRELESS** *(Incorporating Wireless Weekly)*

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Buy your copy every Tuesday

RADIO PRESS LTD.
Bush House, Strand, London, W.C.2.

Split Coil Circuits with Ordinary Coils

(Concluded from page 150)

Construction

The constructional work is very simple, and straightforward. Drill three holes in the panel in the positions shown to take the spindles of the two variable condensers and the filament rheostat. Two further holes will then be required for the fixing screws of the filament rheostat, and one further hole for the indicator of the Collinson condenser, this last hole being countersunk to improve the appearance. Finally, eight holes are drilled for the terminals in the positions shown, and three small holes for the fixing screws.

Mount the two variable condensers and filment resistance on the panel in the positions shown, and insert the eight terminals holding them secure with nuts on the back. Lay out the balancing condenser, the fixed coil holder, the fixed condenser and leak, and the valve holder in the positions shown in the diagram, and make sure that there is plenty of clearance for both the variable condensers to move freely. The components may then be screwed in position, when the set is ready for wiring.

Wiring Up

Wire the set up in accordance with the diagram given in Fig. 3. Care should be taken with the leads at the aerial side of the set to ensure that they do not foul the moving plates of the Collinson condenser when the condenser is in its minimum position. Apart from this no difficulty at all will be experienced in the wiring, which is of a very simple character.

Testing

The preliminary testing should be done without the aerial connected, but with the earth on. Place the reaction condenser at about the middle, insert a suitable coil in the fixed coil holder, and with a wet finger tap the grid terminal of the valve holder. A loud clicking should be heard in the telephones indicating that the set is oscillating. If this is not found to be the case the position of the balancing condenser should be altered slightly from one side to the other until this loud click is obtained. It will then be found that decreasing the value of the reaction condenser will cause this oscillation to cease at some point. A position should be found on the balancing condenser such that it is possible to obtain smooth control of the oscillation with the reaction condenser irrespective of the position of the main tuning condenser.

The aerial may now be connected, and stations may be tuned in in the usual manner. Little difficulty will be experienced as the reaction control will normally be smooth and easy. If this is not so, a slight readjustment of the filament brilliancy or the high-tension voltage will quickly put the matter right.

Coils to Use

For the lower broadcast band a No. 50 or 60 coil will be found suitable, and for Daventry a No. 200 or 250. It will be found that the two coils, one for each wavelength range may be interchanged easily, and that the setting of the receiver will remain adjusted when one coil is replaced by another, provided that a correct adjustment has been found in the first case. It will be obvious that this is a very desirable state of affairs, since the changing from one band to the other simply means the changing over of one coil only, and equally satisfactory reception can be obtained on either range.

Elstree Test Report

On test the receiver was found to be easy to handle once the correct high-tension voltage had been obtained.

London and Daventry were obtained at excellent strength, while several other stations were heard on the telephones. The change over from the lower broadcast band to the Daventry range is particularly easy, only one coil having to be changed.

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In future this coupon must be accompanied by a P.O. for 2/6 for each question and a stamped addressed envelope.

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JULY, 1926.

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This coupon entitles the reader to one blueprint of any set described in the above issue, and must accompany each postal application.