Wireless, incorporating "Wireless Weekly," June 19, 1926.

WIRELESS

INCORPORATING

WIRELESS WEEKLY

2D WEEKLY

Vol. IV.] *JUNE 19, 1926* [No. 4

IN THIS ISSUE:

A LONG-RANGE SINGLE-DIAL RECEIVER

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

SPECIAL ARTICLES BY

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

AND

Lieut.-Commander the Hon. J. M. KENWORTHY, R.N., M.P.

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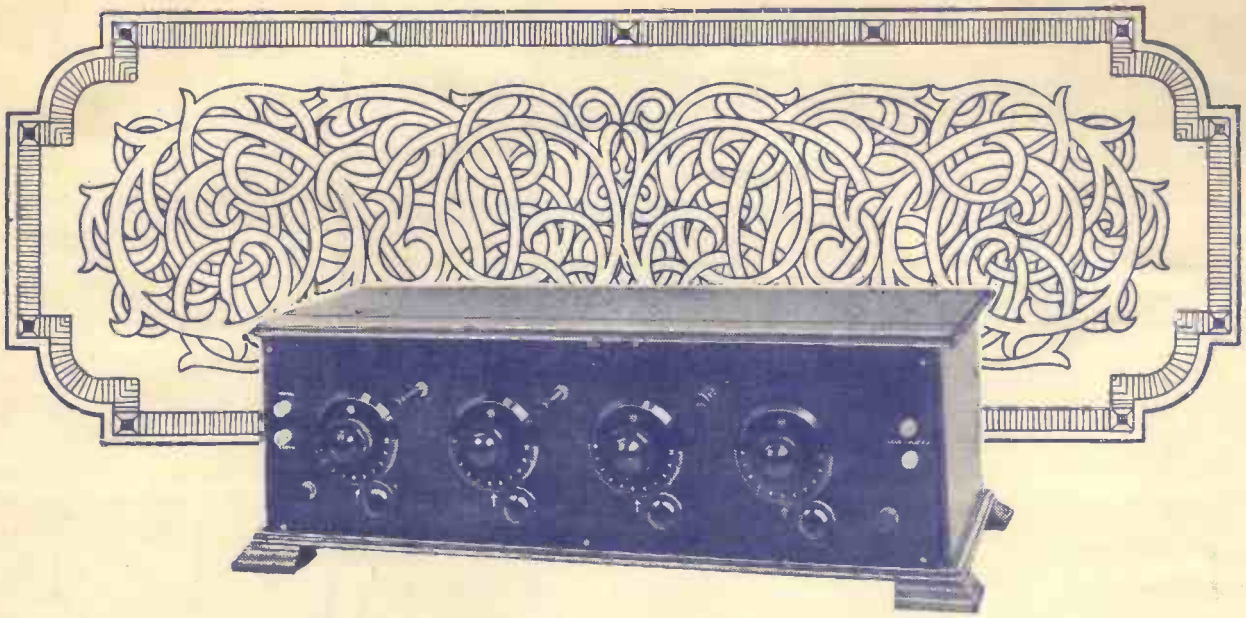

THE "FIVE FIFTEEN"

Mr. J. H. Reyner, with five valves, designs a receiver which combines efficiency and cheapness

THE design of the "Five Fifteen" shows how a highly efficient receiver can be built for the moderate outlay of £15. On test, no less than 27 stations were obtained on the loud-speaker in one run through the tuning range. In addition, numerous other stations were audible in the telephones. Every thought has been taken to retain simplicity of design, construction and operation.

The July issue of "The Wireless Constructor," in which this receiver is described, also contains the constructional details of a receiver particularly suitable for distance reception during the summer and a very ingenious Single Valve Reaction Receiver, by means of which comparative tests can be simply made between different forms of reaction control.

The Editor, Mr. Percy W. Harris, continues his very instructive series of "Talks to Beginners"—this month upon the subjects of crystals and condensers. Many interesting operating tips are given in "Noise" or Quality—an article by L. H. Thomas.

Do not forget, before you build any of the sets described in "The Wireless Constructor," to send the coupon contained in each issue for ONE FREE BACK-OF-PANEL BLUEPRINT.

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

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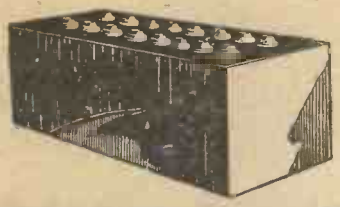
Apparatus Tested

RADIO PRESS, LTD. BUSH HOUSE, STRAND, LONDON, W.C.2



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The Dubilicon is a multiple condenser containing eight separate units, the terminals of each unit being brought out to sockets on the lid. By using Clix plugs (made by Messrs. Autoveyors, Ltd., 84, Victoria Street, S.W.1) of which two are given with every Dubilicon, the units can be connected in a variety of series, parallel, and combined series-parallel arrangements giving a very large number of different capacities ranging from zero up to 0·011μF.

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"DX" RECEPTION MADE EASY

AN INTERESTING TWO-VALVE RECEIVER :: :: WITH ONE-DIAL CONTROL :: ::

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

There is only one tuned circuit in this little set, but careful use of the special reaction control will enable quite good long-distance work to be done.

POSSIBLY many listeners will have noticed that under the present reception conditions of extended daylight hours the tuning-in of the more distant stations on sets other than those of the multi-valve variety is becoming increasingly difficult. This difficulty is largely due to the fact that the desired station is usually weaker in signal strength at this time of the year than, say, during the winter months, and unless some form of reaction control which is really smooth in its action is employed, the actual "picking up" of a weak signal can be a very tedious operation.

The Question of Range

On looking at the circuit of the receiver under review it will be apparent that no high-frequency amplifying valve is used. How then can the set be called a long-range instrument? It is often stated by certain enthusiasts that the use of high-frequency amplification is to increase range, while the use of low-frequency amplification is to increase volume, and though I have no fault to find with these statements, in either case or both the volume and range must have increased over that obtained when using the detector alone. For example, if when using a single valve we can just hear but not understand, say, Bournemouth, adding a high-frequency amplifying valve to the set will increase the volume to understandable strength. Similarly, adding a low-frequency amplifying valve will do the same thing, therefore in either case the range of the detector set alone has been increased to the extent of permitting Bournemouth to be received.

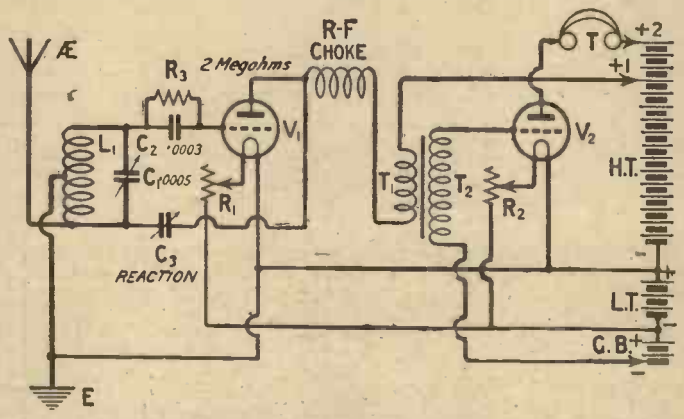


Fig. 1.—From this circuit arrangement it will be seen that no high-frequency amplifying valve is employed.

The Present Arrangement

In the present case the circuit consists of a rectifying valve with reaction, followed by a single stage of transformer-coupled L.F. amplification. The control of the reaction adjustment with the arrangement used is such that the most use may be made of the extra volume associated with the application of reaction, without appreciably upsetting the adjustment of the tuning condenser. Further, by applying a suitable value of anode voltage to the detector valve the operation of the reaction condenser can be made delightfully smooth.

Using such an arrangement as this allows the most to be made of the detector valve, and, as perhaps readers already know, much can be done even with a single valve; the addition of the low-frequency amplifier, however, simplifies matters somewhat in that with its inclusion it is no longer necessary to work the set so near the oscillation point before the distant station is heard.

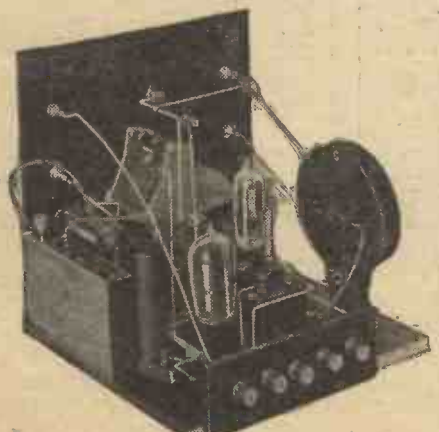
Selectivity Requirements

If a receiver is to be used for the reception of stations other than the local one, some regard must be paid to the question of selectivity, and though the present set is not advocated as being perfect in this respect, it is nevertheless much more so than the average set of the same type. For purposes of general utility and flexibility of wavelength range, plug-in coils are used in the detector grid circuit and the form of aerial coupling used is the popular "auto-coupled" method, the coil being of the centre-tapped variety.

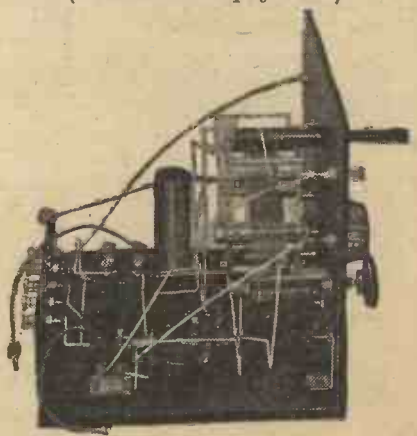
Constructional Details

The design finally adopted for the present receiver is that employing the

(*Continued on page* 114.)



The five terminals mounted on the strip in the foreground connect the H.T. and L.T. batteries to the receiver.



A view of the receiver with coils and valves removed.

"DX" RECEPTION MADE EASY

(*Continued from page 113*)

familiar vertical panel and baseboard, all the components, valves, coil, and so on being contained within the box. In this way the only components fitted to the panel are those requiring adjustment in the ordinary process of operation.

The terminals for the aerial, earth and telephones appear on the front of the panel for reasons of convenience, while those terminals for the high- and low-tension batteries are situated at the back of the receiver.

The grid-bias battery which it may be desired to use is intended to be contained within the cabinet, and so long as the present design is copied in detail this may be allowed to stand along the top edge of the battery terminal strip.

The Circuit

The theoretical circuit diagram will make quite clear exactly how the receiver is made up. The centre-tapped coil is shown as L_1, and it will be seen that the centre tap is connected to earth and low-tension positive. C_1 is the tuning condenser, while C_3 is the reaction condenser. This latter is of very small capacity, and is in fact a Gambrell "Neutrovernia"; by turning this condenser in a clockwise direction the set may be made to oscillate over the whole tuning range of the L_1 C_1 circuit, provided that the radio choke coil is also included in the circuit in the position shown. Should the choke be omitted for any reason or other, then the inclusion of the C_3 condenser will not, in the majority of cases, serve any useful purpose.

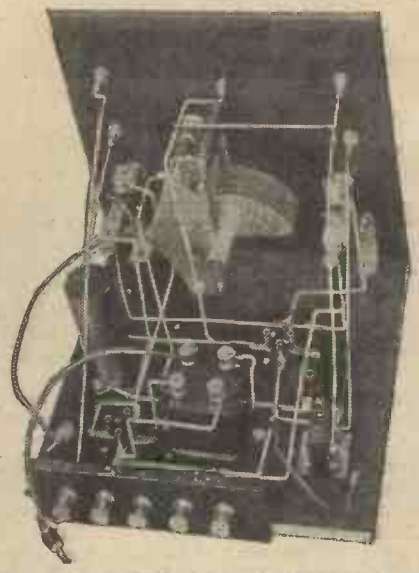
The remainder of the circuit is perfectly straightforward and conventional, while the values of the various components used may be gathered from the practical wiring diagram.

What You Will Require

Readers desirous of building a receiver of this type should first acquire the following components and materials. Following upon many of the components will be found the names or trade marks of the firms from whom these may be obtained, and though other suitable *makes* may be found in the advertisement pages, the *values* where given should be strictly adhered to.

One ebonite panel measuring 9 in. × 9 in. × ¼ in. ("Trelleborg").

One ebonite strip of same origin, 6 in. × 2 in. × ¼ in.



The two grid-bias plugs may be seen on the extreme left of this photograph.

One cabinet to take panel, and baseboard ("Camco").

Two right-angle brackets.

Nine terminals.

Quantity No. 16 "Glazite."

Short length rubber-covered flexible wire.

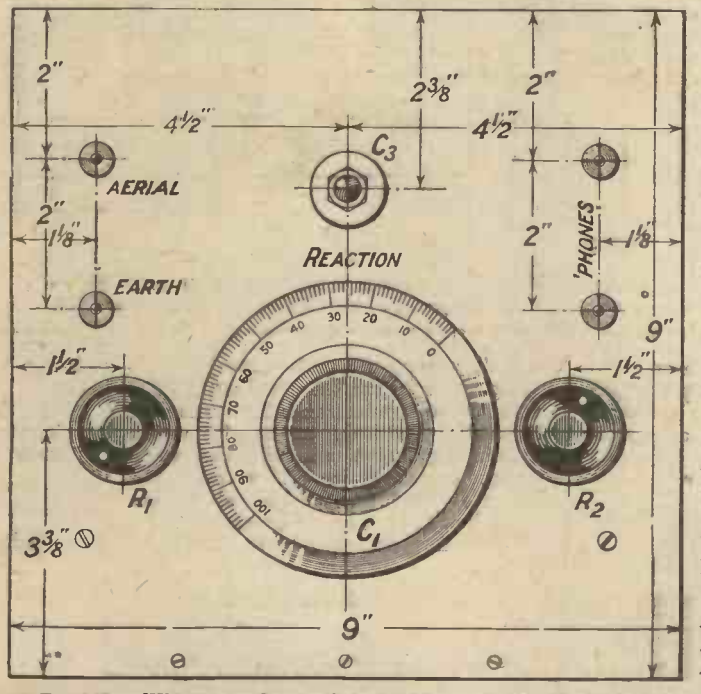


Fig. 2.—When marking the drilling centres on your panel follow carefully the dimensions given in this drawing.

Packet Radio Press panel transfers.

Two valve holders for baseboard mounting.

One coil holder for baseboard mounting.

One .0005 square-law condenser (Igranic Electric Co., Ltd.).

One "Neutrovernia" condenser (Gambrell Bros., Ltd.).

Build this simple long-distance two-valve receiver

One grid-leak and condenser combination, 2 megohms and .0003 respectively (Watmel Wireless Co., Ltd.).

Two 30-ohm filament resistances (C. A. Vandervell & Co., Ltd.).

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

One L.F. transformer (Fuller "Iron-clad").

Two wander plugs, one red and the other black.

Preparation for Assembly

The first requirement in the constructional work is that of preparing the panel, and this should be drilled in accordance with the instructions given in the drawing showing the layout.

After this has been done and the panel has been fitted to the base-board by means of the right-angle brackets the whole should be slid into the cabinet to ensure that no trimming-up with a file is necessary to obtain a good yet easy fit.

This point dismissed, the components should be mounted, bearing in mind that those upon the base-board should be as nearly as possible in the same positions as those indicated in the photographs and wiring diagram.

The ebonite strip carrying the terminals for the H.T. and L.T. battery connections is fitted at right angles to the baseboard and secured in position by two or three small wood screws. When ordering the cabinet it will be as well to remember that there should be a slot at the back to allow this strip, with its terminals, to pass out sufficiently far for the external connections to be made.

Wiring Up the Receiver

The wiring of the components, in conformity with the practical wiring diagram, will not be found difficult, providing that those leads which are nearest to the panel and baseboard are connected in position first.

A careful examination of the photographs showing the wiring will simplify the work to be done to some extent, though in any case sufficient clearance is given between components to allow of easy accessibility.

The connection to the centre tap on the plug-in coil is made from the stem of the aerial terminal by means of a short length of rubber-covered flexible wire terminating at its far end in a spade tag.

Two further flexible connections are made, one from the L.T. negative, ter-

(*Continued on page 115.*)

"DX" RECEPTION MADE EASY—(*continued*)

minating in a red wander plug, and one from one secondary terminal of the low-frequency transformer, terminating in a black wander plug. These two

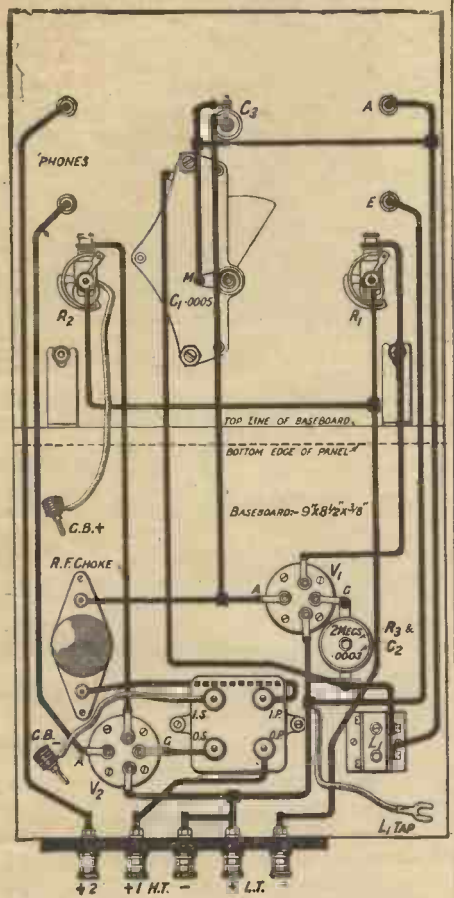


Fig. 3.—This drawing, in conjunction with the photographs, should be referred to when the wiring is commenced.

connections will eventually be made to the grid-bias battery.

Preliminary Tests

Having completed the wiring, carefully check the connections against the practical wiring diagram, and after ascertaining that all is correct, insert a No. 60 centre-tapped coil, or a Gambrell centre-tapped C in the coil socket and join the flexible lead to the tapping point.

Connect an accumulator of suitable voltage across the L.T. terminals, turn the filament resistances to the "off" position, and insert the valves. By slowly turning the rheostats in a clockwise direction, the valves should light, a control of their brilliance being given by the filament resistances.

Testing the H.T. Circuits

As a test of the H.T. connections, transfer the L.T. negative to the H.T. negative terminal and the L.T. positive first to H.T. + 1, and then to H.T. + 2, noting that the valves do not light up irrespective of the positions of the arms of the filament resistances.

Connect the telephones in circuit; connect the aerial and earth, the L.T. battery, H.T. negative, and still with the No. 60 or C coil in position connect H.T. + 1 to, say, the 45-volt tapping on the high-tension battery and H.T. + 2 to, say, 90 volts. Plug in the red wander plug (G.B. +) into the positive of the grid-bias battery and the black wander plug (G.B. —) into, say, 4½ volts.

Operating the Set

With these connections made the set may be tested on signals, and for purposes of simplicity the local station should be the first station to try for. Before switching on the valves, turn the reaction condenser as far as it will go in an anti-clockwise direction, and set the .0005 condenser to its zero reading.

The set adjusted in this manner makes the possibility of causing interference to neighbours a very remote one, so upon lighting the valves until the correct amount of glow is obtained, turn the dial of the .0005 condenser until the local station is received at its loudest (making sure, however, that it is working beforehand). Now turn the "Neutrovernia" condenser in a clockwise direction, when it will soon be found that signals will gradually increase, but once that fact has been discovered leave the set well alone.

Turn the dial of the .0005 condenser well away from that position where the local station is received, in a direction towards 180 deg., and at a setting where there is little likelihood of causing interference to neighbours, say, actually at the 180 deg. position, turn the "Neutrovernia" condenser again in a clockwise direction until the set begins to oscillate.

Adjusting the Reaction Control

In all probability the condition will make itself manifest by a fairly loud "plop" in the telephones, and it should be the ambition of the constructor to adjust the anode and filament voltage until a combination is reached where this "plop" is almost inaudible at any position of the .0005 condenser.

To attain this end the value of the anode voltage applied to the detector valve should be reduced, say, three volts at a time until a value is reached where any further reduction prevents the set from oscillating, whereupon a slight reduction in the filament current will have the desired effect.

Though the process sounds a rather tedious business when committed to paper, in actual fact it is a matter of a very little practical experiment, and once done fully justifies the time spent upon it.

General Hints and Tips

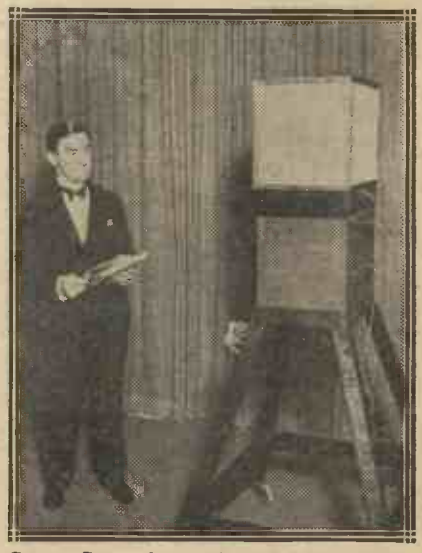
When the reaction adjustment has been made so as to give satisfactory control, the anode voltage and grid-bias for the L.F. stage should be adjusted to give the best possible reproduction. These voltages will depend, of course, upon the make of valve chosen, and in this respect it is as well to comply with the makers' instructions.

As regards valves which may be used in this receiver, practically any make will give satisfactory results, though it must be admitted that valves of the small-power type are preferable in the circumstances. This remark applies equally well to the detector stage in that such valves usually give a smoother reaction control when used in a circuit of the present type.

Should it be desired to receive 5XX, Radio-Paris or other long-wave broadcasting station, then the grid coil L_1 should be either a No. 250 centre-tapped coil or an F in the lettered series.

Distant Reception

To accomplish distant reception with the receiver under discussion the .0005 condenser should be tuned in conjunction with the "Neutrovernia" condenser, so set that the receiver is just



Steve Donoghue, the famous jockey, before the microphone at 2LO on the occasion of his recent broadcast.

off the oscillation point through the full tuning range.

It will be found in practice that one adjustment of the reaction condenser holds good for several degrees of the .0005 condenser, so by a careful manipulation of the two a Continental or distant B.B.C. station can be quickly found.

Once the signal has been picked up

(*Concluded on page* 122.)

Final Steps in Developing the "Elstree Six"

By JOHN SCOTT-TAGGART

How parasitic oscillations are produced—How they have been overcome — Split condenser methods — Anode-current rectification—The final circuit.

NOW we come to a very fascinating part of neutralised receiver circuits. Although perhaps a few people were working privately on the problem, yet curiously nobody published anything even referring to the existence of parasitic oscillations in neutralised circuits. After carefully investigating this curious phenomenon and how it could be cured, the Radio Press disclosed its existence to the great mass of experimenters and home constructors. This parasitic oscillation may occur even though the circuit may be perfectly neutralised for the wavelength to be received; for example, the circuits of Fig. 2 and Fig. 3 last week may be perfectly neutralised for, say, 365 metres, but nevertheless the circuit may not function at all as a high-frequency amplifier on account of a mysterious oscillation which 99 out of 100 people would put down to improper neutralising.

Mysterious Oscillations

If, however, they took a suitable wavemeter they would find that the valve was not giving proper amplification on 365 metres, because all the time it was oscillating strongly at about 60 or 70 metres. We sometimes meet with a similar mysterious parasitic oscillation in low-frequency amplifiers using two or more iron-core low-frequency transformers. In this case a mysterious high-frequency oscillation may occur which, while not altogether preventing low-frequency amplification, reduces it effectively and causes blurring of speech and music.

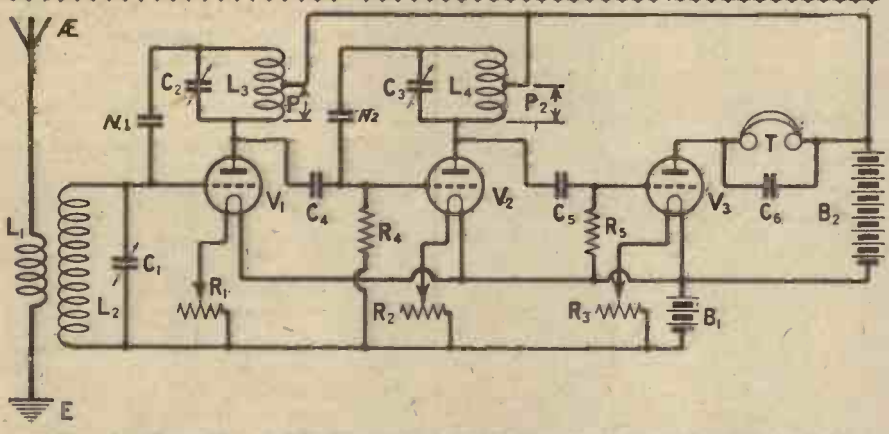


Fig. 4.—Parasitic oscillations are very prone to occur in a circuit like this at the natural frequency of the halves of L3 and L4.

How it Occurs

The parasitic oscillation appears to be due to the fact that in a tapped coil as in the case of Fig. 2 and Fig. 3 one-half of the coil is in the anode circuit of the valve and the other half is also to be regarded as partially in the grid circuit. The two halves of the inductance are coupled together, and a reaction effect on a very short wavelength of about 60 metres is obtained, and this produces self-oscillation on this wavelength, even though the circuit may be neutralised to prevent oscillation on the 365-metre wavelength. In other words, the circuit is neutralised for the wavelength to be received, but is not effectively neutralised for the parasitic oscillation.

A Typical Circuit

The phenomenon is comparatively rare in a single-valve circuit. It is, however, an extremely common symptom in a circuit of the kind shown in Fig. 4, which is a complete receiver in which there are two neutralised stages of high-frequency amplification, the tapped anode coil method being used, neutralising condensers N1 and N2 being employed. The circuit of Fig. 4 will give good results up to a certain point, but if

(*Continued on page* 118.)

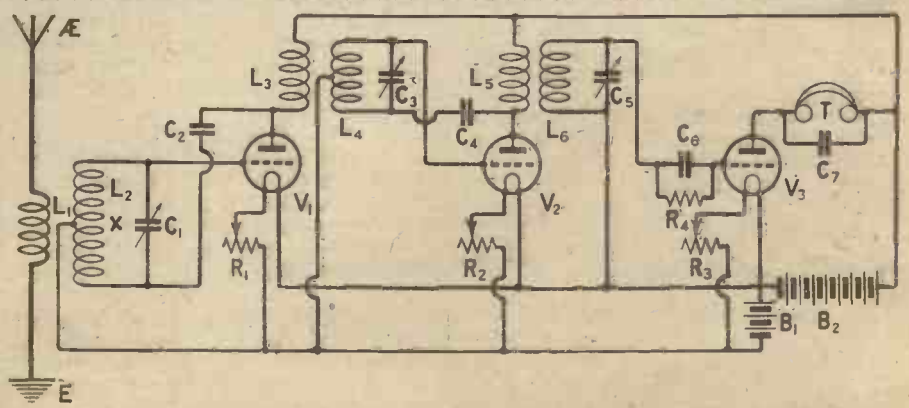


Fig 5.—This circuit differs from that of fig. 4, in that the grid coils are centre tapped. Parasitic oscillations are still troublesome, however.

Only the new Cossor Point One can give you these three advantages

WHEN a man buys a Valve three questions flash through his mind. The first is "Will it be cheap to run? I cannot afford to use a valve that consumes a lot of current." Then follows "Is its filament strong? A valve that becomes useless after the first slight blow is expensive at any price." And finally "Can I be sure that it will give as good results after twelve months as on the first day I use it?"

These are the three essential needs of every wireless enthusiast. In this new low consumption Valve, Cossor is enabled to offer a Dull Emitter which utilises principles of construction so strikingly new that the whole future trend of valve design is likely to be influenced. Read below how this wonderful new valve, consuming only ·1 of an ampere (hence its name) will satisfy your most exacting requirements.

1 Current consumption cut to one-third

Ever since the days of the bright emitter the whole resources of Science have been enlisted in ceaseless efforts to reduce current consumption. In the new Cossor Point One a further tremendous cut has been made. This new valve now requires only one-tenth of an ampere at a voltage of 1·8. That means that a Super-Heterodyne using seven of these new valves would still consume less current than a one-valve Set using one Bright Emitter. Or to make the comparison still more striking the same accumulator which served the one-valve Set for, say, one week, would—with its cells connected in parallel to give two volts only—last longer than two months on a charge. Even then it would only need re-charging to prevent sulphation of its plates. This phenomenally low current consumption renders the Cossor Point One quite suitable for use with dry cells when required.

2 A shockproof filament suspension system

The system now evolved by Cossor offers outstanding advantages and automatically ensures for the valve a greatly increased life. Whereas in many valves the filament, being straight, is held under tension, that in the new Valve is arched and retained in position by a fine wire which is secured to a seonite insulator situated immediately above it. It is not held under tension. The fine wire provides exactly the degree of elasticity required to enable the filament to withstand harmlessly the sharp concussion caused by an accidental blow. A knock which would shatter the filament in an ordinary valve is easily absorbed by this amazingly efficient shockproof suspension system.

3 Long life uniformity due to Co-axial Mounting

If a number of valves were made with identical filaments, grids and anodes without due regard to the exact spacing between these elements, all the valves would show very considerable variations in performance. Absolute uniformity in results can only be obtained among valves of the same class when the relative positions of their elements are identical.

In the new Cossor Point One the system of mounting infallibly aligns the filament, the grid and the anode at the top as well as at the bottom. Even the hardest shock will fail to displace their exact relative positions.

Frequently the working characteristics of a valve will change as time goes on—perhaps due to filament sag or to the grid or anode being moved out of position through an accidental blow. This cannot possibly happen in a Cossor Point One. Users of Neutrodyne Receivers employing two or more stages of *matched* H.F. amplification will appreciate the immense importance of this exclusive Cossor feature.

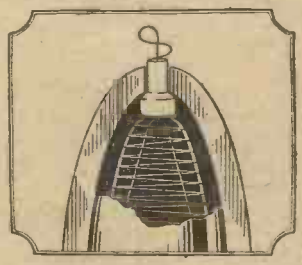
Cossor Point One

RED TOP:
For H.F. use consuming ·1 amp at 1·8 volts. 15/6

PLAIN TOP:
For Detector consuming ·1 amp at 1·8 volts. 15/6

Cossor Stentor Two

GREEN TOP:
For Power Valve consuming ·15 amp at 1·8 volts. 18/6



Observe how the seonite insulator securely aligns and holds in their correct relative positions, the filament, the grid and the anode. Through the centre of the insulator will be seen the fine wire which supports the filament and safeguards it against shocks.

Cossor Valves

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

Gilbert Ad. 5333

Final Steps in Developing the "Elstree Six"—*continued*

a high degree of amplification is desired parasitic oscillation becomes very pronounced.

This kind of parasitic oscillation is much simpler to explain. There is in the anode circuit of the first valve a portion P_1 of the inductance coil L_3. Through this portion flows the actual direct anode current. The coil P_1 is not only in the anode circuit of the first valve, but also in the *grid* circuit of the second. We shall for the moment ignore the fact that it is in the anode circuit of the first valve, the filament of which we can turn off if we so desire. In the anode circuit of the second valve we will see that again there is a portion P_2 of the coil L_4, this portion being of the same size as P_1.

Curious Behaviour

Now it is a fact, although it may seem curious, that the portions P_1 and P_2 act as it were "on their own," and each is shunted by its own self-capacity and the capacity between anode and filament of the valve with which it is associated. We thus have two tuned circuits, one in the grid and one in the anode circuit of the valve, and each of these is tuned to a low wavelength of something like 60 metres. The condensers C_2 and C_3 are ignored by the P_1 and P_2 circuits, which regard themselves as very exclusive and more or less refuse to have anything to do with their big brothers L_3 C_3 and L_4 C_3.

The result is that they may happily oscillate while their big brother circuits are perfectly friendly and refuse to spoil the operation of the whole circuit by oscillating on their wavelength, which we have assumed is 365 metres. The little fellows, however, amuse themselves by oscillating on about 60 metres and spoil the whole operation of the circuit, and cause most experimenters who are not on the lookout for this trouble to imagine that the real fault is an improper neutrodyning of the main circuit.

Remedies

The people at Elstree studied these facts very exhaustively, and have developed a whole series of circuits spoiling the game of the little independent circuits. Fig. 5 is to Fig. 4 what Fig. 3 is to Fig. 2. It is, in reality, a step towards the "Elstree Six" circuit. This time, instead of taking the tapping on the anode coil, it is taken on the grid, but nevertheless the Fig. 5 circuit will give the same horrible parasitic oscillation.

In the "Elstree Six" it is the Fig. 5 circuit which has now been further improved so as to cut out entirely the parasitic oscillation. Instead of taking the tapping actually from the middle of the coil L_2 in the case of the first valve, the tapping has been made not an actual one but an electrical one. Two condensers, C_1 and C_2 (Fig. 6), are connected across the whole of L_2, and the tapping to the filament of the first valve is taken from the point X which corresponds with the point X in Fig. 5.

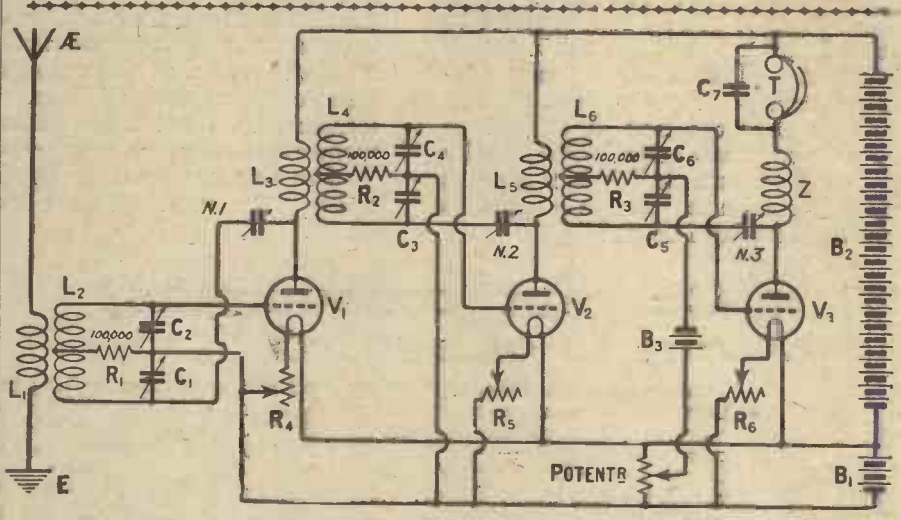


Fig. 7.—This is the final arrangement of split circuits and neutralising arrangements adopted in the "Elstree Six." The condensers N1, N2 and N3 are shown as variables in this practical example.

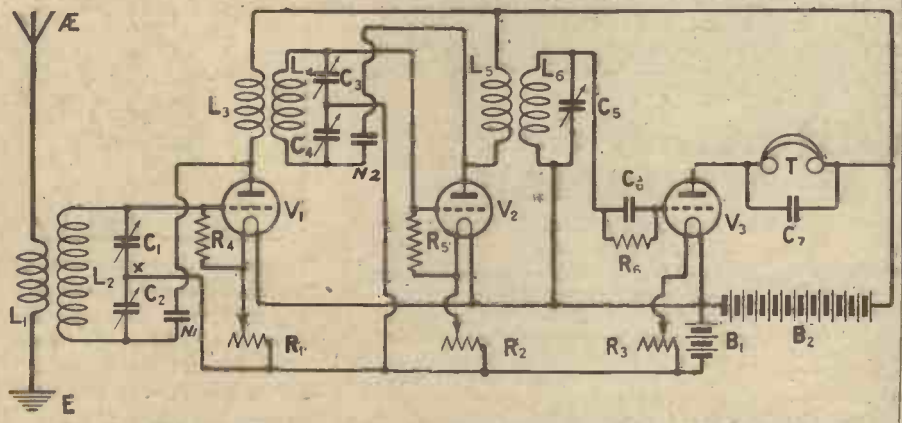


Fig. 6.—This circuit is a step in the direction of the "Elstree Six" circuit, but the resistances R4 and R5 are not in the most desirable positions.

Exit the Parasitics

Provided the capacities of C_1 and C_2 are always the same, the voltages across C_1 and C_2 will be the same, while L_2 C_1 C_2 forms the single circuit just as L_2 C_1 forms a single circuit in Fig. 5. In the Fig. 6 arrangement we get exactly the same effect of neutralising as in Fig. 5, and also as in Fig. 3, except that the parasitic oscillation has no circuit in which to kick its heels about. It therefore simply does not exist.

It will be noticed that in Fig. 6 the grids of the first and second valves are liable to be at a loose end, that is to say, that as we have departed from the scheme with an actual tapping on a coil, the grids will accumulate electrons, and it is consequently necessary to allow these latter to leak away in some manner. Leaks R_1 and R_5 are therefore provided, but they are not intended in any way to make the valves act as rectifiers, and grid batteries could be inserted in each grid lead.

Position of Leaks

The leaks arranged in this manner, however, are not satisfactory, and another step in the development of the "Elstree Six" circuit is given in Fig. 7, where the resistances R_1, R_2 and R_3 are connected in a symmetrical

(*Continued on page* 119.)

FINAL STEPS IN DEVELOPING THE "ELSTREE SIX"—(*cont.*)

manner between the points between the two condensers and the middle turn on each of the grid coils. It might be suggested that by retaining the middle tapping on the coil the parasitic oscillation would pluck up courage and try to re-assert itself. The thought of passing through a 100,000-ohm resistance is, however, enough to quench the ardour of any kind of an oscillation, whether parasitic or otherwise, so that no parasitic oscillation is found in this circuit.

It might be asked why a value of 100,000 ohms is used. The reply is that it does not really matter what value is employed, but a low resistance, provided it prevents parasitic oscillation from occurring, enables us to give the grid a negative bias very readily if we so desire. A similar resistance connected directly across one of the condensers such as C_1 in Fig. 6 would upset the balance and cause damping.

Bottom-bend Rectification

It will be noted in Fig. 7 that the last valve, which is a detector, operates on the anode-current rectification principle. The leaky grid condenser is no longer employed, but a grid battery B_3 and a potentiometer are used, and by moving the slider on the potentiometer, excellent rectification effects are obtained.

Anode-current rectification is better, quieter, and does not give rise to blasting or distortion in the case of strong signals. The leaky grid-condenser method is more effective in the case of weak signals, but when these very powerful high-frequency amplifiers such as are now being introduced by Elstree are used, the much-neglected anode rectification system comes into its own, and is actually used on the "Elstree Six" circuit.

The Final Circuit

The circuit used in the "Elstree Six" receiver, which is very fully described in the June issue of *Modern Wireless*, is given in Fig. 8, and it will be seen that the circuit much resembles Fig. 7, except that there is an additional stage of high-frequency amplification.

An interesting point before I close is that a similar grid circuit is used for the fourth valve as for the others. This is because the condenser C_8 is now no longer acting as a neutralising condenser, but as a means of introducing what the more advanced experimenter will recognise as Hartley reaction. It is in effect a form of capacity reaction

In closing this article I would like to say that the "Elstree Six," the "Magic Five," and other receivers emanating from our Elstree Laboratories have involved the most laborious design work quite apart from circuit invention and development. The practical results are easily-built but extremely efficient receivers, and the fullest demonstrations of their capabilities are available.

THE NEXT ARTICLE

By Mr. SCOTT-TAGGART

Entitled "Reflex Circuits: Will They Come Back"? will appear next week.

A Cabaret Broadcast

Next Saturday, June 19, an English cabaret will be broadcast for the first time from the Cavour Restaurant. The artists will be Miss Helen Chappy, Mr. Sidney Nesbitt and his ukulele, Miss Elsa Lanchester, and Miss Florence Oldham, with syncopated songs at the piano. Mr. Henry Carne, the well-known actor, will, we understand, have quite a lot to do with the programme.

Practical Topics

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

Assistant Editor.

Some notes on safety precautions when using motor-generators for accumulator charging.

I have just had an experience with a small motor-generator for the charging of accumulators, which seems to be worth describing. The outfit consisted of two machines coupled upon the same shaft and mounted upon the same baseboard, one being a small motor running from the 220-volt A.C. mains and the other a dynamo giving, among other outputs, one of a little over 12 volts for the charging of low-tension accumulators.

A Surprise

The machine had been lent to me, and its owner assured me that it was perfectly reliable, and capable of running for a long period without attention, although it got rather hot in the process. Accordingly, I connected the machine up to the mains and to a 6-volt battery, with a suitable variable resistance to cut the current down to a value of 3 amps., observed that the machine ran quite steadily, and left it for the night. I returned in the morning in the expectation of finding a nicely-charged accumulator, but what I actually discovered was a very weary one indeed, which was slowly driving the motor-generator outfit from the wrong end, so to speak. In other words, the A.C. motor had broken down completely, the dynamo was acting as a motor and being driven by the battery which was supposed to be on charge.

A Fortunate Circumstance

A current of 6 amperes was flowing, and by the look of the accumulator plates had been doing so for a considerable number of hours. Fortunately, the battery was one of large

(*Continued on page* 122.)

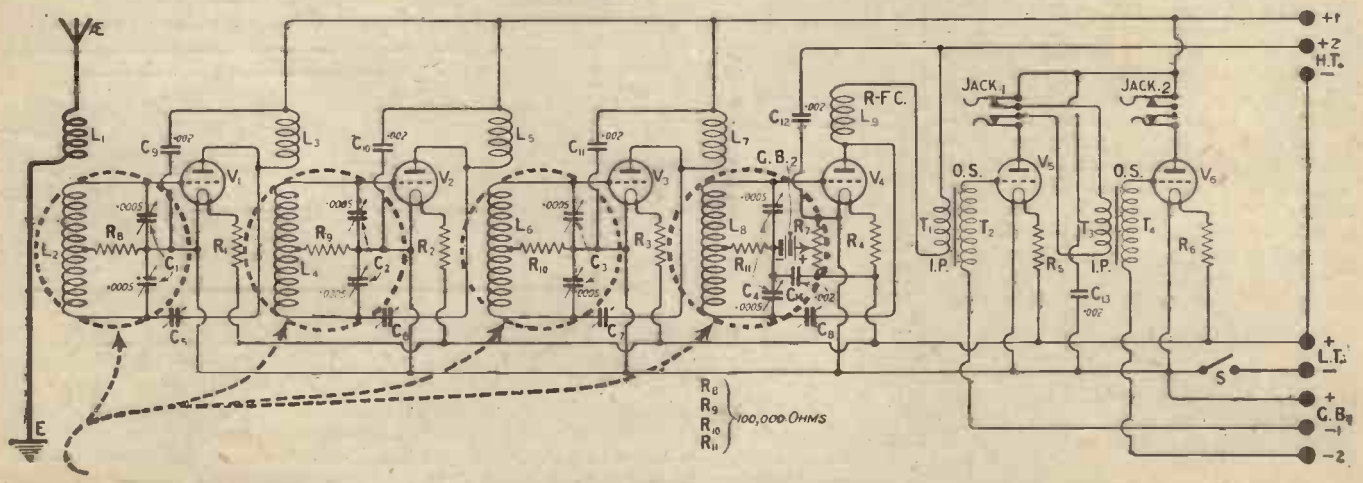


Fig. 8.—This is the actual circuit of the "Elstree Six," the dotted rings serving to emphasise the details which are the secret of its remarkable performance.

PERFECT QUALITY AND HOW TO OBTAIN IT

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

Do you know how to obtain really pure reproduction at varying distances from a broadcasting station? Captain Round is giving this week some very practical instructions for achieving success in a field in which he is one of our principal authorities.

THE desire for purity of reception, even at the expense of more valves, seems to be growing rapidly. Some considerable interest has been shown in the simple circuit I published in WIRELESS recently which I use at my house. Several correspondents have noted, however, that the sensitiveness is not very great. That I knew, and I do not recommend the simple arrangement (which I illustrate again in Fig. 1) beyond 10 miles from 2LO, and that with a good aerial.

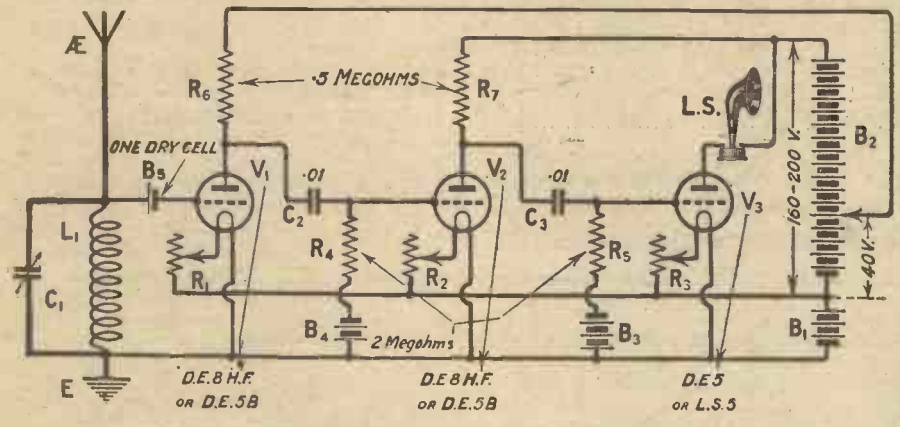


Fig. 1.—Captain Round takes this circuit as his starting point for pure reception at short distances.

A simple detector such as shown in this figure is hardly as sensitive as a picked crystal, but nevertheless it is infinitely more reliable—and reliability is of utmost importance. There is, of course, no novelty in the circuit of Fig. 1, except perhaps that in designing it I have been more extravagant than most designers like to be, and that always makes design quite easy.

Extravagance!

There is a pretty story, which I always remember, of a designer of electric machinery who worked for a well-known firm. The first models of his design always passed the test-room tests without any fault, and consequently the company sacked him because he must have been using too much material to get his results! But perhaps in this difficult art of reproduction of sound we can be forgiven for using too much material at first, because it is so important to get the finest results.

Doubtful Economy

But *are* we using more material because we use another valve or so? I wonder whether extra valves cannot be balanced against other apparatus necessary when they are not used. The unfortunate habit of the public of expecting a two-valve set to do certain distances with certain strengths, and perhaps laughing at the man who uses four valves to do the same distance, is at the bottom of a lot of bad design. I personally like to be able to cut down my number of valves; one takes a kind of pride in doing so, but I will not do it at the expense of quality.

Adding Reaction

Coming back to the circuit of Fig. 1, let us examine how we can improve its sensitiveness without in any way interfering with its quality. The main thing to remember is to keep each valve on one job, and that is where the grid-leak and condenser rectifier really fails—it would be all right for rectification, or all right for producing reaction, but when it is given the two jobs it starts distorting. So we must leave the rectifier alone, and to get the benefit of reaction we must put a reaction valve on quite separately. Fig. 2 shows how to do this, and it certainly seems a waste to have that one valve doing nothing but letting signals circulate inside itself, but the gain of strength will be quite big, and distortion will not be present at all unless you go too near the reaction point.

Local Only

Don't use the circuit for long-distance work, because in searching you cannot help but frequently oscillate—to the annoyance of the neigh-

(*Continued on page* 121.)

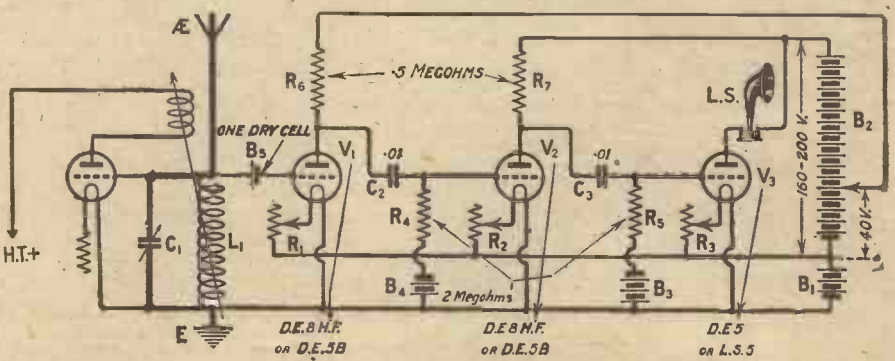


Fig. 2.—The addition of a special reaction valve permits the circuit of Fig. 1 to be used at distances up to about 20 miles on an outside aerial.

bourhood. I cannot claim it as an "N" circuit in any way. Use it for the purpose of working up the circuit of Fig. 1 to a little greater range—say up to 20 miles, or up to 10 miles on an indoor aerial.

Almost any valve will do for the reaction valve, and I leave it to you to choose your H.T. values. A standard two-coil holder will be useful, and any coil available could be tried as a reaction coil. Of course, you will see that you get this coil connected the right way round. I have tested the circuit, and it works splendidly, but, of course, I do not know on every type of aerial how strong signals will be at any distance.

The Results

The quality you get will depend on two things—firstly, your loud-speaker, and, secondly, whether you are putting sufficient H.T. on to the last valve, with, of course, the correct grid bias. As a rough check 200 volts on the last valve (of suitable type, of course) should bring a speaker up to a volume a little greater than an ordinary speaking voice without serious blasting, and if your loud-speaker is a good one the voice should be human as well as intelligible. This will be a greater strength than is wanted in a house.

I will repeat my rule for grid bias for any L.F. valve:—Take twice the magnification constant of the valve given by the maker and divide it into the H.T. volts; then employ this value of grid bias, reckoning about 1½ volts per dry cell.

This rule is independent of whether you are using choke, transformer or resistance amplification, but, of course, does not apply to the rectifier. As an example, take a valve which has a reputed magnification constant of 8. The correct grid bias for 160 volts H.T. will be $\frac{160}{2 \times 8} = 10$ volts, or 6 to 7 dry cells grid bias.

PERFECT QUALITY AND HOW TO OBTAIN IT

(*Continued from page 120*)

used, so that a good big magnification is possible, this will be very necessary.

Any set which has at present a single valve for rectification and reaction will be improved by splitting the actions up and using two valves, one for each operation. But here a word of caution is necessary. The grid-leak rectifier is O.K. with a transformer—the anode rectifier should definitely be used with either a high resistance or a big choke, and while you are about it you might as well continue on the rest of my scheme and cut the second transformer out.

The Grid Cell

A well-known wireless engineer has quarrelled with my diagram in Fig. 1, in which the grid battery B_5 on the rectifier is placed at the "sacred" end of the circuit.

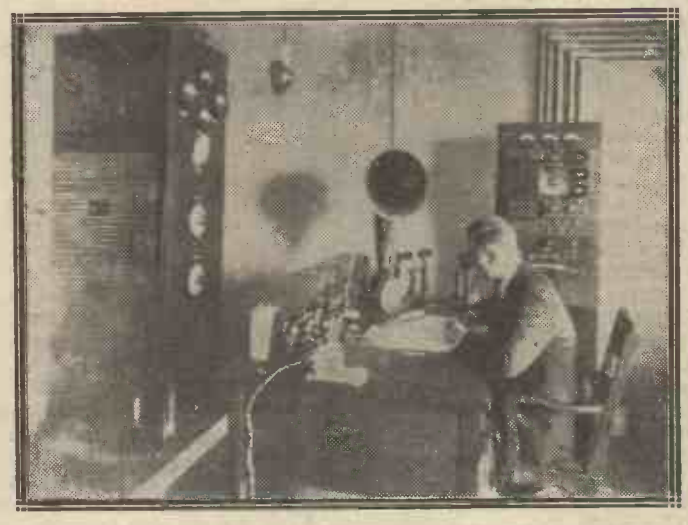
This I have done deliberately, because it is the easiest, cheapest, and most satisfactory way of putting in the bias in this case.

Why Not?

One dry cell is a very small thing of negligible capacity, and the insulation to earth can be made just as good as a condenser of much larger size, so why not put it there, even if it does seem to break some rule? But perhaps a warning is necessary that one small cell only should be used and not a one-cell tapping of a big battery.

□ □ □

ON THE LONG WAVES



Do you listen on the long waves? If you can read Morse there is a great fascination in listening on waves of the order of ten or fifteen thousand metres. A single valve here will bring in American stations such as New Brunswick (whose control desk is seen here) quite easily.

Adding an H.F. Valve

Now if you wish to reach out farther with such a set you will have to add an H.F. valve, and this is easily done with a little modification, as in Fig. 3.

You will notice I have neutralised the H.F. valve, and if one of the modern valves, such as a DE.8 H.F. is

New Grounds for Divorce

In America a man has just divorced his wife because she "constantly belittled his ability as a driver, and wanted to show him how to navigate corners." The next step will be a divorce for the wife who instructs her husband in the most suitable size of reaction coil!

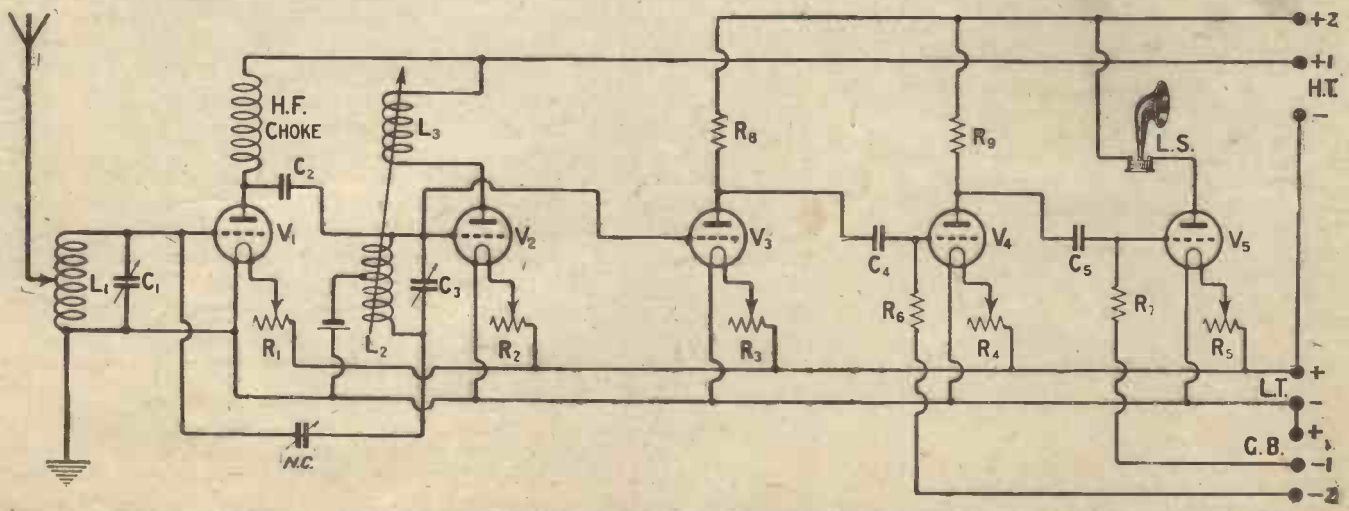


Fig. 3.—For distances a little in excess of those for which the Fig. 2 circuit is adequate an H.F. valve can be added like this.

"DX" RECEPTION MADE EASY

(*Continued from page 115*)

the reaction condenser may be increased to a safe value, when it will be noted that this increase of the reaction effect will not appreciably upset the tuning adjustment previously carried out on the .0005 condenser.

The Author's Results

The receiver has been used for some months in S.E. London as a "family set," its simplicity of operation making it particularly suitable for this purpose.

At a distance of ten miles the local station was received at comfortable loud-speaker strength, though it must be understood that the set is not recommended for the class of work over distances above this.

In telephone reception quite a host of Continental stations have been received, and not a few of the British stations. Local conditions, however, are such that the Crystal Palace is responsible for many stations being completely inaudible.

Of those stations which have been received at good strength the following have been identified, and can be received on most evenings in the locality named, when working:—

Bournemouth, Newcastle, Birmingham, London, Radio-Belgique, Hamburg, Radio-Paris, Daventry, Bremen, Elberfeldt, Radio-Prague, Rome and Hilversum.

NOTE.—If difficulty is found in getting adequate reaction effects with this set, insert a fixed condenser of .0001 in the aerial lead.

One of the very first stations to broadcast a regular programme of music was PCGG, at the Hague, which at first transmitted on Sunday afternoons.

PRACTICAL TOPICS

(*Continued from page 119*)

size, and although it seemed to be pretty well discharged, the plates did not show any signs of serious damage. It was immediately disconnected from the motor-generator and put on charge upon my vibratory rectifier, where it was left until the plates had practically recovered their normal healthy colour. The battery does not actually seem to be any worse for its experience, but had it been one of the smaller size, it would almost certainly have been entirely ruined.

Safeguards

The possibility of this sort of business is worth taking into account when dealing with these small motor-generators, which are capable of being driven by a battery of the size likely to be charged, for under such circumstances it is not likely that an ordinary fuse is an adequate protection. For example, it is doubtful whether a current large enough to blow a fuse would have passed at any time, remembering that the normal charging current might be in the neighbourhood of 4 or 5 amperes, and this amount would therefore have to be carried quite easily by the fuse, which could not be expected to blow under perhaps 8 or 9 amps. Probably what is called a "cut-out" would be the only correct solution of the problem.

Bringing them within Range

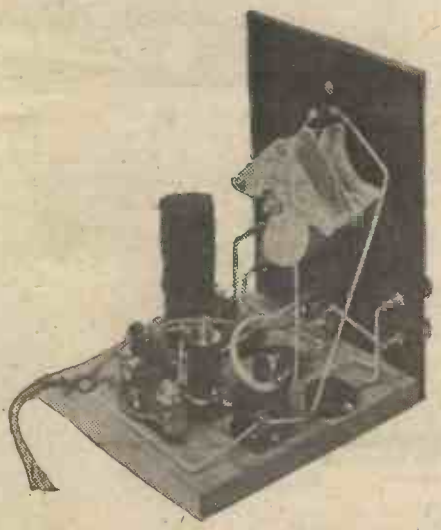
A NON-RADIATING H.F. AMPLIFIER OF SPECIAL MERIT

BY THE LABORATORY STAFF

This special amplifier, designed and built by the "Wireless" laboratory staff, will enable you to bring in many of the distant stations which were previously out of your reach.

THE lure of distant stations is ever present, and the increasing number of Continental stations has enhanced the fascination of turning one's attention to stations other than the local.

There are many people who wish to attempt long-distance reception with comparatively simple receivers. In order to achieve this it is essential to make considerable use of the property known as reaction, in order that maximum efficiency may be obtained from the valve or valves in use. A straightforward reaction circuit, however, more particularly when used with a single valve, is always liable to radiate and so cause interference with the neighbours.



The neutralising condenser may be seen immediately in front of the H.F. choke.

A Danger of Smooth Reaction

With the best intentions it is a matter of some difficulty to pick up and tune in a distant station without allowing the receiver to oscillate during some portion of the process. Receivers have been designed in which the reaction control was so smooth that it was difficult to tell whether the receiver was oscillating or not until, in the process of tuning, the familiar heterodyne whistle was heard on some distant carrier wave which showed that the reaction control had been increased beyond the oscillation point.

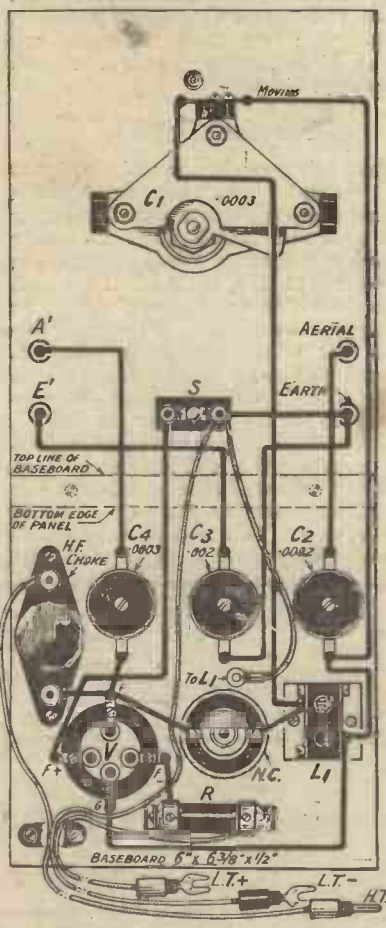


Fig. 1.—The fibre strip which holds the three flex leads to the baseboard has been broken away in this diagram to avoid confusion.

The use of a correctly neutralised high-frequency valve will enable one to permit the later stages of the receiver to oscillate without causing any interference to one's neighbours. The majority of receivers constructed to-day are provided with at least one high-frequency valve because the science of high-frequency amplification has reached such a pitch of perfection that a real and definite advantage can be obtained with comparative ease

What it is For

Many people, on the other hand, already possess receivers which are perhaps giving complete satisfaction for the time being and yet which were constructed in the days before high-frequency amplification became a really practical proposition. It is to meet this demand that the present unit has been designed, to provide the benefit of a high-frequency valve, both as regards the additional signal strength and range and also as regards the non-radiating properties.

Care must be taken when fitting the mount to see that the coil when in position will not foul the cabinet.

Flexibility

The unit has been expressly designed with the intention of being connected in front of any type of receiver. Now, the best method of achieving this would be to have a unit containing four terminals. The aerial and earth would be connected to two of these, while the output terminals, as we may call them, would be con-

(*Continued on page* 124.)

BRINGING THEM WITHIN RANGE—(*continued from page 123*)

nected direct to the aerial and earth terminals on the particular receiver. If we could arrange that whatever type of aerial circuit was used in the particular receiver—either direct-coupled, auto-tapped, tight-coupled, Reinartz—the unit worked equally well

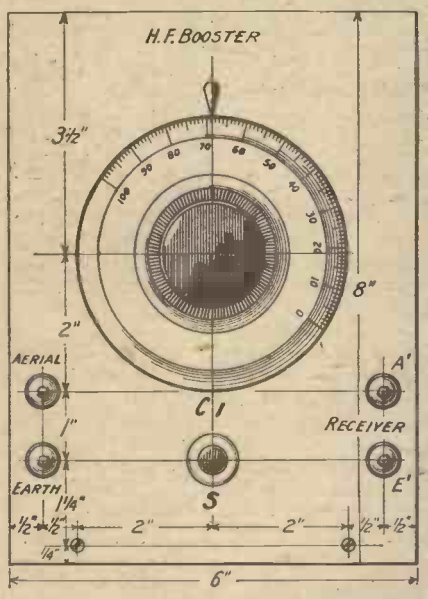


Fig. 2.—By pushing in the switch marked S the filament circuit of the H.F. valve is broken.

on all of them, then we should have a very useful and advantageous component.

A Simple Circuit

The present unit has been designed with this object in view. The circuit is shown in Fig. 3, and will be seen to be comparatively straightforward. The grid circuit of the valve contains a split coil, one end of which is connected to the grid, the centre point being taken to the filament and the remote end connected to the anode through a neutralising condenser. The aerial is connected direct to the grid through a .0002 condenser.

It is the anode circuit which contains the special arrangement designed to render the unit suitable for any type of receiver. The high-tension supply is obtained through a choke feed, and the output to the receiver itself is obtained through a fixed condenser of .0003 capacity. The other output connection, which will be connected to the earth terminal of the receiver, is taken in effect to the actual earth terminal on the input side of the unit.

A Precaution

A direct connection, however, is not permissible, because it will be seen that the earth connection of this unit is connected to the negative of the filament battery, whereas in some receivers it is connected to the positive, and if two such arrangements were connected together, a short circuit in the battery would result. A .002 condenser has therefore been interposed in this unit. This serves to isolate the output terminal from the earth terminal, but keeps the two points very nearly at the same potential as far as any high-frequency current is concerned.

The arrangement, therefore, is comparatively straightforward, but by adopting a method of connection such as this the scheme is suitable for use with a set with any type of aerial circuit. The unit receives the energy from the aerial, amplifies or "boosts" it and hands it on to the receiver. The set thus behaves in a perfectly normal manner with increased efficiency, while the neutralising arrangement on the booster unit ensures that if the receiver is allowed to oscillate, no radiation from the aerial will result if the high-frequency unit has been correctly adjusted.

Practical Details

The tuning condenser and the input and output terminals have been mounted on an ebonite panel, together with an on-off switch. The remainder of the components are housed on a baseboard at the back of the panel, while in order to render the unit as convenient as possible the usual terminal strip has not been provided. Instead of this, three leads have been brought out, one of which is connected to L.T.+ and one to L.T.−, and the third is connected to a suitable point on the high-tension battery.

It will be noted that no high-tension negative connection has been provided on the unit. This is done deliberately in order to permit it to be used with any type of receiver. Although in the majority of Radio Press designs the H.T. negative is connected to L.T. positive for the sake of standardisation, yet it may be desired to use this unit with some other receiver in which this is not the case. There must be a connection from the high-tension negative to one side of the filament battery in the receiver itself, and it will readily be seen that since the unit is to be used in conjunction with some receiver, this connection already existing will suffice, and no additional connection will be required on the booster.

The wiring requirements are few, as may be gathered from this photograph. The flex which forms the tapping on the coil may be seen hanging over the resistor.

Materials

The components you will require are as follows:—

One ebonite panel, 8 in. by 6 in. by ¼ in. (Clayton Ebonite Co.).

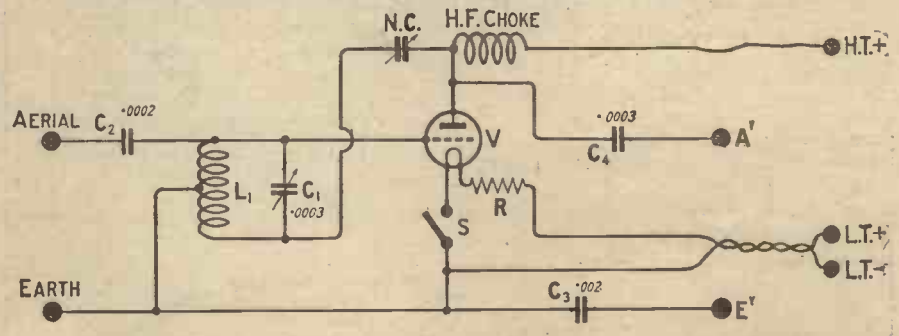


Fig. 3.—With the amplifier correctly neutralised, any reaction effects which may occur in the receiver proper will not be transferred back into the aerial, and thus interference is prevented.

One cabinet to suit with baseboard 6⅜ in. deep.

One .0003 variable condenser (Utility).

One shock-absorbing valve holder (A. H. Hunt, Ltd.).

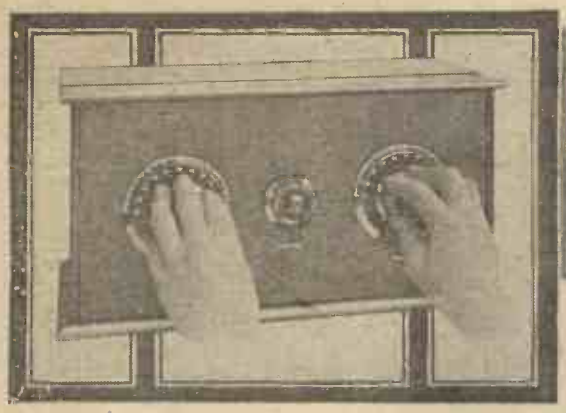
(*Continued on page* 136.)

COUPON.

QUESTIONS AND ANSWERS.

This coupon must be accompanied by a P.O. for 2/6 for each question, and a stamped addressed envelope when sending queries to the Radio Press Information Dept. for a postal reply.

"WIRELESS." Vol. IV. No. 4.



HOW TO IMPROVE SELECTIVITY

By JOHN W. BARBER

Do you experience interference from your local station when receiving those at a distance? Read this interesting article and see how you can improve your set.

BROADCASTING, when in its infancy, was such a novelty that those who invested in a wireless receiving set were quite content to listen to their nearest station, and to comment in awed tones upon "the wonder of it all."

Soon, however, complaints began to be heard that somebody or other was interfering with the music, and such interference, in those days, was principally confined to spark stations, or atmospheric disturbances.

The Distance Craze

The desire then made itself felt to "reach out," and hear some transmission other than that of the local station, and the cry that "I can't get rid of so-and-so station" gradually increased in volume.

Now, in the early days, any sort of set just thrown together satisfied many home constructors, but when "selectivity" became the cry, these sets were found inadequate to the task they were called upon to perform, and so something had to be done.

Suggestions

Nowadays, with so many broadcasting stations upon the ether, selectivity is even more desirable, and some notes upon how to increase the selective properties of an existing receiver may be of use to readers of this journal.

Those readers who read my article entitled "Selectivity," which appeared in Vol. 2, No. 10, will have realised that it is possible to obtain very great selectivity with even quite a simple receiver, using perfectly standard components, while those who read *Wireless Weekly* (Vol. 7, No. 20) will have already seen my article upon a "Selective Reinartz Receiver," and will realise that by going to a little extra trouble in the way of coils extreme selectivity may be obtained.

Results

A receiver, consisting of a detector and two low-frequency valves, which will eliminate signals from London at two miles, and receive Cardiff and Manchester upon the loud-speaker, can hardly be accused of "flat tuning," and in these few notes I propose to give readers the benefit of my extensive experiments in this direction.

First, the old "single-circuit tuner," consisting of a coil and condenser, across which the aerial and earth are joined, must be abandoned, if real selectivity is desired, and some other form of aerial coupling must be adopted.

In my early experiments in selectivity I tried what used to be called "aperiodic" aerial coupling; that is, there is connected between aerial and earth a coil consisting of a few turns, this coil being coupled to a tuned coil joined in the grid circuit of the first valve. This gave considerable improvement over the older method mentioned above, but was only just capable of cutting out London on Bournemouth at a distance of 4½ miles from 2LO. Although obviously a step in the right direction, this was not sufficient, and further alterations were made.

The Grid Coil

The coil in the grid circuit, which is tuned by a variable condenser, was then wound with No. 36 d.s.c. copper wire upon a 3-in. diameter ebonite former, after the style of Mr. Reyner's coils. A further increase in selectivity resulted from this, and the effect was then tried of tapping the aerial on to this coil, rather than to have a separate aerial coupling coil, in order to simplify matters.

The Tapping Point

The number of turns from the earth end of the coil at which this tapping should be made varies with different aerials, as all who have read Mr. Kendall's articles in *Wireless Weekly* will have learned, and the tapping must be varied until the best position is found.

Once this has been found there is no occasion to change it, excepting for a very considerable change in wavelength, as long as the set is used on the same aerial.

If you find the best tapping on a wavelength of, say, 360 metres, the tapping will hold good in all probability up to about 450 metres and down to below 300 metres. Above 450 metres, however, it may be necessary to increase slightly the number of turns included between aerial and earth.

Reaction Control

The method of applying reaction will vary in different cases, but where the easiest control is desired there is little doubt that some form of "Reinartz reaction" is called for. This may easily be included by winding on about 20 turns of wire from the filament end of the grid circuit coil and taking the free end to a variable condenser, the other side of which goes to anode.

(*Continued on page* 135.)

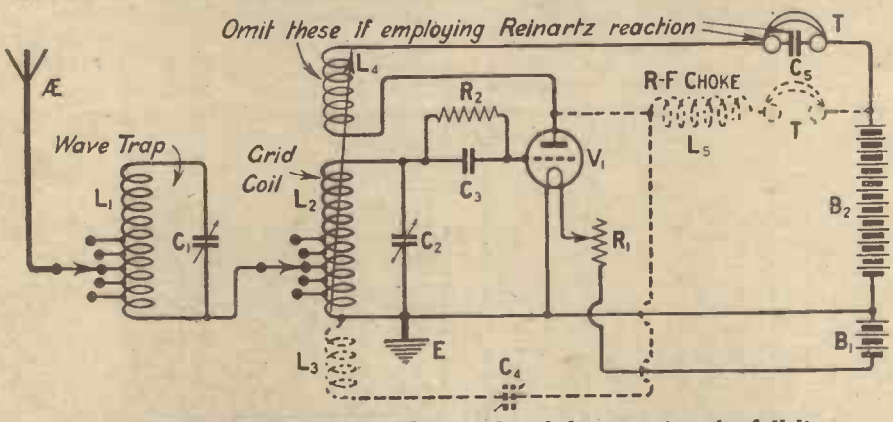


Fig. 1.—Reinartz reaction may be employed by ignoring the full lines from plate to H.T.+ through the reaction coil and phones, and by following the dotted portion of the circuit.

WHAT SHOULD WE HAVE DONE WITHOUT IT?

By Lieut.-Commander The Hon. J. M. KENWORTHY, R.N., M.P.

This special article from the pen of Commander Kenworthy emphasises how really indispensable is our broadcasting service, more particularly at a time of State emergency such as that produced by the recent General Strike. We do not necessarily associate ourselves with the opinions expressed.

IT is an ill wind that blows nobody any good. One trade to benefit by the recent General Strike was the manufacture of wireless sets, the demand for which was colossal. Nor is the reason far to seek. The returns of new licences issued are not yet to hand, but it is believed that nearly 100,000 new licences were taken out, and presumably nearly 100,000 sets purchased. The "pirates" were hardly likely to suffer from qualms of conscience while the strike lasted.

Was it General?

England has never had a General Strike before, and it should be remembered that the so-called "general" strike was not general. Wireless proved a very great boon, and, in fact, a necessity; but it would have been a still greater boon if the Post Office workers and telephone and telegraph operators had been called out on strike with the other Unions. This undoubtedly could have been done by the Trade Union Congress, and from what we know of the obedience to the strike call, and the almost pathetic loyalty of the Unions and their members, the call to bring out all these workers on the lines of communication would, undoubtedly, have been obeyed to a great extent.

What Would Have Remained?

There would have then remained three means of communication in England — motor-cars, aeroplanes and wireless. And the greatest and swiftest of these was wireless. The almost complete closing down of the daily Press cut off millions of people from reliable news. The crop of rumours, accordingly, was amazing. There is a kind of underground wireless by which rumour passes from lip to lip and across great distances in an incredibly short space of time. Motoring through England in the early days of the strike, one of the most remarkable features was that every town visited had extraordinary stories, always untrue, about the next town. In this atmosphere, and with this state of affairs, wireless was indeed a boon.

Government Control

The British Broadcasting Company was, of course, in a delicate position.

This photograph, taken just before the vessel was launched, shows the "MU-I" which is claimed to be the first marine broadcasting station. The call letters are WRMU, and the station will transmit a regular programme from American waters.

The Government has always had the right of censorship in the British Broadcasting Company, and the power to take it over in time of war or national emergency. Such national emergency was declared. The British Broadcasting Company was not actually taken over, but it is common knowledge that a powerful section of the Cabinet wished to take it over completely and use it entirely for propaganda purposes. How it would have been used if it had been, for example, placed in charge of the Chancellor of the Exchequer, Mr. Churchill, we can see very plainly by examining the Government newspaper known as the *British Gazette*.

A Contract

Now compare the wireless news. For the first time the proceedings of Parliament were broadcast. The actual speeches were not broadcast, as unfortunately there were no arrangements for doing it, but the news agencies' reports, as they appeared on the tape, were broadcast. This was very right and proper. The Prime Minister's special speech on the wireless played a very great part in steadying public opinion, and, I venture to say, in deciding the Trades Union Congress that the time had come to call off the strike. In fact, the British Broadcasting Company, under extraordinary difficulties, played its part very well. The Government bulletins were issued, news items were given, and the directors were wise enough to give as much entertainment and music as they could. The effect of this was to steady public opinion, give reliable news and some diversion of people's thoughts from the grave events occurring in the country. The monotonous recitals of railway time-tables were, no doubt, irksome to those who had not to travel, but they were of the greatest service to those who had to find their way about the country by rail in default of motor-cars or other means of transport.

The Archbishop's Message

One episode has been severely criticised. The Archbishop of Canterbury was censored by the British Broadcasting Company for four days. His Grace, speaking on behalf of the Christian Protestant Churches whom he had called together in conference and with the approval of the Catholic

(*Continued on page* 128.)

WHAT SHOULD WE HAVE DONE WITHOUT IT?

(*Continued from page 127*)

Archbishop of Westminster, issued a suggestion for a peaceful solution of our difficulties. He also asked permission to broadcast it. The exact facts are difficult to get at, but from what is generally known and without betraying anything that is not common knowledge, I may say that the Archbishop was requested not to broadcast his message.

The Reason

The reason for this action, so far as can be gathered, is that it was known to the B.B.C. that a section of the Government were determined to seize on any excuse to commandeer the British Broadcasting Company and to use its goodwill for the broadcasting of propaganda. It was known that the broadcasting of the Archbishop's message would have been seized upon as an excuse to take over the whole organisation. Now the British Broadcasting Company has a goodwill built up during the successful years of its existence and operations.

If the Government had taken over the British Broadcasting Company completely they would have used this goodwill up to a point and, no doubt, have benefited from it. And this goodwill had grown in the first days of the strike as people realised the enormous benefits of reliable wireless news when the newspapers were suppressed. This goodwill might have been so abused as to destroy much of its value in the future. To have identified the British Broadcasting Company with the *British Gazette*, for example, would have done a lasting injury to broadcasting in Britain. Those who understand the great future of broadcasting and the great power for good it can be, realise the importance of not antagonising any section of listeners.

Indirect Services

Apart from keeping people informed of what was going on and steadying the public generally, wireless performed an indirect but no less real serice by keeping great numbers of people at home. This was all to the good. In times of turmoil like the General Strike, it was important that great crowds should not gather together in our crowded industrial centres. Such minor troubles as we had in Hull during the strike, and, in passing, I may say that they were greatly exaggerated, as was every other event of the kind, were due to people congregating in crowds out of mere curiosity.

A recent portrait of Lt. Commander Kenworthy.

In such a gathering a few bad characters are in a position to make trouble very easily. If the police have to take drastic action by charging a crowd, it is usually the innocent who suffer the most. Therefore, a service was performed to public order by people having some attraction at home, especially at a time when they did not care to go to the theatres and kinemas, and, in fact, in the large towns, would have had difficulty in doing so owing to the lack of transport facilities. If the strike had continued much longer there might have been serious disorder and the importance of people remaining at home would have been increased.

Many amateurs confine their listening to short-wave stations, forgetting that there is much of interest to be heard on the longer wavelengths, such as, for instance, Koenigswusterhausen, which station often transmits programmes on very high power.

Reaching the Distant Listeners

It is interesting, in passing, to note that the British Broadcasting Company instructed its engineers to overmodulate the transmissions. This extended the range of reception and gave an advantage to owners of crystal sets. The owners of valve sets suffered, as the over-modulation was only effected at the risk of a loss of quality in transmission. There is no doubt, however, that it was in the public interest that the greatest number of people should benefit from the wireless service, and the over-modulation was justified. This, if long continued, would have placed a great strain on the transmissions, and there might have been a breakdown. This, however, did not happen. Nor, fortunately, did the attempts of ill-advised persons deliberately to oscillate interfere to any great extent with the service. If, however, the Government had been running the British Broadcasting Company entirely, and the strikers' organisation had been in real earnest, deliberate oscillation might have seriously interfered with the service.

Once again, during the recent national emergency the broadcasting service has proved its great value to the community.

Justification

Our experience in the wireless world during the General Strike shows very clearly that the present organisation of the British Broadcasting Company is highly efficient, and its independence of the Government desirable in the public interest.

These considerations add weight to the protests already made against the Government proposals virtually to nationalise the British Broadcasting Company. A bureaucratically managed and controlled wireless service would, in all probability, have made a complete mess of things, and it is to be hoped that this recent experience will strengthen the hands of those who are opposed to the nationalisation of broadcasting in this country.

The News Service

It should be particularly noticed that for the first time the broadcasting service was enabled to operate as a news service. Except during the strike, its agreement with the news agencies and the Press generally preclude purely news items before a certain hour. The question of whether a broadcasting company in the future should be permitted to publish regular and early news bulletins is sure to receive examination afresh in the light of recent events.

Indispensable

To sum up: Wireless in the Great Strike was invaluable, especially in

(*Continued on page* 137.)

COMPONENTS WE HAVE TRIED

Conducted by the "Wireless" Laboratories, Elstree.

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-supporting, 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 the 700 to 2,400 metres band. Both models are soundly constructed and efficient, and can be thoroughly recommended. A special graduated dial and knob is provided with each.

The Peto-Scott Universal H.F. Transformer is of low-loss construction.

"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.

"Atlas" Variable Condenser

AN "Atlas" .0005 variable condenser manufactured by Messrs. H. Clarke & Co. (Manchester), Ltd., has been tested. It is of low-loss construction and provided with a clearly marked metal dial. The H.F. resistance was satisfactorily low and the insulation resistance infinite. This condenser is strongly constructed and efficient and can be recommended.

"Ne'er Fail" Lead-in Fuse

IT is claimed that the "Ne'er Fail" lead-in fuse, made by Messrs. The Ne'er Fail Manufacturing Co., acts as a lead-in and a fuse box simultaneously. It consists of a length of semi-transparent tubing fitted with terminals, a length of wire being carried inside. The tubing was found to have excellent insulating properties and not to ignite easily, while it could be bent to any desired shape if warmed by steam. The wire fused when made to carry a fair current, and the component is a novel attempt at solving the problem of safeguarding a set from lightning.

Lamplugh Anode Reactance

AN anode reactance has been submitted for test by Messrs. S. A. Lamplugh, Ltd. This consists of a disc, into which may be plugged various anode units, carrying a spindle to which is fixed a reaction coil. It was found that the lower wavelength unit covered a range of from 220 to 600 metres, while the second unit was suitable for 5XX.

This component is well constructed and neatly finished, but the size of the reaction winding could be slightly reduced with advantage. It gave good results as an H.F. coupling, and the knob and pointer proved useful to indicate the amount of reaction in use. Considering its low price its performance may be considered very satisfactory indeed.

"Bico" Multi-Valve Switch

INTENDED for controlling the number of valves in use in a multi-valve receiver, "Bico" switches are made by Messrs. the Burner Insulator Co., three types being available. The sample tested is suitable for use with a detector and 2 L.F. stages, and incorporates a number of contacts actuated by a spindle and a cam device. The switch was found to be satisfactory electrically, and provides an easy and convenient method of controlling the number of valves in operation in a set. It can be put to a number of other uses also.

"Cosmos" Anti-Vibration Valve Holder

A "COSMOS" anti-vibration valve holder has been sent for test by Messrs. Metro-Vick Supplies, Ltd. The socket is mounted on spiral springs fixed to a circular base, stops being provided to limit the movement of the socket during the insertion and removal of a valve. On test its insulation resistance was found to be infinity, while it gave adequate protection from shock and vibration to a dull-emitter valve. Finish and construction are good.

Audio Transformer

THE 5 to 1 ratio low-frequency transformer sent in for test by Messrs. Brandes, Ltd., is of shrouded type, standing 3 in. high, and has both terminals and tags for connecting purposes. On test, it gave excellent quality and amplification above the average in the first stage, while very good quality was maintained in the second stage. It can be thoroughly recommended.

"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

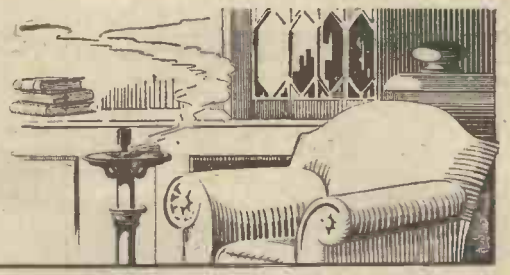
From 200 to 4,000 metres are covered by this H.F. anode reactance, which is made by Messrs. Radio Instruments, Ltd.

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.

Russell's Hertzite

A SAMPLE of Russell's Hertzite crystal has been tested by us for Messrs. the L. G. Russell Laboratories. It is of fairly coarse structure. On test it gave very satisfactory results, many sensitive spots being located with ease.

From my Armchair



BY EARL RUSSELL.

In these columns Lord Russell expresses each week his own personal views on matters of interest to "Wireless" readers.

Theory and Practice

For some time practice in wireless has been a good deal ahead of theory, and many results have been obtained, some of which were apparently theoretically impossible and others only inexplicable. Theory is now making a gallant attempt to catch up with practice and to reconcile the observed phenomena.

Of course, no scientific theory professes to be the final and ultimate explanation, but is always provisional to this extent, that while it is useful as a guide to further experiment and as a linking up of different phenomena, it has at once to be abandoned or modified in face of any phenomenon which it cannot explain.

Wave Propagation

The form of propagation of etheric waves from an undulatory source such as a transmitting aerial is now the subject of much study and observation. The old, happy, simple idea was that they were propagated in all directions equally at the uniform velocity of light. The only thing that is certain is that this is not so, at any rate, on the earth's surface. They appear to travel round the earth, rather than through it, and their feet are said to be retarded where they touch the earth. On the other hand, many of the observed facts of reception cry aloud for some such conception as the Heaviside Layer to reflect the waves down again, and its actual height has been variously estimated at 50 to 80 kilometres. This only means, of course, that if, in fact, a reflecting layer does exist, mathematics require that such should be its height.

Conditions of Reception

These also are forming the subject of careful scientific investigation, and knowledge of wave propagation will, of course, affect the form of the most desirable aerial. The conditions of resonant circuits and the nature of the losses which occur in them are being better understood, and both components and lay-out are being modified to reduce these losses as far as possible. Finally, the characteristics of valves are being more carefully taken into account in considering the electrical constants of the components with which they should be associated in a receiving set. Special work is also being done at the Radio Press Laboratories on parasitic losses in the ordinary receiver.

Atmospherics

These have not escaped the universal investigation that is going on and an interesting paper was read before the I.E.E. a short time ago giving an account of a most ingenious recording instrument which from day to day and throughout the day recorded all the atmospherics received. The authors were inclined to ascribe them all to thunderstorms, although owing to the difficulty of conceiving so many thunderstorms continuously going on it has been the habit to suggest other causes. To discover their causes is, not of course, to eliminate their effects, but something can be done in this direction already, and at any rate those spurious atmospherics which are due to an old H.T. battery, a loose connection, and so on, can already be completely eliminated.

STATIONS I HAVE VISITED

By

CAPTAIN L. F. PLUGGE, B.Sc.

This week Captain Plugge describes an interesting visit which he has recently paid to the Zurich station.

I APPROACHED Zurich in the glorious sunset of a summer evening, and it was with a feeling almost of relief, after having been for days surrounded on all sides by towering peaks and snowclad mountains, that I saw spreading out before me a country of gentler slopes and smiling cultivated valleys. Although with no pretensions to grandeur, Lake Zurich is very beautiful. Both banks rise gently from the green waters, dotted with villages, orchards and vineyards, scattered over a highly cultivated country, and in the background rise the snowclad Alps.

An Intellectual Centre

The town of Zurich, at the head of the lake, is not only the largest and busiest manufacturing town in Switzerland, but has for centuries led the way in all things intellectual in that country. It was, therefore, to be expected that it would be, as indeed it was, the leader in matters of radio.

The Zurich Broadcasting Station, run by the Radio Genossenschaft, was the first Swiss Broadcasting Station of any great importance. It has, within the last two or three months, been equalled, but not superseded, by the Berne Station, which many of my readers have no doubt heard, and of which I hope to write in a future article. For some considerable time after its installation the Zurich station was one of the best Continental stations which could be received in London on the short wave-band, but within the last year so many new stations have been erected in various parts of Europe, that this wave-band is very much overcrowded, and there are numerous other stations which now come in quite as well as Zurich does.

This view was taken on the occasion of an earlier visit which our contributor paid to Zurich, when he broadcast a special message. He is seen here seated before the microphone.

The Studio

The studio of the Zurich station is situated on the fourth floor of a building in the Lindenhoffstrasse in the centre of Zurich. There the premises of the company occupy the whole of an upper floor, and spacious apartments are provided for the studio, the control room, the waiting room of the artistes, and the offices in which all business is transacted.

The Director of the Company is Mr. Speorri, and his name has been associated more intimately with broadcasting in Switzerland than perhaps any other name in that country. It is thanks to his great energy and untiring efforts that broadcasting ever commenced in his country on a scale which might be truly termed "broadcasting." He has endeavoured in every way in his power to develop radio transmission and make conditions easier for listeners. He brought about such innovations as special Italian, German, and French nights which were provided to cater for the various parts of his country.

Language Difficulties

Of course Switzerland is faced with a problem unlike that which is experienced in any other country in Europe, as three languages are spoken there, and all these must be taken into account in broadcasting. The language most usually employed, however, is German, as Zurich is situated in the German part of Switzerland, not very far from the German frontier. For this reason nights devoted to Italian and to French occur only once a week, the remaining days of the week being kept for transmissions in German. Another interesting point connected with Zurich programmes is the great amount of outside broadcast which takes place at this station. On many nights of the week re-broadcasts take place from the Zurich National Opera House, and also from the Zurich Theatre.

(*Continued on page* 132.)

STATIONS I HAVE VISITED—(*continued from page 131*)

Novel Broadcasts

Certain new features have recently been in evidence at the Zurich station. Among other things might be mentioned the lecture given by William le Queux whilst he was enjoying the winter sports at St. Moritz. During the last wireless exhibition, which was held in Zurich, a stage was made from which broadcasting took place in a similar way to that carried out by the British Broadcasting Co. at the Ideal Homes Exhibition. Perhaps the experiment in London was inspired by what occurred in Zurich a year ago.

After visiting the studio and the premises in Lindenhoffstrasse, I drove off with Mr. Speorri to the transmitting station proper, which is some three miles outside the town on elevated ground about 600 feet above the level of the Zurich Lake.

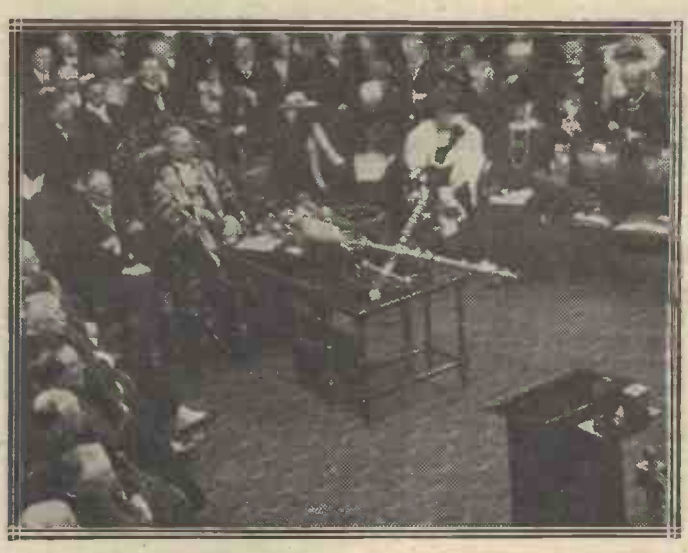
The Transmitting Plant

We reached a place known as "Hongg," and we narrowly escaped a very bad crash on the way, the danger being caused by a large char-a-banc turning out of a side street into the main road where we were driving, and then playing at "circus" in the middle of the road. Fortunately, owing to the excellence of Mr. Speorri's driving, we cleared the road and drove up on to a slight embankment at the side, thus avoiding what might have been a serious accident.

However, after this mishap, we arrived at "Hongg," and there, in a very large field, the two high and powerful masts could be seen. Each of these masts towers 65 metres above ground level, and they are 140 metres apart. The aerial, which is composed of a cage using 6 wires, has a length of approximately 240 feet, and the span available is not used in its entirety. This is due to the fact that the wavelength first contemplated when erecting the station was 800 metres, and when it was reduced to the 515 metres subsequently used, the length of the horizontal part of the aerial had to be reduced.

The Aerial

The aerial is of the "T" type, and the feeder, which comes down from the centre, is also of cage form, but has its diameter gradually reduced until the wires become a cable as it nears the transmitting station. Above each of the towers is an electric light which is continuously alight. This was made compulsory by the Swiss Government owing to the transmitting station being in the vicinity of a military aerodrome. It was thought that the lights would be a guide to aeroplanes when night flying, and obviate the danger of their crashing into the aerial, as a French aviator did in Paris not long ago.



As usual at important ceremonies, the microphone occupied the place of honour at the Guildhall when the Marquis of Reading received the Freedom of the City of London

Earthing Arrangements

A large counterpoise is used at the Zurich station, and it consists of a great number of wires radiating from the transmitting equipment situated immediately beneath the aerial. The concrete building housing the transmitting gear is situated at the foot of one of the masts. There, very compactly arranged, can be seen the Western Electric .5 kilowatt transmitter with the usual panels and amplifiers. Adjoining this is a room where the necessary generators are housed.

The aspect of the station from the inside is very pleasing, and one can readily appreciate the fact that everything has been done according to accepted methods, and as much use as possible has been made of the small

(*Continued on page* 142.)

HOW TO IMPROVE SELECTIVITY

(Continued from page 126)

A suitable H.F. choke should be used in the anode circuit, which is made quite easily by winding 250 turns of No. 36 d.s.c. wire on to a piece of ebonite tube 1 in. in diameter and 2½ in. long.

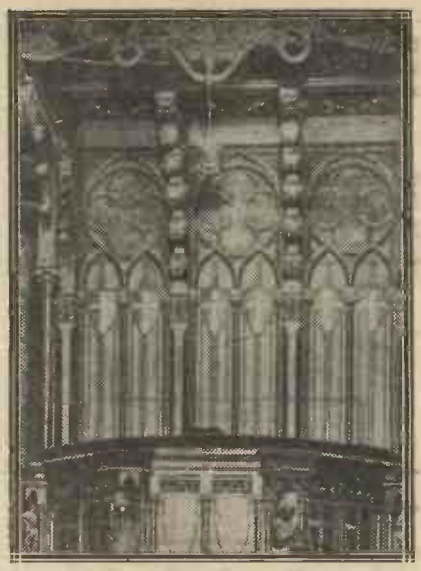
Having got thus far with the hunt for selectivity, the next step was to see how much further could be gone without unduly complicating the controls. The addition of a further tuned circuit in some way or other, such, for example, as adding an H.F. valve, would double the tuning controls, and was ruled out as undesirable in this heading.

Use of Wavetraps

Attention was then directed to a form of wavetrap. I can hear readers saying all sorts of things about wavetraps, because they possibly have not experienced the success with them that they probably expected.

I have only one reply to that, namely, that a wavetrap which works well with one aerial may give relatively poor results with another, but the one I pin my faith to has given satisfaction upon several aerials.

It is a form of the "type D" wavetrap, but with some modifications. To commence with, it is made up on similar lines to the auto-coupled coil already discussed. The ebonite tube is



The pulpit of the Notre Dame, Paris, from which many broadcasts have taken place. The microphone may be seen suspended from the canopy.

of the same diameter, namely, 3 in., and about 1 in. long. About 40 turns of No. 36 are wound on, tapped at various points up to 15 turns.

The Final Arrangement

The aerial is joined to one of these taps, and the whole coil is tuned by a variable condenser. Fig. 1 shows such a circuit in detail, complete with wavetrap, and while ordinary reaction is shown, Reinartz reaction may be employed by ignoring the full lines from plate to H.T. + through reaction coil and 'phones, and by following the dotted portion of the circuit in this respect.

Practical Hints

I am afraid I have already overrun the space that the Editor has allotted to me, but I must close these notes with a few hints.

Don't expect too much from a simple circuit, as you are sure to be disappointed.

Don't expect to get selectivity without doing a little work to find it.

Nothing worth having in this world was ever obtained by sitting down and waiting for it to come along. Hunt for selectivity, and you'll find it!

Bringing them within Range—(*continued from page 124*)

One single coil holder.
One neutralising condenser (A. F. Bulgin and Co.).
One on-off switch (A. F. Bulgin & Co.).
One H.F. choke (Lissen, Ltd.).
One .002 fixed condenser (Watmel).
One .0003 fixed condenser (Watmel).
One .0002 fixed condenser (Watmel).
One Cyldon "Tempryte" to suit valve (S. Bird & Co.).
Four terminals (Lissenin Co.).
Two spade tags, one red, one black (Lissenin Co.).
One wander plug (Lissenin Co.).
One Decko dial indicator (A. F. Bulgin & Co.).
Packet Radio Press panel transfers.
"Glazite" for wiring and some lengths of flex.

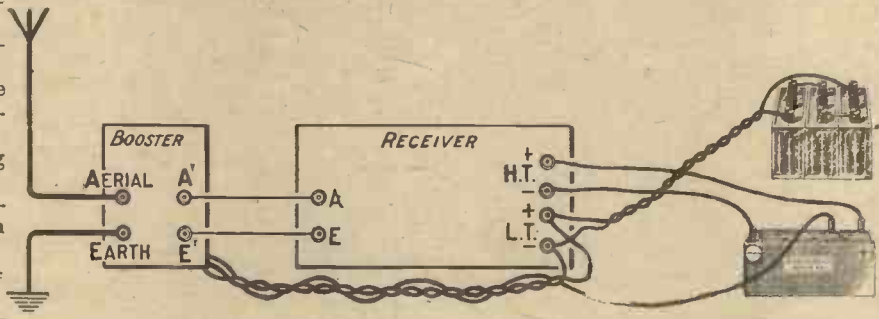


Fig. 4.—Few are the connections necessary when it is desired to attach the booster to an existing set.

Constructional Work

The construction of the unit will present no difficulty. First of all mark out the panel to take the variable condenser. If the "Utility" condenser is employed, a ¼-in. hole must be drilled to take the spindle, which is of the one-hole fixing type. Drill a further hole immediately underneath this as shown for the on-off switch, while finally four more holes are required in the positions shown to take the input and output terminals.

The remainder of the components should now be laid out on the baseboard. A centre-tapped plug-in coil has been provided for, a Gambrell C coil being used in the unit shown, and the coil holder must be so mounted that there is ample room for this coil to be plugged into position without fouling either the panel or the side of the case. On the other side of the baseboard the high-frequency choke has been mounted, while the neutralising condenser and valve holder are placed in between these two components.

Filament Control

In order to cut down the number of adjustments, a fixed resistor has been employed instead of the usual variable resistance. This has the further advantage of adding considerably to the life of the valve, since the current can never exceed the safe limit if the correct resistor is employed. The three fixed condensers required are mounted in the front of the baseboard as shown.

Wiring Up

In wiring up the unit the baseboard components should be connected up as far as possible before mounting the panel in position. After this the panel may be screwed into position and the wiring completed. It will be observed that the nature of the wiring is simple and no difficulty should be experienced.

The three flex leads carrying the low-tension and high-tension current should be made as long as is necessary to suit the convenience of the receiver with which the unit is to be used. A measurement should be made to ascertain how long the distance is from either the battery or the terminals on the receiver proper to the position which will normally be occupied by the unit. Having decided the length required, three equal lengths of flex may be cut off and braided together to form a single cord. The three connections are made, one to the on-off switch, one to the fixed resistor, and the third to one side of the high-frequency choke as shown in the wiring diagram.

Testing the Unit

The unit is then ready for test, and may be connected up in front of the particular receiver. As has just been stated, the battery connections from the booster may be taken either to the terminals on the main receiver itself, or, if desired, direct to the battery. The former is perhaps the preferable arrangement for the L.T. leads. The high-tension lead has been provided with a wander plug so that it may be taken direct to a suitable point on the high-tension battery.

The operation of the unit is very simple, the only process requiring any extra care being the neutralising. Having connected up the unit as just described, the receiver should be adjusted approximately to the setting at which the local station is usually received.

Neutralising

Next place the neutralising condenser all in and then unscrew it two or three turns. This will be an approximate setting for preliminary work. Now, on switching on the unit and rotating the tuning dial, the local station will be heard.

The setting of the dials of the receiver proper will change somewhat, and it will probably be found that less reaction is required than before. Tune on the receiver and the booster until maximum signals are obtained. The unit is now ready for balancing.

Switch off the valve of the booster and adjust the neutralising condenser until no signals are heard. It will be found that at one particular point the signals die away to nothing. This point, which is fairly critical, occurs when the unit is exactly neutralised. With the unit in this condition, any oscillations occurring in the receiver circuits following the unit will not cause interference to neighbours.

The use of a "Public Address" system of amplifiers and loud-speakers is now common in America on important occasions. In this view (taken in Washington) it would appear that "talks" have had their customary effect on the gentleman in the foreground!

WHAT SHOULD WE HAVE DONE WITHOUT IT?

(*Concluded from page 128*)

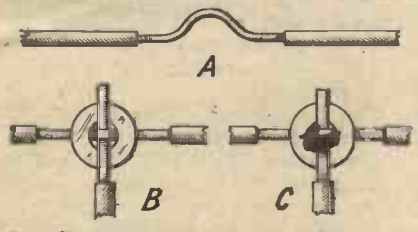
the country districts and remote towns where it was the only means of communication with the outside world for a great many people. When public attention had been drawn to the omission, the Archbishop of Canterbury's message was broadcast, and as soon as the strike had been called off, Mr. J. H. Thomas, the railwaymen's leader, was allowed facilities to explain the settlement with the railway companies to the 700,000 members of the National Union of Railwaymen and their relatives and friends.

The absence of broadcasting during the General Strike would have placed a premium on liars!

FROM A READER

SIR,—After reading through your page of "Hints . . . to Home Constructors," which appeared in WIRELESS, I thought perhaps the following hint would be of interest to readers.

The making of really neat connections between two pieces of wire is not quite as simple a matter as it seems. Here, however, is an efficient method: Take the wires that are to be joined, bare of insulation for an inch, and proceed as shown in the diagram.



Mr. Wilkie's method of making neat and efficient joints.

After the wire has been bent, as shown, a washer and some solder combine in making a really efficient connection.—Yours faithfully, D. WILKIE.

SPECIAL FEATURES NEXT WEEK

Will Reflex Circuits Come Back?

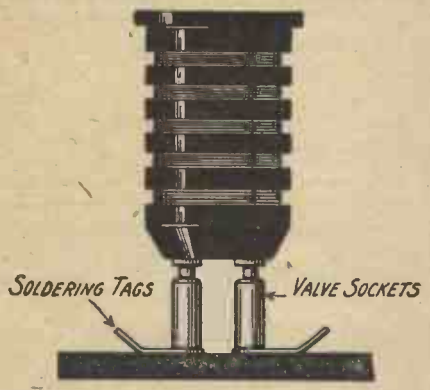
A Simple One-Valve Set

A Wave-Trap and Crystal Set in One

"Summer Programmes"

A NEW USE FOR OLD H.F. TRANSFORMERS

TO every experimenter there comes a time when one particularly requires a certain component, and has very little hope of procuring one. The time is usually after the shops have closed down for the



Only two of the pins on the former will be needed when it has been converted into a choke.

night, or perhaps too early for them to open, and it was in this position that the writer found himself a few mornings ago. The experiment was becoming particularly interesting, and to cease work at this juncture because of a missing component was, as the experimenter knows, impossible.

The Simplest Choke

A hasty glance round the den proved that abundant material was at hand to make any amount of H.F. chokes. The simplest solution would have been to have wound about three hundred turns of wire round the fingers and bound them up with a little string. The gauge of wire is not important, anything between 26 S.W.G. and 36 S.W.G. cotton or silk covered will do. This type of H.F. choke is perfectly satisfactory for many purposes, but as the writer wished to incorporate this component in a good receiver afterwards, it would not have been quite the thing, and was therefore ruled out.

Another False Start

A search for a piece of $\frac{1}{2}$ in or $\frac{3}{4}$ in. ebonite, fibre, or even cardboard tube proved that there was not any in the place. If there had been, we could have wound on about 400 turns of No. 36 D.S.C. wire, the ends secured to terminals inserted in the ends of the rod. The best way, if extreme compactness were essential, would have been to have wound the wire in bunches along the tube, a little shellac or celluloid solution keeping them in place.

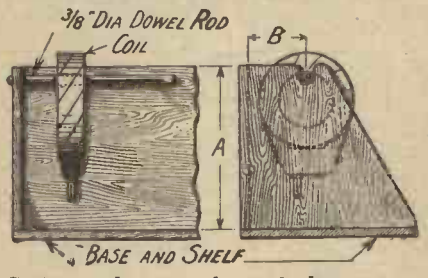
The Solution of the Problem

Further investigation of scrap boxes brought to light an old plug-in transformer which had been discarded in favour of other forms of H.F. coupling. The windings were stripped off and replaced by No. 36 S.W.G., D.S.C. wire. Each slot was filled to the level of the former, the wire being transferred to the next empty slot across the groove already existing for this purpose. Two of the pins were removed from the base of the former and the two ends of the choke connected to the remaining two. (The filament pins were removed, thus leaving the grid and plate pins, because these were further apart.)

A small piece of ebonite was then cut and fitted with two valve legs into which the choke could be plugged, and this arangement, which is illustrated in Fig. 1, has been finally incorporated in the finished receiver.

A SIMPLE RACK FOR COILS

It is not advisable to leave coils of the plug-in type lying about, as they



Coils can be stored neatly but accessibly with this rack.

are apt to get damaged. It is an easy matter, however, to construct a neat rack whereupon such coils may always be placed. In addition to this, it is a desirable feature to always have immediate access to these coils and to have them arranged in such a way as to enable one to lay hands on any particular coil required.

Construction

The diagram, Fig. 1, shows the constructional details. All that is necessary is some $\frac{3}{8}$-in. thick wood for the base, sides and back, and a length of $\frac{3}{8}$-in. diameter dowel rod, such as is used by carpenters for making dowelled joints. Little need be said relating to the construction, as most readers will be able to knock up a piece of woodwork of this description to suit their own taste.

As regards the dimensions, however, the length of the rack should be in accordance with the number of coils which it is desired to place upon it. It should also be seen that dimension "A," shown in the diagram, should be well in excess of the space occupied by the largest type of coil to be used. Dimension "B" should be a trifle in excess of half of the external diameter of the largest coil to be held. A bearing is cut in each of the side pieces, as shown, to receive the dowel rod which rests therein.

Storing the Coils

To place the coils upon the rack is easy. Lift the dowel rod from its bearings, pass it through the centre of the coils themselves, and drop the rod back into position. For purposes of convenience, coils should be placed upon the rod in order of their numbers; thus it will be easy to detach any particular coil from the rod, replacing any coils not wanted, and finally replacing the rod.

B. R. A. M.

ADDING TO YOUR TOOL KIT

No. 2—PLIERS

THE next outstanding tool for the amateur to possess is a good pair of pliers. Pliers, of course, are very varied in character, each type having its own use, and it is a good plan only to employ each pair exclusively for the one particular job for which it is designed.

The first pair of pliers the amateur should purchase is the type known as "combination" pliers. This tool will quite adequately do a number of useful jobs, including cutting, usually two types of wires, hard and soft, turning nuts, holding round rods, etc., etc.

The accompanying illustration depicts the tool, and is marked so that the reader will know which part of the pliers to use for each particular job.

The handiest size for the amateur is a pair about 5 in. long, which may

A pair of combination pliers is one of the first tools which should be bought.

cost approximately one shilling and sixpence.

A pair of pliers of this sort should not be used for drawing out nails.

FINDING THAT ELUSIVE STATION

By A. V. D. HORT, B.A.

This interesting article explains how simple it is to find an elusive station with the aid of a buzzer wavemeter, providing of course that the station is within range.

A DESIRE to see that the receiver will do in the way of picking up programmes other than that sent out by the local station comes to most owners of wireless receivers at one time or another.

To possess a receiver which can be tuned to the wavelength of Hamburg or Madrid, for instance, and which is capable of giving plainly audible speech and music from such stations, even if it is only on the telephones, must tempt one at some time to try to find these or other Continental stations.

To be the proud owner of a four or five valve set and never to use it for anything other than the reception of the local programme is somewhat akin to purchasing a 40 h.p. car and driving it at a speed never exceeding 15 miles per hour.

A Common Instance

The stumbling block in the way of most people, especially those with receivers which are not multi-valve sets, or which are very sharp in their tuning, though sensitive enough, is probably the difficulty experienced in locating the stations on the dials of the tuning controls.

Sometimes too, it happens that by a lucky chance one night a distant station is picked up and its programme is enjoyed. When the set is next used, unless careful note has been taken of the dial settings, the station cannot be found at all.

All too often on these occasions it is to be feared that a number of people cause their sets to oscillate. By this means they are enabled to pick up the carrier waves of the distant stations and so to locate them, even if they are unable to tune them in subsequently to comfortable strength.

A Dangerous Habit

There is no doubt that this method of searching is very attractive to the man with a set with which he can only just hear well enough to identify the station picked up, but equally there is no doubt that the neighbours will not bless him when he is searching.

It is, of course, true enough that experience and practice in the handling of receivers will often enable a skilled operator to find weak signals simply by extreme care in tuning. He will probably be assisted to a certain extent by knowing from experience the exact faint sounds to listen for as he turns the dials of the receiver, sounds which would not be noticed at all by others. It is, however, a mistake to assume that this skill and experience can be acquired by the habit of always using the carrier wave method of searching.

Use a Wavemeter

The really satisfactory way of getting over the difficulties of searching for weak signals lies in the construction or purchase of a wavemeter. The type of meter which is most generally suitable for employment in conjunction with broadcasting receivers is of the type known as a Buzzer Wavemeter.

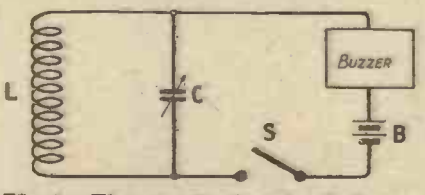


Fig. 1.—The circuit of a simple buzzer wavemeter. A high-note buzzer is always desirable.

The circuit of a simple buzzer wavemeter is shown in Fig. 1, and it will be seen to consist of a coil, a variable condenser, a buzzer, a battery and a switch. These are the essential components, and unless a very accurately calibrated instrument is required, an instrument of this type can quite well be made up by anyone.

How it Works

It is not proposed to describe here the construction of such an instrument, but to indicate its usefulness in practice and to show how it is employed to assist in the search for those elusive stations.

When the switch in the circuit of Fig. 1 is closed, the buzzer will start to buzz, and it will perform the function of a minute transmitter. The tuned circuit L.C., which is placed in series with the buzzer and battery will tune the oscillations set up to a definite wavelength, this wavelength being varied by means of the variable condenser. Thus it will be possible to send out by means of the wavemeter weak signals on the band of wavelengths covered by the particular coil and condenser in use.

"Setting" the Wavemeter

A wavemeter will only be of use in the finding of stations on the receiver if the wavelengths of those stations are known. Since the wavelengths of the British and Continental stations are regularly published nowadays, no difficulty should be encountered in this direction.

When the wavemeter has been calibrated, either its condenser dial is marked directly in metres, so that the wavelength to which it is to be set is on the instrument; alternatively the dial is marked in the usual way in degrees and a separate chart is used with the dial readings plotted against wavelengths, so that the required settings may be read off the chart. Conversely, the chart will give the wavelength in metres corresponding to any dial reading to which the meter is set.

An Example

Now suppose that we wish to try and pick up the transmission from the station Petit Parisien in Paris, which is at present using a wavelength of 333 metres. First of all we shall set the dial of the wavemeter to the reading corresponding to 333 metres and switch on the buzzer. Then with the reaction control of the receiver adjusted in such a position that self-oscillation cannot be set up at any setting of the main tuning control, the receiver should be tuned in the ordinary way as though tuning the local station.

If the wavemeter is close to the receiver the buzz from it will probably be picked up over a wide arc of the tuning condenser. Over a smaller arc, however, the buzz will be very much louder. This means that in the

(*Continued on page* 140.)

FINDING THAT ELUSIVE STATION—(*continued from page 139*)

centre of the smaller arc is the point required.

Position of Wavemeter

To make accurate tuning possible the wavemeter should be slowly moved away from the receiver, the tuning condenser being readjusted in order to keep on the band where the buzz is heard loudest. Finally a point should be reached when it is only just possible to hear the buzzer over a very small arc of the tuning condenser. The receiver will then be practically tuned to 333 metres.

Finding the Station

Once this has been done, the reaction may be slowly and carefully increased with the necessary readjustments of the main tuning control. Just as much care should be exercised in bringing up the reaction coil or increasing the effective capacity of the reaction condenser as would be used in tuning in the transmission from the local station.

It may be noted that when it becomes apparent that the receiver is getting near to the state of oscillation, no advantage will be gained by going any further. If the transmission is not loud enough to be intelligible then, the distortion consequent on oscillation will certainly render it unintelligible if the reaction is pushed too far, even if a slight increase in signal strength is noticed.

Identifying Stations

The advantages of a wavemeter as an aid to the search for distant stations will be obvious from the above. For the identification of unknown stations too a wavemeter may prove extremely useful.

Suppose, for example, that a station has been picked up on the receiver, but that the signals obtained from it are too weak to enable it to be identified from the programme transmitted.

In this case care is taken not to disturb the adjustment of the receiver, and the buzzer of the wavemeter is switched on. The dial of the wavemeter condenser is then turned, the precaution of moving it away from the receiver being taken as already described, and the point on the wavemeter dial at which the buzz is heard loudest on the receiver is noted. On reading off the metres direct from the dial, or referring to the chart, whichever method is employed, it may be found perhaps that the wavemeter is set to 404 metres. This gives the necessary clue to determine Newcastle as the station heard.

Flat Tuning

It should be noted that a buzzer wavemeter is somewhat flat in its tuning, so that it is not easily possible to discriminate between wavelengths which are only a metre or so apart. The strength of the signals received, however, or some other indication will usually act as an additional guide to the identification of a doubtful station.

The wavemeter will probably prove most useful in its application to the finding of stations already known. It renders marking of the receiver unnecessary and is, of course, independent of such wavelength changes as are made from time to time.

So long as the wavelength of the required station is known, it is only necessary to set the wavemeter to that wavelength and tune the receiver to it, when the station, if the receiver is capable of receiving it, will become audible.

WHO SAID INSULATORS?

The large objects in the foreground, very much resembling flower pots, will give a good idea of the size of the insulators used in the construction of the giant aerials at Rugby.

AN EXPERIMENTAL PANEL

Those who are accustomed to experimenting to some extent with their receiver, and who make alterations from time to time in their choice of components, or circuit, may have found that a large amount of work is entailed in the making of such alterations, and also that the panel has to be drilled accordingly from time to time.

A Wasteful Method

Others, however, on deciding to alter their receiver in accordance with a new circuit, may be in the habit of scrapping their existing panel and providing a new one for this purpose. This is really a wasteful method of procedure, and a suggestion is made whereby a panel, together with a baseboard, may be permanently used with a view to several subsequent alterations which may be made to the receiver.

"One-Hole" Fixing

As nowadays practically all components which are mounted upon panels are of the single-hole mounting type, this idea is particularly adaptable. It is advisable to commence by providing a panel of such a size as will suit the requirements of the constructor.

The panel may measure 24 in. by 10 in. It is then divided horizontally into nine equal parts, and vertically into three. Holes are drilled where these lines intersect. We now have twenty-four holes arranged in the form of squares. If each of these holes is made with a ⅜-in. diameter drill, they will be found to suit most of the standard bushes of the single-hole mounting components. The baseboard may be 24 in. long by, say, 8 in. wide.

Using the Arrangement

Having prepared a panel and baseboard on these lines, we are able to mount upon the panel in a minimum of time any desired component; further, such a component or components may be mounted symmetrically, as we have, from the drillings made, twenty-four positions from which to choose. It is improbable that we would wish to mount twenty-four components, but even this may be done. On the other hand, if we wish to mount, say, twelve components, they may be arranged with a little skill in several desirable positions. F. O. R. D.

AMATEUR TRANSMITTING NOTES

QRA's Wanted

P-RXY, U-NIDK, M-1J, 9WJ, BZ-9QA, DA-1CW, 9YU, B82, A-7HL, Y-1BR, Y-1FA, Y-1CG, BE-1AX, G-6CM, D-PK7, G-2ZA, G-2NC, A-5KN, G-6XI, GBM, G-5CQ, G-2BAJ, G-2BFI, LAXX, GW-3XX, GW-3ZZ, G-6OU, G-2SN, AGK.

QRA's Found

G-2BSQ: E. Wilson, Bramhall Lane, Bramhall, Cheshire.

G-2KA: B. Hodson, 31, Broomfield Avenue. Palmer's Green, N.13.

CH-2AB: Jorge Bernain, St. Templeman 131, Valparaiso, Chili.

SMTK: H. Carlsson, Kullagatan 40, Hälsingborg.

M-26B: R. Krausse, Tampico, Tamps, Mexico.

QSL Cards Held

We have cards addressed to the following:—

PCLL, N-0RP, GBM, N-2PZ, G-5UQ, 2LF, 2IA, 6EP, 5SO, 6XI, 2ZA, 2OO, 5JX, 2UD, 5FQ, 5RB, 6BD, 5TD, L-1AG, L-1JW, RRP, U-1AI, SMUV, I-1AF, BE-1AX, TPAI, Y-1CD, A-5KN, SS-8LBT, D-PK7, G-6SU, X-GB2, PKX, 12BB, H-9XA.

AN APPRECIATION

DEAR SIR,—I am writing this to tell you how pleased I am with the best two-pennyworth on the market. I have taken WIRELESS since the first issue, and now in its enlarged form and pleasing cover I like it better than ever. I have, however, a suggestion to make which I think will meet with approval from all readers. Would it be possible to issue periodically an index, of course as a separate publication, and at a price consistent with the cost of compiling same? This would, I feel sure, be of great use to readers, who, like myself, do a little experimenting, and when wanting to refer to something one has read in WIRELESS, have to go through all the back numbers. By the way, one sees a lot of reports of results obtained on sets constructed of the best components, but how about the poor enthusiast who, if he waited until he could afford the best, perhaps would never own a set?

I have a three-valve set, D. and 2 L.F., made up from all cheap components, and with an aerial 25 ft. long and 20 ft. high, and screened by roofs almost touching it, I have logged more than 30 stations, the furthest being Prague. How's that, using 7s. 6d. transformers and 4s. 6d. valves? All of these were heard on a 19s. 6d. loud-speaker.

Why don't the B.B.C. study the working man a little more? I have no real cause to complain, but think that as the majority of listeners must be men who, like myself, have to rise early in the morning, and, much as we would like to, cannot stop up to hear the dance music, it therefore seems hard that we should only have about 1½ hours' variety every night from 8 to 9.30 p.m.

While on the subject of programmes, here is an idea for the B.B.C. to save money. Let every main station have a real good entertainment of about three hours' duration and keep this programme on for a week. Daventry to relay each station in turn. This would give everyone a chance to hear a better programme, besides being less expense to the B.B.C. I think this is all for now, so close, wishing the Radio Press the best of luck.—Yours faithfully,

A. J. WILLIAMS.

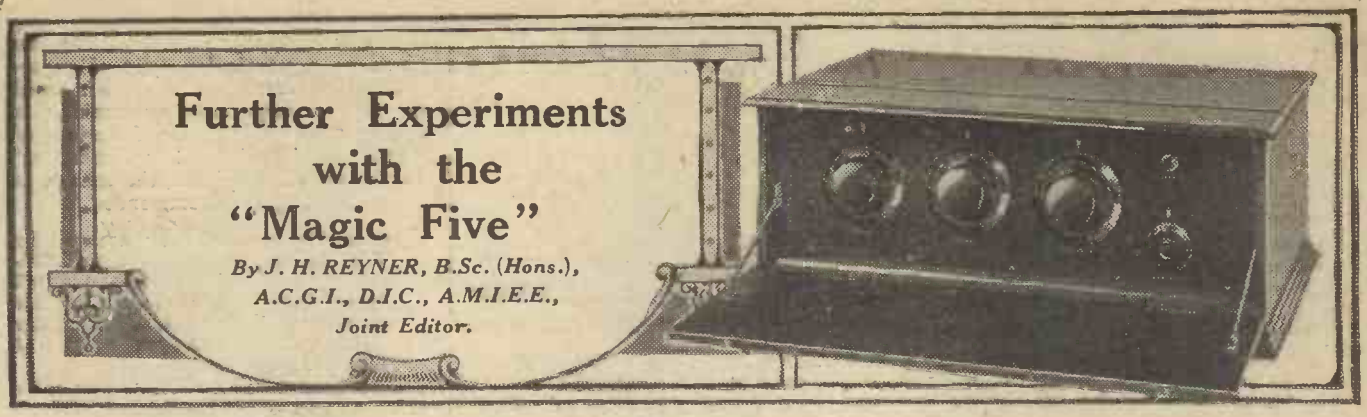
STATIONS I HAVE VISITED

(*Continued from page 132*)

and confined space. The connection between the transmitting station proper and Lindenhoffstrasse is carried out by means of a special cable which is laid partly overground between Zurich and the transmitting station.

Wavelength Changes

One frequently hears a number of complaints as to interference between the Zurich and the Berne Stations, and for this reason the former has been experimenting with various wavelengths of late. The station has gone up as far as 540 metres, and now, at the time of our going to press, it is back to 515 metres. However, this wavelength is not permanent.



Further Experiments with the "Magic Five"

By J. H. REYNER, B.Sc. (Hons.), A.C.G.I., D.I.C., A.M.I.E.E., Joint Editor.

Coils for the Daventry waveband—How to add a reaction adjustment.

SINCE the time when the "Magic Five" was first described I have been carrying out further investigations with a view to extending the usefulness of the receiver as a standard "All-station" set. I have demonstrated it to several readers who have been considerably impressed by the ease of control, the absolute stability and the number of stations which can be received.

Interchangeable Coils

One of the first objects of investigation was the provision of coils, interchangeable with those already in use, for the reception of Daventry, Radio Paris, Hilversum and other stations on this waveband. The original idea in designing the screened coils which are used in this receiver was that the coils themselves could be changed without the necessity for purchasing a separate screen.

A Saving in Expense

This therefore means a considerable saving, because the screen and base which are the expensive components have only to be bought once, and the reception of wavelengths outside the normal is simply a matter of changing the plug-in aerial coil and H.F. transformers. I am giving this week details of the Daventry coils, and I hope at a future date to give particulars of coils suitable for other ranges.

Daventry and Radio-Paris

The new coils cover a range of about 900 to 2,000 metres, so that the majority of the longer wave stations can satisfactorily be received. The details are as follows:—

AERIAL COIL.—300 turns of No. 40 s.s.c. wire wound unspaced on a 2-inch diameter former. Tappings are taken at 50 and 100 turns.

H.F. TRANSFORMERS. — *Secondary:* Same as aerial coil without the tappings, viz., 300 turns of No. 40 s.s.c. on a 2-inch former.

Primary and Neutralising Windings. —These each consist of 85 turns of No. 36 s.s.c. on a 1⅝-inch diameter former placed inside the secondary. As in the former case the neutralising winding is put on

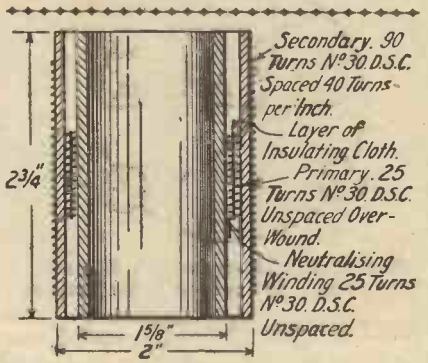


Fig. 1.—In making the transformer for 5XX the windings are placed exactly as were those of the unit for the shorter waves, the details of which are given here.

first and the primary is over-wound, a layer of insulating cloth being placed in between.

The Connections

The connections to the H.F. transformers are taken as shown in Fig. 2,

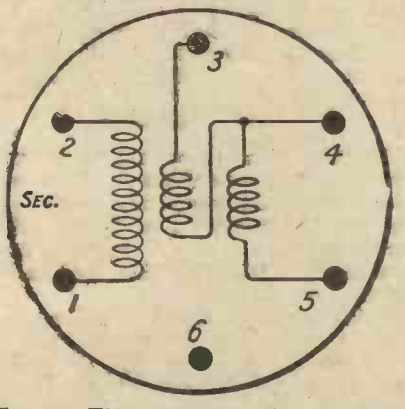


Fig. 2.—This diagram of connections is repeated for reference, and it should be understood that it shows the underside of the transformer.

which is a view looking at the bottom of the transformer itself. The pins will thus appear in the reverse order to those on the base of the screen.

It should be noted that the actual sizes of the formers employed are exactly the same as those in the previous case.

No Alteration of Neutralising

The set will not require to be re-neutralised when these coils are inserted, provided that it was correctly adjusted on the lower waveband. It may be found desirable to increase the condensers somewhat to produce a reaction effect or alternatively a reaction adjustment may be provided as will be described shortly.

Test Report

A brief test report is appended. All the stations given were tuned in during daylight, on the loud-speaker. No other stations were working at the time.

Dial Setting.	Station.	Wavelength (Metres).
50	Hilversum	1,050
59	Soro	1,150
80	Koenigswusterhausen	1,320
110	Daventry	1,600
122	Radio-Paris	1,780

Radio-Paris, of course, was received absolutely clear of any interference by Daventry.

Tendency to Oscillate

Many readers have asked me whether a reaction adjustment can be provided if desired. In some cases a somewhat weak station may be improved to really good strength by means of a reaction control which need not be at all critical to operate; and this would thus seem to be a desirable feature.

It will be remembered that in the original description of the receiver I mentioned that there was a greater tendency to oscillate towards the bottom of the condensers. This means that the sensitivity at the top of the scale is not as great as it might be.

A Reaction Control

I have experimented on the receiver, therefore, in order to find whether a simple reaction adjustment could be provided, and as a matter of fact it

(*Continued on page* 144.)

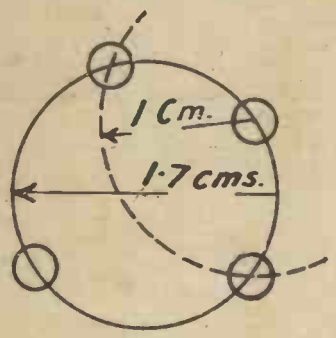
I HAVE BEEN ASKED....

What can I do to cut out Morse interference from the North Foreland station, which is only 10 miles from my home?

The trouble with powerful spark stations is that the tuning is usually very broad, so that, for example, when sending out on a nominal wavelength of 600 metres the signals are audible over an extensive band on either side of this figure. It follows, therefore, that if you try to receive a transmission close in wavelength to that of the interfering transmitter, the signals from this latter may be of a strength comparable, if not equal, to the strength of those wanted. Under such circumstances no set will permit you to obtain the programme you want free from Morse. When the required signal is the stronger, by sharpening your tuning—*i.e.*, by employing loose-coupling or by adding a tuned stage of high-frequency amplification—an improvement may be effected.

I travel and stay in hotels a good deal and propose to take a pocket crystal set with me for use near B.B.C. stations. What would you suggest for an aerial?

Very close to a station a length of flex strung across the room near the ceiling, and a further length on the floor in lieu of an earth connection, will prove effective. A better scheme still is to utilise the electric wiring



Given these dimensions, it is quite an easy matter to make a valve template.

where possible. This may be done by twisting two or three feet of the aerial rubber-covered flex round the lead to a hanging lamp or by utilising a special plug-in unit, such as the Ducon. A further length of wire on the floor should be used instead of the normal earth.

What is meant by a "Tropadyne" set?

The "Tropadyne" is the name given to a particular type of super-heterodyne circuit. One valve is saved in this arrangement by making a single valve perform the functions of "first detector" and "oscillator." In the author's opinion the scheme is to be thoroughly recommended.

I am unable to employ an accumulator H.T. battery, owing to charging difficulties, and ordinary large dry cell types have not proved altogether satisfactory for my set, which utilises eight valves. Can you suggest a solution?

I am confronted with the same difficulty and have used a Léclanché type battery for some months with every success. Mine is a 90-volt Ripault's battery, which, after filling, dropped about 10 volts and has since kept this voltage constant under all sorts of varying conditions. Any tendency towards "creeping," a common trouble with such batteries, has been counteracted successfully by using a thin film of paraffin on the electrolyte in the cells. Such batteries, I believe, are also obtainable from Messrs. Siemens. I would strongly advise that the largest type cells be obtained.

Can you give me the dimensions for making a valve template?

The centres for the four legs fall on the circumference of a circle of 1.7 centimetres in diameter. The plate and grid legs are on one diameter, whilst the filament legs are located at the points of intersection of the arc of a circle of 1 centimetre radius and the circle previously mentioned. The centre of the former circle is taken at the grid leg. The diagram given will make these points clear.

FURTHER EXPERIMENTS, Etc.—(*continued from page 143*)

can be done very easily. It is simply necessary to connect a vernier condenser between the anode of the detector valve and the anode of the first high frequency valve. There is ample space at the right-hand end of the panel to place a condenser of this sort. A Peto-Scott panel-mounting neutralising condenser is very suitable, or an Igranic vernier condenser. Any instrument used in this position should have a reasonably long handle to avoid hand-effects.

Correct Neutralising

If a reaction adjustment such as this is fitted then the operation of the receiver is simplified somewhat. It is only necessary to find the true balance point on the neutralising condensers. In the description of the original set I gave details as to how to balance up the high frequency side first, by switching out first one valve and then the next and adjusting the neutralising condensers in each case until no signals were heard.

After this I suggested that the set could be brought to the point of oscillation by increasing the values of the neutralising condensers. This second operation is not necessary if a reaction adjustment is provided, and the set should be left correctly neutralised.

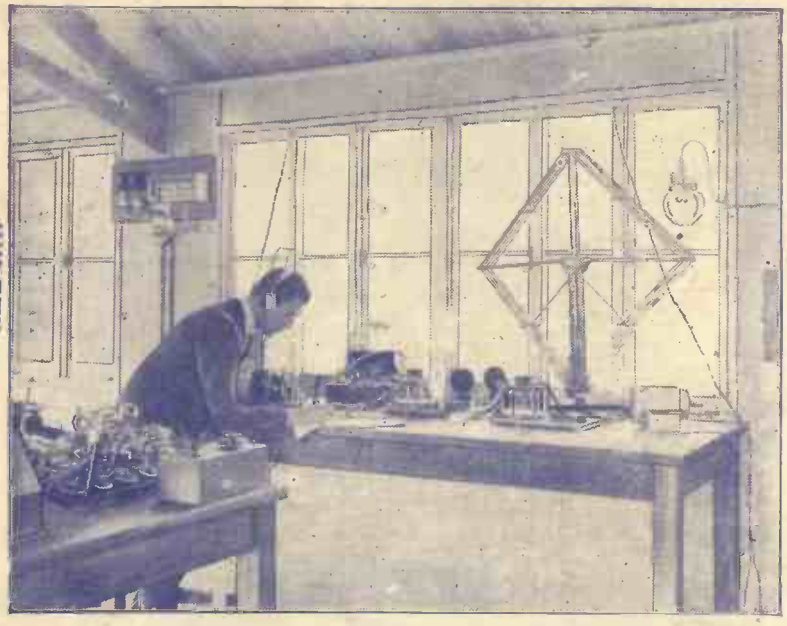
"Safe" Reaction

Provided this is done the set is still non-radiating even if the reaction control is increased beyond the oscillating point. The provision of this "tickler" therefore causes a marked improvement in the reception, and as it requires so little alteration to the existing arrangements it is well worth while.

A Transformer Point

I have observed two points in my further experiments with the receiver which are worthy of note. The first is in connection with the high-frequency transformers, details of which were given recently. The inside former contains two windings, the one being wound over the other. The two are identical as regards number of turns and gauge of wire, but it is important to note that the *primary is the outside winding*, the inside winding being the neutralising winding. Although the receiver will work with the windings the other way round, the signal strength is distinctly weaker.

The other point relates to the screens. It is important that these shall be efficiently earthed. The earth connection is made to the base, so that the cover is only earthed through the rubbing contact between it and the base. This should be cleaned occasionally therefore, as the metal tends to oxidise. A simple rub round with emery cloth or glass paper will suffice.



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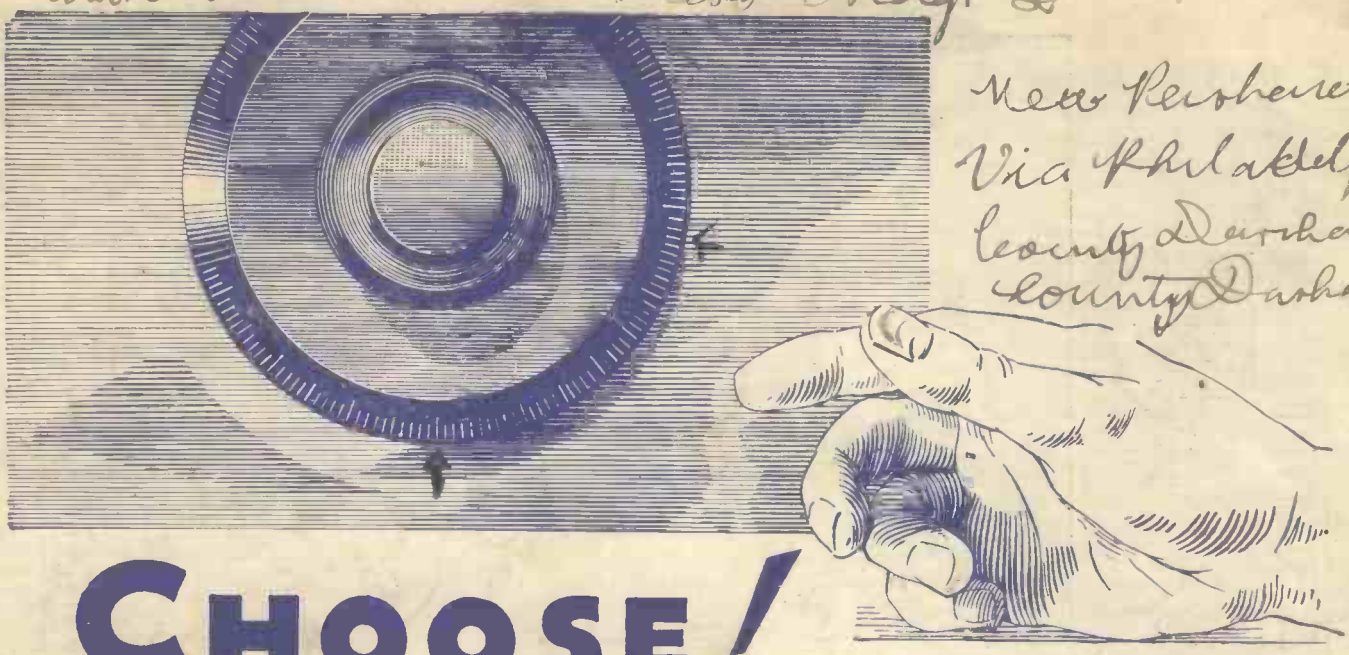

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